September 3, 2021 2018-3854

Mr. Andrew Grenzer, Chief of Solid Waste
1800 Washington Boulevard
Baltimore, MD 21230

RE: Response to Comments Letter for
Proposed Chesapeake Terrace Rubble Landfill
Odenton, Maryland

Dear Mr. Grenzer:

Provided below are responses to comments contained in the Maryland Department of the Environment (MDE) comment letter issued to National Waste Managers, Inc. (NWM) on July 27, 2021 (Doc Control No. 1993-WRF-0225) regarding the Phase III Engineering Plans and Specification Report, and the Phase II Addendum for the proposed Chesapeake Terrace Rubble Landfill. This document has been prepared in a comment and response format, with your comment followed by the NWM response.

Accompanying this letter are 10 hard copies of the Revised Phase III Engineering Plans and Specification Report. Each hard copy consists of 3 binders and a roll of full size drawings (90 sheets per set). Reduced copies of the drawings in 11x17 format can also be found in Section 18 of the Application.

To facilitate your review, we can also provide copies of the revised text in redline/strikeout format.

I. Comments Pertaining to the Phase III report:

1. The Phase III Report should include a narrative stating that the landfill is not located within 200 feet of a fault that has had displacement in Holocene time.
Response: We have added a statement to Section 8.3 of the Phase III Report stating that no Holocene faults have been identified on or within 200 feet of the proposed landfill.

2. Section 1, Executive Summary, page 1-1, 2nd paragraph states:

    a. That the leachate will be transported to a local leachate treatment plant for treatment and disposal; and in Section 10.11 Leachate Disposal states “We have received a favorable response from Environmental Recovery Corporation (ERC) of Maryland, located in Baltimore … and they have provided a preliminary quote for disposal of the leachate, up to 75,000 gallons per day from our site.” Please provide a copy of a supporting document from ERC that the facility has sufficient permitted capacity to accept this volume of landfill leachate.

Response: A copy of the quote and acceptance criteria from Environmental Recovery Corporation is provided as an Attachment to Section 10 of the Application.

b. That the proposed landfill will have 20 Cells/Subcells. Will the landfill design have both cells and subcells? If so, clearly state which of the cells will have subcells and if there will not be any subcells, please clarify the statement to read that the proposed landfill will have 20 Cells. Furthermore, some Tables included in the report and Drawing 27 show 21 Cells, comprising of Cells 1 through 4, 5A through 5F, and Cells 6 through 16, which does not support the statement made in the Executive Summary. Please correct the discrepancy.
Response: The proposed landfill will have 21 cell and no subcells. The statement has been clarified. We have corrected the discrepancies regarding the number of cell in the drawings and text.

3. Section 2.1 states that the landfill will be operated 5.5 days per week, but this is not in conformance with the zoning approval which provides for operating 5 days per week. Landfill permits generally specify the same hours and days of operation that are allowed under the zoning approval for the facility, and provide that the operating hours can be changed with written documentation that the local zoning authority does not object to the proposed change. However, at this time the approval specifies 5 days of operation. Please correct and update the stated operating hours where appropriate, and the calculations for the life of the landfill.
Response: We have changed the assumed number of operating days from 5.5 to 5.0. We have also updated the operating life calculations based on a revised volume.

4. Section 3.2 Existing Site, 3rd paragraph states that "Final disposition of the leachate from the storage tank will be detailed in the Phase III Application." This is the Phase III Application, the sentence should be revised to clarify that the final disposition of the leachate from the storage tank is addressed under Section 10.11, Leachate Disposal, of this Phase III Report.
Response: The change has been made.

5. Section 3.4 Access/Site Entrances, Section 7.11 and elsewhere proposes three possible entrances for the site. The letter from Anne Arundel County dated July 27, 2005, states that the zoning of the rubble landfill was approved in the form of a "special exception" and the condition stipulated allows only the use of Conway Road as the entrance to the landfill. Alternate landfill entrances may be permitted but the landfill must be operated in accordance with the local zoning special exception.
Response: We have revised the text in Section 3.4 to more clearly state that the intended entrance is the East Entrance as stipulated in the County special exception, and that the proposed Optional North or Optional South entrances could only be constructed if the special exception is changed or nullified.

6. Section 3.4.1 Site Entrance Infrastructure and Queue Lanes - Please clearly state that no queuing onto public roads will be allowed.
Response: We have added the requested language to the end of the last

paragraph in Section 3.4.1.

7. Section 3.5 Proposed Rubble Landfill Description states that the landfill will consist of approximately 117 acres dedicated for landfill waste disposal, and that the total site disturbance is approximately 183 acres. Section 1.0 of the Executive Summary states that the proposed landfill is approximately 140 acres, as shown on Figure 1-2 (and is labeled fill boundary). Section 8.5 Soil Volume shows the West Section Cell Area is 83.8 acres, and the East Section Cell Area is 30.8 acres [114.3 acres total]. Section 8.6 Total Disturbance states that the disturbed area is 60.5 [please label unit as acres] in the East Section and 132.7 acres in the West Section [60.5+132.7 = 193.2 acres]. The information on acreage appears to be inconsistent. What is the acreage of the fill area? What is the acreage of disturbance? The acreages of the individual cells should be included in the narrative, and depicted in the drawings.
   Response: The acreage of the landfill waste disposal area is 114.4 acres, as measured along the inside top of perimeter berm. The total area of disturbance is 193.2 acres. We have added a table presenting the area within each cell to Section 3.5 and to drawings 6 and 7, and 10 and 11. We have reviewed the documents for inconsistencies and made revisions, where appropriate.

8. Section 3.5.1, Liner System, page 3-6, paragraph 4, states the prepared subbase is commonly known as Geosynthetic Clay Liner (GCL). This statement is misleading. The prepared subbase is made of clay soil, while the GCL is made of geotextile layers containing a layer of bentonite clay. Please correct this statement.
   Response: As recommended by MDE we have eliminated the GCL from the approved design. This comment is no longer applicable.

9. Section 3.5.2 Leachate Management System does not need to provide information on where leachate will not be taken, please remove the extraneous information. Please discuss if pre-treatment will be necessary to meet the requirements of the receiving wastewater treatment plant, and if so discuss where the pretreatment will take place, either onsite or with an outside contractor, and what types of pretreatment may be required.
   Response: We have eliminated the extraneous language from Section 3.5.2. The need for pre-treatment will be dependent on the nature of the materials placed in the landfill. We have added at statement to Section 5.5.2 saying that pre-treatment is not expected to be required. Acceptance criteria for the proposed ERC treatment facility is provided in the Section 10 Attachment.

10. Section 3.5.3, Cap/Closure System, page 3-8, the first paragraph states as waste grades attain maximum permitted filling elevations, a minimum 12-inch thick intermediate cover will be placed and shall be seeded. Please note that areas that have reached final grade must be covered with 2 feet of final cover and vegetated. Please see the distinctions between intermediate and final soil cover required by COMAR 26.04.07.18G and H, which are accessible on line at www.dsd.state.md.us/comar/comarhtml/26/26.04.07.18.htm.
    Response: We have revised Section 3.5.3 to clearly indicate that the waste will be covered by a 24-inch (min) thick Final Cover Layer and that the Final Cover Layer is overlain by the Closure Cap.

11. Section 3.5.3, Cap/Closure System, page 3-9, the first paragraph proposes the use of 20 mil synthetic material for capping, while Drawing 34 shows a 40 mil textured LLDPE liner. Please revise this section to be consistent with the Drawing.
    Response: The text has been revised to eliminate the minimum 20 mil geomembrane referenced in the regulations, and clearly state that the geomembrane will be a 40 mil textured LLDPE.

12. Section 3.5.4, Landfill Gas Collection & Control, page 3-9, paragraph one states "Depending upon the concentration of methane in the landfill gas, a passive landfill gas management system may be used". Section 11 of the report that discusses the landfill gas management plan does not include the details for a passive landfill gas system.
    Response: At this time expectations and intentions are to install and operate an active landfill gas system. If gas generation rates do not support operation of an active system, NWM will seek an appropriate permit modification to convert to a passive system.

13. Section 3.6, Solid Waste Management Plan, states that the proposed rubble landfill was included in the Anne Arundel County Solid Waste Management Plan in April 2001. Please revise it to in the 10-Yr Solid Waste Management Plan 2013-2023 as a proposed facility.
    Response: We have made the change, as requested.

14. Figure 4-1 Landfill Bottom Grades Compared with Highest Observed Groundwater Levels:

    a. Figure 4-1 is included in Section 3, Project Description but should be re-organized and included in Section 4, Groundwater Separation.
       Response: The Figure is Section 4 in the revised Phase III Permit Application.

    b. Figure 4-1 shows Cell 5E having a groundwater separation between the bottom of the sump and the groundwater table of 3.8 ft. The sump elevation at this location is shown to be 118 ft, and the groundwater elevation is shown to be greater than 115 ft. Cell 5C has a groundwater elevation of 115 ft at the sump and a bottom of sump elevation of 118 ft but is labeled 5.0 ft separation. Please clarify and review all groundwater separations. The groundwater separation is required to be a minimum of 3' and the cell floor must be raised to meet that separation. Also, note that this separation is required from the highest anticipated occurrence of groundwater, not just the highest observed, so if circumstances occur that might cause a higher elevation of groundwater, then the proposed cell floor elevations must be increased accordingly.
       Response: We have modified Drawings 6 and 7, and 10 and 11 to include a tables specifying critical invert elevations at each of the sumps. The lowest elevation at each sump was set to provide a minimum vertical separation of 3 ft. between the bottom of the 24-inch thick prepared subbase and the highest observed/predicted groundwater elevation. We have re-created Figure 4-1 using the modified 3D bottom of Subbase

surface and 3D highest observed/predicted groundwater surface. Also, as presented in the Phase II Application and discussed with MDE during preparation of the Phase II Application, the highest observed/predicted groundwater elevations (developed using the highest observed groundwater elevation at each individual well at any time) was adopted as the highest predicted groundwater elevations for design purposes.

c. Figure 4-1 shows that the proposed Cells 1, 2, 3, 6, 5E & 10 have two numbers for the elevation of the sump in these cells. Be advised, the sump is the lowest portion within the cell designed to facilitate leachate movement and collection at the sump. Please correct this discrepancy.
Response: Figure 4-1 is an isopach map presenting the distance between the top of the groundwater surface (Highest Observed/Predicted) and the bottom of the cell. Figure 4-1 does not show elevations, as a result, the smallest amount of separation, does not always occur at the sump. The previous version of Figure 4-1 showed two numbers in Cells 1, 2, 3, 6 and 10 because the smallest groundwater separation distance beneath these cells did not occur at the sump. So one of the numbers represented the separation at the sump and the second represented the location with the smallest separation within the cell. This is a function of the configuration of the potentiometric surface relative to the bottom of the cell subbase and does not represent a second or alternate low point in the cell. Cell 5E had 2 numbers because the one represented the sump in cell 5F which was not depicted on the drawing.

The revised version of Figure 4-1, developed using the new Bottom of Subbase Grading Plan (Drawings 6 and 7), has the smallest groundwater separation distance at the sumps in all cells except Cells 1 and 2.

15. Section 4.0, Groundwater Separation, paragraph two, states that the proposed cell floor grading maintains a minimum of 3 feet buffer at all locations as required under Code of Maryland Regulation, COMAR 26.04.07.16(C)(6A). This statement is incorrect, as Cells 1, 2, 3, 10 and 11 did not meet the minimum vertical buffer distance of 3 feet. As noted in Comment 14, Figure 4-1 and Drawings 10 and 11 depict an insufficient vertical buffer in Cells 1, 2, and 11 between the highest observed/anticipated unconfined groundwater elevations compared with the proposed cell floor elevation. These three cell floors must be designed to be above the unconfined groundwater. In addition, Cells 3 and 10 have 0.79 and 2.2 feet vertical buffer distances. These do not satisfy the requirement of COMAR 26.04.07.16(C)(6A). Please correct this discrepancy in the narrative and all inadequate plan sheets. The cell floor design must comply with the buffer requirement at all locations.
Response: The landfill bottoms have been revised and regraded as appropriate to ensure the 3.0 ft. of separation from the bottom of the subbase. In all the cells, except cells 1 and 2, this now occurs at the cells. As stated above, the smallest separation distance (but still equal to or greater than 3.0 ft.) in cells 1 and 2 occurs at a location away from the sumps as a result of sharp changes in the gradient of the potentiometric surface below these cells.

16. Section 5 Landfill Air Space Estimate: The air space estimation does not include the 2-feet of prepared subbase, the 12 inches barrier layer shown on Drawing 14 Detail 1, and the 2-feet of soil placed over the final lift of waste. Please note that the cap thickness is four feet minimum; for final closure COMAR 26.04.07.19E(5) and COMAR 26.04.07.21 require the components listed below:

    - 2 feet of final cover placed over the waste
    - A geomembrane layer or 1 foot of clay with a permeability ≤ $1x10^{-5}$
    - A geocomposite drainage layer or minimum 6 inches thick drainage layer with a permeability ≥ $1x10^{-3}$.
    - 2 feet of final earthen cover (including 6 inches of topsoil).

    Please amend the estimate and any appropriate pan sheets to reflect an acceptable cap design.
    Response: Section 5 has been revised based on the revised top of the Leachate Collection Layer and Top of Waste grading plans.

17. Section 5.1 Landfill Air Space Estimate, page 5-1, states that the final closure cap thickness is 3 feet. Attachment 5A, Landfill Airspace Estimate, sheet 1 of 2, does not depict the 2- feet prepared subbase layer for the cell liner system and the 2- feet of earthen cover over the waste for final cover system. Please see comment 16 above.
    Response: The proposed landfill design Attachment 5A, has been revised based on a 2 ft. thick Final Cover and 2 ft. thick Closure Cap.

18. Section 5, Landfill Design Life, please check the value of 44.0 tons/cubic yard as it appears this should be 44 lbs/cubic foot, as used in the calculations in Attachment 5B. Also, Attachment 5B Cell Life Summary was not included in the hard copy of the Report. Please ensure that when the revised Phase III is resubmitted, both the digital and print copies of the reports and plans are identical.
    Response: The value has been corrected in the text to be 44 lbs/cf. The revised version of the report includes an updated Attachment 5B.

19. Section 6.2.1 Historical Flood Plain Analysis, states the footprint of the landfill is located approximately 5 feet above the influence of the 100-year floodplain. Please explain how the landfill does not restrict the flow of the 100-year flood, or reduce temporary water storage capacity of the floodplain.
    Response: The landfill does not encroach into the floodplain. We have reworded the statement in Section 6.2.1 to clarify the meaning of our statement.

20. Section 6.4, Residential Well Monitoring, references Section 16 Appendix C instead of Attachment 16C. Revise accordingly.
    Response: The required change has been made.

21. Section 7, page 7-1, revise the “final intermediate cover” to “final cover”. Please see comment 16.
    Response: This change has been made here and throughout the drawings and

text.

22. Section 7.2.4 Intermediate Construction Stage Plan Depiction, No. 2 references Drawing 39 instead of Drawing 42.
    Response: This change has been made.

23. Section 7.5.2 Sequence of Cell Construction and Waste Placement, No. 2 states that during the life of cell construction and waste placement, sediment basins will be constructed and dewatered per details on Drawing 62. Please note whenever the accumulated sediment exceeds one-half of the pond's storage capacity design, a schedule must be developed for removal of the accumulated sediment to restore the pond to its design storage capacity. Please include language in the operation and maintenance plan outlining this requirement.
    Response: Operations Plan Section 12.11.4 has been modified to include a statement regarding sediment removal.

24. Section 8.4, Soils Description is missing a discussion of the Final Cover Soil. Final soil cover is missing throughout the report. Please see comment 16.
    Response: We have added a new subsection to Section 8.4 for Final Cover Layer.

25. Section 8.4.2 Prepared Cell Subbase Soil, lacks a detailed discussion of the subbase preparation. Please include here what is discussed in Section 13-Construction Quality Assurance Plan.
    Response: We have added language to Section 8.4.2 regarding construction of the prepared soil subbase.

26. Section 8.4.4, Protective Layer, page 8-5, sentence four, states "The regulations also provide the option to place clean fill instead of select waste as the protective layer." Please note COMAR 26.04.07.18(B) does not provide the option to use clean fill in-lieu of the minimum of 4 feet of select waste. Please correct this discrepancy in the Report.
    Response: We have eliminated the statement regarding use of clean fill for the 48-inch thick protective layer above the Leachate Collection System.

27. Section 8.4.6, Intermediate Cover Soil, states that Specification Section 02224 distinguishes between the general layers of intermediate cover and the "final layer' of intermediate cover. Please note that the intermediate cover should not be confused with the 2-feet of final cover placed over the waste, to minimize confusion please change the "final layer of intermediate cover" to "final cover" in the report and in the drawings. Please see comment 16.
    Response: We have created a separate Specification Section (02229) for Final Cover and removed references to "final layer or intermediate cover" from Section 02224.

28. Section 8.4.7.1 Closure Cap Protective Cover states that final cover soil is miscellaneous soil material. Please clarify what is meant by miscellaneous. Please see comment 16.
    Response: The referenced section has been revised to specify that the

protective cover soil layer component of the Closure Cap shall be Structural Fill. The Structural Fill Specification (Section 02223) has been revised to specify that the maximum particle size of Structural Fill utilized as the protective cover soil layer is <2-inches.

29. Section 9.1.2:

    a. COMAR 26.04.07.16C(3) requires the design of the liner to "Include a liner installed over a prepared subbase, free of objects which could damage the liner material, with a minimum thickness of 2 feet and having a permeability less than or equal to 1 × 10-5 centimeters/second" The proposed alternative liner must include 1 foot of prepared subbase in addition to the geosynthetic clay liner.
    Response: Based on MDEs statement that the GCL would not be approved as an alternative liner during the July 20, 2021 review of the comments, we have revised the designed to specify a 24-inch thick prepared subbase with permeability equal to or less than 1x10^{-5}cm/sec. This comment is no longer relevant.
    b. You have proposed to use a geosynthetic clay liner (GCL) instead of the required prepared subbase clay soil to be placed under 60 mil high density geomembrane (HDPE) synthetic liner. MDE has approved the use of GCL on a case by case basis based on site specific demonstration. Also, it is important to note that the permeability of the GCL is not the only factor of consideration for demonstrating GCL's equivalency with the required subbase clay soil. The subbase soil must be constructed of material capable of supporting the liner and be resistant to pressure gradient above and below the liner in order to prevent failure of the liner due to settlement, compression, puncturing, tearing, or cutting during liner placement and landfill operations. MDE has observed at other sites GCL panel separation under the HDPE liner due to inadequate support of the liner composite by the subsurface materials. Please revise the liner system design in accordance with COMAR 26.04.07.16C(3).
    Response: Based on MDEs statement that the GCL would not be approved as an alternative liner during the July 20, 2021 review of the comments, we have revised the designed to specify a 24-inch thick prepared subbase with permeability equal to or less than 1x10-5cm/sec. This comment is no longer relevant.

30. Page 9-1 states that the landfill will include 4 ft of protective cover. Please clarify that the 4 ft. of protective cover is select waste containing no long pipes, boards, or other materials that could damage the liner and leachate collection system. It is recommended to use the "select waste" throughout the report to minimize confusion.
    Response: We have revised the submission to refer to the 48-inch thick layer as Select Waste and we added additional detail as requested to the description of Select Waste in Section 9.1.2.

31. Section 9.2 Cap and Closure System, COMAR 26.04.07.18H requires a uniform compacted layer of earthen material not less than 2 feet in depth shall be placed over the final lift not later than 90 days following completion of that lift. The plans and design show the final waste lift only covered with a 1' intermediate cover. Please correct

throughout the report and drawings. Please see comment 16.
Response: The design has been revised to specify a 24-inch thick Final Cover over the top of waste within 90 days.

32. Section 9.2 Cap and Closure System, it is recommended that the proposed 40 mil LLDPE liner clearly state that it is textured on both the top and bottom of the geomembrane.
Response: The LLDPE description under Section 9.2 specifically calls out that the LLDPE shall be textured on both sides.

33. Section 9, Geotechnical Considerations, the table of contents and attachments have discrepancies, there are two attachments named 9E; Attachment 9F in the electronic copy does not match with the attachment in the print copy; the table of contents shows that Attachments 9E, 9F, and 9K are "in progress"; and Attachment 9G listed in the table of contents is not included in either the hard or electronic copy. Please revise the narrative and plans accordingly, and ensure that when resubmitted both the digital and print copies are identical.
Response: Section 9 Table of contents and Attachments have been reviewed and revised for consistency. The "in-progress" statement should have been removed prior to the previous submission. We will provide a link to our file server for the updated/corrected digital copy upon request.

34. Section 10, Leachate Management, Tables 4 and 5, include Cell 5F. However, Cell 5F is not depicted in all of the drawings included in the report. To minimize confusion, the narrative and the drawings must show all the proposed cells listed on Tables 4 and 5 in the report. Please revise the narrative and plans accordingly, and ensure that when resubmitted both the digital and print copies are identical.
Response: These revisions have been made.

35. Section 10.3 Leachate Collection System COMAR Regulations, page 10-2, revise the typo "COMAR 26.04.07.160C(6)(a)" to "COMAR 26.04.07.16C(6)(a)".
Response: The requested revision has been made.

36. Section 10.4.1 Pump Levels Sensors and Alarm Systems states that level sensor pump-off position will be 9 inches above the sump floor, pump-on position will be 6 inches above top of sump, and pump high level alarm will be 1 foot above top of sump. Please include a detail on Drawing 19 that depicts these pump control positions.
Response: The requested revision has been made. We have set the on level at 12 inches above the bottom of the sump and the off level at 6 inches.

37. Section 10.9 Develop Leachate Generation Rates, Table 2 Closure Cap (Final Cover) system configuration lacks the 2 feet of final cover placed over the waste. Please see comment 16.
Response: Table 2 has been revised to state that the Final Cover Layer is 24-inches thick.

38. Table 11-1, Gas Extraction Well, the table has waste thickness errors. Revise accordingly.
Response: Table 11-1 has been revised.

39. Section 11.3.3.4: Please also record the highest methane reading in addition to the steady state reading.
Response: We have added a statement requiring that the highest methane level be recorded.

40. Section 11.3.5 states "If the methane levels in the monitoring probes remain in compliance for a period of two (2) years, or eight (8) quarters, the frequency of monitoring can be scaled-back to annually with notification to MDE of the change." This language must be removed. Quarterly gas monitoring will be required throughout the life of the landfill and will continue, at minimum, until the 5-year post-closure period has ended. Sampling frequency may only be reduced after the permittee has petitioned MDE with supporting data and that petition for a reduction in frequency has been granted.
Response: The text has been modified as requested.

41. Section 11.4.2 Notification requirements. The gas management plan should specify that MDE will be notified in writing within 24 hours of a methane compliance level exceedance. Additionally, a remedial plan will be required within 60 days, not 90 days.
Response: The text has been modified as requested.

42. Section 11.8.2, Piping and Condensate Management, states that condensate sumps or leachate collection system are designed to collect and dispose of the condensate. Section 11.8.3, states that a moisture separator is an expansion chamber located just upstream of the blowers. Please show these features in a drawing.
Response: We have modified the design to eliminate the drain from low points in the header on the landfill to the leachate collection system riser pipes, because the interconnection could result in loss of negative pressure in the headers. The design has been revised to include a standard condensate sump configuration that allows the condensate to enter the sump through a J connection and infiltrate back into the waste. A detail of the sump has been added to Drawing 88. We have added a schematic for the expansion chamber (a.k.a. "knock-out tank"), blower and filter system at the Flare Paddock to Drawing 59. Specific details regarding the size of the knock-out tank will be prepared during final design of the skid mounted flare system. Typically the Knock-out chamber will be 2 to 3 feet in diameter and 4 to 8 feet high.

43. Section 12, a typo "landfill managermanager" occurs several times.
Response: This edit has been made.

44. Section 12, Operations and Maintenance Plan, the plan must describe that the disposal site shall be graded and drained to minimize runoff onto the fill area, prevent erosion and ponding within the fill areas, and drain water from the surface of the rubble landfill, as required by COMAR 26.04.07.18I. The cell sequencing plan shall describe in detail how operations will minimize runoff onto the fill area, prevent erosion and ponding. This should include a sequence for staged land clearing.

Response: We have provided a "typical Stormwater Separation Berm" on Drawing 84. This shows the creation of a berm on the perimeter of active cells that abut an undeveloped cell area that is higher in elevation and could shed water onto the cell. The sequence plans (Drawings 64 to 81) show the grading for the "clean water" drainage channels at various stages of development and filling. We have also added language to Section 12 describing that surface of the waste will be graded and drained to shed water off the surface of the waste and into the leachate collection system. The limits of clearing will be defined by the area of grading at each stage of development.

45. Section 12.1 General, page 12-1, last paragraph states that in the event of a transfer of ownership, all responsibilities of the Operator shall remain. Please note that a permit is valid only for the permittee named and may not be transferred to another entity. The new entity must obtain a new Refuse Disposal Permit from MDE. The permittee remains responsible for fulfilling the requirements of the permit until such time as a new permit is issued.
Response: This statement has been removed.

46. Section 12.3 Service Information, page 12-3, states "The landfill will be operated until the design capacity has been reached" should be amended to read, "The landfill will be operated until the design capacity has been reached or the life allowed under the special exception has expired." All other references in the document to the life of the landfill should reference the life allowed under the approved special exception.
Response: We have modified the text to clearly state that the operating life for receiving waste is 12 years.

47. Section 12.6.2.1 Hours of Operation includes information about Millersville Landfill. This is not relevant to this landfill. Also, this section states that "There may be some operational activities that are addressed for half a day for cleanup and maintenance efforts." All landfill operations must occur during the approved hours of operation.
Response: The reference to Millersville has been corrected. We have added language indicating that no waste receipt will be performed on weekends. It is our understanding that the Special Exception limitations on operations is limited to receipt and placement of waste. Leachate management and repair required to maintain compliance may need to be performed on weekends, depending on nature and urgency of the item.

48. Section 12.6.2.3 Optional North and South Entrances discusses daily waste acceptance rates, vehicle arrival and processing times. Additional information should be provided regarding the vehicular traffic needed for recycling of materials salvaged in accordance with Section 12.7.6. Section 12.6.2.3 refers to Section 3.6.3 and 3.6.4 of the Phase III Report, but these sections do not exist in the report. Please include the missing information.
Response: The reference has been corrected. We have added discussions regarding the traffic associated with recycling and salvage, and included estimates for leachate transportation.

49. Section 12.7.1 Types of Waste states “No hazardous materials will be accepted or disposed within this landfill unless approved by the MDE.” COMAR 26.07.07.03B(5) specifically prohibits solid waste facilities from accepting controlled hazardous waste. Please change this sentence to be clear that hazardous materials will not be accepted or disposed of at the landfill. Also, the lists of solid waste to be accepted and not to be accepted should be described in this section instead of Section 12.3 Service Information.
Response: The requested change has been made.

50. Section 12.7.7, Filling Operation, states that the select waste shall contain no long pipes, boards, or other objects judged by the operator to be detrimental to the underlying liner system or leachate collection system. Please note that the permittee must notify MDE prior to the placement of the select waste. Also, Filling Operations discusses stripping periodic and intermediate soil cover. Stripped cover material is considered contaminated and cannot be used again for cover materials. Intermediate cover should not be removed after placement. Please update soil balance calculations.
Response: We have added a statement that the MDE must be notified ahead of time for placement of Select Waste. We have added language stating that cover soils cannot be reused.

51. Section 12.7.8, Alternate Periodic Cover Material (APCM), states APCM may be in use at site, with prior approval of MDE. For this project the APCM considered are fabric type alternative cover, incinerator ash and flyash/bottom ash. You also cited the use of fly ash approved by the USEPA, PADEP, and CAL/EPA. Please be advised that the proposed landfill is a rubble landfill, and COMAR 26.04.07.13B(2) and COMAR 26.04.07.13B(3) prohibit the use of industrial waste or byproducts, such as incinerator ash or coal combustion byproducts including coal fly ash. Also, incinerator ash and flyash are not permitted as cover or fill in Anne Arundel County.
Response: The text has been revised to limit the APCM to synthetic covers.

52. Section 12.7.9 Handling of Special Waste should include a statement that if hazardous waste is identified in waste accepted at the facility, the permittee shall immediately (within 2 hours) report to MDE all incidents of discovery of any unacceptable hazardous waste materials in a load of waste. The landfill shall then submit to the Department a written report within 5 working days following the discovery. When the source of waste is known, the written report shall include the source of the waste, the transporter of the waste, the circumstances of discovery, a description of efforts to secure and control the waste and any release of pollutants from the waste, the current location and if known, the final disposition of the waste. If the source of waste is unknown, the written report shall include the circumstances of discovery, a description of efforts to secure and control the waste and any release of pollutants from the waste, and the current location and final disposition of the waste. If the source of unacceptable hazardous waste is known, the permittee shall reject the waste material and advise the generator or hauler of the reason of rejection. If the source of unacceptable hazardous waste is unknown, the permittee shall separate and handle the waste material in accordance with the applicable requirements of COMAR 26.13.02 “Disposal of Controlled Hazardous Substances”.
Response: The text has been revised to include the requested text/requirements for responding to incidents of hazardous waste being delivered

to the site.

53. Section 12.9.3 Periodic Cover should include a statement that the cover will be graded to minimize infiltration and erosion, and prevent standing water at the working face.
Response: The requested language has been added.

54. Section 12.9.5 Final Cover includes description of a 12-inch intermediate layer and an additional 24 inches of intermediate cover. COMAR 26.04.07.18H "Final Cover Material" requires a uniform compacted layer of earthen material not less than 2 feet in depth shall be placed over the final lift not later than 90 days following completion of that lift. COMAR 26.04.07.21G provides that rubble landfill closure caps must have a minimum 2 feet of final earthen cover placed over the drainage layer of the capping system. Intermediate cover is not part of the final cover. This section is confusing as it seems to be discussing both the final cover material and the capping system, but also includes intermediate cover. Please revise for clarity.
Response: This section and other portions of the text and design Drawings have been revised to provide greater clarity regarding the Final Cover, Intermediate Cover and Closure Cap.

55. Section 12.11.7, Areas Subject to Spills Inspection Plan, page 12-21, states the fuel storage area will be surrounded by an earthen containment of adequate capacity to hold the entire contents of the tanks should a spill occur. The Phase III Report should include a stormwater pollution prevention plan.
Response: We have added language to the section stating that a SWPPP is being prepared and will be submitted to MDE under separate cover. The SWPPP is being prepared in accordance with the MDE standard Template required as part of the NOI for stormwater discharge.

56. Section 12.12.1.2.1 Leachate Pumps

    a. The third paragraph discusses the sensor pump-off position will be set at 9-inches foot above the sump floor. Please clarify where the sensor position will be located. You are required to maintain less than one foot of leachate on the liner. Please see comment 36 above.
    Response: We have revise the settings for the pumps to turn on at 12 inches above the bottom of the sump, turn off at 6 inches, and to trigger a high level alarm at 16 inches.
    b. The last paragraph and Section 10.4.1 Pump Level Sensors and Alarm systems state that during landfill non-operation hours, the landfill manager will receive a high-level alarm signal, via telemetry from the Pump control Panel. Please provide, by title, a minimum of two people who will receive leachate alarm notification. Also, Section 10.4.1 states that a master control panel will be located in the leachate storage facility controls building. Please depict the building on the Drawing.
    Response: The master control buildings are located adjacent to the leachate storage tanks and are called out on Drawing 10. We have added the Landfill Superintendent as the second contact.

c. Please provide information on the frequency of emptying of the storage tank.
Response: We have added language regarding the emptying of the storage tanks.

57. In Section 12.12.1.2.1.2, Force Main Access and Maintenance, the 2nd paragraph states that forcemain cleanouts are provided at minimum 400 feet intervals as noted on Drawings but Drawing 22 shows 500 feet maximum spacing. Please revise the plan and/or text to eliminate the discrepancy.
Response: The spacing on the drawing has been changed to 400 feet.

58. Section 12 Attachment 12C, Safety Precautions for Equipment Operators, 3.S, states "do not mix heavy traffic with light trucks". The operation plan must describe the procedure if separate unloading areas for pickups and other light vehicles will be provided.
Response: We have added language to Section 12 regarding the intent of keeping light trucks and heavy truck away from each other. As described this may include sending one type of truck to one active cell and the other to a second active cell, or directing one type of truck to one end of the working face and the other type of truck to the opposite end.

59. Section 12 Attachment 12D paragraph states, "This written plan has been developed to assist the Chesapeake Terrace Rubble Landfill in the management of emergencies that might reasonably be expected to occur at the landfill site located at (insert landfill street address here)." Revise to include the address.
Response: A street address will not be known until the final entrance location is determined. The plan will be modified with the address at that time.

60. Section 12, the Operation Plan must include that when there is power outage a standby generator and portable pumps to pump the leachate from the sumps to the leachate storage tanks is available on site, also pumps in various capacity, lighting for emergency work.
Response: We have added language requiring that standby power be provided for the scale house, leachate collection systems and the leachate storage tank areas. The statement also requires that it be included as a requirement of the County electrical building permit. We also included language that the site must maintain at least one mobile, generator powered light standard.

61. Section 13, lacks a statement including the ≤ 15% carbonate content acceptance limit for the leachate sump aggregate. The testing frequency listed in Table 1 is 1 per source but it should include the frequency per stockpile.
The statement has been added and included in the Table.

62. Section 13.1.3 Project Design, is missing the final cover layer under the landfill cap. Please see comments 16 and 54.
Response: We have added text regarding the Final Cover layer.

63. Section 14, states "intermediate cover is material used as the final grading layer on the waste prior to the installation of the geosynthetic closure capping system and Technical

Specification 02224, states that the final grading layer on the waste shall consist of at least 12-inches of soil. Please see comment 16 and 54.
Response: The text and drawings have been revised to clarify the differences between the various types of cover layers/materials.

64. Section 15 Closure and Post Closure Plan

    a. This section lacks the required provision that a uniform layer of earthen material, not less than 2 feet in thickness will be placed over the final lift of waste not later than 90 days after the completion of the final lift, and within 30 days after the final earthen cover has been installed, the area shall be vegetatively stabilized as required by COMAR 26.04.07.21(E)(4). Please see comments 16 and 54.
    Response: The Section 15.1.2.1, and other relevant portions of the text have been revised as requested.
    b. Deed notation should be included in the plan to indicate that the land has been used as a solid waste disposal site and that the use of the land is restricted.
    Response: We have added text to Section 15.1.1 referencing the deed restriction. NWM will file the deed notice as stated in our response to comment 79.

65. Section 15.1.4 Leachate Collection System, states the leachate will be collected into the leachate collection sumps and pumped to the on-site leachate storage tanks and subsequently transported by tanker truck to a water treatment facility in the area. Please include the name of the leachate treatment plant.
Response: We have added information regarding the off-site leachate treatment/disposal facility to Section 15.1.4.

66. Section 15.1.8 lacks a sentence stating that certified as-built plans for the completion of the closure cap will be submitted to MDE no later than 90 days after completion of the cap.
Response: We have added language to Section 15.1.8 regarding certified as-built plans within 90 days after cap completion.

67. Section 15.1.2.5.1 Erosion and Sedimentation Control Plan, states that the revised design will be submitted to AA Soil Conservation District for review and approval. The approved erosion and sediment control plan and stormwater management plan must be submitted to MDE prior to the approval of the Phase III plan as required by COMAR 26.04.07.16A(11).
Response: The revised Phase III Application is being submitted to AASCD for review and approval concurrently with this submission to MDE. We will forward proof of the AASCD approval, as soon as it is received.

68. Section 15.2.3.1, states that once leachate is no longer detected in the cell sumps for a minimum period of 6 months, the pumps may be removed and no further maintenance/inspection is required for the leachate collection system. This practice is unacceptable. Please revise this section to address that the leachate collection system stays operational throughout the post-closure period.
Response: The requested change has been made.

69. Section 15.2.4, Inspection Plan, references Table 1 instead of Table 15. Also, include a language in Table 15-1 stating the closure cap will be inspected as soon as possible after major storm events.
Response: The reference has been revised to state Table 15-1. We added a new line item to Table 15-1 regarding cap inspections monthly and as soon as possible after major storm events.

70. Section 15.2.5.1 Water Quality Monitoring, states that the sampling of the surface water sedimentation basins are described in the facilities NPDES Permit. Please include a copy of this permit in the Report.
Response: We submitted a request to MDE for a copy of the NPDES and contacted a former consultant involved in the project regarding a facilities NPDES Permit. Based on those efforts, we have concluded that the reference to an existing NPDES Permit for the Site is erroneous and therefore have removed the reference from the text.

71. Section 15 Table 15-2, Landfill Closure Cap Inspection includes a checklist which sets the standard for the identification of an area of poor vegetation as being an area of >3000 square feet area with <30% vegetation. This is unacceptable. Revise the checklist to include a language stating any areas of poor vegetative cover will be considered a reportable issue, and require repair.
Response: We have revised the referenced checklist items to remove the square footage and replaced it with "areas of any size".

72. Section 16.3.1 states, "[T]he permanent groundwater monitoring network will consist of one (1) exiting* and fifteen (15) new wells around the perimeter...". Please revise the typo from "exiting" to existing".
Response: The requested change has been made.

73. Section 16.4.3 Groundwater Sampling and Analysis, states that "Groundwater from the permanent groundwater monitoring network wells will be sampled a minimum of 4 consecutive events prior to the start of waste placement within their respective areas (e.g. Area A wells will be sampled a minimum of 4 time prior to the start of waste placement in Area A disposal cells, and Area B wells will be sampled a minimum of 4 times prior to the start of waste placement in in Area B disposal cells). The results from the 4 initial sampling events (plus any previous results from PMW-6) will be used to establish a statistical database for groundwater quality. Each sampling event shall be no less than 6 weeks after the end of the previous event and no greater than 20 weeks after the end of the previous event." The 4 consecutive sampling events collected prior to waste placement should occur through all seasons throughout the year to help interpret any seasonal variability. The permittee may elect to collect samples at minimum every six weeks; however, please be advised that frequency of sampling may not capture yearly seasonality, and so MDE may require more than 4 samples. Also, this requirement must be met at all wells.
Response: The Section 16.4.3 text has been revised to state "The first sampling event will begin approximately 2 to 3 weeks after the completion of well installation and development. Subsequent sampling events shall be performed

once each subsequent calendar quarter." NWM will install and begin sampling all wells in the proposed groundwater monitoring network following MDE permit issuance. In addition, monthly depth water reading will be collected from all new and all available existing wells.

74. Section 16.8 The permit will require MDE be notified of a Maximum Contaminant Level exceedance in writing within 24 hours of receipt of the laboratory report detecting the occurrence. Please note this requirement in this section.
Response: The requested change has been made.

75. Section 16.10 and Attachment 16C regarding the evaluation of residential well water levels states: "Quarterly water level measurements at wells PMWs-120, 121, 122 and 123 will continue through the operating life of disposal cells 5A through 5D and cells 6 through 10." Monthly water level readings for all site wells and piezometers will be required upon issuance of a refuse disposal permit regardless of which cells are in operation. Section 16.10 and Attachment 16C must be revised to reflect that requirement.
Response: Section 16.10 and 16.4.1 to state the requirement for monthly water level measurements throughout the construction and operating life of the facility.

76. Section 16, Table 1 Note includes the following, "The screened interval for the typical Unconfined WBZ wells will begin at approximately one foot above the highest observed/predicted groundwater level as presented on Table 1 (above) or a minimum of 7 feet below the ground surface (whichever is greater). When the interval from one foot above the highest observed/predicted groundwater level to the top of the MCU is less than 10 feet but greater than 8 feet, utilize the full 10 ft screen length and set the bottom of the screen into the MCU. When the interval is less than 8 feet, set the bottom of the screen 2 feet into the MCU and set the top of the screen at greater than 1 foot above the highest observed/predicted groundwater level, as necessary to maintain the 10 foot screen length. Where the 7 feet of separation between the top of the screen and ground surface cannot be maintained using a 10 foot screen length, reduce the screen length as necessary to maintain the minimum 7 feet of separation". MDE recommends a smaller screen length to reduce oxidation and reduction potential due to water level fluctuations which can impact groundwater chemistry.
Response: At the request of the MDE we have modified the text at the bottom of Table 1 to specify that the wells will be screened using a 5 ft. screen.

77. Section 16, Table 2: The lead Practical Quantitation Limit (PQL) for lead is listed as 10 ug/L. This does not meet the PQL of 2 ug/L which was provided in previous correspondence and will be part of an issued permit. Please amend the proposed PQL, or include documentation from the laboratory as to why the PQL listed in Table I cannot be achieved.
Response: PQL for lead in Section 16, Table 2 has been corrected from 10 ug/L to 2 ug/L.

78. Section 16 Attachment 16D: Please include a map for the groundwater plan that only depicts groundwater contours and removes the cross-section lines.
Response: Section 16, Attachment 16D is a copy of Figure 12 from the Phase II

Application. As requested, we have removed the cross-section lines from the Figure.

79. Prior to issue of the permit you must submit proof that the deed pertaining to the proposed site has been amended to stipulate that upon close-out of the operation, construction or excavation on this site may not begin without first obtaining written authorization from MDE as required by COMAR 26.04.07.17B and 26.04.07.09B.
Response: NWM is prepared to amend the deed for the property as stipulated, after notification that the Permit is approved and ready for finalization.

80. Comment: Drawing 3, The East Entrance is labeled assumed future entrance (see Drawing 3). This is Drawing 3, please clarify. The North Entrance refers to Drawing 5 but should refer to Drawing 6. Please review all Drawing references for accuracy.
Response: The references cited on Drawing 3 have been reviewed and edited. Please note that the Drawings for the North and South entrances have been changed to 89 and 90, respectively.

81. Drawing 4, Note 9 states that the wheel wash shall have a water storage compartment with the pipe drain connected to a concrete cleanout, and that the landfill operator shall pump water from the clean out to a tanker truck. Please address where the water pumped to tanker truck be disposed of, and the conditions for determining when the sediment in the cleanout concrete must be cleaned out (e.g., a frequency, depth of sediment, etc.).
Response: We have added additional language to Note 10 on Drawing 4, Note 9 on Drawing 5, and Note 9 on Drawings 89 and 90 (formerly Drawings 6 and 7) stating that the water pumped from the clean out may be used for dust suppression in active waste fill areas or shall be transferred to the leachate tanks.

82. Drawing 6 shows a three lane entrance road (39 feet wide) with a 15 feet wide 'queue lane" and a 24-feet wide egress/ingress for the Optional North Entrance but the width of the entrance road shown on Drawing 8 is 24 feet. Also, on Drawings 64 and 65, the optional north entrance is labeled as the East Entrance. Please revise the plans to eliminate these discrepancies.
Response: We have added a new detail to Drawing 8 specifying a width of 45 feet wide for the "Optional North Entrance" and 60 feet wide for the "Optional South Entrance" queue lanes. We have revised the referenced notes on Drawings 64 and 65 to more clearly state that the 12 feet wide emergency vehicle lane and associated 30 feet wide clearing are only required if the "Optional North Entrance" is not constructed as the main facility entrance.

83. Drawings 10 and 11:

    a. These drawings are titled "Top of Subbase Grading Plan", but Drawing 14 "Liner System Details" does not show the required two feet of subbase. Also, please include a Drawing that shows the prepared subbase plan, and include a note that the cell floor shall have a minimum of 2 percent slope post-settlement at all locations.
    Response: We have created grading plans showing the Bottom of

Subbase (Drawings 6 and 7) based on a subbase thickness of 24 inches. (Previous Drawings 6 "Optional North Entrance Plan" and 7 "Optional South Entrance Plan" have been renumbered as Drawings 89 and 90 respectively). Drawings 10 and 11 present the Top of Subbase, with grading that is 24 inches higher than bottom of subbase grading. We have added a note to Drawings 10 and 11 that "the cell floor shall have a minimum of 2 percent slope post-settlement at all locations".

b. Please label the percent slope of the cell floors. Some slope arrows are not pointing in the direction of the leachate flow and seem to have an elevation labeled that is not consistent with the cell floor, but instead the closure elevation. Also please provide the acreage of the cells.
Response: The cell floor slope arrows on Drawings 6 and 7 (presenting bottom of prepared subgrade) and Drawings 10 and 11 (presenting the top of prepared subgrade) have been revised to show the slope alignment towards the sumps. The slope for the leachate collection headers and laterals can be found on Drawings 17 and 18. The slope arrows for the cross cell laterals do not point to the sump, but rather to the header. We have added tables providing the cell areas and critical sump elevations to Drawing 6 and 10 for West cells and Drawing 7 and 11 for the East cells.

c. The meaning of the blue lines in the drainage area, and the green, purple and orange lines, are not included in the legend.
Response: The blue lines on Drawings 10 and 11 is the floodplain, we have revised the line type in the legend to more closely match the line type in the Drawing. The green line on Drawing 11 is the wetlands line, this is already in the legend. There are no wetlands on Drawing 10. There are no purple or orange lines on Drawings 10 or 11. We identified a small section of purple contours in Basin 4 on Drawings 18 and 39 that has been changed to black. There are no orange lines on Drawing 10 or 11. The only orange lines in the entire drawing set that were not defined in the legend are on Drawings 31 and 39. We have added a label to this line identifying it as "the alignment of the emergency access road if the North Entrance option is not constructed".

d. Cell 5C appears to be missing a contour line in the corner farthest away from the sump if the slope remains consistent throughout the cell floor. Show the 2% minimum slope in this corner.
Response: We added the missing contour line in the corner of Cell 5C.

84. Drawing 14:

a. You have proposed an alternate liner system. The report must be revised using the COMAR liner system. Please remove references to the unapproved alternate design.
Response: We have eliminated the alternate liner system and revised the details and design grading plans to clearly state that the liner system shall consist of (from top to bottom) 48 inches of Select Waste; 10 oz/sy nonwoven geotextile; 24 inches of Leachate Collection Layer; Geocomposite Drainage Layer; 60 mil HDPE Geomembrane; and 24 inches of prepared Subbase (with a permeability less than or equal to $1x10^{-5}$

cm/sec).

b. Detail 1 shows 24-inches of select rubble waste instead of 48-inches.
Response: The design has been revised to specify 48 inches of Select Waste above the leachate collection layer.

c. In Detail 2/14 it is recommended that the anchor trench be 2' x 2' with geosynthetics running through the bottom of the trench, like an L shape, to prevent pullout.
Response: We have modified the anchor trench detail to show a bottom width of 24 inches, with the geosynthetic components running to the back of the trench.

d. In Detail 2/14 the geocomposite label points to the geotextile layer, please correct this misidentification.
Response: The geocomposite leader line has been fixed.

e. It is recommended that the "protective cover" be called "select waste" to minimize confusion.
Response: We have made the revision as requested.

f. In Detail 2/14 the 1 foot minimum temporary cover shown must be a well compacted select fill.
Response: The referenced detail has been revised and does not call out the temporary cover layer.

g. Detail 3/14 should show the 3 feet minimum buffer distance from the highest observed or predicted groundwater elevation.
Response: We have added the 3 feet minimum separation to the detail.

h. Detail 4/14 does not label the 10 oz non-woven geotextile over the leachate collection layer.
Response: The referenced detail has been modified and the geotextile layer referenced.

i. Liner System Detail (Sheet 1 of 3), Detail 1-COMAR Required Liner System and Detail 2-Alternate Liner System Floor shows the 3 feet buffer requirement as part of the prepared subgrade. This nomenclature is confusing. Please note, the 3 feet buffer should be depicted based on the maximum observed/expected groundwater elevation and not part of the cell floor subgrade preparation. The cell floor grading through excavation and/or structural fill must be above the 3 feet buffer requirement. Please correct the details to show this information.
Response: We have modified the design and design details to indicate at least 3 feet of vertical separation between the maximum observed/predicted groundwater level and the bottom of the 24-inch thick prepared subbase layer.

85. Drawing 17:

a. Cell 5E has a leachate header pipe along the crest of the cell floor - what purpose does this serve?
Response: Cell 5E was separated into two cells (Cell 5E and Cell 5F). The referenced header pipe is for the Cell 5F. We have modified the Drawings to depict the additional Cell.

b. Leachate Collection System Grading Plan & Layout West (1-10) shows two 8-inch leachate collection headers in Cell 5E. As depicted on this drawing, there are to lowest points/sumps for this cell. What is the reason for having two sumps

in one cell? Should there be an intercell berm for Cell 5F that was included in Tables 4 and 5 (see comment 33 above) but not depicted in drawings? Please clarify this.
Response: Cell 5E was separated into two cells (Cell 5E and Cell 5F). The referenced header pipe is for the Cell 5F. We have modified the Drawings to depict the additional Cell and show the inter-cell berm.

86. Drawing 18, Cell 11 has a 6" leachate collection lateral that doesn't connect to the force main. Please clarify. There is a cleanout pipe missing on the other 6" leachate collection lateral.
Response: The 6" leachate line was an erroneous line that has been removed. We have added the missing cleanout.

87. Drawing 19:
    a. Detail A/19 Section A-A' shows a 2" HDPE SDR-17 Forcemain inside 6" HDPE SDR-17 Containment. All other references to forcemain sizes are 6" pipes inside 10" containment. Please clarify if this is an error, or if the pipe changes sizes.
    Response: The referenced details should be a 6" inside a 10" containment pipe. With have corrected the detail.

    b. Detail A shows a protective cover/select waste and mulch/wood chips placed on the side slope, please note the select waste should be placed on all areas of the side slope. Also, mulch/wood chips are proposed as a temporary fill; please note that a structural fill should be used as temporary fill.
    Response: We have changed the specified detail and material to structural fill beneath the riser pipes and added a notation that it will be removed at time of cap construction.

88. Drawing 20:
    a. Detail 2 – How will the cleanout be supported/protected?
    Response: Detail 2 on Drawing 20 depicts the Cleanout Pipe during filling operations. The Cleanout Pipe is supported by the Structural Fill placed as Temporary Cover over the liner system. We have added a note to Drawing 20 indicating that the length of the pipe protruding from the Temporary Cover shall be 3 feet (max). This will ensure the pipes will be self-supporting. We have added additional detail to Detail 3 on Drawing 35 showing the Cleanout configuration after Closure finished in an HDPE box with bolted lid set in concrete.
    b. Details 2 and 3 show the side slope at 2:1 slope instead of 3:1.
    Response: The referenced side slopes are intended to e 3:1. The details have been revised.
    c. Detail B does not show the type of geotextile placed on the 57 stone aggregate.
    Response: We have added a notation regarding the geotextile weight around the 57 stone.

89. Drawing 22: Please provide a detail that shows the forcemain coming from the cell connecting into the forcemain that carries leachate to the storage tanks. Also, see comment 55 above for forcemain cleanouts spacing.

Response: We have added details regarding the transition from the forcemain with secondary containment from the cells to the tanks. As shown on Details 1 and 2 on Drawing 28 and Detail 2 on Drawing 29, the forcemains will remain underground until they reach a valve vault adjacent to their respective leachate tank containment areas. From the vaults, the lines will turn vertically to follow the outside wall of the containment area and then turn horizontal at the top of the wall. The secondary containment will termination 2 feet inside the containment wall and the primary pipe will proceed to the tank inlet. There will be separate inlets for each forcemain. We have also modified the spacing for the forcemain clean out spacing to 400 feet (max).

90. Drawing 27: sub-cells 5A through 5F are shown in the "list of pumps table" but Drawings 3, 10, 12, and 71 through 81 show sub-cells 5A through 5E. Revise the plans to eliminate these discrepancies.
Response: This discrepancy has been corrected.

91. Drawing 29, Detail 2 shows the pipe to drain spilled leachate from the leachate loading pad to the secondary containment sump but there is no further description of how and when this liquid will be pumped from this sump. Also, Detail 3, lacks a pipe connection from Tank 101 or Tank 102 to the loading pipe.
Response: We have added a note to Drawing 29, stating that leachate spilled during tanker truck loading shall be pumped from the tank containment area sumps to the leachate tanks. We have modified detail 3 on Drawing 29 to show both tanks connected to the loading pipes. We also modified to pipe material from 2" HDPE to 2" SCH 80 PVC.

92. Drawing 34:
    a. Details 1, 2 and 4 – As discussed in previous comments, 24" of final cover is required under the liner.
    Response: This change has been made.
    b. Detail 2 –How will the lower geocomposite be anchored to prevent slide? How will the upper geocomposite prevent stormwater from backflowing inward if the bench is at full capacity, the detail does not clearly show if it is at a higher elevation than at the top of the bench. Is it designed this way because there is a concern that the geocomposite will not be able to adequately manage the infiltrated stormwater conveyance, and if so, is there a different geocomposite with a greater capacity?
    Response: Detail 2 has been revised to eliminate the toe drain above the Final Cover Terrace. The geocomposite is adequately sized to convey the anticipated flow rates within the geocomposite Drainage Layer.
    c. Detail 3 – Why is there an anchor trench on the flat portion of the cap and how will this trench convey stormwater off the top of the landfill if it is left in place? It does not appear that the trench would be removed after being tied into the next phase. Please explain this design feature.
    Response: The anchor trench is intended to be temporary. We have added notes stating that the trench will be removed when the future Closure Cap is installed, that the 10 oz/sy non-woven geotextile and rub sheets are temporary, and that the temporary anchor trench should be backfilled with

Final Cover material.

d. Detail 4 – Select waste is shown directly over the prepared subgrade, without a bottom liner system present. The cap liner system must be tied into the bottom liner system.
Response: We have modified the detail to clarify that the Liner System geosynthetic components are present, and that the Select Waste layer terminates inside the top of berm.

93. Drawing 35:

a. Detail 2, see comment 16.
Response: Detail 2 has been revised to show 6-inches of vegetative support layer, 18-inches of protective cover, cap geosynthetics and 24-inchese of Final Cover
b. the geocomposite drainage net is labeled as “turf reinforcement matt”.
Response: The Figure has been revised.
c. a 12-inch intermediate cover is labeled “AASHTO No. 57 stone”.
Response: The details have been revised.

94. Drawings 36 and 37 show the proposed maximum grade elevation is 270 feet above mean sea level (ft-amsl), please confirm that the max elevation for the landfill will not exceed 30 feet above the natural grade of the surrounding to conform with the Anne Arundel County Code § 18-11-131. Drawing 36, Note 4, revise the typo “time of concentration”.
Response: The landfill cap grades have been revised. The revised top of cap grades have been set at or below elevation 226. The highest natural grade is elevation 196. In addition, the cap slope has been reduced from 3:1 to 4:1. The result of the cap changes and the raised bottom of cell elevations is a reduction in volume of approximately 40-percent. The revised volumes are provided in greater detail in Section 5.0.

95. Drawing 46 Sediment Trap Details is blank. Are there Sediment Trap Details?
Response: A sediment trap will be required at the discharge to the Amtrak/Conrail right-of-way in the southwest corner of the site. Drawing 46 presents the general configuration for a sediment trap sized to accommodate the Optional South Entrance configuration. If the Optional South Entrance is not developed then a smaller sediment trap consistent with the Maryland Standards and Specifications for Soil Erosion and Sediment Control Detail G-1-2 (Drawing 61) will be required in the same location. We are preparing the Anne Arundel County Erosion and Sediment Control Permit Application based on the assumption that the Optional South Entrance will not be constructed (i.e. that the standard detail will be utilized). The remaining sediment traps are integrated with the propose based basins.

96. Drawings 64 and 65, revise the road labeled “assumed east entrance” to “optional north entrance”, and there is “tank overflow pipe” written on the drawing but no pipe is shown.
Response: The requested changes have been made.

97. Drawings 66, 67, 68 and 69 do not include elevations on the contours.
Response: We have intentionally left the contours for the bottom of cell grading off the sequence of construction drawings because the contours are intended to represent the cell that is under construction/awaiting to begin receipt of the waste. Therefore the contours present in the bottom of the cells could be Bottom of Subbase, Top of Subbase, and Top of Leachate Collection Layer, depending on the stage of construction. We have removed the contour labels from Drawings 71 through 80 for consistency between the East and West area information. Please see drawings 6 and 7, 10 and 11, and 17 and 18 for the Bottom of Subbase, Top of Subbase, and Top of Leachate Collection Layer elevations specifically.

98. Drawings 71 and 72 show stockpiles on the Cells 3 and 4 prepared subgrade. Notes on Drawings 72 through 81 state that place intermediate cover on portions of Cells which have achieved maximum filling grades. Please see comment 16 above.
Response: The referenced stockpiles will be removed prior to the start of subbase construction. We have changed the term Intermediate Cover in the notes to Final Cover and Closure Cap.

99. Drawing 85 – The gas probes are too far away from the landfill. By the time gas migration is detected, the gas will be leaving the property boundary. The gas detection wells should be located closer to the landfill. What are the arrows being depicted on this drawing? Please provide more information about this drawing.
Response: We have revised to locations for the gas wells. The revised locations are immediately outside the perimeter access road and drainage features. We have also shown the wells relative to the proposed cell grading.

100. Drawing 86, West Section Landfill Gas Collection Control System Plan shows Flare Paddock A and Flare Paddock B (See Drawing 85). Drawing 85 does not provide information about the Flare Paddocks. Does the gas collection system piping connect to the Flare Paddocks? The drawing does not show a connection to either flare paddock.
Response: Flare Paddock information has been added to Drawing 59. We have performed preliminary sizing for the system and have determined that for the projected volume of waste, the system will most likely be prefabricated modular or skid mounted unit(s). Drawing 59 shows the paddock as a single location near Leachate Storage Facility No. 1. Our layout shows separate units for the East and West areas, although the system may be a single unit if deemed appropriate by the vendor. We have specified the use of enclose flames. The connections will come to the paddock underground from the direction of their disposal areas. Within the paddock the header piping will come to the ground surface and connect to the modular/skid unit(s).

101. Drawing 87, the top of the landfill has a significant area that is void of gas collection system's area of influence. The gas collection system must be able to capture the gas that rises to the top of the landfill. Also, Flare Paddock B, depicted in Drawing 86, is not included in the same location on this drawing. Please clarify.
Response: Minor adjustments to the gas collection well locations have been made to reduce overlap and improve coverage. In addition, we determined that the radius of influence shown on the previous submission was only 120 feet. The

calculated radius was 132 feet. We have modified the radius of influence depicted on the Drawing to 130 feet.

102. Drawing 88:

    a. Details 2, 5, and 6 show 12" intermediate cover as the top layer. Detail 4 shows 16" of intermediate cover. Is the gas header pipe tying into the leachate collection system? Please provide a detail of the proposed header piping connection to the gas collection wells for collection, or vents to release the gas.
    Response: The details on Drawing 88 have been revised to show the 24-inch thick Closure Cap and 24-inch thick Final Cover. Detail 4 on Drawings 88 previously showed that the gas collection system header pipes had condensate drains connected to the leachate side slope risers. We have modified the design to eliminate this interconnection with the leachate collection system and are now proposing condensate sumps be located at the header low points. The sump is a 12-inch diameter HDPE pipe with bolted lid and a stone filled bottom set into the waste. The header will be interconnected with the sump by a 3-inch diameter HDPE pipe. See Detail 1 on Drawing 88 for the connection between the wells and the header pipe.
    b. Detail 2 shows a 14-foot depth from top of final cover to top of screen, and states that screen length is usually the well depth minus 16 feet. Is this always true?
    Response: We have modified the detail to include the 24-inch thick Closure Cap and 24-inch thick Final Cover. Based on the revised detail, the top of the screen is 18.5 feet below finished grade. The screen length will always be set as well depth minus 19 feet (18.5 feet plus 0.5 feet separation from bottom).
    c. and this detail lacks to show the depth between bottom of boring and bottom of screen.
    Response: We have revised the detail to show that the distance between the bottom of the hole and the bottom of the screen is 0.5 feet.

103. Drawing 40 is not included in the full-size drawing sets. Drawings 45 and 46 are described as being "in progress". Drawings 59, 82, 83, 84, 89, and 90 are reserved. Why are these Drawings listed in the Index?
Response: The drawing set has been completed. There are no longer any "Reserved" drawings.

II. Comments Pertaining to the Phase II Addendum:

104. The July 2020 sample for MW-22 returned a detection of acetone of 21 ug/L. No preceding sampling event detected acetone at MW-22. An equipment blank associated with the same day of sampling as MW-22 detected acetone at 25 ug/L. Considering the lack of detection during the previous events and that a similar concentration of acetone was detected within a blank sample, MDE questions whether the acetone detection at MW-22 is valid. The discussion must be enhanced to explain how laboratory or sampling error has been eliminated as a source. If this determination cannot be made conclusively, the highest observed result within the Sample Summary Table of Section 4.6.2 will require revision.

Response: Our chemist reviewed the data and contacted the lab. The detection showed up in the equipment blank and the sample. A specific source for the reading could not be identified. We have updated the text to report the higher value. A copy of the revised report page is attached to this response to comments letter.

105. Table 10B-1, which summarizes the March 23-28, 2020 sampling event, lists the detection of nitrate at well MW-29 as 446 mg/L with a reporting limit of 20 mg/L. The concentration as indicated from the laboratory analysis dated March 25th was 475 mg/L with a reporting limit of 0.1 mg/L. Table 10B-1 should be revised to reflect the correct laboratory information. Furthermore, MDE acknowledges the March nitrate concentration for MW-29 was rejected, and a sample was re-analyzed on April 17, 2020. Time-series data within Table 11 only includes the rejected nitrate concentration. Table 11 must be revised to reflect the accepted nitrate concentration.
Response: The Table has been revised. A copy of the revise table is attached to this response to comments letter.

106. The discussion within Section 6.4.1 states several wells reported suspect pH values during the July 2020 sampling event. MDE previously indicated the need to confirm possible erroneous sampling data. The pH values should have been verified upon discovery of the extent the data was out of the normal range for the well. MDE previously advised and now maintains another round of sampling is necessary during the 4th quarter of 2020. MDE will not accept suspect data prior to waste placement and expects protocols for sampling confirmation to be developed and implemented.
Response: The MDE comment was received in July 2021, too late for a repeat sampling event in 4th quarter 2020. The Phase III Application is proposing a new groundwater monitoring network consisting of 31 wells. NWM anticipates that it will be required to install and complete 4 consecutive quarterly groundwater monitoring events and 12 consecutive monthly groundwater level measurements at all the new wells prior to the start of waste placement.

107. Section 6.4.1 misreports a pH value as 18.2 SU, which is beyond the range of the standard pH scale. Please revise this section as necessary.
Response: The correct value should be 13.2 S.U.s (PMW-6). Section 6.4.1 of the September 9, 2020 Phase II Permit Application Addendum has been modified. A copy of the revised page is provided as an attachment to this response to comments letter.

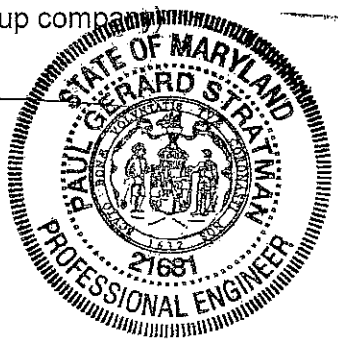
108. Several columns of Table 10 are cut off due to the formatting and must be resubmitted to show the data in its entirety. MDE made the same comment for tables within the previous Phase II submittal.
Response: The referenced Table has been reformatted to eliminate the cutoff. A copy of the revised table is attached.to this response to comments letter.

ADVANCED GeoServices
a Montrose Environmental Group company

We believe that the response provided above and the revised Phase III Application (attached) address the comments contained in your July 27 2021 letter. Please contact me at 610-389-2468 if you have any additional questions or comments.

Sincerely,

ADVANCED GEOSERVICES CORP
(A Montrose Environmental Group company)



Paul G Stratman, P.E.,P.G.
Consultant

PGS:mav

Attachments

cc: Steve Fleischman (NWM)

15 through 22, MW-25, 27, 29 and 30, and PMW-28 where one or more rounds was above the secondary drinking water standards of 300 µg/L and 50 µg/L, respectively.

Volatile Organic Compounds (VOCs)
Sampling for Volatile Organic Compounds (VOCs) detected three (3) compounds in the Unconfined WBZ above their corresponding reporting limits. Those compounds were acetone, chloroform and methyl tert-butyl ether (MTBE).

- Acetone was detected in the unconfined WBZ three (3) times (MW-15 twice and MW-22 once). The highest observed acetone result was 21 µg/L (MW-22, July 9, 2020). Although there is not a MCL for acetone, for comparison purposes, when compared against the USEPA Regional Screening Level (RSL) for tap water (14,000 µg/L) the observed result was significantly below.
- Chloroform was detected in the unconfined WBZ 11 times (MW-16 – 3 times, and MW-19 and MW-20 - 4 times each). The highest observed chloroform result was 4.1 µg/L (MW-20, July 7, 2020). The chloroform screening level is 80 µg/L. MW-16, 19 and 20 are located in the same vicinity in the southwest portion of Area B.
- MTBE was detected in the unconfined WBZ nine (9) times (MW-4 and MW-5 – 4 times each, and MW-6 – once). The highest observed MTBE was 1.6 µg/L (MW-4, May 21, 2020). There is not a MCL for MTBE, for comparison purposes, the USEPA Regional Screening Level (RSL) for tap water (14.0 µg/L). MW-4, 5 and 6 are located in the same general vicinity in Area A.

6.4.2 Groundwater Quality - Confined WBZ

pH
pH levels in the Confined WBZ were typically observed at levels between 3.4 and 6.7 SUs. The lowest pH value was observed at PMW-23 (3.4 SU, Round 1). Similar to the Unconfined WBZ, wells sampled on July 10, 2020 (MW-10, 14 and PMW-18) by both samplers exhibited field pH values notably higher than previous rounds. The Confined WBZ wells sampled by R. Christy on July 10, 2020, MW-10 and PMW-18 had pH levels of 8.5 and 8.54 SUs, respectively. The Confined WBZ well sampled by A. Doubleday on July 10, 2020, MW-14 and PMW-23, had pH levels of 12.6 SUs. Alkalinity and the concentrations of multi-valent cations in the samples remained relatively unchanged between the first three rounds and the fourth round. The specific cause of the Round 4 pH results on 10 could not be deciphered and the results have not been disqualified from consideration, however, they remain suspect.

Alkalinity
Measured alkalinity in the Confined WBZ in the 2020 sampling were at levels considered very low to low (Non-detect to 50.8 mg/L). This is reflected in the typically low pH conditions.

Hardness
Hardness results for the Confined WBZ were all below 20 mg/L, except in MW-14 and PMW-28 where levels up to 56 and 36 mg/L, respectively, were observed. Any water <60 mg/L is considered "soft".

Chloride
The secondary drinking water standard for chloride is 250 mg/L. The observed results in the Confined WBZ were all below 3.41 mg/L.

Specific Conductance
The observed values for the Confined WBZ were between 0.029-0.123 mS/cm, which indicates low concentrations of dissolved solids. There is not a standard for Specific Conductance.

Nitrate

Nitrate has a primary drinking water standard of 10 mg/L. The Nitrate results in the Confined WBZ were all less than 1.4 mg/L.

Chemical Oxygen Demand

COD levels in the Confined WBZ were low (<20 mg/L) or below detection, except in MW-14 where COD was measured in all 4 rounds between 6.3 to 44.8 mg/L and MW-28 where COD was measured in all four rounds between 11.4 and 28.8 mg/L. As described below MW-14 had PCE above its MCL in Round 1 and detectable concentrations of acetone in Round 3. MW-28 did not have any VOC detections.

Metals

COMAR 26.04.07.15 requires analysis for arsenic, barium, cadmium, chromium, lead, mercury and zinc. Metals analysis for the COMAR 26.04.07.15 Parameters detected total concentrations of barium, chromium, lead and zinc above their respective reporting limits, although none was above its corresponding screening levels. Similar to the 2020 Unconfined WBZ groundwater sampling, low flow sampling techniques were successfully utilized in all the Confined WBZ wells.
Although not required by COMAR 26.04.07.15 groundwater analysis also included antimony, beryllium, calcium, cobalt, copper, iron, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium and vanadium. All the additional metals were below their corresponding MCL/screening level except iron that was above the secondary drinking water standard of 300 µg/L on two (2) or more occasions in every Confined WBZ well and manganese in MW-14 and 28, and PMW-12 that was above its corresponding secondary drinking water standard of 50 µg/L.

Volatile Organic Compounds (VOCs)

Sampling for Volatile Organic Compounds (VOCs) detected three (3) compounds in the Confined WBZ above their corresponding reporting limits. All VOC detections were in groundwater monitoring well MW-14. The compounds were acetone, cis-1,2-DCE, and PCE.

- Acetone was detected once in MW-14 at 5.0 µg/L (May 21, 2020) and in MW-22 at 21 µg/L (July 7, 2020). The MW-22 result was accompanied by an equipment blank result of 25 µg/L, however after discussions with the lab an explanation for the acetone could not be found. In addition, the MS/MSD corresponding to the result was outside of control limits. Therefore, the result is qualified F1, but could not be completely rejected. Although there is not a MCL

for acetone, when compared against the USEPA Regional Screening Level (RSL) for tap water (14,000 µg/L) the observed result in MW-14 was 5 µg/L.

- cis-1,2-DCE was detected once in MW-14. The observed concentration was 1.9 µg/L (February 3, 2020). The MCL for cis-1,2-DCE is 70 µg/L.
- PCE was detected twice in MW-14. The highest observed detection in MW-14 occurred in Round 1 and was 7 µg/L (February 3, 2020). The MCL for PCE is 5 µg/L.

TCE was also detected in MW-14, however the detected concentration (0.68 µg/L) was "J" qualified.

Sample Summary Table
2020 Groundwater Sampling - 4 Events

					Unconfined WBZ Wells				Confined WBZ Wells			
Parameter	CAS	MDE MCL Criteria	Screening Criteria Notes	Unit	Total Number of Samples Analyzed	Total Number of Detections Above Reporting Limit	Highest Observed Result	Detections Above Screening Criteria	Total Number of Samples Analyzed	Total Number of Detections	Highest Observed Result	Detections Above Screening Criteria
Volatile Organic Compounds												
Acetone	67-64-1	NS		ug/L	72	3	21	NS	36	1	5	NS
Chloroform	67-66-3	80	TTHM	ug/L	72	11	4.1	0	36	0	ND	0
cis-1,2-Dichloroethene	156-59-2	70	P	ug/L	72	0	ND	0	36	1	1.9	0
MTBE	1634-04-4	NS		ug/L	72	9	1.6	NS	36	0	0	0
Tetrachloroethene	127-18-4	5	P	ug/L	72	0	ND	0	36	2	7	1
Total Metals												
Arsenic	7440-38-2	10	P	ug/L	72	18	8.5	0	36	12	2	0
Barium	7440-39-3	2000	P	ug/L	72	72	130	0	36	35	43.5	0
Cadmium	7440-43-9	5	P	ug/L	72	6	0.33	0	36	1	0.51	0
Chromium	7440-47-3	100	P	ug/L	72	31	7.9	0	36	20	9.3	0
Lead	7439-92-1	15	AL	ug/L	72	34	4.7	0	36	27	5.5	0
Mercury	7439-97-6	2	P	ug/L	72	0	ND	0	36	0	ND	0
Zinc	7440-66-6	5000	S	ug/L	72	44	284	0	36	26	411	0
General Chemistry												
Alkalinity, Total	ALK	NS		mg/L	72	30	23.8	NS	36	16	50.8	NS
Chemical Oxygen Demand	COD	NS		mg/L	72	13	76.6	NS	36	10	44.8	NS
Chloride	16887-00-	250	S	mg/L	72	72	6.98	0	36	36	3.41	0
Hardness, Calcium Carbonate	HARDCA	NS		mg/L	72	70	58	NS	36	29	56	NS
Nitrate as N	14797-55-	10	P	mg/L	72	53	2.18	0	36	18	1.4	0

Notes:
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
ND- - Below Reporting Limit
NS - No Standard

6.5 STATISTICAL ANALYSIS

A statistical analysis of the four (4) 2020 sampling event results was attempted using the USEPA ProUCL statistical package. A copy of the statistical analysis for the Unconfined WBZ and Confined WBZ are provided in Appendix Q1 and Q2, respectively. The following table presents the calculated 95% Upper Confidence Limits for detected COMAR 26.04.07.15 parameters. Those parameters with too few detections or no detections to produce a reliable 95% UCL are marked with Insufficient Data or No Detections, respectively.

Parameter	Unconf. WBZ	Confin. WBZ	Parameter	Unconf. WBZ	Confin. WBZ
Arsenic	1.628	1.069	Barium	42.77	20.26
Cadmium	0.293	Insufficient Data	Chromium	3.254	3.666
Lead	1.278	1.967	Mercury	No Detects	No Detects
Zinc	44.34	68.66	Acetone	Insufficient Data	Insufficient Data
Chloroform	1.131	No Detections	MTBE	0.815	No Detections

TABLE 10A-1 - UNCONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				MW-4			MW-5			MW-6			MW-6-D			MW-15			MW-16			MW-17			MW-18			MW-19			MW-20			MW-21			MW-22		
Lab ID				460-202111-02 460-202236-02			460-202111-01 460-202236-01			460-202215-03 460-202362-03			460-202215-04 460-202362-04			460-201978-09			460-201978-10			460-201978-01			460-201978-02			460-201978-03			460-201978-04			460-201978-13			460-202215-01 460-202362-01		
Sample Date				1/31/2020			1/31/2020			2/3/2020			2/3/2020			1/30/2020			1/30/2020			1/29/2020			1/29/2020			1/29/2020			1/29/2020			1/30/2020			2/3/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening											FD of MW-6																										
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																						
1,1,1,2-Tetrachloroethane	NS		ug/L		U *	1		U F1 *	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U *	1		U F1 *	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U F1	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromoethane	0.05	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U F1	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U *	5		U *	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U *	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5	6.4		5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U *	1		U F1 *	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1	1.4		1		U	1		U	1	1.8		1	1.1		1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U *	1		U *	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L	0.95	J	1	0.82	J	1	0.54	J	1	0.47	J	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U F1	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U F1	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																						
Antimony	6	P	ug/L		U	2	2.2	B	2		U	2		U	2	0.8	J	2	0.6	J	2	0.65	J	2	0.53	J	2	0.55	J	2	0.67	J	2	0.51	J	2	0.59	J	2
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2	8.5		2		U	2	1	J	2		U	2	0.74	J	2	1.1	J	2		U	2		U	2
Barium	2000	P	ug/L	44.2		4	9.1		4	20.7		4	21.8		4	26		4	113		4	29.5		4	16.2		4	75.2		4	66		4	44.8		4	32.6		4
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8	1.9		0.8	0.29	J	0.8		U	0.8	1.4		0.8	1.7		0.8	0.26	J	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	2280		200	2130		200	2340		200	2400		200	4180		200	7380		200	1610		200	3030		200	564		200	826		200	2950		200	2730		200
Chromium	100	P	ug/L	3	J	4		U	4		U	4		U	4	5.1		4		U	4	4.6		4		U	4		U	4	4.3		4	2.3	J	4		U	4
Cobalt	NS		ug/L	4		4	1.8	J	4		U	4		U	4		U	4	17.7		4	5.6		4		U	4	34.6		4	21.1		4	2.3	J	4		U	4
Copper	1300	AL	ug/L	7.5		4	2.8	J	4		U	4		U	4	13.8		4	6.9		4	7.7		4	2.9	J	4	7.2		4	10.8		4	3.7	J	4		U	4
Iron	300	S	ug/L	52.1	J	120		U	120		U	120		U	120	4980		120	116	J	120	2660		120	322		120	2560		120	1670		120	77.2	J	120	342		120
Lead	15	AL	ug/L		U	1.2	0.87	J	1.2		U	1.2		U	1.2	2.1		1.2		U	1.2	2.8		1.2		U	1.2	0.57	J	1.2	3.5		1.2		U	1.2		U	1.2
Magnesium	NS		ug/L	2960		200	1570		200	1910		200	1850		200	847		200	1140		200	879		200	6160		200	1160		200	760		200	4350		200	2940		200
Manganese	50	S	ug/L	22.1		8	13.7		8	8.2		8	7.9	J	8	105		8	51.6		8	78.3		8	11.4		8	176		8	96.7		8	86.9		8	69.5		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	7.1		4	5.5		4		U	4		U	4	3.2	J	4	22.1		4	9.9		4	4.7		4	15.7		4	14.6		4	9		4	2.7	J	4
Potassium	NS		ug/L	973		200	798		200	1110		200	1120		200	1920		200	837		200	297		200	1460		200	458		200	935		200	1120		200	1110		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	3430		200	4670		200	2850		200	2840		200	727		200	1860		200	2740		200	1870		200	1910		200	1310		200	2570		200	1480		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4		U	4		U	4		U	4	8.4		4		U	4	5.6		4		U	4		U	4	4.9		4		U	4	1.8	J	4
Zinc	5000	S	ug/L	15.5	J	16		U	16		U	16		U	16	45.8		16	284		16	27.2		16	30.3		16	67.4		16	50.7		16		U	16		U	16

TABLE 10A-1 - UNCONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				MW-4			MW-5			MW-6			MW-6-D			MW-15			MW-16			MW-17			MW-18			MW-19			MW-20			MW-21			MW-22		
Lab ID				460-202111-02 460-202236-02			460-202111-01 460-202236-01			460-202215-03 460-202362-03			460-202215-04 460-202362-04			460-201978-09			460-201978-10			460-201978-01			460-201978-02			460-201978-03			460-201978-04			460-201978-13			460-202215-01 460-202362-01		
Sample Date				1/31/2020			1/31/2020			2/3/2020			2/3/2020			1/30/2020			1/30/2020			1/29/2020			1/29/2020			1/29/2020			1/29/2020			1/30/2020			2/3/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening											FD of MW-6																										
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																							
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA	
Conventionals																																							
Alkalinity	NS		mg/L		U	5		U	5	5.4		5		U	5	8.3		5	13.5		5		U	5	23.8		5		U	5		U	5		U	5	6.5		5
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	0.1	0.14		0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U F1	0.1
Chemical Oxygen Demand	NS		mg/L		U	10		U F1	10		U	10		U	10	26.6		10		U	10	5.2	J	10		U F1	10	4.2	J	10		U	10		U	10		U F1	10
Chloride	250	S	mg/L	5.62		0.12	6.01	F1	0.24	5.18		0.12	5.22		0.12	1.37		0.12	2.65		0.12	1.62		0.12	2.28		0.12	3.24		0.12	2.62		0.12	3.38		0.12	2.1	F1	0.12
Hardness as calcium carbonate	NS		mg/L	26		5	18		5	14		5	14		5	52		10	30		5	18		5	36		5	14		5	12		5	58		5	18		5
Nitrate as N	10	P	mg/L	0.2		0.1	0.39		0.1	0.22		0.1	0.24		0.1		U	0.1		U	0.1		U H	0.1	0.48		0.1		U	0.1		U	0.1	0.47		0.1	0.18		0.1
Sulfate	250	S	mg/L	12.7		0.6	5.83		0.6	7.52		0.6	8.38		0.6	5.69		0.6	13.4		0.6	10.7		0.6	13.2		0.6	28.9		0.6	23.8		0.6	25		0.6	15.2	F1	0.6
Total Dissolved Solids	500	S	mg/L	30		10	27		10	39		10	39		10	46		10		U	10	88		10	45		10	38		10	33		10	55		10	48		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10A-1 - UNCONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				MW-24			MW-25			MW-27			MW-29			MW-30			PMW-6			PMW-6D			PMW-28		
Lab ID				460-201978-12			460-202111-06 460-202236-07			460-202362-10			460-202215-05 460-202362-05			460-202111-05 460-202236-06			460-202111-04 460-202236-04			460-202111-07 460-202236-05			460-202111-03 460-202236-03		
Sample Date				1/30/2020			1/31/2020			2/4/2020			2/3/2020			1/31/2020			1/31/2020			1/31/2020			1/31/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																				FD of PMW-6					
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																											
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U *	1		U	1		U	1		U *	1		U *	1		U *	1		U *	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U *	1		U	1		U	1		U *	1		U *	1		U *	1		U *	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromoethane	0.05	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U *	5		U *	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U *	1		U	1		U	1		U *	1		U *	1		U *	1		U *	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U *	1		U	1		U	1		U *	1		U *	1		U *	1		U *	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																											
Antimony	6	P	ug/L	0.48	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2	0.99	J	2		U	2		U	2		U	2
Barium	2000	P	ug/L	18.9		4	26.6		4	43.3		4	26.1		4	22		4	26.4		4	27.6		4	49		4
Beryllium	4	P	ug/L		U	0.8		U	0.8	0.27	J	0.8	1.3		0.8		U	0.8		U	0.8		U	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	3710		200	2610		200	1910		200	1730		200	3230		200	2460		200	2690		200	2560		200
Chromium	100	P	ug/L		U	4	3.3	J	4		U	4		U	4	3	J	4		U	4		U	4	5.9		4
Cobalt	NS		ug/L		U	4		U	4	3.4	J	4	6.4		4	1.7	J	4		U	4		U	4		U	4
Copper	1300	AL	ug/L	4.3		4	4.9		4	2.5	J	4		U	4	3.7	J	4		U	4		U	4	9.1		4
Iron	300	S	ug/L	260		120	607		120	513		120	1010		120	2260		120	100	J	120	143		120	1090		120
Lead	15	AL	ug/L		U	1.2	1.5		1.2		U	1.2		U	1.2	0.85	J	1.2		U	1.2		U	1.2	1.9		1.2
Magnesium	NS		ug/L	3740		200	1420		200	1380		200	862		200	2600		200	2010		200	2110		200	1820		200
Manganese	50	S	ug/L	24.7		8	11.1		8	99.8		8	24.4		8	55.6		8	12.4		8	13.4		8	31.8		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	3.4	J	4	4.4		4	5.4		4	10.9		4	2.8	J	4		U	4		U	4	6.5		4
Potassium	NS		ug/L	1060		200	1250		200	754		200	1360		200	1880		200	990		200	977		200	1330		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	2270		200	2540		200	1690		200	5080		200	3630		200	3410		200	3560		200	4040		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4	3	J	4		U	4		U	4	2.3	J	4		U	4		U	4	2.9	J	4
Zinc	5000	S	ug/L	13.4	J	16	11.7	J	16		U	16	57.5		16	26.3		16		U	16		U	16	59.6		16

TABLE 10A-1 - UNCONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				MW-24			MW-25			MW-27			MW-29			MW-30			PMW-6			PMW-6D			PMW-28		
Lab ID				460-201978-12			460-202111-06 460-202236-07			460-202362-10			460-202215-05 460-202362-05			460-202111-05 460-202236-06			460-202111-04 460-202236-04			460-202111-07 460-202236-05			460-202111-03 460-202236-03		
Sample Date				1/30/2020			1/31/2020			2/4/2020			2/3/2020			1/31/2020			1/31/2020			1/31/2020			1/31/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																				FD of PMW-6					
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																											
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Conventionals																											
Alkalinity	NS		mg/L	9.9		5	6.8		5		U	5		U	5	17.8		5		U	5		U	5		U	5
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1	0.086	J	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Chloride	250	S	mg/L	3.36		0.12	3.5		0.12	2.01		0.12	3.26		0.12	1.26		0.12	3.49		0.12	3.66		0.12	6.81		0.24
Hardness as calcium carbonate	NS		mg/L	30		5	18		5	12		5	8		5	24		5	24		5	26		5	28		5
Nitrate as N	10	P	mg/L	0.6		0.1	0.073	J	0.1		U	0.1		U	0.1		U	0.1	0.37		0.1	0.06	J	0.1	0.11		0.1
Sulfate	250	S	mg/L	14.2		0.6	5		0.6	21.7		0.6	18.3		0.6	6.17		0.6	12.4		0.6	12		0.6	7.73		0.6
Total Dissolved Solids	500	S	mg/L	52		10	28		10	40		10	36		10	26		10	28		10	22		10	28		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10A-1 - UNCONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				EB-01-012920			EB-02-013020			EB-03-013120			EB-04-020320			EB-05-020420			TB-01-013020			TB-02-013120			TB-03-020320		
Lab ID				460-201978-06			460-201978-14			460-202111-08 460-202236-08			460-202215-08 460-202362-08			460-202362-12			460-201978-15			460-202236-09			460-202362-14		
Sample Date				1/29/2020			1/30/2020			1/31/2020			2/3/2020			2/4/2020			1/30/2020			1/31/2020			2/4/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																											
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromoethane	0.05	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U *	5		U *	5		U	5		U	5		U *	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1	1.1		1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																											
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA		
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA		
Barium	2000	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA		
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA			NA		
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA		
Calcium	NS		ug/L	102	J	200	111	J	200	110	J	200		U	200		U	200		NA			NA			NA		
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA		
Cobalt	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA		
Copper	1300	AL	ug/L		U	4	4.3		4	2.7	J	4		U	4		U	4		NA			NA			NA		
Iron	300	S	ug/L		U	120		U	120		U	120		U	120		U	120		NA			NA			NA		
Lead	15	AL	ug/L		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA			NA			NA		
Magnesium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA			NA		
Manganese	50	S	ug/L		U	8		U	8		U	8		U	8		U	8		NA			NA			NA		
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA			NA			NA		
Nickel	100	RE	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA		
Potassium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA			NA		
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		NA			NA			NA		
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA		
Sodium	NS		ug/L	372		200	487		200	472		200	435		200	382		200		NA			NA			NA		
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA			NA		
Vanadium	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA		
Zinc	5000	S	ug/L		U	16		U	16		U	16		U	16		U	16		NA			NA			NA		

TABLE 10A-1 - UNCONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				EB-01-012920			EB-02-013020			EB-03-013120			EB-04-020320			EB-05-020420			TB-01-013020			TB-02-013120			TB-03-020320		
Lab ID				460-201978-06			460-201978-14			460-202111-08 460-202236-08			460-202215-08 460-202362-08			460-202362-12			460-201978-15			460-202236-09			460-202362-14		
Sample Date				1/29/2020			1/30/2020			1/31/2020			2/3/2020			2/4/2020			1/30/2020			1/31/2020			2/4/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																											
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		
Conventionals																											
Alkalinity	NS		mg/L		U	5		U	5		U	5		U	5		U	5		NA			NA			NA		
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA			NA		
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10		U	10		U	10		NA			NA			NA		
Chloride	250	S	mg/L		U	0.12		U	0.12		U	0.12		U	0.12		U	0.12		NA			NA			NA		
Hardness as calcium carbonate	NS		mg/L		U	5		U	5		U	5		U	5		U	5		NA			NA			NA		
Nitrate as N	10	P	mg/L		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA			NA		
Sulfate	250	S	mg/L		U	0.6		U	0.6		U	0.6		U	0.6		U	0.6		NA			NA			NA		
Total Dissolved Solids	500	S	mg/L		U	10		U	10		U	10	13		10		U	10		NA			NA			NA		

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10A-2 - CONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-13D			PMW-18			PMW-19			PMW-23		
Lab ID				460-202362-11			460-202215-07 460-202362-07			460-202215-09 460-202362-09			460-201978-05			460-201978-11			460-201978-07			460-201978-08			460-202215-06 460-202362-06			460-202362-13			460-202215-02 460-202362-02		
Sample Date				2/4/2020			2/3/2020			2/3/2020			1/29/2020			1/30/2020			1/30/2020			1/30/2020			2/3/2020			2/4/2020			2/3/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																				FD of PMW-13											
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																	
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromoethane	0.05	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U *	5		U *	5		U *	5		U	5		U	5		U	5		U	5		U *	5		U *	5		U *	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1	1.9		1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1	7		1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1	0.68	J	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																	
Antimony	6	P	ug/L	0.51	J	2	0.76	J	2		U	2		U	2	0.58	J	2	0.97	J	2	0.95	J	2	0.43	J	2		U	2		U	2
Arsenic	10	P	ug/L	0.91	J	2	0.98	J	2		U	2		U	2	0.89	J	2		U	2		U	2		U	2	2		U	2		2
Barium	2000	P	ug/L	4.7		4	26.9		4	37		4	3.7	J	4	40.9		4	8.5		4	9.6		4	7.3		4	16.8		4	31.6		4
Beryllium	4	P	ug/L	0.29	J	0.8		U	0.8	0.28	J	0.8		U	0.8	1.1		0.8		U	0.8		U	0.8		U	0.8	0.28	J	0.8	0.48	J	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	4650		200	14400		200	8050		200	613		200	3860		200	1010		200	961		200	534		200	1970		200	799		200
Chromium	100	P	ug/L		U	4		U	4	3.9	J	4		U	4	7.9		4	2.7	J	4	2.5	J	4		U	4		U	4	9.2		4
Cobalt	NS		ug/L	2.2	J	4	3.3	J	4		U	4	2.6	J	4	2.4	J	4	4.5		4	4.3		4	2.6	J	4		U	4	2.1	J	4
Copper	1300	AL	ug/L		U	4	4.1		4	17.6		4	2.4	J	4	8.6		4	16.7		4	13.4		4	5.2		4		U	4	11.4		4
Iron	300	S	ug/L	1250		120	6250		120	9940		120		U	120	7670		120	1170		120	1080		120	348		120	4920		120	6020		120
Lead	15	AL	ug/L		U	1.2	4.1		1.2	2		1.2		U	1.2	2.5		1.2	3.3		1.2	3		1.2	0.65	J	1.2		U	1.2	5.5		1.2
Magnesium	NS		ug/L	124	J	200	1920		200	1350		200	256		200	1170		200	508		200	494		200	386		200	507		200	529		200
Manganese	50	S	ug/L	8.3		8	180		8	60.3		8	6.5	J	8	64		8	11.4		8	10.8		8	10.4		8	36		8	20.8		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	4.2		4	4		4	3.5	J	4	4.2		4	6.2		4	10.6		4	9.8		4	3.8	J	4		U	4	4.8		4
Potassium	NS		ug/L	397		200	5750		200	1510		200	551		200	2550		200	721		200	694		200	774		200	1020		200	1840		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	2070		200	939		200	2280		200	1610		200	2720		200	1490		200	1490		200	1060		200	1500		200	1580		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8	0.19	J	0.8	0.2	J	0.8		U	0.8		U	0.8	0.16	J	0.8
Vanadium	NS		ug/L	1.5	J	4	3.1	J	4	11.3		4		U	4	12.7		4	2.6	J	4	2.4	J	4	1.9	J	4	2.3	J	4	15.9		4
Zinc	5000	S	ug/L		U	16	73.1		16	35.1		16		U	16	411		16	17.4		16	16.2		16		U	16	70		16	16.2		16

TABLE 10A-2 - CONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-13D			PMW-18			PMW-19			PMW-23		
Lab ID				460-202362-11			460-202215-07 460-202362-07			460-202215-09 460-202362-09			460-201978-05			460-201978-11			460-201978-07			460-201978-08			460-202215-06 460-202362-06			460-202362-13			460-202215-02 460-202362-02		
Sample Date				2/4/2020			2/3/2020			2/3/2020			1/29/2020			1/30/2020			1/30/2020			1/30/2020			2/3/2020			2/4/2020			2/3/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																				FD of PMW-13											
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																	
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			U	2
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			U	2
Barium, Dissolved	2000	P	ug/L		NA			NA			NA		3.1	J	4	21.8		4		NA			NA			NA			NA		3.8	J	4
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			U	0.8	0.33	J	0.8		NA			NA			NA			NA			U	0.8
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			U	2
Calcium, Dissolved	NS		ug/L		NA			NA			NA		671		200	4140		200		NA			NA			NA			NA		650		200
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			NA			U	4
Cobalt, Dissolved	NS		ug/L		NA			NA			NA		2.2	J	4		U	4		NA			NA			NA			NA			U	4
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			NA			U	4
Iron, Dissolved	300	S	ug/L		NA			NA			NA			U	120	3650		120		NA			NA			NA			NA			U	120
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			U	1.2		U	1.2		NA			NA			NA			NA			U	1.2
Magnesium, Dissolved	NS		ug/L		NA			NA			NA		194	J	200	904		200		NA			NA			NA			NA		286		200
Manganese, Dissolved	50	S	ug/L		NA			NA			NA		4.9	J	8	52.2		8		NA			NA			NA			NA		11		8
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			U	0.2		U	0.2		NA			NA			NA			NA			U	0.2
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA		3.5	J	4		U	4		NA			NA			NA			NA			U	4
Potassium, Dissolved	NS		ug/L		NA			NA			NA		466		200	1370		200		NA			NA			NA			NA		463		200
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			U	10		U	10		NA			NA			NA			NA			U	10
Silver, Dissolved	100	S	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			U	2
Sodium, Dissolved	NS		ug/L		NA			NA			NA		1200		200	2180		200		NA			NA			NA			NA		1610		200
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			U	0.8		U	0.8		NA			NA			NA			NA			U	0.8
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			NA			U	4
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			U	16	315		16		NA			NA			NA			NA			U	16
Conventionals																																	
Alkalinity	NS		mg/L	9.1		5	40.8		5	33.4		5		U	5	5.4		5		U	5		U	5		U	5	12.7		5		U	5
Ammonia	NS		mg/L		U	0.1	0.048	J	0.1		U	0.1		U	0.1		U	0.1		U	0.1	0.34		0.1		U	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10	12.3		10	28.8		10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Chloride	250	S	mg/L	3.41		0.12	1.17		0.12	0.85		0.12	1.65		0.12	1		0.12	2.17		0.12	2.19		0.12	1.41		0.12	1.88		0.12	2.72		0.12
Hardness as calcium carbonate	NS		mg/L	14		5	44		5	34		5	6		5	18		5	8		5	10		5		U	5	12		5	18		5
Nitrate as N	10	P	mg/L		U	2		U	0.1		U	0.1	0.14		0.1		U	0.1		U	0.1		U	0.1	0.32		0.1		U	0.1	0.39		0.1
Sulfate	250	S	mg/L	9.62		0.6	6.27		0.6	0.38	J	0.6	4.94		0.6	15.9		0.6	18.6		0.6	17.4		0.6	4.44		0.6	3.59		0.6	3.46		0.6
Total Dissolved Solids	500	S	mg/L	42		10	70		10	85		10	18		10	43		10	13		10	22		10	15		10	34		10	16		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10A-2 - CONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location			EB-01-012920				EB-02-013020			EB-03-013120			EB-04-020320			EB-05-020420			TB-01-013020			TB-02-013120			TB-03-020320		
Lab ID			460-201978-06				460-201978-14			460-202111-08 460-202236-08			460-202215-08 460-202362-08			460-202362-12			460-201978-15			460-202236-09			460-202362-14		
Sample Date			1/29/2020				1/30/2020			1/31/2020			2/3/2020			2/4/2020			1/30/2020			1/31/2020			2/4/2020		
Matrix			Aqueous				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening	Equipment Blank				Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																											
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromoethane	0.05	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U *	5		U *	5		U	5		U	5		U *	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1	1.1		1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U *	1		U	1		U	1		U	1		U *	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																											
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA	
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA	
Barium	2000	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA	
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA			NA	
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA	
Calcium	NS		ug/L	102	J	200	111	J	200	110	J	200		U	200		U	200		NA			NA			NA	
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA	
Cobalt	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA	
Copper	1300	AL	ug/L		U	4	4.3		4	2.7	J	4		U	4		U	4		NA			NA			NA	
Iron	300	S	ug/L		U	120		U	120		U	120		U	120		U	120		NA			NA			NA	
Lead	15	AL	ug/L		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA			NA			NA	
Magnesium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA			NA	
Manganese	50	S	ug/L		U	8		U	8		U	8		U	8		U	8		NA			NA			NA	
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA			NA			NA	
Nickel	100	RE	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA	
Potassium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA			NA	
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		NA			NA			NA	
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA			NA	
Sodium	NS		ug/L	372		200	487		200	472		200	435		200	382		200		NA			NA			NA	
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA			NA	
Vanadium	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA			NA	
Zinc	5000	S	ug/L		U	16		U	16		U	16		U	16		U	16		NA			NA			NA	

TABLE 10A-2 - CONFINED
Event 1: GW Sampling Results Table
January 29 -February 4, 2020

Sample Location			EB-01-012920				EB-02-013020			EB-03-013120			EB-04-020320			EB-05-020420			TB-01-013020			TB-02-013120			TB-03-020320		
Lab ID			460-201978-06				460-201978-14			460-202111-08 460-202236-08			460-202215-08 460-202362-08			460-202362-12			460-201978-15			460-202236-09			460-202362-14		
Sample Date			1/29/2020				1/30/2020			1/31/2020			2/3/2020			2/4/2020			1/30/2020			1/31/2020			2/4/2020		
Matrix			Aqueous				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening	Equipment Blank				Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																											
Antimony, Dissolved	6	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L	NA				NA			NA			NA			NA			NA			NA			NA		
Conventionals																											
Alkalinity	NS		mg/L	U	5			U	5		U	5		U	5		U	5		NA			NA			NA		
Ammonia	NS		mg/L	U	0.1			U	0.1		U	0.1		U	0.1		U	0.1		NA			NA			NA		
Chemical Oxygen Demand	NS		mg/L	U	10			U	10		U	10		U	10		U	10		NA			NA			NA		
Chloride	250	S	mg/L	U	0.12			U	0.12		U	0.12		U	0.12		U	0.12		NA			NA			NA		
Hardness as calcium carbonate	NS		mg/L	U	5			U	5		U	5		U	5		U	5		NA			NA			NA		
Nitrate as N	10	P	mg/L	U	0.1			U	0.1		U	0.1		U	0.1		U	0.1		NA			NA			NA		
Sulfate	250	S	mg/L	U	0.6			U	0.6		U	0.6		U	0.6		U	0.6		NA			NA			NA		
Total Dissolved Solids	500	S	mg/L	U	10			U	10		U	10	13		10		U	10		NA			NA			NA		

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10B-1 - UNCONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				MW-4			MW-5			MW-6			MW-15			MW-16			MW-17			MW-18			MW-18-D			MW-19			MW-20			MW-21			MW-22			MW-24		
Lab ID				460-205754-06			460-205754-09			460-205754-05			460-205844-02			460-205844-03			460-205844-07			460-205844-05			460-205844-06			460-205924-06			460-205924-01			460-205924-02			460-205924-04			460-205973-01		
				460-206064-07			460-206064-09			460-206064-06			460-206064-13			460-206064-14			460-206064-18			460-206064-16			460-206064-17			460-206064-25			460-206064-20			460-206064-21			460-206064-23			460-206064-28		
Sample Date				3/24/2020			3/24/2020			3/24/2020			3/25/2020			3/25/2020			3/25/2020			3/25/2020			3/25/2020			3/26/2020			3/26/2020			3/26/2020			3/26/2020			3/27/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																							FD of MW-18																	
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																										
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5	4.7	J	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1	0.84	J	1		U	1		U	1		U	1	1.2		1	0.97	J	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L	0.8	J	1	0.48	J	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																											
Antimony	6	P	ug/L	0.96	J	2	0.87	J	2	0.92	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Arsenic	10	P	ug/L		U	2		U	2		U	2	4.2		2	0.83	J	2	1.3	J	2		U	2		U	2		U	2	1	J	2		U	2	0.83	J	2		U	2
Barium	2000	P	ug/L	49.7		4	11		4	30.7		4	26.6		4	130		4	28.1		4	14.8		4	13.7		4	71.4		4	67.7		4	37.1		4	31.7		4	18.6		4
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8	3.5		0.8	0.51	J	0.8		U	0.8		U	0.8	1.5		0.8	1.8		0.8		U	0.8		U	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	2180		200	2490		200	2790		200	3530		200	2220		200	1540		200	3060		200	2970		200	737		200	657		200	2700		200	2240		200	4190		200
Chromium	100	P	ug/L		U	4		U	4		U	4	5.9		4		U	4	3.7	J	4		U	4		U	4		U	4	3	J	4		U	4	3.4	J	4	4.2		4
Cobalt	NS		ug/L	3.6	J	4		U	4		U	4		U	4	20.5		4	5.4		4		U	4		U	4	36.5		4	22		4	2.5	J	4		U	4		U	4
Copper	1300	AL	ug/L	2.2	J	4		U	4		U	4	10.4		4	7.2		4	4.7		4	2.2	J	4		U	4	5.9		4	10.4		4	2.5	J	4		U	4	2.2	J	4
Iron	300	S	ug/L	274		120	73.4	J	120		U	120	3440		120	397		120	2630		120	160		120	98.8	J	120	1080		120	1010		120	283		120	457		120	333		120
Lead	15	AL	ug/L		U	1.2	2.5		1.2		U	1.2	2.6		1.2	0.66	J	1.2	2.5		1.2		U	1.2		U	1.2		U	1.2	1.9		1.2		U	1.2		U	1.2	1	J	1.2
Magnesium	NS		ug/L	2730		200	1370		200	1990		200	772		200	1120		200	748		200	5470		200	5320		200	1170		200	724		200	3700		200	2970		200	5390		200
Manganese	50	S	ug/L	19		8	12.5		8	8.4		8	90.3		8	56.1		8	67.6		8	9.8		8	9.7		8	200		8	96.2		8	71.3		8	70.6		8	22.4		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	5.6		4	4.6		4		U	4	4		4	21.3		4	9.9		4	3.2	J	4	2.4	J	4	16.4		4	12.7		4	7.2		4	3.1	J	4	5.2		4
Potassium	NS		ug/L	990		200	774		200	1260		200	1890		200	711		200	229		200	1480		200	1420		200	472		200	779		200	1080		200	1140		200	1130		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	3100		200	4040		200	2710		200	869		200	1690		200	2110		200	2080		200	2000		200	1940		200	1320		200	2280		200	2160		200	2050		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4		U	4		U	4	6.8		4	1.8	J	4	5.2		4		U	4		U	4		U	4	3.6	J	4	1.4	J	4	2.6	J	4	1.3	J	4
Zinc	5000	S	ug/L		U	16		U	16		U	16	40.5		16	103		16	28.1		16	28.4		16	26.6		16	76.1		16	62.3		16		U	16		U	16		U	16

TABLE 10B-1 - UNCONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				MW-4			MW-5			MW-6			MW-15			MW-16			MW-17			MW-18			MW-18-D			MW-19			MW-20			MW-21			MW-22			MW-24		
				460-205754-06			460-205754-09			460-205754-05			460-205844-02			460-205844-03			460-205844-07			460-205844-05			460-205844-06			460-205924-06			460-205924-01			460-205924-02			460-205924-04			460-205973-01		
Lab ID				460-206064-07			460-206064-09			460-206064-06			460-206064-13			460-206064-14			460-206064-18			460-206064-16			460-206064-17			460-206064-25			460-206064-20			460-206064-21			460-206064-23			460-206064-28		
Sample Date				3/24/2020			3/24/2020			3/24/2020			3/25/2020			3/25/2020			3/25/2020			3/25/2020			3/25/2020			3/26/2020			3/26/2020			3/26/2020			3/26/2020			3/27/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																							FD of MW-18																	
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																										
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			U	2		NA			U	2		NA			NA			NA			U	2		NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA		3.5		2		NA			U	2		NA			NA			NA			U	2		NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA		22.1		4		NA		21		4		NA			NA			NA		70.1		4		NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			U	0.8		NA		0.28	J	0.8		NA			NA			NA		1.8		0.8		NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			U	2		NA			U	2		NA			NA			NA			U	2		NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA		3490		200		NA		1520		200		NA			NA			NA		735		200		NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			U	4		NA			U	4		NA			NA			NA			U	4		NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			U	4		NA		4.9		4		NA			NA			NA		23.2		4		NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA		4		4		NA		3.3	J	4		NA			NA			NA		9.8		4		NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA		2270		120		NA		158		120		NA			NA			NA			U	120		NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			U	1.2		NA			U	1.2		NA			NA			NA		0.84	J	1.2		NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA		786		200		NA		669		200		NA			NA			NA		788		200		NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA		97.2		8		NA		65.2		8		NA			NA			NA		105		8		NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			U	0.2		NA			U	0.2		NA			NA			NA			U	0.2		NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA		2.7	J	4		NA		8		4		NA			NA			NA		13.4		4		NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA		1890		200		NA			U	200		NA			NA			NA		639		200		NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			U	10		NA			U	10		NA			NA			NA			U	10		NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			U	2		NA			U	2		NA			NA			NA			U	2		NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA		1010		200		NA		2260		200		NA			NA			NA		1430		200		NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			U	0.8		NA			U	0.8		NA			NA			NA			U	0.8		NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA		2.1	J	4		NA			U	4		NA			NA			NA			U	4		NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA		34.3		16		NA		25.7		16		NA			NA			NA		57.5		16		NA			NA			NA		
Conventionals																																										
Alkalinity	NS		mg/L		U	5		U	5	5.6		5		U	5		U	5		U	5	22.1		5	17.5		5		U	5		U	5		U	5	8.2		5	13.7		5
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1	0.14		0.1		U F1	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10	26.5		10		U F1	10	766	J	1000		U	10	201	J	500		U	10		U	10		U	10					U	10
Chloride	250	S	mg/L	5.28		0.12	5.76		0.12	5.18		0.12	1.26		0.12	2.84		0.12	1.29		0.12	3.17		0.12	3.18		0.12	3.11		0.12	2.3		0.12	4.04		0.12	1.89		0.12	2.81		0.12
Hardness as calcium carbonate	NS		mg/L	22		5	16		5	16		5	14		5	10		5			U	5	26		5	26		5	6		5		U	5	16		5	14		5	30		5
Nitrate as N	10	P	mg/L	0.16		0.1	0.63		0.1	0.23		0.1	0.11		0.1		U	0.1			U	0.1	0.83		0.1	0.82		0.1		U	0.1		U	0.1	0.41		0.1	0.077	J	0.1	1.01		0.1
Nitrate as N (reanalysis)	10	P	mg/L		NA						NA			NA			NA						NA			NA				NA				NA				NA				NA	
Sulfate	250	S	mg/L	16.4		0.6	22.4		0.6	11.2		0.6	10.8		0.6	18.4	F1	0.6	10.6		0.6	10.6		0.6	10.3		0.6	23.3		0.6	17.7		0.6	66.5	D	6	13.6		0.6	17.7		0.6
Total Dissolved Solids	500	S	mg/L	55		10	34		10	48		10	50		10	31		10	101		10	56		10	51		10	48		10	52		10	72		10	66		10	88		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
E: Sample value exceeded upper calibration range
MCL: Maximum Containment Level

TABLE 10B-1 - UNCONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				MW-24-D			MW-25			MW-27			MW-29			MW-30			PMW-6			PMW-6-D			PMW-28			EB-01-032420			EB-02-032520			EB-03-032620			EB-04-032720			Trip Blank		
				460-205973-02			460-205973-03			460-205924-08			460-205754-07			460-205973-05			460-205754-02			460-205754-03			460-205754-04			460-205754-08			460-205844-08			460-205924-03			460-205973-04			460-206064-35		
Lab ID				460-206064-29			460-206064-30			460-206064-27			460-206064-08			460-206064-32			460-206064-02			460-206064-03			460-206064-04			460-206064-05			460-206064-19			460-206064-22			460-206064-31					
Sample Date				3/27/2020			3/27/2020			3/26/2020			3/24/2020			3/27/2020			3/24/2020			3/24/2020			3/24/2020			3/24/2020			3/25/2020			3/26/2020			3/27/2020			3/23/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		FD of MW-24																		FD of PMW-6						Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																										
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																											
Antimony	6	P	ug/L	0.73	J	2	0.61	J	2	0.63	J	2	1	J	2	0.7	J	2	0.96	J	2	0.96	J	2		U	2		U	2		U	2		U	2		U	2		NA		
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2	0.99	J	2		U	2		U	2		U	2		U	2		NA		
Barium	2000	P	ug/L	20.5		4	24.4		4	30.7		4	38.6		4	23.7		4	27.1		4	30.1		4	51.4		4		U	4		U	4		U	4		U	4		NA		
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8	1.4		0.8		U	0.8		U	0.8		U	0.8	0.31	J	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA		
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA		
Calcium	NS		ug/L	4820		200	2640		200	1530		200	1990		200	3600		200	2700		200	2920		200	2670		200	117	J	200	99.3	J	200		U	200	106	J	200		NA	
Chromium	100	P	ug/L		U	4		U	4		U	4	2.6	J	4		U	4		U	4		U	4	6.3		4		U	4		U	4		U	4		U	4		NA		
Cobalt	NS		ug/L		U	4	1.7	J	4	3.4	J	4	7		4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA		
Copper	1300	AL	ug/L		U	4		U	4		U	4		U	4		U	4		U	4	2.5	J	4		U	4		U	4		U	4		U	4		U	4		NA		
Iron	300	S	ug/L	126		120	1020		120	1110		120	763		120	1300		120		U	120		U	120	1330		120		U	120	81.9	J	120		U	120		U	120		NA		
Lead	15	AL	ug/L		U	1.2	0.94	J	1.2		U	1.2	0.77	J	1.2	0.59	J	1.2		U	1.2		U	1.2	2.1		1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA		
Magnesium	NS		ug/L	5340		200	1270		200	1170		200	919		200	2520		200	1890		200	2070		200	1940		200		U	200		U	200		U	200		U	200		NA		
Manganese	50	S	ug/L	20.2		8	13.5		8	88.4		8	26.3		8	31.2		8	10.5		8	10.8		8	24.1		8		U	8		U	8		U	8		U	8		NA		
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA		
Nickel	100	RE	ug/L		U	4	3.2	J	4	5.3		4	12.7		4		U	4		U	4		U	4	4.1		4		U	4		U	4		U	4		U	4		NA		
Potassium	NS		ug/L	1190		200	1190		200	640		200	1390		200	1740		200	862		200	1000		200	1560		200		U	200		U	200		U	200		U	200		NA		
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		NA		
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA		
Sodium	NS		ug/L	1990		200	2170		200	1390		200	5260		200	2560		200	2820		200	3190		200	3880		200	382		200	412		200	424		200	386		200		NA	
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA		
Vanadium	NS		ug/L		U	4	3.1	J	4		U	4		U	4	1.9	J	4		U	4		U	4	5.4		4		U	4		U	4		U	4		U	4		NA		
Zinc	5000	S	ug/L		U	16		U	16		U	16	75.3		16	21.6		16		U	16		U	16	62.7		16		U	16		U	16		U	16		U	16		NA		

TABLE 10B-1 - UNCONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				MW-24-D			MW-25			MW-27			MW-29			MW-30			PMW-6			PMW-6-D			PMW-28			EB-01-032420			EB-02-032520			EB-03-032620			EB-04-032720			Trip Blank		
				460-205973-02			460-205973-03			460-205924-08			460-205754-07			460-205973-05			460-205754-02			460-205754-03			460-205754-04			460-205754-08			460-205844-08			460-205924-03			460-205973-04			460-206064-35		
Lab ID				460-206064-29			460-206064-30			460-206064-27			460-206064-08			460-206064-32			460-206064-02			460-206064-03			460-206064-04			460-206064-05			460-206064-19			460-206064-22			460-206064-31					
Sample Date				3/27/2020			3/27/2020			3/26/2020			3/24/2020			3/27/2020			3/24/2020			3/24/2020			3/24/2020			3/24/2020			3/25/2020			3/26/2020			3/27/2020			3/23/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		FD of MW-24																		FD of PMW-6						Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																										
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA		38.3		4		NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	0.8		NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA		2660		200		NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	4		NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			U	4		NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			U	4		NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA			U	120		NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			U	1.2		NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA		1770		200		NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA		10.9		8		NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	0.2		NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA		3.1	J	4		NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA		1060		200		NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	10		NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA		4020		200		NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			U	0.8		NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			U	4		NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA		55.9		16		NA			NA			NA			NA			NA		
Conventionals																																										
Alkalinity	NS		mg/L	14.9		5	7.3		5		U	5		U	5	11.1		5	5.6		5		U	5		U	5		U	5		U	5		U	5		U	5		NA		
Ammonia	NS		mg/L		U F1	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA		
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U F1	10		U	10		U	10		U	10		U	10		U	10		U	10		U	100		U	10		U	10		NA		
Chloride	250	S	mg/L	2.85		0.12	3.33		0.12	1.8	F1	0.12	3.93		0.12	1.67		0.12	3.18		0.12	3.26		0.12	6.64		0.6		U	0.12		U	0.12		U	0.12		U	0.12		NA		
Hardness as calcium carbonate	NS		mg/L	28		5	8		5	6		5	14		5	16		5	20		5	18		5	18		5		U	5		U	10		U	5		U	5		NA		
Nitrate as N	10	P	mg/L	1.02		0.1		U	0.1		U	0.1	475	ER	0.1		U	0.1		U	0.1		U	0.1	0.11		0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA		
Nitrate as N (reanalysis)	10	P	mg/L		NA			NA			NA		0.11	H	0.1		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Sulfate	250	S	mg/L	16.4		0.6	5.51		0.6	20.5	F1	0.6	15		6	10.7		0.6	13.8		0.6	14.1		0.6	15		0.6		U	0.6		U	0.6		U	0.6		U	0.6		NA		
Total Dissolved Solids	500	S	mg/L	60		10	59		10	40		10	54		10	65		10	41		10	42		10	49		10		U	10		U	10	28		10	24		10		NA		

Notes:

Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
E: Sample value exceeded upper calibration range
MCL: Maximum Containment Level

R: The original Nitrate data for MW-29 was rejected (R) by Advanced GeoServices. The initial undiluted analysis was reported. The laboratory confirmed after analysis and reporting that the sample bottle had a pH <2 resulting in a high Nitrate concentration. The sample was reanalyzed by the laboratory from a separate sample container.

TABLE 10B-2 - CONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-18			PMW-19			PMW-23		
Lab ID				460-205754-01			460-205754-10			460-205973-07			460-205924-07			460-205844-04			460-205844-01			460-205754-11			460-205973-06			460-205924-05		
				460-206064-01			460-206064-10			460-206064-34			460-206064-26			460-206064-15			460-206064-12			460-206064-11			460-206064-33			460-206064-24		
Sample Date				3/23/2020			3/24/2020			3/27/2020			3/26/2020			3/25/2020			3/25/2020			3/24/2020			3/27/2020			3/26/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																												
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																														
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1	3.6		1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																														
Antimony	6	P	ug/L	0.74	J	2	0.47	J	2	0.62	J	2		U	2		U	2		U	2		U	2	0.82	J	2		U	2
Arsenic	10	P	ug/L		U	2	0.95	J	2		U	2	0.98	J	2	0.77	J	2	0.81	J	2	1.2	J	2		U	2	0.84	J	2
Barium	2000	P	ug/L	4.1		4	21.3		4	43.5		4	10		4	37.6		4	9.3		4	13.1		4	15.5		4	12.8		4
Beryllium	4	P	ug/L	0.27	J	0.8		U	0.8		U	0.8		U	0.8	1.3		0.8		U	0.8	0.35	J	0.8		U	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	3760		200	16800		200	7540		200	512		200	3240		200	984		200	710		200	1920		200	681		200
Chromium	100	P	ug/L		U	4		U	4	2.5	J	4	4.9		4	7.1		4	2.8	J	4	3.6	J	4		U	4	9.3		4
Cobalt	NS		ug/L	2.1	J	4	2	J	4		U	4	2.5	J	4	2.4	J	4	4.6		4	3	J	4		U	4		U	4
Copper	1300	AL	ug/L		U	4	2.7	J	4	4.9		4	3.1	J	4	9.6		4	3.7	J	4	7.9		4		U	4	5.2		4
Iron	300	S	ug/L	595		120	2620		120	12900		120	1790		120	7740		120	523		120	1150		120	4540		120	1580		120
Lead	15	AL	ug/L	1.1	J	1.2	2.1		1.2	0.92	J	1.2	1.5		1.2	3.2		1.2	2		1.2	1.8		1.2		U	1.2	3		1.2
Magnesium	NS		ug/L	111	J	200	2730		200	1580		200	266		200	1380		200	518		200	507		200	481		200	383		200
Manganese	50	S	ug/L	6.4	J	8	53.6		8	84.1		8	7.5	J	8	66.2		8	7.7	J	8	19.5		8	33.7		8	17.7		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	4		4	3.3	J	4		U	4	6.3		4	5.9		4	10.6		4	5.8		4		U	4	7.8		4
Potassium	NS		ug/L	360		200	7200		200	1500		200	890		200	2120		200	767		200	962		200	971		200	987		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	2070		200	901		200	2600		200	1360		200	1490		200	1510		200	1150		200	1450		200	1690		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8	0.19	J	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4	2.7	J	4	7.2		4	4.2		4	14.4		4	2.9	J	4	4.7		4	1.2	J	4	4.8		4
Zinc	5000	S	ug/L		U	16	65.2		16	22.6		16		U	16	52.6		16		U	16	15.7	J	16	50.7		16		U	16

TABLE 10B-2 - CONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-18			PMW-19			PMW-23		
Lab ID				460-205754-01 460-206064-01			460-205754-10 460-206064-10			460-205973-07 460-206064-34			460-205924-07 460-206064-26			460-205844-04 460-206064-15			460-205844-01 460-206064-12			460-205754-11 460-206064-11			460-205973-06 460-206064-33			460-205924-05 460-206064-24		
Sample Date				3/23/2020			3/24/2020			3/27/2020			3/26/2020			3/25/2020			3/25/2020			3/24/2020			3/27/2020			3/26/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																												
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																														
Antimony, Dissolved	6	P	ug/L		NA			NA			U	2		U	2		U	2		NA			U	2		NA			U	2
Arsenic, Dissolved	10	P	ug/L		NA			NA			U	2		U	2		U	2		NA			U	2		NA			U	2
Barium, Dissolved	2000	P	ug/L		NA			NA		44.6		4	4.3		4	21.3		4		NA		7.9		4		NA		4.6		4
Beryllium, Dissolved	4	P	ug/L		NA			NA			U	0.8		U	0.8		U	0.8		NA		0.33	J	0.8		NA			U	0.8
Cadmium, Dissolved	5	P	ug/L		NA			NA			U	2		U	2		U	2		NA			U	2		NA			U	2
Calcium, Dissolved	NS		ug/L		NA			NA		8490		200	523		200	3230		200		NA		748		200		NA		742		200
Chromium, Dissolved	100	P	ug/L		NA			NA			U	4		U	4		U	4		NA			U	4		NA			U	4
Cobalt, Dissolved	NS		ug/L		NA			NA			U	4	2.4	J	4		U	4		NA		3.6	J	4		NA			U	4
Copper, Dissolved	1300	AL	ug/L		NA			NA			U	4	2.2	J	4		U	4		NA		6		4		NA			U	4
Iron, Dissolved	300	S	ug/L		NA			NA		15100		120		U	120	6500		120		NA			U	120		NA			U	120
Lead, Dissolved	15	AL	ug/L		NA			NA			U	1.2		U	1.2		U	1.2		NA			U	1.2		NA			U	1.2
Magnesium, Dissolved	NS		ug/L		NA			NA		1960		200	238		200	1400		200		NA		560		200		NA		354		200
Manganese, Dissolved	50	S	ug/L		NA			NA		97.6		8	5.7	J	8	68.4		8		NA		11.8		8		NA		16.1		8
Mercury, Dissolved	2	P	ug/L		NA			NA			U	0.2		U	0.2		U	0.2		NA			U	0.2		NA			U	0.2
Nickel, Dissolved	100	RE	ug/L		NA			NA			U	4	3.8	J	4		U	4		NA		5.3		4		NA		2.7	J	4
Potassium, Dissolved	NS		ug/L		NA			NA		1600		200	548		200	1180		200		NA		770		200		NA		532		200
Selenium, Dissolved	50	P	ug/L		NA			NA			U	10		U	10		U	10		NA			U	10		NA			U	10
Silver, Dissolved	100	S	ug/L		NA			NA			U	2		U	2		U	2		NA			U	2		NA			U	2
Sodium, Dissolved	NS		ug/L		NA			NA		3230		200	1430		200	1660		200		NA		1280		200		NA		1800		200
Thallium, Dissolved	2	P	ug/L		NA			NA			U	0.8		U	0.8		U	0.8		NA			U	0.8		NA			U	0.8
Vanadium, Dissolved	NS		ug/L		NA			NA		4		4		U	4		U	4		NA			U	4		NA			U	4
Zinc, Dissolved	5000	S	ug/L		NA			NA			U	16		U	16	42.1		16		NA		12.1	J	16		NA			U	16
Conventionals																														
Alkalinity	NS		mg/L	8.5		5	50.3		5	34.5		5		U	5		U	5		U	5		U	5	11.1		5		U	5
Ammonia	NS		mg/L		U F1	0.1		U	0.1	0.14		0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10	6.3	J	10	20.5		10		U	10		U	10		U	10		U	10		U	10		U	10
Chloride	250	S	mg/L	2.52	F1	0.12	0.98		0.12	0.82		0.12	1.72		0.12	0.95		0.12	2.17		0.12	1.22		0.12	1.72		0.12	2.62		0.12
Hardness as calcium carbonate	NS		mg/L	18		5	50		5	26		5		U	5	14		5		U	5	6		5	6		5		U	10
Nitrate as N	10	P	mg/L		U	0.1	0.094	J	0.1		U	0.1	0.17		0.1		U	0.1		U	0.1	0.29		0.1		U	0.1	0.35		0.1
Nitrate as N (reanalysis)	10	P	mg/L		NA			NA			NA			NA			NA			NA			NA			NA			NA	
Sulfate	250	S	mg/L	13.3	F1	0.6	9.75		0.6	1.88		0.6	5.88		0.6	17.7		0.6	26.4		0.6	9.54		0.6	2.47		0.6	2.91		0.6
Total Dissolved Solids	500	S	mg/L	37		10	88		10	92		10	37		10	56		10	40		10	20		10	40		10	37		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10B-2 - CONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				EB-01-032420			EB-02-032520			EB-03-032620			EB-04-032720			Trip Blank		
				460-205754-08			460-205844-08			460-205924-03			460-205973-04			460-206064-35		
Lab ID				460-206064-05			460-206064-19			460-206064-22			460-206064-31					
Sample Date				3/24/2020			3/25/2020			3/26/2020			3/27/2020			3/23/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																		
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2
Total Metals																		
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		NA	
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		NA	
Barium	2000	P	ug/L		U	4		U	4		U	4		U	4		NA	
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		NA	
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		NA	
Calcium	NS		ug/L	117	J	200	99.3	J	200		U	200	106	J	200		NA	
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		NA	
Cobalt	NS		ug/L		U	4		U	4		U	4		U	4		NA	
Copper	1300	AL	ug/L		U	4		U	4		U	4		U	4		NA	
Iron	300	S	ug/L		U	120		U	120	81.9	J	120		U	120		NA	
Lead	15	AL	ug/L		U	1.2		U	1.2		U	1.2		U	1.2		NA	
Magnesium	NS		ug/L		U	200		U	200		U	200		U	200		NA	
Manganese	50	S	ug/L		U	8		U	8		U	8		U	8		NA	
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		NA	
Nickel	100	RE	ug/L		U	4		U	4		U	4		U	4		NA	
Potassium	NS		ug/L		U	200		U	200		U	200		U	200		NA	
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		NA	
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		NA	
Sodium	NS		ug/L	382		200	412		200	424		200	386		200		NA	
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		NA	
Vanadium	NS		ug/L		U	4		U	4		U	4		U	4		NA	
Zinc	5000	S	ug/L		U	16		U	16		U	16		U	16		NA	

TABLE 10B-2 - CONFINED
Event 2: GW Sampling Results Table
March 23 - March 28, 2020

Sample Location				EB-01-032420			EB-02-032520			EB-03-032620			EB-04-032720			Trip Blank		
				460-205754-08			460-205844-08			460-205924-03			460-205973-04			460-206064-35		
Lab ID				460-206064-05			460-206064-19			460-206064-22			460-206064-31					
Sample Date				3/24/2020			3/25/2020			3/26/2020			3/27/2020			3/23/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																		
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA	
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA	
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA	
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA	
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA	
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA	
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA	
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA	
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA	
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA	
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA	
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA	
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA	
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA	
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA	
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA	
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA	
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA	
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA	
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA	
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA	
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA	
Conventionals																		
Alkalinity	NS		mg/L		U	5		U	5		U	5		U	5		NA	
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	0.1		NA	
Chemical Oxygen Demand	NS		mg/L		U	10		U	100		U	10		U	10		NA	
Chloride	250	S	mg/L		U	0.12		U	0.12		U	0.12		U	0.12		NA	
Hardness as calcium carbonate	NS		mg/L		U	5		U	10		U	5		U	5		NA	
Nitrate as N	10	P	mg/L		U	0.1		U	0.1		U	0.1		U	0.1		NA	
Nitrate as N (reanalysis)	10	P	mg/L		NA			NA			NA			NA			NA	
Sulfate	250	S	mg/L		U	0.6		U	0.6		U	0.6		U	0.6		NA	
Total Dissolved Solids	500	S	mg/L		U	10		U	10	28		10	24		10		NA	

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10C-1 - UNCONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				MW-4			MW-5			MW-6			MW-15			MW-16			MW-17			MW-18			MW-19			MW-20			MW-21			MW-22			MW-24			MW-25		
Lab ID				460-209451-05			460-209451-04			460-209329-05			460-209329-02			460-209451-01			460-209329-06			460-209192-02			460-209192-01			460-209270-07			460-209270-06			460-209270-01			460-209516-04			460-209270-04		
				460-209657-26			460-209657-25			460-209657-18						460-209657-22			460-209657-19			460-209329-10			460-209329-09			460-209329-19			460-209329-18			460-209329-13			460-209657-34			460-209329-16		
																						460-209657-02			460-209657-01			460-209657-11			460-209657-10			460-209657-05						460-209657-08		
Sample Date				5/21/2020			5/21/2020			5/20/2020			5/20/2020			5/21/2020			5/20/2020			5/18/2020			5/18/2020			5/19/2020			5/19/2020			5/19/2020			5/22/2020			5/19/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																																							
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																									
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U *	1		U *	1		U	1		U *	1		U *	1		U *	1		U	1		U	1		U *	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1	1.4		1		U	1		U	1	1.2		1	2.4		1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L	1.6		1	0.58	J	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																										
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Arsenic	10	P	ug/L		U	2		U	2		U	2	7.7		2		U	2	1.6	J	2		U	2		U	2	0.85	J	2		U	2		U	2		U	2		U	2		U	2
Barium	2000	P	ug/L	39		4	8.6		4	22.4		4	25.3		4	131		4	26.4		4	21		4	106		4	69.9		4	33.8		4	43		4	15.3		4	21.6		4
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8	3.6		0.8		U	0.8		U	0.8	1.3		0.8	1.7		0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	1890		200	2020		200	2420		200	4680		200	1750		200	1680		200	3620		200	837		200	750		200	2440		200	2570		200	3130		200	2470		200
Chromium	100	P	ug/L		U	4		U	4		U	4	4.4		4		U	4	3.8	J	4		U	4		U	4	2.7	J	4	2.7	J	4		U	4		U	4		U	4		U	4
Cobalt	NS		ug/L	3.6	J	4	1.6	J	4		U	4		U	4	22.3		4	4.9		4		U	4	33.9		4	18.7		4	2.5	J	4		U	4		U	4		U	4		U	4
Copper	1300	AL	ug/L	2.3	J	4		U	4		U	4	4.2		4	7.8		4	5.9		4	2.3	J	4	6.5		4	10.1		4	3.4	J	4		U	4		U	4		U	4		U	4
Iron	300	S	ug/L	53.3	J	120	85	J	120		U	120	7410		120	53.6	J	120	3550		120		U	120	193		120	1050		120	406		120	140		120	227		120	326		120
Lead	15	AL	ug/L		U	1.2	0.87	J	1.2		U	1.2	0.92	J	1.2		U	1.2	1.6		1.2		U	1.2		U	1.2	1.6		1.2	0.58	J	1.2		U	1.2		U	1.2	0.62	J	1.2
Magnesium	NS		ug/L	2710		200	1490		200	1900		200	1430		200	1100		200	706		200	6420		200	1180		200	634		200	2910		200	3060		200	4190		200	1330		200
Manganese	50	S	ug/L	16.2		8	12		8	8.3		8	112		8	55.9		8	66.9		8	13.1		8	182		8	87.9		8	58.6		8	70.8		8	11.3		8	11.8		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	6.4		4	4.1		4		U	4	3.7	J	4	22.1		4	8.9		4	3	J	4	17.4		4	10.6		4	6.7		4		U	4		U	4	2.7	J	4
Potassium	NS		ug/L	965		200	771		200	1080		200	1670		200	616		200	226		200	1580		200	518		200	634		200	1020		200	1070		200	1050		200	1130		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	3490		200	4510		200	2620		200	1460		200	1800		200	2520		200	2180		200	1810		200	1280		200	2080		200	2060		200	1940		200	2300		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4		U	4		U	4	7.5		4		U	4	4.7		4		U	4		U	4	2.7	J	4	2	J	4		U	4		U	4	1.3	J	4
Zinc	5000	S	ug/L		U	16		U	16		U	16	45.3		16	72.4		16	32.9		16	46		16	81.4		16	49.8		16		U	16		U	16		U	16	14.9	J	16		U	16

TABLE 10C-1 - UNCONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				MW-4			MW-5			MW-6			MW-15			MW-16			MW-17			MW-18			MW-19			MW-20			MW-21			MW-22			MW-24			MW-25		
Lab ID				460-209451-05			460-209451-04			460-209329-05			460-209329-02			460-209451-01			460-209329-06			460-209192-02			460-209192-01			460-209270-07			460-209270-06			460-209270-01			460-209516-04			460-209270-04		
				460-209657-26			460-209657-25			460-209657-18						460-209657-22			460-209657-19			460-209329-10			460-209329-09			460-209329-19			460-209329-18			460-209329-13			460-209657-34			460-209329-16		
																						460-209657-02			460-209657-01			460-209657-11			460-209657-10			460-209657-05						460-209657-08		
Sample Date				5/21/2020			5/21/2020			5/20/2020			5/20/2020			5/21/2020			5/20/2020			5/18/2020			5/18/2020			5/19/2020			5/19/2020			5/19/2020			5/22/2020			5/19/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																																								
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																										
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		75.2		4		NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		1.8		0.8		NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		724		200		NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	4		NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		20.1		4		NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		6.7		4		NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	120		NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		0.66	J	1.2		NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		629		200		NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		94.8		8		NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	0.2		NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		11		4		NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		529		200		NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	10		NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	2		NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA		1160		200		NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	0.8		NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			U	4		NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA		48.9		16		NA			NA			NA			NA		
Conventionals																																										
Alkalinity	NS		mg/L		U	5		U	5		U	5	10.7		5		U	5		U	5	12.6		5		U	5		U	5		U	5	7.2		5	12.3		5	6.4		5
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1	0.22		0.1		U F1	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10	29.1		10		U	10	15.6		10		U	10	6.4	J	10		U	10		U	10		U	10		U	10		U	10
Chloride	250	S	mg/L	5.15		0.24	5.87		0.12	4.7		0.12	2.56		0.12	2.73	F1	0.12	1.45		0.12	2.25		0.12	2.92		0.12	2.4		0.12	3.33		0.12	2.02		0.12	2.34		0.12	3.23		0.12
Hardness as calcium carbonate	NS		mg/L	14		5	12		5	6		5	20		5	8		5	6		5	34		5	12		5	8		5	16		5	18		5	24		5	14		5
Nitrate as N	10	P	mg/L	0.23	H	0.1	0.44	H	0.1	0.29		0.1	0.17		0.1		U H	0.1	0.12		0.1	1.33		0.1	0.14		0.1	0.12		0.1	2.18		0.1	0.17		0.1	0.55		0.1	0.16		0.1
Sulfate	250	S	mg/L	9.65		0.6	5.44		0.6	8.98		0.6	8.27		0.6	13.5	F1	0.6	9.72		0.6	19.6		0.6	3.22		0.6	22.4		0.6	21.4		0.6	12.7		0.6	11.1		0.6	4.82		0.6
Total Dissolved Solids	500	S	mg/L	75		10	51		10	60		10	97		10	39		10	85		10	57		10	39		10	35		10	44		10	49		10	75		10	27		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10C-1 - UNCONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				MW-25D			MW-27			MW-29			MW-30			PMW-6			PMW-28			EB-01-051820			EB-02-051920			EB-03-052020			EB-04-052120			EB-05-052220			TB-01-051820			TB-02-051820		
Lab ID				460-209270-05			460-209516-03			460-209657-29			460-209270-03			460-209270-09			460-209329-04			460-209192-04			460-209270-08			460-209329-08			460-209451-03			460-209516-05			460-209329-21			460-209657-36		
				460-209329-17			460-209657-33						460-209329-15			460-209329-22			460-209657-17			460-209329-12			460-209329-20			460-209657-21			460-209657-24			460-209657-35								
				460-209657-09												460-209657-13						460-209657-04			460-209657-12																	
Sample Date				5/19/2020			5/22/2020			5/21/2020			5/19/2020			5/19/2020			5/20/2020			5/18/2020			5/19/2020			5/20/2020			5/21/2020			5/22/2020			5/18/2020			5/18/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		FD of MW-25																		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																											
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5	8.4		5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U *	1		U	1		U *	1		U *	1		U	1		U *	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1	0.51	J	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1	0.27	J	1	0.24	J	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																												
Antimony	6	P	ug/L		U	2	0.4	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Barium	2000	P	ug/L	21.9		4	42.3		4	20.7		4	23.9		4	29.6		4	40.9		4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Beryllium	4	P	ug/L		U	0.8		U	0.8	0.76	J	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA		
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Calcium	NS		ug/L	2480		200	1740		200	2950		200	3510		200	2390		200	1790		200		U	200	111	J	200		U	200	100	J	200	135	J	200		U	200		NA			NA		
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Cobalt	NS		ug/L		U	4		U	4	6		4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Copper	1300	AL	ug/L		U	4	4.2		4		U	4	2.7	J	4	5.7		4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Iron	300	S	ug/L	146		120	3000		120	597		120	1780		120	138		120	194		120		U	120		U	120		U	120		U	120		U	120		U	120		NA			NA		
Lead	15	AL	ug/L	0.56	J	1.2		U	1.2		U	1.2	1.1	J	1.2		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA			NA		
Magnesium	NS		ug/L	1370		200	960		200	786		200	2630		200	1800		200	1470		200		U	200		U	200		U	200		U	200		U	200		U	200		NA			NA		
Manganese	50	S	ug/L	11.7		8	71.9		8	22		8	28.4		8	17.7		8	19.6		8		U	8		U	8		U	8		U	8		U	8		U	8		NA			NA		
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA			NA		
Nickel	100	RE	ug/L	2.9	J	4	5.1		4	10		4		U	4		U	4	2.7	J	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Potassium	NS		ug/L	1140		200	814		200	1110		200	1510		200	852		200	1040		200		U	200		U	200		U	200		U	200		U	200		U	200		NA			NA		
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		NA			NA		
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Sodium	NS		ug/L	2400		200	1920		200	4710		200	2760		200	2800		200	4270		200	364		200	382		200	319		200	414		200	407		200			NA			NA		
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA		
Vanadium	NS		ug/L		U	4		U	4		U	4	2.6	J	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Zinc	5000	S	ug/L		U	16	17.7		16	103		16	42.8		16		U	16	26.8		16		U	16		U	16		U	16		U	16		U	16		U	16		NA			NA		

TABLE 10C-1 - UNCONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				MW-25D			MW-27			MW-29			MW-30			PMW-6			PMW-28			EB-01-051820			EB-02-051920			EB-03-052020			EB-04-052120			EB-05-052220			TB-01-051820			TB-02-051820		
Lab ID				460-209270-05			460-209516-03			460-209657-29			460-209270-03			460-209270-09			460-209329-04			460-209192-04			460-209270-08			460-209329-08			460-209451-03			460-209516-05			460-209329-21			460-209657-36		
				460-209329-17			460-209657-33						460-209329-15			460-209329-22			460-209657-17			460-209329-12			460-209329-20			460-209657-21			460-209657-24			460-209657-35								
				460-209657-09												460-209657-13						460-209657-04			460-209657-12																	
Sample Date				5/19/2020			5/22/2020			5/21/2020			5/19/2020			5/19/2020			5/20/2020			5/18/2020			5/19/2020			5/20/2020			5/21/2020			5/22/2020			5/18/2020			5/18/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		FD of MW-25																		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																											
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			NA		
Conventionals																																												
Alkalinity	NS		mg/L	6.2		5		U	5		U	5	12.6		5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		NA			NA		
Ammonia	NS		mg/L		U	0.1		U	0.1		U F1	0.1		U	0.1		U F1	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA		
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		NA			NA		
Chloride	250	S	mg/L	3.22		0.12	1.99		0.12	2.75		0.12	1.54		0.12	3.16		0.12	4.29		0.12		U	0.12		U	0.12		U	0.12		U	0.12		U	0.12		U	0.12		NA			NA		
Hardness as calcium carbonate	NS		mg/L	10		5	12		5	12		5	18		5	16		5	10		5		U	5		U	5		U	5		U	5		U	5		U	5		NA			NA		
Nitrate as N	10	P	mg/L	0.16		0.1		U	0.1	0.12	F1	0.1	0.12		0.1	0.15		0.1	0.2		0.1		U	0.1		U	0.1		U	0.1		U	0.1		U H	0.1		U	0.1		NA			NA		
Sulfate	250	S	mg/L	4.87		0.6	22.3		0.6	13.4		0.6	10		0.6	14.8		0.6	15		0.6		U	0.6		U	0.6		U	0.6		U	0.6		U	0.6		U	0.6		NA			NA		
Total Dissolved Solids	500	S	mg/L	39		10	65		10	52		10	48		10	47		10	67		10		U	10		U	10	15		10	36		10		U	10		NA			NA		

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA
TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane,
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10C-2 - CONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-13D			PMW-18			PMW-18-D			PMW-19			PMW-23		
Lab ID				460-209192-03			460-209451-07			460-209516-02			460-209329-07			460-209451-02			460-209329-01			460-209329-03			460-209451-06			460-209451-09			460-209516-01			460-209270-02		
				460-209329-11			460-209657-28			460-209657-32			460-209657-20			460-209657-23			460-209657-14			460-209657-16			460-209657-27			460-209657-30			460-209657-31			460-209329-14		
				460-209657-03																															460-209657-06		
Sample Date				5/18/2020			5/21/2020			5/22/2020			5/20/2020			5/21/2020			5/20/2020			5/20/2020			5/21/2020			5/21/2020			5/22/2020			5/19/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																				FD of PMW-13						FD of PMW-18								
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																				
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5	5		5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U F1 *	1		U	1		U	1		U *	1		U	1		U *	1		U *	1		U	1		U	1		U	1		U *	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																				
Antimony	6	P	ug/L		U	2	0.47	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Arsenic	10	P	ug/L		U	2	1.1	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Barium	2000	P	ug/L	4.8		4	21.9		4	41.5		4	3.4	J	4	20.3		4	7.9		4	8.5		4	6.5		4	6.2		4	17.5		4	4		4
Beryllium	4	P	ug/L	0.28	J	0.8		U	0.8		U	0.8		U	0.8	0.39	J	0.8		U	0.8		U	0.8		U	0.8		U	0.8	0.25	J	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	3720		200	14100		200	7210		200	529		200	2970		200	989		200	1020		200	448		200	486		200	1690		200	720		200
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4	2.5	J	4
Cobalt	NS		ug/L	2.2	J	4	3	J	4		U	4	2.6	J	4		U	4	4		4	4.7		4	2.1	J	4	2.2	J	4		U	4		U	4
Copper	1300	AL	ug/L		U	4	9.6		4	4.2		4	2.7	J	4		U	4	6.1		4	4.8		4	4.4		4	6.1		4		U	4		U	4
Iron	300	S	ug/L	840		120	3370		120	12500		120		U	120	6570		120	293		120	344		120	269		120	334		120	5260		120		U	120
Lead	15	AL	ug/L	1.3		1.2	3.9		1.2	0.73	J	1.2		U	1.2		U	1.2	1.6		1.2	1.7		1.2		U	1.2		U	1.2		U	1.2		U	1.2
Magnesium	NS		ug/L	127	J	200	1860		200	1570		200	236		200	1360		200	449		200	496		200	348		200	350		200	530		200	316		200
Manganese	50	S	ug/L	6	J	8	106		8	78.6		8	5.6	J	8	63.8		8	7.4	J	8	8.3		8	9		8	9.9		8	38.4		8	8.5		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	4		4	4.6		4		U	4	4.5		4		U	4	9.5		4	10.4		4	3.2	J	4	3.3	J	4		U	4	4.2		4
Potassium	NS		ug/L	419		200	4990		200	1390		200	522		200	1130		200	605		200	648		200	538		200	609		200	880		200	529		200
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	2230		200	662		200	2990		200	1460		200	1570		200	1600		200	1530		200	1090		200	1130		200	1780		200	1620		200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8	0.17	J	0.8	0.18	J	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4	2.2	J	4	6.3		4		U	4		U	4	1.3	J	4	1.4	J	4	1.1	J	4	1.3	J	4	1.2	J	4		U	4
Zinc	5000	S	ug/L	12.4	J	16	79.2		16	15.7	J	16		U	16	31.1		16	12.9	J	16		U	16		U	16	86.7		16		U	16		U	16

TABLE 10C-2 - CONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-13D			PMW-18			PMW-18-D			PMW-19			PMW-23		
Lab ID				460-209192-03			460-209451-07			460-209516-02			460-209329-07			460-209451-02			460-209329-01			460-209329-03			460-209451-06			460-209451-09			460-209516-01			460-209270-02		
				460-209329-11			460-209657-28			460-209657-32			460-209657-20			460-209657-23			460-209657-14			460-209657-16			460-209657-27			460-209657-30			460-209657-31			460-209329-14		
				460-209657-03																															460-209657-06		
Sample Date				5/18/2020			5/21/2020			5/22/2020			5/20/2020			5/21/2020			5/20/2020			5/20/2020			5/21/2020			5/21/2020			5/22/2020			5/19/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																				FD of PMW-13						FD of PMW-18								
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																				
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			NA			U	2
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			NA			U	2
Barium, Dissolved	2000	P	ug/L		NA			NA			NA		3.5	J	4	21		4		NA			NA			NA			NA			NA		3.6	J	4
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			U	0.8	0.35	J	0.8		NA			NA			NA			NA			NA			U	0.8
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			NA			U	2
Calcium, Dissolved	NS		ug/L		NA			NA			NA		484		200	2990		200		NA			NA			NA			NA			NA		632		200
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			NA			NA			U	4
Cobalt, Dissolved	NS		ug/L		NA			NA			NA		2	J	4		U	4		NA			NA			NA			NA			NA			U	4
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			NA			NA			U	4
Iron, Dissolved	300	S	ug/L		NA			NA			NA			U	120	6100		120		NA			NA			NA			NA			NA			U	120
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			U	1.2		U	1.2		NA			NA			NA			NA			NA			U	1.2
Magnesium, Dissolved	NS		ug/L		NA			NA			NA		196	J	200	1200		200		NA			NA			NA			NA			NA		272		200
Manganese, Dissolved	50	S	ug/L		NA			NA			NA		4.7	J	8	58.1		8		NA			NA			NA			NA			NA		7.4	J	8
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			U	0.2		U	0.2		NA			NA			NA			NA			NA			U	0.2
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA		3.3	J	4		U	4		NA			NA			NA			NA			NA			U	4
Potassium, Dissolved	NS		ug/L		NA			NA			NA		471		200	1040		200		NA			NA			NA			NA			NA		466		200
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			U	10		U	10		NA			NA			NA			NA			NA			U	10
Silver, Dissolved	100	S	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			NA			NA			U	2
Sodium, Dissolved	NS		ug/L		NA			NA			NA		1140		200	1220		200		NA			NA			NA			NA			NA		1390		200
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			U	0.8		U	0.8		NA			NA			NA			NA			NA			U	0.8
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			NA			NA			U	4
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			U	16	27.9		16		NA			NA			NA			NA			NA			U	16
Conventionals																																				
Alkalinity	NS		mg/L	7.4		5	50.8		5	32.9		5		U	5		U	5		U	5		U	5		U	5		U	5	5.9		5		U	5
Ammonia	NS		mg/L		U F1	0.1	0.2		0.1	0.15		0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10	44.8		10	22.2		10		U	10		U	10		U	10		U	10		U	10		U	10	6.1	J	10		U	10
Chloride	250	S	mg/L	2.35		0.12	0.83		0.12	0.95		0.12	1.62		0.12	1		0.12	2.08		0.12	2.01		0.12	1.4		0.12	1.41		0.12	1.78		0.12	2.43		0.12
Hardness as calcium carbonate	NS		mg/L	10		5	56		5	32		5		U	5	16		5	6		5		U	5		U	5		U	5	8		5		U	5
Nitrate as N	10	P	mg/L	0.11	F1	0.1	0.12		0.1	1.4		0.1	0.24		0.1		U H	0.1		U	0.1	0.11		0.1	0.37		0.1	0.38		0.1		U	0.1	0.45		0.1
Sulfate	250	S	mg/L	3.82		0.6	0.61		0.6	0.6		0.6	5.38		0.6	15.5		0.6	17.8		0.6	17.7		0.6	3.98		0.6	2.85		0.6	2		0.6	1.85		0.6
Total Dissolved Solids	500	S	mg/L	26		10	90		10	103		10	18		10	53		10	28		10	44		10	26		10	33		10	55		10	21		10

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA

TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10C-2 - CONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				EB-01-051820			EB-02-051920			EB-03-052020			EB-04-052120			EB-05-052220			TB-01-051820			TB-02-051820		
Lab ID				460-209192-04			460-209270-08			460-209329-08			460-209451-03			460-209516-05			460-209329-21			460-209657-36		
				460-209329-12			460-209329-20			460-209657-21			460-209657-24			460-209657-35								
				460-209657-04			460-209657-12																		
Sample Date				5/18/2020			5/19/2020			5/20/2020			5/21/2020			5/22/2020			5/18/2020			5/18/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																								
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5	8.4		5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U *	1		U	1		U *	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1	0.51	J	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L	0.27	J	1	0.24	J	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																								
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Barium	2000	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA	
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Calcium	NS		ug/L		U	200	111	J	200		U	200	100	J	200	135	J	200		NA			NA	
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Cobalt	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Copper	1300	AL	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Iron	300	S	ug/L		U	120		U	120		U	120		U	120		U	120		NA			NA	
Lead	15	AL	ug/L		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA			NA	
Magnesium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA	
Manganese	50	S	ug/L		U	8		U	8		U	8		U	8		U	8		NA			NA	
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA			NA	
Nickel	100	RE	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Potassium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA	
Selenium	50	P	ug/L		U	10		U	10		U	10		U	10		U	10		NA			NA	
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Sodium	NS		ug/L	364		200	382		200	319		200	414		200	407		200		NA			NA	
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA	
Vanadium	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Zinc	5000	S	ug/L		U	16		U	16		U	16		U	16		U	16		NA			NA	

TABLE 10C-2 - CONFINED
Event 3: GW Sampling Results Table
May 18 - May 22, 2020

Sample Location				EB-01-051820			EB-02-051920			EB-03-052020			EB-04-052120			EB-05-052220			TB-01-051820			TB-02-051820		
Lab ID				460-209192-04			460-209270-08			460-209329-08			460-209451-03			460-209516-05			460-209329-21			460-209657-36		
				460-209329-12			460-209329-20			460-209657-21			460-209657-24			460-209657-35								
				460-209657-04			460-209657-12																		
Sample Date				5/18/2020			5/19/2020			5/20/2020			5/21/2020			5/22/2020			5/18/2020			5/18/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																								
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA	
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA	
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA	
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Conventionals																								
Alkalinity	NS		mg/L		U	5		U	5		U	5		U	5		U	5		NA			NA	
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA	
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10		U	10		U	10		NA			NA	
Chloride	250	S	mg/L		U	0.12		U	0.12		U	0.12		U	0.12		U	0.12		NA			NA	
Hardness as calcium carbonate	NS		mg/L		U	5		U	5		U	5		U	5		U	5		NA			NA	
Nitrate as N	10	P	mg/L		U	0.1		U	0.1		U	0.1		U H	0.1		U	0.1		NA			NA	
Sulfate	250	S	mg/L		U	0.6		U	0.6		U	0.6		U	0.6		U	0.6		NA			NA	
Total Dissolved Solids	500	S	mg/L		U	10		U	10	15		10	36		10		U	10		NA			NA	

Notes:
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA

TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
RL: Reporting Limit
Q: Qualifier
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
ug/L: micrograms per liter
mg/L: milligram per liter
NS: No Standard
NA: Not analyzed
F1: MS and/or MSD exceeds control limits
*: LCS and/or LCSD outside of control limits
H: Sample analyzed beyond method holding time
MCL: Maximum Containment Level

TABLE 10D-1 - UNCONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				MW-4			MW-5			MW-6			MW-15			MW-16			MW-17			MW-18			MW-19			MW-20			MW-21			MW-22			MW-24			MW-24D			MW-25		
Lab ID				460-212997-09			460-212997-08			460-212997-06			460-212898-03			460-212898-02			460-212898-06			460-212898-09			460-212898-08			460-212774-07			460-213318-09			460-212997-01			460-212997-04			460-213318-23			460-213318-07		
				460-213318-27			460-213318-26			460-213318-24			460-213318-14			460-213318-13			460-213318-17			460-213318-02			460-212685-01			460-213318-10			460-212774-06			460-213318-19			460-213318-22			460-212997-05			460-212898-14		
																									460-213318-01			460-212898-16			460-212898-15												460-212774-04		
Sample Date				7/9/2020			7/9/2020			7/9/2020			7/8/2020			7/8/2020			7/8/2020			7/6/2020			7/6/2020			7/7/2020			7/7/2020			7/9/2020			7/9/2020			7/9/2020			7/7/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																																					FD of MW-24					
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																													
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5	21	F1	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1	1.6		1	4.1		1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L	1.2		1	0.65	J	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																															
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Arsenic	10	P	ug/L		U	2		U	2		U	2	3.5		2		U	2	2.5		2		U	2		U	2	2.6		2		U	2	1.3	J	2		U	2		U	2		U	2		U	2
Barium	2000	P	ug/L	39.4		4	8.5		4	21.1		4	16		4	107		4	22.3		4	20.3		4	65.4		4	60.1		4	29.7		4	24.1		4	17.2		4	13.3		4	20.8		4
Beryllium	4	P	ug/L	0.15	J	0.8		U	0.8		U	0.8		U	0.8	2.8		0.8	0.19	J	0.8		U	0.8	1.2		0.8	1.6		0.8	0.1	J	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Cadmium	5	P	ug/L	0.17	J	2		U	2		U	2	0.28	J	2	0.29	J	2		U	2	0.33	J	2	0.21	J	2	0.24	J	2		U	2		U	2		U	2		U	2		U	2
Calcium	NS		ug/L	1940		200	2180		200	2530		200	3360		200	5160		200	1340		200	3930		200	571		200	801		200	2170		200	1720		200	3780		200	3200		200	2380		200
Chromium	100	P	ug/L	1.9	J	4	1.2	J	4		U	4	7.9		4	0.88	J	4	5.6		4	1	J	4		U	4	6.7		4	1.7	J	4	3.2	J	4	1.2	J	4	1.4	J	4	3.5	J	4
Cobalt	NS		ug/L	3.9	J	4	1.6	J	4	0.56	J	4	0.54	J	4	19.8		4	4.1		4	0.63	J	4	22.6		4	16.6		4	2.5	J	4	1.1	J	4		U	4		U	4	1.3	J	4
Copper	1300	AL	ug/L		U	4		U	4		U	4	7.1		4	6.6		4	7.6		4		U	4	5.6		4	13.3		4		U	4	2.9	J	F1	4		U	4		U	4	4		4
Iron	300	S	ug/L	83.1	J	120	182		120		U	120	2490		120	74.9	J	120	5850		120	149		120	201		120	4320		120	168		120	1170		120	353		120	301		120	1530		120
Lead	15	AL	ug/L		U	1.2	1.8		1.2		U	1.2	1	J	1.2	0.17	J	1.2	3.4		1.2		U	1.2	0.29	J	1.2	4.7		1.2		U	1.2	0.6	J	1.2	1.4		1.2	0.12	J	1.2	1.3		1.2
Magnesium	NS		ug/L	3260		200	1620		200	2020		200	711		200	1190		200	709		200	7870		200	908		200	756		200	2950		200	2520		200	5110		200	4210		200	1390		200
Manganese	50	S	ug/L	22.7		8	13.7		8	9.2		8	66.7		8	57.4		8	56.7		8	12.6		8	134		8	78.2		8	51.2		8	58.3		8	14.1		8	18.4		8	13.1		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	6		4	3.9	J	4	1.9	J	4	3.2	J	4	23.2		4	7.5		4	3	J	4	12.4		4	10.7		4	7.4		4	2.1	J	4	2.6	J	4	2.4	J	4	3.5	J	4
Potassium	NS		ug/L	983		200	865		200	1200		200	1350		200	822		200	348		200	1420		200	551		200	1160		200	1050		200	1030		200	1200		200	1030		200	1270		200
Selenium	50	P	ug/L	0.52	J	2.5	0.62	J	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	3260		200	4730		200	3040		200	661	B	200	1770	B	200	1760	B	200	2220	B	200	1830	B	200	1420	B	200	2360	B	200	2280	B	200	1920		200	1780		200	2490	B	200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L		U	4		U	4		U	4	5.7		4		U	4	7.6		4		U	4		U	4	8.2		4		U	4	3	J	4		U	4		U	4	4.6		4
Zinc	5000	S	ug/L	8.4	J	16	7.4	J	16		U	16	37.7		16	102		16	33.7		16	44.7		16	60.1		16	58.1		16	7.9	J	16	10.8	J	16	8.8	J	16	12.5	J	16	17.9		16

Sample Location				MW-4			MW-5			MW-6			MW-15			MW-16			MW-17			MW-18			MW-19			MW-20			MW-21			MW-22			MW-24			MW-24D			MW-25		
Lab ID				460-212997-09			460-212997-08			460-212997-06			460-212898-03			460-212898-02			460-212898-06			460-212898-09			460-212898-08			460-212774-07			460-213318-09			460-212997-01			460-212997-04			460-213318-23			460-213318-07		
				460-213318-27			460-213318-26			460-213318-24			460-213318-14			460-213318-13			460-213318-17			460-213318-02			460-212685-01			460-213318-10			460-212774-06			460-213318-19			460-213318-22			460-212997-05			460-212898-14		
																									460-213318-01			460-212898-16			460-212898-15												460-212774-04		
Sample Date				7/9/2020			7/9/2020			7/9/2020			7/8/2020			7/8/2020			7/8/2020			7/6/2020			7/6/2020			7/7/2020			7/7/2020			7/9/2020			7/9/2020			7/9/2020			7/7/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																																					FD of MW-24					
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																													
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			U	2		NA			NA			U	2		NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA		1.7	J	2		NA			NA			U	2		NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA		23.6		4		NA			NA		64.8		4		NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA		0.26	J	0.8		NA			NA		1.8		0.8		NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			U	2		NA			NA		0.18	J	2		NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA		1570		200		NA			NA		813		200		NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA		2	J	4		NA			NA			U	4		NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA		4.3		4		NA			NA		17.7		4		NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA		4.3		4		NA			NA		8		4		NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA		3300		120		NA			NA		12	J	120		NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA		2.8		1.2		NA			NA		1.5		1.2		NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA		661		200		NA			NA		697		200		NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA		62		8		NA			NA		83.2		8		NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			U	0.2		NA			NA			U	0.2		NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA		7.4		4		NA			NA		11.4		4		NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA		183	J	200		NA			NA		841		200		NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			U	2.5		NA			NA			U	2.5		NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			U	2		NA			NA			U	2		NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA		1720		200		NA			NA		1330		200		NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			U	0.8		NA			NA			U	0.8		NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA		3.1	J	4		NA			NA			U	4		NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA		22.5		16		NA			NA		54.3		16		NA			NA			NA			NA			NA		
Conventionals																																													
Alkalinity	NS		mg/L		U	5		U	5	5.5		5	14		5	11		5		U	5	21		10		U	10		U	5	6		5	9.2		5	8		5	7.5		5	11		5
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1	0.058	J	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U F1	0.1		U	0.1		U	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L	4.1	J	10		U	10		U	10	46.8		10		U	10	10.7		10		U	10		U	10		U	10		U	10		U	10		U	10		U	10		U	10
Chloride	250	S	mg/L	4.81		0.12	5.36		0.12	4.65		0.12	0.45		0.12	2.22		0.12	1.27		0.12	2.01		0.12	2.72		0.12	1.91		0.12	3.04		0.12	1.82		0.12	2.13		0.12	2.22		0.12	3.3		0.12
Hardness as calcium carbonate	NS		mg/L	14		5	10		5	12		5	16		5	16		5	10		5	34		5	6		5	8		5	14		5	12		5	26		5	26		5	10		5
Nitrate as N	10	P	mg/L	0.18		0.1	0.45		0.1	0.25		0.1	0.093	J	0.1	0.095	J	0.1	0.089	J	0.1	1.46		0.1	0.096	J	0.1	0.1		0.1	0.37		0.1	0.13		0.1	0.76		0.1	0.76		0.1	0.13		0.1
Sulfate	250	S	mg/L	14.7		0.6	5.83		0.6	7.61		0.6	1.73		0.6	17.9		0.6	15.2		0.6	23.2		0.6	37.3		0.6	15.3		0.6	13.5		0.6	11.1	F1	0.6	14.5		0.6	13.8		0.6	3.82		0.6
Total Dissolved Solids	500	S	mg/L	57		10	49		10	45		10	48		10	51		10	21		10	56		10	17		10	20		10	48		10	35		10	65		10	72		10	35		10

Notes:
MCL: Maximum Containment Level
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA

TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
ug/L: micrograms per liter
mg/L: milligram per liter
RL: Reporting Limit
Q: Qualifier
NS: No Standard
NA: Not analyzed
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
H: Sample analyzed beyond method holding time
F1/F2: MS and/or MSD exceeds control limits

TABLE 10D-1 - UNCONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				MW-25D			MW-27			MW-29			MW-29D			MW-30			PMW-6			PMW-28			EB-01-070620			EB-02-070720			EB-03-070820			EB-04-070920			EB-05-071020			TB-01-070620			TB-02-070920		
Lab ID				460-212898-19			460-212898-05			460-213077-03			460-213318-31			460-212774-03			460-213077-02			460-213318-28			460-212685-03			460-212774-08			460-213318-18			460-213318-21			460-213318-33			460-212898-18			460-213318-36		
				460-212774-05			460-213318-16			460-213318-30			460-213077-04			460-213318-06			460-213318-29			460-213077-01			460-213318-03			460-212898-17			460-212898-07			460-212997-03			460-213077-06								
				460-213318-08												460-212898-13									460-212898-10			460-213318-11																	
Sample Date				7/7/2020			7/8/2020			7/10/2020			7/10/2020			7/7/2020			7/10/2020			7/10/2020			7/6/2020			7/7/2020			7/8/2020			7/9/2020			7/10/2020			7/6/2020			7/9/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		FD of MW-25									FD of MW-29												Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																																													
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5	25		5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																																													
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2	0.99	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Barium	2000	P	ug/L	21.5		4	33		4	20.3		4	22.1		4	14.5		4	23.5		4	41.7		4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Beryllium	4	P	ug/L		U	0.8	0.16	J	0.8	0.69	J	0.8	0.71	J	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA		
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Calcium	NS		ug/L	2350		200	1340		200	2000		200	2060		200	5500		200	2330		200	2620		200	143	J	200	157	J	200	164	J	200	142	J	200	150	J	200	NA			NA		
Chromium	100	P	ug/L	2.7	J	4	1.9	J	4	0.81	J	4	0.77	J	4	4.2		4		U	4	1.2	J	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Cobalt	NS		ug/L	1.3	J	4	2.9	J	4	6.9		4	7.1		4	0.42	J	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Copper	1300	AL	ug/L	29.1		4	3.1	J	4		U	4		U	4	5.6		4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Iron	300	S	ug/L	1190		120	2890		120	1800		120	1890		120	1700		120	22.5	J	120	130		120		U	120	20.8	J	120		U	120		U	120		U	120		NA			NA		
Lead	15	AL	ug/L	2.2		1.2	1.3		1.2		U	1.2	0.11	J	1.2	1.6		1.2		U	1.2	0.18	J	1.2		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA			NA		
Magnesium	NS		ug/L	1360		200	873		200	871		200	909		200	1130		200	2100		200	2030		200		U	200		U	200		U	200		U	200		U	200		NA			NA		
Manganese	50	S	ug/L	20.9		8	65.3		8	26.2		8	22.4		8	14.6		8	10		8	17.3		8		U	8		U	8		U	8		U	8		U	8		NA			NA		
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA			NA		
Nickel	100	RE	ug/L	3.3	J	4	2.9	J	4	12.1		4	12.3		4	1.6	J	4	1	J	4	2.9	J	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Potassium	NS		ug/L	1220		200	902		200	1350		200	1390		200	1290		200	1080		200	1230		200		U	200		U	200		U	200		U	200		U	200		NA			NA		
Selenium	50	P	ug/L		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		NA			NA		
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		NA			NA		
Sodium	NS		ug/L	2500	B	200	1690	B	200	5310		200	5600		200	1060	B	200	3470		200	4400		200	536	B	200	535	B	200	606	B	200	557		200	577		200	NA			NA		
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA		
Vanadium	NS		ug/L	3.2	J	4	2	J	4		U	4		U	4	4.2		4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		U	4		NA			NA		
Zinc	5000	S	ug/L	33.4		16	9.9	J	16	76.9		16	76		16	96.9		16		U	16	44.1		16		U	16		U	16		U	16		U	16		U	16		U	16		NA			NA		

TABLE 10D-1 - UNCONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				MW-25D			MW-27			MW-29			MW-29D			MW-30			PMW-6			PMW-28			EB-01-070620			EB-02-070720			EB-03-070820			EB-04-070920			EB-05-071020			TB-01-070620			TB-02-070920		
Lab ID				460-212898-19			460-212898-05			460-213077-03			460-213318-31			460-212774-03			460-213077-02			460-213318-28			460-212685-03			460-212774-08			460-213318-18			460-213318-21			460-213318-33			460-212898-18			460-213318-36		
				460-212774-05			460-213318-16			460-213318-30			460-213077-04			460-213318-06			460-213318-29			460-213077-01			460-213318-03			460-212898-17			460-212898-07			460-212997-03			460-213077-06								
				460-213318-08												460-212898-13									460-212898-10			460-213318-11																	
Sample Date				7/7/2020			7/8/2020			7/10/2020			7/10/2020			7/7/2020			7/10/2020			7/10/2020			7/6/2020			7/7/2020			7/8/2020			7/9/2020			7/10/2020			7/6/2020			7/9/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		FD of MW-25									FD of MW-29												Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																																														
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA		10.1		4		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			U	0.8		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA		5850		200		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			U	4		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA		0.32	J	4		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA		3.7	J	4		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA		126		120		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA		0.23	J	1.2		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA		1080		200		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA		16.7		8		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			U	0.2		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA		0.87	J	4		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA		1100		200		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			U	2.5		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			U	2		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA		1120		200		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			U	0.8		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			U	4		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA		88.7		16		NA			NA			NA			NA			NA			NA			NA			NA			NA		
Conventionals																																														
Alkalinity	NS		mg/L	11		5		U	5		U	5		U	5	21		5	5.9		5		U	5		U	10		U	5		U	5		U	5		U	5		NA			NA		
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	F1 0.1		U	0.1		U	F1 0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA		
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10		U	10	18.6		10		U	10	4.1	J	10		U	10		U	10		U	10		U	10		U	10		NA			NA		
Chloride	250	S	mg/L	3.29		0.12	1.76		0.12	2.86		0.12	2.82		0.12	0.72		0.12	3.06		0.12	6.98		0.12		U	0.12		U	0.12		U	0.12		U	0.12		U	0.12		NA			NA		
Hardness as calcium carbonate	NS		mg/L	10		5	10		5	10		5	10		5	20		5	12		5	12		5		U	5		U	5		U	5		U	5		U	5		NA			NA		
Nitrate as N	10	P	mg/L	0.13		0.1	1.47		0.1		U	0.1		U	0.1	0.089	J	0.1	0.12	H	0.1	0.23	H	0.1		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA		
Sulfate	250	S	mg/L	4.38		0.6	31.3		0.6	16.8		0.6	19.1		0.6	1.99		0.6	14.1	F1	0.6	11.6		0.6		U	0.6		U	0.6		U	0.6		U	0.6		U	0.6		NA			NA		
Total Dissolved Solids	500	S	mg/L	39		10	45		10	39		10	95		10	48		10	36		10	41		10		U	10		U	10		U	10		U	10		U	10		NA			NA		

Notes:
MCL: Maximum Containment Level
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA

TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
ug/L: micrograms per liter
mg/L: milligram per liter
RL: Reporting Limit
Q: Qualifier
NS: No Standard
NA: Not analyzed
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
H: Sample analyzed beyond method holding time
F1/F2: MS and/or MSD exceeds control limits

TABLE 10D-2 - CONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-18			PMW-19			PMW-23		
Lab ID				460-213318-35			460-213077-07			460-212774-02			460-213318-25			460-213318-12			460-213318-15			460-213318-32			460-212898-11			460-212997-02		
				460-213077-08			460-213318-34			460-212898-12			460-212997-07			460-212898-01			460-212898-04			460-213077-05			460-213318-04			460-213318-20		
										460-213318-05															460-212774-01					
Sample Date				7/10/2020			7/10/2020			7/7/2020			7/9/2020			7/7/2020			7/8/2020			7/10/2020			7/7/2020			7/9/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																												
Parameter	Criteria	Criteria Notes	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																														
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U F2	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																														
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Arsenic	10	P	ug/L	1.1	J	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Barium	2000	P	ug/L	3.8	J	4	15.8		4	38.4		4	7.9		4	22.7		4	7		4	6.3		4	14.9		4	12.4		4
Beryllium	4	P	ug/L	0.16	J	0.8		U	0.8		U	0.8		U	0.8	0.64	J	0.8		U	0.8	0.12	J	0.8	0.18	J	0.8		U	0.8
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2	0.51	J	2		U	2		U	2		U	2
Calcium	NS		ug/L	4100		200	13000		200	7290		200	533		200	2700		200	1010		200	507		200	1650		200	669		200
Chromium	100	P	ug/L	1.5	J	4	2.1	J	4	2	J	4	2.3	J	4	2.6	J	4	1.2	J	4	1	J	4	0.73	J	4	2.4	J	4
Cobalt	NS		ug/L	1.9	J	4	1.9	J	4		U	4	2	J	4	2	J	4	4.3		4	2.3	J	4	0.41	J	4	1.2	J	4
Copper	1300	AL	ug/L		U	4	4.9		4	3.6	J	4	3.9	J	4	4		4		U	4	3.8	J	4		U	4	2.9	J	4
Iron	300	S	ug/L	1370		120	2170		120	12700		120	1270		120	5260		120	307		120	391		120	5170		120	1040		120
Lead	15	AL	ug/L	3.2		1.2	2.3		1.2	0.61	J	1.2	0.67	J	1.2	1	J	1.2	1.5		1.2	0.32	J	1.2	0.26	J	1.2	0.8	J	1.2
Magnesium	NS		ug/L	157	J	200	1700		200	1740		200	262		200	1160		200	547		200	432		200	538		200	379		200
Manganese	50	S	ug/L	19.2		8	63.7		8	84.2		8	14.6		8	69.3		8	8		8	13.2		8	37.8		8	16.4		8
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2
Nickel	100	RE	ug/L	9.1		4	3.7	J	4	1.7	J	4	4		4	3.8	J	4	9.4		4	4.1		4	1.5	J	4	2.8	J	4
Potassium	NS		ug/L	496		200	4780		200	1450		200	860		200	1500		200	723		200	717		200	966		200	877		200
Selenium	50	P	ug/L		U	2.5		U	2.5		U	2.5	0.95	J	2.5		U	2.5		U	2.5	0.46	J	2.5		U F1	2.5		U	2.5
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Sodium	NS		ug/L	2230		200	665		200	3100	B	200	1470		200	1790	B	200	1690	B	200	1210		200	1730	B	200	1740	B	200
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8
Vanadium	NS		ug/L	0.46	J	4	1.4	J	4	5.2		4	2	J	4	3.5	J	4	0.63	J	4	0.7	J	4	0.97	J	4	2.2	J	4
Zinc	5000	S	ug/L	15.1	J	16	54.3		16	21.9		16	15.3	J	16	213		16	10.5	J	16	14.8	J	16	137		16	13	J	16

TABLE 10D-2 - CONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				MW-10			MW-14			MW-28			PMW-11			PMW-12			PMW-13			PMW-18			PMW-19			PMW-23		
Lab ID				460-213318-35			460-213077-07			460-212774-02			460-213318-25			460-213318-12			460-213318-15			460-213318-32			460-212898-11			460-212997-02		
				460-213077-08			460-213318-34			460-212898-12			460-212997-07			460-212898-01			460-212898-04			460-213077-05			460-213318-04			460-213318-20		
										460-213318-05																460-212774-01					
Sample Date				7/10/2020			7/10/2020			7/7/2020			7/9/2020			7/7/2020			7/8/2020			7/10/2020			7/7/2020			7/9/2020		
Matrix				Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater			Groundwater		
Remarks	EPA MCL	Screening																												
Parameter	Criteria	Criteria Notes	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																														
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			U	2
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			U	2
Barium, Dissolved	2000	P	ug/L		NA			NA			NA		4.7		4	20.3		4		NA			NA			NA		4.2		4
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA		0.15	J	0.8	0.49	J	0.8		NA			NA			NA		0.1	J	0.8
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			U	2
Calcium, Dissolved	NS		ug/L		NA			NA			NA		555		200	2940		200		NA			NA			NA		731		200
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			U	4
Cobalt, Dissolved	NS		ug/L		NA			NA			NA		2.1	J	4	0.53	J	4		NA			NA			NA		1.2	J	4
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			U	4
Iron, Dissolved	300	S	ug/L		NA			NA			NA			U	120	4660		120		NA			NA			NA			U	120
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			U	1.2		U	1.2		NA			NA			NA			U	1.2
Magnesium, Dissolved	NS		ug/L		NA			NA			NA		220		200	1140		200		NA			NA			NA		317		200
Manganese, Dissolved	50	S	ug/L		NA			NA			NA		5.7	J	8	59.1		8		NA			NA			NA		8		8
Mercury, Dissolved	2	P	ug/L		NA			NA			NA		0.092	J	0.2		U	0.2		NA			NA			NA			U	0.2
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA		3.6	J	4	2.6	J	4		NA			NA			NA		2.2	J	4
Potassium, Dissolved	NS		ug/L		NA			NA			NA		498		200	1110		200		NA			NA			NA		478		200
Selenium, Dissolved	50	P	ug/L		NA			NA			NA		1.1	J	2.5		U	2.5		NA			NA			NA			U	2.5
Silver, Dissolved	100	S	ug/L		NA			NA			NA			U	2		U	2		NA			NA			NA			U	2
Sodium, Dissolved	NS		ug/L		NA			NA			NA		1380		200	1680		200		NA			NA			NA		1690		200
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			U	0.8		U	0.8		NA			NA			NA			U	0.8
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			U	4		U	4		NA			NA			NA			U	4
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA		7.9	J	16	197		16		NA			NA			NA			U	16
Conventionals																														
Alkalinity	NS		mg/L		U	5	48.6		5	32.3		5		U	5		U	5		U	5		U	5	11.9		5		U	5
Ammonia	NS		mg/L		U	0.1		U	0.1	0.15		0.1		U	0.1		U	0.1		U	0.1		U	0.1		U F1	0.1		U	0.1
Chemical Oxygen Demand	NS		mg/L		U	10	19.9		10	11.4		10		U	10		U	10		U	10		U	10	7.8	J	10		U	10
Chloride	250	S	mg/L	2.36		0.12	0.57		0.12	0.93		0.12	1.46		0.12	1.08		0.12	2.11		0.12	1.42		0.12	1.61		0.12	2.41		0.12
Hardness as calcium carbonate	NS		mg/L	16		5	36		5	36		5	6		5	12		5	8		5	6		5	12		5	10		5
Nitrate as N	10	P	mg/L	0.085		0.1	0.2		0.1		U	0.1	0.19		0.1		U	0.1		U	0.1	0.32		0.1		U	0.1	0.39		0.1
Sulfate	250	S	mg/L	2.62		0.6	0.52		0.6	1.62		0.6	3.78		0.6	18.2		0.6	18.1		0.6	6.55		0.6	5.33	F1	0.6	1.76		0.6
Total Dissolved Solids	500	S	mg/L	33		10	70		10	73		10	14		10	50		10	40		10	22		10	14		10	31		10

Notes:
MCL: Maximum Containment Level
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA

TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
ug/L: micrograms per liter
mg/L: milligram per liter
RL: Reporting Limit
Q: Qualifier
NS: No Standard
NA: Not analyzed
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
H: Sample analyzed beyond method holding time
F1/F2: MS and/or MSD exceeds control limits

TABLE 10D-2 - CONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				EB-01-070620			EB-02-070720			EB-03-070820			EB-04-070920			EB-05-071020			TB-01-070620			TB-02-070920		
Lab ID				460-212685-03			460-212774-08			460-213318-18			460-213318-21			460-213318-33			460-212898-18			460-213318-36		
				460-213318-03			460-212898-17			460-212898-07			460-212997-03			460-213077-06								
				460-212898-10			460-213318-11																		
Sample Date				7/6/2020			7/7/2020			7/8/2020			7/9/2020			7/10/2020			7/6/2020			7/9/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria Notes	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Volatiles																								
1,1,1,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,1-Trichloroethane	200	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2,2-Tetrachloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1,2-Trichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,1-Dichloroethene	7	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2,3-Trichloropropane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dibromo-3-Chloropropane	0.2	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dibromoethane	0.05	P	ug/L		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02		U	0.02
1,2-Dichlorobenzene	600	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloroethane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,2-Dichloropropane	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
1,4-Dichlorobenzene	75	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
2-Butanone (MEK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5
2-Hexanone	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5
4-Methyl-2-pentanone (MIBK)	NS		ug/L		U	5		U	5		U	5		U	5		U	5		U	5		U	5
Acetone	NS		ug/L		U	5		U	5		U	5	25		5		U	5		U	5		U	5
Acrylonitrile	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Benzene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromochloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromodichloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromoform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Bromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon disulfide	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Carbon tetrachloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chlorobenzene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloroform	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Chloromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,2-Dichloroethene	70	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
cis-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromochloromethane	80	TTHM	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Dibromomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Ethylbenzene	700	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Iodomethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methyl tert-butyl ether	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Methylene Chloride	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Styrene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Tetrachloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Toluene	1000	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,2-Dichloroethene	100	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,3-Dichloropropene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
trans-1,4-Dichloro-2-butene	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichloroethene	5	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Trichlorofluoromethane	NS		ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Vinyl acetate	NS		ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Vinyl chloride	2	P	ug/L		U	1		U	1		U	1		U	1		U	1		U	1		U	1
Xylenes, Total	10000	P	ug/L		U	2		U	2		U	2		U	2		U	2		U	2		U	2
Total Metals																								
Antimony	6	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Arsenic	10	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Barium	2000	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Beryllium	4	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA	
Cadmium	5	P	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Calcium	NS		ug/L	143	J	200	157	J	200	164	J	200	142	J	200	150	J	200		NA			NA	
Chromium	100	P	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Cobalt	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Copper	1300	AL	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Iron	300	S	ug/L		U	120	20.8	J	120		U	120		U	120		U	120		NA			NA	
Lead	15	AL	ug/L		U	1.2		U	1.2		U	1.2		U	1.2		U	1.2		NA			NA	
Magnesium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA	
Manganese	50	S	ug/L		U	8		U	8		U	8		U	8		U	8		NA			NA	
Mercury	2	P	ug/L		U	0.2		U	0.2		U	0.2		U	0.2		U	0.2		NA			NA	
Nickel	100	RE	ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Potassium	NS		ug/L		U	200		U	200		U	200		U	200		U	200		NA			NA	
Selenium	50	P	ug/L		U	2.5		U	2.5		U	2.5		U	2.5		U	2.5		NA			NA	
Silver	100	S	ug/L		U	2		U	2		U	2		U	2		U	2		NA			NA	
Sodium	NS		ug/L	536	B	200	535	B	200	606	B	200	557		200	577		200		NA			NA	
Thallium	2	P	ug/L		U	0.8		U	0.8		U	0.8		U	0.8		U	0.8		NA			NA	
Vanadium	NS		ug/L		U	4		U	4		U	4		U	4		U	4		NA			NA	
Zinc	5000	S	ug/L		U	16		U	16		U	16		U	16		U	16		NA			NA	

TABLE 10D-2 - CONFINED
Event 4: GW Sampling Results Table
July 6 - July 10, 2020

Sample Location				EB-01-070620			EB-02-070720			EB-03-070820			EB-04-070920			EB-05-071020			TB-01-070620			TB-02-070920		
Lab ID				460-212685-03			460-212774-08			460-213318-18			460-213318-21			460-213318-33			460-212898-18			460-213318-36		
				460-213318-03			460-212898-17			460-212898-07			460-212997-03			460-213077-06								
				460-212898-10			460-213318-11																		
Sample Date				7/6/2020			7/7/2020			7/8/2020			7/9/2020			7/10/2020			7/6/2020			7/9/2020		
Matrix				Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous			Aqueous		
Remarks	EPA MCL	Screening		Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Equipment Blank			Trip Blank			Trip Blank		
Parameter	Criteria	Criteria Notes	**Units**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**	**Result**	**Q**	**RL**
Dissolved Metals																								
Antimony, Dissolved	6	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Arsenic, Dissolved	10	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Barium, Dissolved	2000	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Beryllium, Dissolved	4	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Cadmium, Dissolved	5	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Calcium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Chromium, Dissolved	100	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Cobalt, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Copper, Dissolved	1300	AL	ug/L		NA			NA			NA			NA			NA			NA			NA	
Iron, Dissolved	300	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Lead, Dissolved	15	AL	ug/L		NA			NA			NA			NA			NA			NA			NA	
Magnesium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Manganese, Dissolved	50	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Mercury, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Nickel, Dissolved	100	RE	ug/L		NA			NA			NA			NA			NA			NA			NA	
Potassium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Selenium, Dissolved	50	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Silver, Dissolved	100	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Sodium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Thallium, Dissolved	2	P	ug/L		NA			NA			NA			NA			NA			NA			NA	
Vanadium, Dissolved	NS		ug/L		NA			NA			NA			NA			NA			NA			NA	
Zinc, Dissolved	5000	S	ug/L		NA			NA			NA			NA			NA			NA			NA	
Conventionals																								
Alkalinity	NS		mg/L		U	10		U	5		U	5		U	5		U	5		NA			NA	
Ammonia	NS		mg/L		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA	
Chemical Oxygen Demand	NS		mg/L		U	10		U	10		U	10		U	10		U	10		NA			NA	
Chloride	250	S	mg/L		U	0.12		U	0.12		U	0.12		U	0.12		U	0.12		NA			NA	
Hardness as calcium carbonate	NS		mg/L		U	5		U	5		U	5		U	5		U	5		NA			NA	
Nitrate as N	10	P	mg/L		U	0.1		U	0.1		U	0.1		U	0.1		U	0.1		NA			NA	
Sulfate	250	S	mg/L		U	0.6		U	0.6		U	0.6		U	0.6		U	0.6		NA			NA	
Total Dissolved Solids	500	S	mg/L		U	10		U	10		U	10		U	10		U	10		NA			NA	

Notes:
MCL: Maximum Containment Level
Shading exceeds EPA MCL screening criteria
P: EPA Primary MCL
S: EPA Secondary MCL
AL: EPA Action Level
RE: No MCL but recommended level by EPA

TTHM: Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
ug/L: micrograms per liter
mg/L: milligram per liter
RL: Reporting Limit
Q: Qualifier
NS: No Standard
NA: Not analyzed
U: Compound not detected
J: The concentration is an estimated value.
B: Compound detected in sample and blank
H: Sample analyzed beyond method holding time
F1/F2: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-4			MW-4			MW-4			MW-4		
			Sample Name	MW-4			MW-4			MW-4			MW-4		
			Sample Date	1/31/2020			3/24/2020			5/21/2020			7/9/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U *	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U *	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U *	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U *	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	0.95	J	0.47	0.8	J	0.47	1.6		0.47	1.2		0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	0.96	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	44.2		1.2	49.7		1.2	39		1.2	39.4		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	0.15	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.17	J	0.16
Calcium	NS		ug/L	2280		98.8	2180		98.8	1890		98.8	1940		22.7
Chromium	100	P	ug/L	3	J	2.3	< 2.3	U	2.3	< 2.3	U	2.3	1.9	J	0.69
Cobalt	NS		ug/L	4		1.6	3.6	J	1.6	3.6	J	1.6	3.9	J	0.26
Copper	1300	AL	ug/L	7.5		2	2.2	J	2	2.3	J	2	< 2.5	U	2.5
Iron	300	S	ug/L	52.1	J	51.1	274		51.1	53.3	J	51.1	83.1	J	8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium	NS		ug/L	2960		73.7	2730		73.7	2710		73.7	3260		15.4
Manganese	50	S	ug/L	22.1		2.9	19		2.9	16.2		2.9	22.7		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	7.1		2.4	5.6		2.4	6.4		2.4	6		0.45
Potassium	NS		ug/L	973		86.7	990		86.7	965		86.7	983		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	0.52	J	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	3430		128	3100		128	3490		128	3260		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	15.5	J	11.1	< 11.1	U	11.1	< 11.1	U	11.1	8.4	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	4.1	J	3.3
Chloride	250	S	mg/L	5.62		0.014	5.28		0.014	5.15		0.028	4.81		0.014
Hardness, Calcium Carbonate	NS		mg/L	26		5	22		5	14		5	14		5
Nitrate as N	10	P	mg/L	0.2		0.056	0.16		0.056	0.23	H	0.056	0.18		0.056
Sulfate	250	S	mg/L	12.7		0.35	16.4		0.35	9.65		0.35	14.7		0.35
Total Dissolved Solids	500	S	mg/L	30		10	55		10	75		10	57		10
Field Data															
pH	NS		SU	4.82			5.05			4.37			4.21		
Temperature	NS		C°	10.4			12.48			13.9			16.8		
Specific Conductivity	NS		mS/cm	0.063			0.043			0.063			0.059		
Dissolved Oxygen	NS		mg/L	3.6			6.96			7.2			7.16		
Oxidation Reduction Potential	NS		mV	295.4			396			267.4			391		
Turbidity	NS		NTU	7.08			7.1			7.87			17.9		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

				Sample Location	MW-5			MW-5			MW-5			MW-5		
				Sample Name	MW-5			MW-5			MW-5			MW-5		
				Sample Date	1/31/2020			3/24/2020			5/21/2020			7/9/2020		
				N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U F1 *	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U F1 *	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U F1	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U F1	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U F1 *	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U *	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	0.82	J	0.47	0.48	J	0.47	0.58	J	0.47	0.65	J	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	2.2	B	0.4	0.87	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	9.1		1.2	11		1.2	8.6		1.2	8.5		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2130		98.8	2490		98.8	2020		98.8	2180		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	1.2	J	0.69
Cobalt	NS		ug/L	1.8	J	1.6	< 1.6	U	1.6	1.6	J	1.6	1.6	J	0.26
Copper	1300	AL	ug/L	2.8	J	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron	300	S	ug/L	< 51.1	U	51.1	73.4	J	51.1	85	J	51.1	182		8.5
Lead	15	AL	ug/L	0.87	J	0.55	2.5		0.55	0.87	J	0.55	1.8		0.11
Magnesium	NS		ug/L	1570		73.7	1370		73.7	1490		73.7	1620		15.4
Manganese	50	S	ug/L	13.7		2.9	12.5		2.9	12		2.9	13.7		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	5.5		2.4	4.6		2.4	4.1		2.4	3.9	J	0.45
Potassium	NS		ug/L	798		86.7	774		86.7	771		86.7	865		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	0.62	J	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	4670		128	4040		128	4510		128	4730		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	7.4	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U F1	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	6.01	F1	0.028	5.76		0.014	5.87		0.014	5.36		0.014
Hardness, Calcium Carbonate	NS		mg/L	18		5	16		5	12		5	10		5
Nitrate as N	10	P	mg/L	0.39		0.056	0.63		0.056	0.44	H	0.056	0.45		0.056
Sulfate	250	S	mg/L	5.83		0.35	22.4		0.35	5.44		0.35	5.83		0.35
Total Dissolved Solids	500	S	mg/L	27		10	34		10	51		10	49		10
Field Data															
pH	NS		SU	3.38			4.45			4.99			8.89		
Temperature	NS		C°	11.34			12.84			13.4			15.4		
Specific Conductivity	NS		mS/cm	0.049			0.049			0.05			0.053		
Dissolved Oxygen	NS		mg/L	9.51			4.28			6.67			6.35		
Oxidation Reduction Potential	NS		mV	417			420			246.9			288.6		
Turbidity	NS		NTU	6.8			3.2			7.41			14.1		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-6			MW-6			MW-6			MW-6		
			Sample Name	MW-6			MW-6			MW-6			MW-6		
			Sample Date	2/3/2020			3/24/2020			5/20/2020			7/9/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	0.54	J	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	0.92	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	20.7		1.2	30.7		1.2	22.4		1.2	21.1		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2340		98.8	2790		98.8	2420		98.8	2530		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	0.56	J	0.26
Copper	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron	300	S	ug/L	< 51.1	U	51.1	< 51.1	U	51.1	< 51.1	U	51.1	< 8.5	U	8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium	NS		ug/L	1910		73.7	1990		73.7	1900		73.7	2020		15.4
Manganese	50	S	ug/L	8.2		2.9	8.4		2.9	8.3		2.9	9.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	< 2.4	U	2.4	< 2.4	U	2.4	< 2.4	U	2.4	1.9	J	0.45
Potassium	NS		ug/L	1110		86.7	1260		86.7	1080		86.7	1200		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2850		128	2710		128	2620		128	3040		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	< 5.1	U	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	5.4		5	5.6		5	< 5	U	5	5.5		5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	5.18		0.014	5.18		0.014	4.7		0.014	4.65		0.014
Hardness, Calcium Carbonate	NS		mg/L	14		5	16		5	6		5	12		5
Nitrate as N	10	P	mg/L	0.22		0.056	0.23		0.056	0.29		0.056	0.25		0.056
Sulfate	250	S	mg/L	7.52		0.35	11.2		0.35	8.98		0.35	7.61		0.35
Total Dissolved Solids	500	S	mg/L	39		10	48		10	60		10	45		10
Field Data															
pH	NS		SU	4.92			4.74			4.58			9.14		
Temperature	NS		C°	13.94			12.8			14.2			16.1		
Specific Conductivity	NS		mS/cm	0.045			0.51			0.054			0.052		
Dissolved Oxygen	NS		mg/L	6.82			1.98			6.9			6.45		
Oxidation Reduction Potential	NS		mV	329			332.5			253.9			-24.4		
Turbidity	NS		NTU	0			6.21			0.32			1.12		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-10			MW-10			MW-10			MW-10		
			Sample Name	MW-10			MW-10			MW-10			MW-10		
			Sample Date	2/4/2020			3/23/2020			5/18/2020			7/10/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U F1 *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.51	J	0.4	0.74	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	0.91	J	0.73	< 0.73	U	0.73	< 0.73	U	0.73	1.1	J	0.89
Barium	2000	P	ug/L	4.7		1.2	4.1		1.2	4.8		1.2	3.8	J	0.91
Beryllium	4	P	ug/L	0.29	J	0.25	0.27	J	0.25	0.28	J	0.25	0.16	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	4650		98.8	3760		98.8	3720		98.8	4100		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	1.5	J	0.69
Cobalt	NS		ug/L	2.2	J	1.6	2.1	J	1.6	2.2	J	1.6	1.9	J	0.26
Copper	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron	300	S	ug/L	1250		51.1	595		51.1	840		51.1	1370		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	1.1	J	0.55	1.3		0.55	3.2		0.11
Magnesium	NS		ug/L	124	J	73.7	111	J	73.7	127	J	73.7	157	J	15.4
Manganese	50	S	ug/L	8.3		2.9	6.4	J	2.9	6	J	2.9	19.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	4.2		2.4	4		2.4	4		2.4	9.1		0.45
Potassium	NS		ug/L	397		86.7	360		86.7	419		86.7	496		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2070		128	2070		128	2230		128	2230		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	1.5	J	1.1	< 1.1	U	1.1	< 1.1	U	1.1	0.46	J	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	12.4	J	11.1	15.1	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	9.1		5	8.5		5	7.4		5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U F1	0.034	< 0.034	U F1	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.41		0.014	2.52	F1	0.014	2.35		0.014	2.36		0.014
Hardness, Calcium Carbonate	NS		mg/L	14		5	18		5	10		5	16		5
Nitrate as N	10	P	mg/L	< 1.12	U	1.12	< 0.056	U	0.056	0.11	F1	0.056	0.085		0.056
Sulfate	250	S	mg/L	9.62		0.35	13.3	F1	0.35	3.82		0.35	2.62		0.35
Total Dissolved Solids	500	S	mg/L	42		10	37		10	26		10	33		10
Field Data															
pH	NS		SU	5.56			5.66			4.95			8.5		
Temperature	NS		C°	13.49			11.81			13.7			24.8		
Specific Conductivity	NS		mS/cm	0.036			0.025			0.035			0.019		
Dissolved Oxygen	NS		mg/L	0.45			0.19			0.69			8.24		
Oxidation Reduction Potential	NS		mV	175			213			215			-30.7		
Turbidity	NS		NTU	6			11.8			7.19			26.4		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C^{o} - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-14			MW-14			MW-14			MW-14		
			Sample Name	MW-14			MW-14			MW-14			MW-14		
			Sample Date	2/3/2020			3/24/2020			5/21/2020			7/10/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	5		4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	1.9		0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	7		0.25	3.6		0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	0.68	J	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.76	J	0.4	0.47	J	0.4	0.47	J	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	0.98	J	0.73	0.95	J	0.73	1.1	J	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	26.9		1.2	21.3		1.2	21.9		1.2	15.8		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	14400		98.8	16800		98.8	14100		98.8	13000		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	2.1	J	0.69
Cobalt	NS		ug/L	3.3	J	1.6	2	J	1.6	3	J	1.6	1.9	J	0.26
Copper	1300	AL	ug/L	4.1		2	2.7	J	2	9.6		2	4.9		2.5
Iron	300	S	ug/L	6250		51.1	2620		51.1	3370		51.1	2170		8.5
Lead	15	AL	ug/L	4.1		0.55	2.1		0.55	3.9		0.55	2.3		0.11
Magnesium	NS		ug/L	1920		73.7	2730		73.7	1860		73.7	1700		15.4
Manganese	50	S	ug/L	180		2.9	53.6		2.9	106		2.9	63.7		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	4		2.4	3.3	J	2.4	4.6		2.4	3.7	J	0.45
Potassium	NS		ug/L	5750		86.7	7200		86.7	4990		86.7	4780		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	939		128	901		128	662		128	665		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	3.1	J	1.1	2.7	J	1.1	2.2	J	1.1	1.4	J	0.37
Zinc	5000	S	ug/L	73.1		11.1	65.2		11.1	79.2		11.1	54.3		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	40.8		5	50.3		5	50.8		5	48.6		5
Ammonia	NS		mg/L	0.048	J	0.034	< 0.034	U	0.034	0.2		0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	12.3		3.3	6.3	J	3.3	44.8		3.3	19.9		3.3
Chloride	250	S	mg/L	1.17		0.014	0.98		0.014	0.83		0.014	0.57		0.014
Hardness, Calcium Carbonate	NS		mg/L	44		5	50		5	56		5	36		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	0.094	J	0.056	0.12		0.056	0.2		0.056
Sulfate	250	S	mg/L	6.27		0.35	9.75		0.35	0.61		0.35	0.52		0.35
Total Dissolved Solids	500	S	mg/L	70		10	88		10	90		10	70		10
Field Data															
pH	NS		SU	5.81			6.28			6.69			12.8		
Temperature	NS		C°	13.4			14.1			22.8			22.5		
Specific Conductivity	NS		mS/cm	0.113			0.123			0.115			0.101		
Dissolved Oxygen	NS		mg/L	0.41			2.19			0.3			1.22		
Oxidation Reduction Potential	NS		mV	-20.8			220.9			-40.2			87.8		
Turbidity	NS		NTU	63.2			48.7			27.6			27.9		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-15			MW-15			MW-15			MW-15		
			Sample Name	MW-15			MW-15			MW-15			MW-15		
			Sample Date	1/30/2020			3/25/2020			5/20/2020			7/8/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	6.4		4.4	4.7	J	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.8	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	8.5		0.73	4.2		0.73	7.7		0.73	3.5		0.89
Barium	2000	P	ug/L	26		1.2	26.6		1.2	25.3		1.2	16		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.28	J	0.16
Calcium	NS		ug/L	4180		98.8	3530		98.8	4680		98.8	3360		22.7
Chromium	100	P	ug/L	5.1		2.3	5.9		2.3	4.4		2.3	7.9		0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	0.54	J	0.26
Copper	1300	AL	ug/L	13.8		2	10.4		2	4.2		2	7.1		2.5
Iron	300	S	ug/L	4980		51.1	3440		51.1	7410		51.1	2490		8.5
Lead	15	AL	ug/L	2.1		0.55	2.6		0.55	0.92	J	0.55	1	J	0.11
Magnesium	NS		ug/L	847		73.7	772		73.7	1430		73.7	711		15.4
Manganese	50	S	ug/L	105		2.9	90.3		2.9	112		2.9	66.7		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	3.2	J	2.4	4		2.4	3.7	J	2.4	3.2	J	0.45
Potassium	NS		ug/L	1920		86.7	1890		86.7	1670		86.7	1350		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	727		128	869		128	1460		128	661	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	8.4		1.1	6.8		1.1	7.5		1.1	5.7		0.37
Zinc	5000	S	ug/L	45.8		11.1	40.5		11.1	45.3		11.1	37.7		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	8.3		5	< 5	U	5	10.7		5	14		5
Ammonia	NS		mg/L	0.14		0.034	0.14		0.034	0.22		0.034	0.058	J	0.034
Chemical Oxygen Demand	NS		mg/L	26.6		3.3	26.5		3.3	29.1		3.3	46.8		3.3
Chloride	250	S	mg/L	1.37		0.014	1.26		0.014	2.56		0.014	0.45		0.014
Hardness, Calcium Carbonate	NS		mg/L	52		10	14		5	20		5	16		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	0.11		0.056	0.17		0.056	0.093	J	0.056
Sulfate	250	S	mg/L	5.69		0.35	10.8		0.35	8.27		0.35	1.73		0.35
Total Dissolved Solids	500	S	mg/L	46		10	50		10	97		10	48		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L		NA		< 0.40	U	0.4		NA			NA	
Arsenic, Dissolved	10	P	ug/L		NA		3.5		0.73		NA			NA	
Barium, Dissolved	2000	P	ug/L		NA		22.1		1.2		NA			NA	
Beryllium, Dissolved	4	P	ug/L		NA		< 0.25	U	0.25		NA			NA	
Cadmium, Dissolved	5	P	ug/L		NA		< 0.81	U	0.81		NA			NA	
Calcium, Dissolved	NS		ug/L		NA		3490		98.8		NA			NA	
Chromium, Dissolved	100	P	ug/L		NA		< 2.3	U	2.3		NA			NA	
Cobalt, Dissolved	NS		ug/L		NA		< 1.6	U	1.6		NA			NA	
Copper, Dissolved	1300	AL	ug/L		NA		4		2		NA			NA	
Iron, Dissolved	300	S	ug/L		NA		2270		51.1		NA			NA	
Lead, Dissolved	15	AL	ug/L		NA		< 0.55	U	0.55		NA			NA	
Magnesium, Dissolved	NS		ug/L		NA		786		73.7		NA			NA	
Manganese, Dissolved	50	S	ug/L		NA		97.2		2.9		NA			NA	
Mercury, Dissolved	2	P	ug/L		NA		< 0.091	U	0.091		NA			NA	
Nickel, Dissolved	100	RE	ug/L		NA		2.7	J	2.4		NA			NA	
Potassium, Dissolved	NS		ug/L		NA		1890		86.7		NA			NA	
Selenium, Dissolved	50	P	ug/L		NA		< 5.4	U	5.4		NA			NA	
Silver, Dissolved	100	S	ug/L		NA		< 0.59	U	0.59		NA			NA	
Sodium, Dissolved	NS		ug/L		NA		1010		128		NA			NA	
Thallium, Dissolved	2	P	ug/L		NA		< 0.16	U	0.16		NA			NA	
Vanadium, Dissolved	NS		ug/L		NA		2.1	J	1.1		NA			NA	
Zinc, Dissolved	5000	S	ug/L		NA		34.3		11.1		NA			NA	
Field Data															
pH	NS		SU	4.54			3.82			5.45			4.31		
Temperature	NS		C°	10.03			10.41			12.7			20.1		
Specific Conductivity	NS		mS/cm	0.043			0.045			0.071			0.031		
Dissolved Oxygen	NS		mg/L	1.61			0.6			0.65			4.17		
Oxidation Reduction Potential	NS		mV	190			310			60.7			232.4		
Turbidity	NS		NTU	49.3			119			38.4			35.2		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-16			MW-16			MW-16			MW-16			MW-16		
			Sample Name	MW-16			MW-16			MW-16			MW-16			MW-16		
			Sample Date	1/30/2020			3/25/2020			5/21/2020			7/8/2020					
			N=Normal, FD=Field Duplicate	N			N			N			N					
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL			
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27			
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24			
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37			
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26			
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26			
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66			
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009			
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009			
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35			
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33			
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9			
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1			
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3			
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4			
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77			
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2			
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41			
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34			
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54			
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55			
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82			
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21			
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38			
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Chloroform	80	TTHM	ug/L	1.4		0.33	0.84	J	0.33	1.4		0.33	< 0.33	U	0.33			
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4			
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22			
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22			
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28			
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6			
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3			
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48			
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47			
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42			
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25			
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38			
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24			
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49			
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34			
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31			
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83			
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17			
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65			
Total Metals																		
Antimony	6	P	ug/L	0.6	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76			
Arsenic	10	P	ug/L	< 0.73	U	0.73	0.83	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89			
Barium	2000	P	ug/L	113		1.2	130		1.2	131		1.2	107		0.91			
Beryllium	4	P	ug/L	1.9		0.25	3.5		0.25	3.6		0.25	2.8		0.098			
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.29	J	0.16			
Calcium	NS		ug/L	7380		98.8	2220		98.8	1750		98.8	5160		22.7			
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	0.88	J	0.69			
Cobalt	NS		ug/L	17.7		1.6	20.5		1.6	22.3		1.6	19.8		0.26			
Copper	1300	AL	ug/L	6.9		2	7.2		2	7.8		2	6.6		2.5			
Iron	300	S	ug/L	116	J	51.1	397		51.1	53.6	J	51.1	74.9	J	8.5			
Lead	15	AL	ug/L	< 0.55	U	0.55	0.66	J	0.55	< 0.55	U	0.55	0.17	J	0.11			
Magnesium	NS		ug/L	1140		73.7	1120		73.7	1100		73.7	1190		15.4			
Manganese	50	S	ug/L	51.6		2.9	56.1		2.9	55.9		2.9	57.4		1.1			
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091			
Nickel	100	RE	ug/L	22.1		2.4	21.3		2.4	22.1		2.4	23.2		0.45			
Potassium	NS		ug/L	837		86.7	711		86.7	616		86.7	822		112			
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46			
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19			
Sodium	NS		ug/L	1860		128	1690		128	1800		128	1770	B	58.2			
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17			
Vanadium	NS		ug/L	< 1.1	U	1.1	1.8	J	1.1	< 1.1	U	1.1	< 0.37	U	0.37			
Zinc	5000	S	ug/L	284		11.1	103		11.1	72.4		11.1	102		5.1			
General Chemistry																		
Alkalinity, Total	NS		mg/L	13.5		5	< 5	U	5	< 5	U	5	11		5			
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U F1	0.034	< 0.034	U F1	0.034	< 0.034	U	0.034			
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U F1	3.3	< 3.3	U	3.3	< 3.3	U	3.3			
Chloride	250	S	mg/L	2.65		0.014	2.84		0.014	2.73	F1	0.014	2.22		0.014			
Hardness, Calcium Carbonate	NS		mg/L	30		5	10		5	8		5	16		5			
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U H	0.056	0.095	J	0.056			
Sulfate	250	S	mg/L	13.4		0.35	18.4	F1	0.35	13.5	F1	0.35	17.9		0.35			
Total Dissolved Solids	500	S	mg/L	< 10	U	10	31		10	39		10	51		10			
Field Data																		
pH	NS		SU	5.26			5.03			4.61			4.18					
Temperature	NS		C^o	9.06			11.78			13.3			18.7					
Specific Conductivity	NS		mS/cm	0.066			0.03			0.046			0.058					
Dissolved Oxygen	NS		mg/L	6.19			5.98			6.61			4.72					
Oxidation Reduction Potential	NS		mV	336			375			326.5			313					
Turbidity	NS		NTU	2.8			13.6			5.64			2.72					

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
QC - Quality Control
SU - Standard Units
C^o - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-17			MW-17			MW-17			MW-17		
			Sample Name	MW-17			MW-17			MW-17			MW-17		
			Sample Date	1/29/2020			3/25/2020			5/20/2020			7/8/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U*	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.65	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	1	J	0.73	1.3	J	0.73	1.6	J	0.73	2.5		0.89
Barium	2000	P	ug/L	29.5		1.2	28.1		1.2	26.4		1.2	22.3		0.91
Beryllium	4	P	ug/L	0.29	J	0.25	0.51	J	0.25	< 0.25	U	0.25	0.19	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	1610		98.8	1540		98.8	1680		98.8	1340		22.7
Chromium	100	P	ug/L	4.6		2.3	3.7	J	2.3	3.8	J	2.3	5.6		0.69
Cobalt	NS		ug/L	5.6		1.6	5.4		1.6	4.9		1.6	4.1		0.26
Copper	1300	AL	ug/L	7.7		2	4.7		2	5.9		2	7.6		2.5
Iron	300	S	ug/L	2660		51.1	2630		51.1	3550		51.1	5850		8.5
Lead	15	AL	ug/L	2.8		0.55	2.5		0.55	1.6		0.55	3.4		0.11
Magnesium	NS		ug/L	879		73.7	748		73.7	706		73.7	709		15.4
Manganese	50	S	ug/L	78.3		2.9	67.6		2.9	66.9		2.9	56.7		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	9.9		2.4	9.9		2.4	8.9		2.4	7.5		0.45
Potassium	NS		ug/L	297		86.7	229		86.7	226		86.7	348		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2740		128	2110		128	2520		128	1760	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	5.6		1.1	5.2		1.1	4.7		1.1	7.6		0.37
Zinc	5000	S	ug/L	27.2		11.1	28.1		11.1	32.9		11.1	33.7		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	5.2	J	3.3	766	J	329	15.6		3.3	10.7		3.3
Chloride	250	S	mg/L	1.62		0.014	1.29		0.014	1.45		0.014	1.27		0.014
Hardness, Calcium Carbonate	NS		mg/L	18		5	< 5	U	5	6		5	10		5
Nitrate as N	10	P	mg/L	< 0.056	U H	0.056	< 0.056	U	0.056	0.12		0.056	0.089	J	0.056
Sulfate	250	S	mg/L	10.7		0.35	10.6		0.35	9.72		0.35	15.2		0.35
Total Dissolved Solids	500	S	mg/L	88		10	101		10	85		10	21		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L		NA		< 0.4	U	0.4		NA		< 0.76	U	0.76
Arsenic, Dissolved	10	P	ug/L		NA		< 0.73	U	0.73		NA		1.7	J	0.89
Barium, Dissolved	2000	P	ug/L		NA		21		1.2		NA		23.6		0.91
Beryllium, Dissolved	4	P	ug/L		NA		0.28	J	0.25		NA		0.26	J	0.098
Cadmium, Dissolved	5	P	ug/L		NA		< 0.81	U	0.81		NA		< 0.16	U	0.16
Calcium, Dissolved	NS		ug/L		NA		1520		98.8		NA		1570		22.7
Chromium, Dissolved	100	P	ug/L		NA		< 2.3	U	2.3		NA		2	J	0.69
Cobalt, Dissolved	NS		ug/L		NA		4.9		1.6		NA		4.3		0.26
Copper, Dissolved	1300	AL	ug/L		NA		3.3	J	2		NA		4.3		2.5
Iron, Dissolved	300	S	ug/L		NA		158		51.1		NA		3300		8.5
Lead, Dissolved	15	AL	ug/L		NA		< 0.55	U	0.55		NA		2.8		0.11
Magnesium, Dissolved	NS		ug/L		NA		669		73.7		NA		661		15.4
Manganese, Dissolved	50	S	ug/L		NA		65.2		2.9		NA		62		1.1
Mercury, Dissolved	2	P	ug/L		NA		< 0.091	U	0.091		NA		< 0.091	U	0.091
Nickel, Dissolved	100	RE	ug/L		NA		8		2.4		NA		7.4		0.45
Potassium, Dissolved	NS		ug/L		NA		< 86.7	U	86.7		NA		183	J	112
Selenium, Dissolved	50	P	ug/L		NA		< 5.4	U	5.4		NA		< 0.46	U	0.46
Silver, Dissolved	100	S	ug/L		NA		< 0.59	U	0.59		NA		< 0.19	U	0.19
Sodium, Dissolved	NS		ug/L		NA		2260		128		NA		1720		58.2
Thallium, Dissolved	2	P	ug/L		NA		< 0.16	U	0.16		NA		< 0.17	U	0.17
Vanadium, Dissolved	NS		ug/L		NA		< 1.1	U	1.1		NA		3.1	J	0.37
Zinc, Dissolved	5000	S	ug/L		NA		25.7		11.1		NA		22.5		5.1
Field Data															
pH	NS		SU	4.28			4.4			4.26			5.36		
Temperature	NS		C^0	6.8			9.5			15.1			21.3		
Specific Conductivity	NS		mS/cm	0.039			0.024			0.038			0.035		
Dissolved Oxygen	NS		mg/L	4.87			4.51			0.5			0.34		
Oxidation Reduction Potential	NS		mV	274.8			355			260.7			140.7		
Turbidity	NS		NTU	74.8			73.2			35.3			102.1		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C^0 - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-18			MW-18			MW-18			MW-18		
			Sample Name	MW-18			MW-18			MW-18			MW-18		
			Sample Date	1/29/2020			3/25/2020			5/18/2020			7/6/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.53	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	16.2		1.2	14.8		1.2	21		1.2	20.3		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.33	J	0.16
Calcium	NS		ug/L	3030		98.8	3060		98.8	3620		98.8	3930		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	1	J	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	0.63	J	0.26
Copper	1300	AL	ug/L	2.9	J	2	2.2	J	2	2.3	J	2	< 2.5	U	2.5
Iron	300	S	ug/L	322		51.1	160		51.1	< 51.1	U	51.1	149		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium	NS		ug/L	6160		73.7	5470		73.7	6420		73.7	7870		15.4
Manganese	50	S	ug/L	11.4		2.9	9.8		2.9	13.1		2.9	12.6		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	4.7		2.4	3.2	J	2.4	3	J	2.4	3	J	0.45
Potassium	NS		ug/L	1460		86.7	1480		86.7	1580		86.7	1420		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1870		128	2080		128	2180		128	2220	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	30.3		11.1	28.4		11.1	46		11.1	44.7		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	23.8		5	22.1		5	12.6		5	21		10
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U F1	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	2.28		0.014	3.17		0.014	2.25		0.014	2.01		0.014
Hardness, Calcium Carbonate	NS		mg/L	36		5	26		5	34		5	34		5
Nitrate as N	10	P	mg/L	0.48		0.056	0.83		0.056	1.33		0.056	1.46		0.056
Sulfate	250	S	mg/L	13.2		0.35	10.6		0.35	19.6		0.35	23.2		0.35
Total Dissolved Solids	500	S	mg/L	45		10	56		10	57		10	56		10
Field Data															
pH	NS		SU	5.49			5.31			5.51			5.41		
Temperature	NS		C°	12.2			10.5			13.3			22.3		
Specific Conductivity	NS		mS/cm	0.086			0.074			0.088			0.094		
Dissolved Oxygen	NS		mg/L	3.43			4.37			5.03			4.26		
Oxidation Reduction Potential	NS		mV	215.5			217.3			219.5			214.8		
Turbidity	NS		NTU	13.2			9.71			7.33			19.7		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-19			MW-19			MW-19			MW-19		
			Sample Name	MW-19			MW-19			MW-19			MW-19		
			Sample Date	1/29/2020			3/26/2020			5/18/2020			7/6/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	1.8		0.33	1.2		0.33	1.2		0.33	1.6		0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.55	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	0.74	J	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	75.2		1.2	71.4		1.2	106		1.2	65.4		0.91
Beryllium	4	P	ug/L	1.4		0.25	1.5		0.25	1.3		0.25	1.2		0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.21	J	0.16
Calcium	NS		ug/L	564		98.8	737		98.8	837		98.8	571		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt	NS		ug/L	34.6		1.6	36.5		1.6	33.9		1.6	22.6		0.26
Copper	1300	AL	ug/L	7.2		2	5.9		2	6.5		2	5.6		2.5
Iron	300	S	ug/L	2560		51.1	1080		51.1	193		51.1	201		8.5
Lead	15	AL	ug/L	0.57	J	0.55	< 0.55	U	0.55	< 0.55	U	0.55	0.29	J	0.11
Magnesium	NS		ug/L	1160		73.7	1170		73.7	1180		73.7	908		15.4
Manganese	50	S	ug/L	176		2.9	200		2.9	182		2.9	134		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	15.7		2.4	16.4		2.4	17.4		2.4	12.4		0.45
Potassium	NS		ug/L	458		86.7	472		86.7	518		86.7	551		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1910		128	1940		128	1810		128	1830	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	67.4		11.1	76.1		11.1	81.4		11.1	60.1		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 10	U	10
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	4.2	J	3.3	< 3.3	U	3.3	6.4	J	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.24		0.014	3.11		0.014	2.92		0.014	2.72		0.014
Hardness, Calcium Carbonate	NS		mg/L	14		5	6		5	12		5	6		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	0.14		0.056	0.096	J	0.056
Sulfate	250	S	mg/L	28.9		0.35	23.3		0.35	3.22		0.35	37.3		0.35
Total Dissolved Solids	500	S	mg/L	38		10	48		10	39		10	17		10
Field Data															
pH	NS		SU	4.19			4.14			3.74			4.21		
Temperature	NS		C°	11.92			18.05			13.5			17.6		
Specific Conductivity	NS		mS/cm	0.068			0.066			0.072			0.064		
Dissolved Oxygen	NS		mg/L	5.84			7.76			6.59			6.3		
Oxidation Reduction Potential	NS		mV	368			469			347.6			198.4		
Turbidity	NS		NTU	19.5			2.61			4.37			1.95		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recomme
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochlo
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-20			MW-20			MW-20			MW-20		
			Sample Name	MW-20			MW-20			MW-20			MW-20		
			Sample Date	1/29/2020			3/26/2020			5/19/2020			7/7/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	1.1		0.33	0.97	J	0.33	2.4		0.33	4.1		0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.67	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	1.1	J	0.73	1	J	0.73	0.85	J	0.73	2.6		0.89
Barium	2000	P	ug/L	66		1.2	67.7		1.2	69.9		1.2	60.1		0.91
Beryllium	4	P	ug/L	1.7		0.25	1.8		0.25	1.7		0.25	1.6		0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.24	J	0.16
Calcium	NS		ug/L	826		98.8	657		98.8	750		98.8	801		22.7
Chromium	100	P	ug/L	4.3		2.3	3	J	2.3	2.7	J	2.3	6.7		0.69
Cobalt	NS		ug/L	21.1		1.6	22		1.6	18.7		1.6	16.6		0.26
Copper	1300	AL	ug/L	10.8		2	10.4		2	10.1		2	13.3		2.5
Iron	300	S	ug/L	1670		51.1	1010		51.1	1050		51.1	4320		8.5
Lead	15	AL	ug/L	3.5		0.55	1.9		0.55	1.6		0.55	4.7		0.11
Magnesium	NS		ug/L	760		73.7	724		73.7	634		73.7	766		15.4
Manganese	50	S	ug/L	96.7		2.9	96.2		2.9	87.9		2.9	78.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	14.6		2.4	12.7		2.4	10.6		2.4	10.7		0.45
Potassium	NS		ug/L	935		86.7	779		86.7	634		86.7	1160		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1310		128	1320		128	1280		128	1420	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	4.9		1.1	3.6	J	1.1	2.7	J	1.1	8.2		0.37
Zinc	5000	S	ug/L	50.7		11.1	62.3		11.1	49.8		11.1	58.1		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	2.62		0.014	2.3		0.014	2.4		0.014	1.91		0.014
Hardness, Calcium Carbonate	NS		mg/L	12		5	< 5	U	5	8		5	8		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	0.12		0.056	0.1		0.056
Sulfate	250	S	mg/L	23.8		0.35	17.7		0.35	22.4		0.35	15.3		0.35
Total Dissolved Solids	500	S	mg/L	33		10	52		10	35		10	20		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L			NA	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic, Dissolved	10	P	ug/L			NA	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium, Dissolved	2000	P	ug/L			NA	70.1		1.2	75.2		1.2	64.8		0.91
Beryllium, Dissolved	4	P	ug/L			NA	1.8		0.25	1.8		0.25	1.8		0.098
Cadmium, Dissolved	5	P	ug/L			NA	< 0.81	U	0.81	< 0.81	U	0.81	0.18	J	0.16
Calcium, Dissolved	NS		ug/L			NA	735		98.8	724		98.8	813		22.7
Chromium, Dissolved	100	P	ug/L			NA	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt, Dissolved	NS		ug/L			NA	23.2		1.6	20.1		1.6	17.7		0.26
Copper, Dissolved	1300	AL	ug/L			NA	9.8		2	6.7		2	8		2.5
Iron, Dissolved	300	S	ug/L			NA	< 51.1	U	51.1	< 51.1	U	51.1	12	J	8.5
Lead, Dissolved	15	AL	ug/L			NA	0.84	J	0.55	0.66	J	0.55	1.5		0.11
Magnesium, Dissolved	NS		ug/L			NA	788		73.7	629		73.7	697		15.4
Manganese, Dissolved	50	S	ug/L			NA	105		2.9	94.8		2.9	83.2		1.1
Mercury, Dissolved	2	P	ug/L			NA	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel, Dissolved	100	RE	ug/L			NA	13.4		2.4	11		2.4	11.4		0.45
Potassium, Dissolved	NS		ug/L			NA	639		86.7	529		86.7	841		112
Selenium, Dissolved	50	P	ug/L			NA	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver, Dissolved	100	S	ug/L			NA	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium, Dissolved	NS		ug/L			NA	1430		128	1160		128	1330		58.2
Thallium, Dissolved	2	P	ug/L			NA	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium, Dissolved	NS		ug/L			NA	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc, Dissolved	5000	S	ug/L			NA	57.5		11.1	48.9		11.1	54.3		5.1
Field Data															
pH	NS		SU	3.96			3.88			3.76			3.73		
Temperature	NS		C^o	9.8			11.8			15.2			21.3		
Specific Conductivity	NS		mS/cm	0.063			0.057			0.058			0.051		
Dissolved Oxygen	NS		mg/L	9.63			8.49			6.75			4.04		
Oxidation Reduction Potential	NS		mV	359.5			406.1			405.3			368.5		
Turbidity	NS		NTU	98.1			74.2			107.5			112		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C^o - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

				Sample Location	MW-21			MW-21			MW-21			MW-21		
				Sample Name	MW-21			MW-21			MW-21			MW-21		
				Sample Date	1/30/2020			3/26/2020			5/19/2020			7/7/2020		
				N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.51	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	44.8		1.2	37.1		1.2	33.8		1.2	29.7		0.91
Beryllium	4	P	ug/L	0.26	J	0.25	< 0.25	U	0.25	< 0.25	U	0.25	0.1	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2950		98.8	2700		98.8	2440		98.8	2170		22.7
Chromium	100	P	ug/L	2.3	J	2.3	< 2.3	U	2.3	2.7	J	2.3	1.7	J	0.69
Cobalt	NS		ug/L	2.3	J	1.6	2.5	J	1.6	2.5	J	1.6	2.5	J	0.26
Copper	1300	AL	ug/L	3.7	J	2	2.5	J	2	3.4	J	2	< 2.5	U	2.5
Iron	300	S	ug/L	77.2	J	51.1	283		51.1	406		51.1	168		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	0.58	J	0.55	< 0.11	U	0.11
Magnesium	NS		ug/L	4350		73.7	3700		73.7	2910		73.7	2950		15.4
Manganese	50	S	ug/L	86.9		2.9	71.3		2.9	58.6		2.9	51.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	9		2.4	7.2		2.4	6.7		2.4	7.4		0.45
Potassium	NS		ug/L	1120		86.7	1080		86.7	1020		86.7	1050		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2570		128	2280		128	2080		128	2360	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	1.4	J	1.1	2	J	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	7.9	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	6		5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.38		0.014	4.04		0.014	3.33		0.014	3.04		0.014
Hardness, Calcium Carbonate	NS		mg/L	58		5	16		5	16		5	14		5
Nitrate as N	10	P	mg/L	0.47		0.056	0.41		0.056	2.18		0.056	0.37		0.056
Sulfate	250	S	mg/L	25		0.35	66.5	D	3.46	21.4		0.35	13.5		0.35
Total Dissolved Solids	500	S	mg/L	55		10	72		10	44		10	48		10
Field Data															
pH	NS		SU	2.84			4.77			4.78			4.25		
Temperature	NS		C°	9.09			12.2			14.7			19.1		
Specific Conductivity	NS		mS/cm	0.067			0.075			0.066			0.057		
Dissolved Oxygen	NS		mg/L	6.98			8.36			6.26			9.88		
Oxidation Reduction Potential	NS		mV	482			425			211.5			304.3		
Turbidity	NS		NTU	28.1			13.4			23.3			7.86		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chlorof
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-22			MW-22			MW-22			MW-22		
			Sample Name	MW-22			MW-22			MW-22			MW-22		
			Sample Date	2/3/2020			3/26/2020			5/19/2020			7/9/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	21	F1	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U F1	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U F1	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.59	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	0.83	J	0.73	< 0.73	U	0.73	1.3	J	0.89
Barium	2000	P	ug/L	32.6		1.2	31.7		1.2	43		1.2	24.1		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2730		98.8	2240		98.8	2570		98.8	1720		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	3.4	J	2.3	< 2.3	U	2.3	3.2	J	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	1.1	J	0.26
Copper	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	2.9	J F1	2.5
Iron	300	S	ug/L	342		51.1	457		51.1	140		51.1	1170		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	0.6	J	0.11
Magnesium	NS		ug/L	2940		73.7	2970		73.7	3060		73.7	2520		15.4
Manganese	50	S	ug/L	69.5		2.9	70.6		2.9	70.8		2.9	58.3		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	2.7	J	2.4	3.1	J	2.4	< 2.4	U	2.4	2.1	J	0.45
Potassium	NS		ug/L	1110		86.7	1140		86.7	1070		86.7	1030		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1480		128	2160		128	2060		128	2280	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	1.8	J	1.1	2.6	J	1.1	< 1.1	U	1.1	3	J	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	10.8	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	6.5		5	8.2		5	7.2		5	9.2		5
Ammonia	NS		mg/L	< 0.034	U F1	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U F1	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U F1	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	2.1	F1	0.014	1.89		0.014	2.02		0.014	1.82		0.014
Hardness, Calcium Carbonate	NS		mg/L	18		5	14		5	18		5	12		5
Nitrate as N	10	P	mg/L	0.18		0.056	0.077	J	0.056	0.17		0.056	0.13		0.056
Sulfate	250	S	mg/L	15.2	F1	0.35	13.6		0.35	12.7		0.35	11.1	F1	0.35
Total Dissolved Solids	500	S	mg/L	48		10	66		10	49		10	35		10
Field Data															
pH	NS		SU	4.99			4.95			4.99			7.4		
Temperature	NS		C°	11.03			12.88			13.8			16.1		
Specific Conductivity	NS		mS/cm	0.049			0.056			0.058			0.049		
Dissolved Oxygen	NS		mg/L	4.27			2.7			2.15			2.5		
Oxidation Reduction Potential	NS		mV	322			418			216.4			-32.3		
Turbidity	NS		NTU	63			21.6			30.3			21.6		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended le
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochlorometha
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an app
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1/F2: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-24			MW-24			MW-24			MW-24		
			Sample Name	MW-24			MW-24			MW-24			MW-24		
			Sample Date	1/30/2020			3/27/2020			5/22/2020			7/9/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.48	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	18.9		1.2	18.6		1.2	15.3		1.2	17.2		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	3710		98.8	4190		98.8	3130		98.8	3780		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	4.2		2.3	< 2.3	U	2.3	1.2	J	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	< 0.26	U	0.26
Copper	1300	AL	ug/L	4.3		2	2.2	J	2	< 2	U	2	< 2.5	U	2.5
Iron	300	S	ug/L	260		51.1	333		51.1	227		51.1	353		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	1	J	0.55	< 0.55	U	0.55	1.4		0.11
Magnesium	NS		ug/L	3740		73.7	5390		73.7	4190		73.7	5110		15.4
Manganese	50	S	ug/L	24.7		2.9	22.4		2.9	11.3		2.9	14.1		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	3.4	J	2.4	5.2		2.4	< 2.4	U	2.4	2.6	J	0.45
Potassium	NS		ug/L	1060		86.7	1130		86.7	1050		86.7	1200		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2270		128	2050		128	1940		128	1920		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	1.3	J	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	13.4	J	11.1	< 11.1	U	11.1	14.9	J	11.1	8.8	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	9.9		5	13.7		5	12.3		5	8		5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.36		0.014	2.81		0.014	2.34		0.014	2.13		0.014
Hardness, Calcium Carbonate	NS		mg/L	30		5	30		5	24		5	26		5
Nitrate as N	10	P	mg/L	0.6		0.056	1.01		0.056	0.55		0.056	0.76		0.056
Sulfate	250	S	mg/L	14.2		0.35	17.7		0.35	11.1		0.35	14.5		0.35
Total Dissolved Solids	500	S	mg/L	52		10	88		10	75		10	65		10
Field Data															
pH	NS		SU	4.91			4.89			5.3			8.18		
Temperature	NS		C^{o}	10.1			12.9			13.7			20		
Specific Conductivity	NS		mS/cm	0.07			0.083			0.071			0.073		
Dissolved Oxygen	NS		mg/L	7.09			5.65			6.54			5.01		
Oxidation Reduction Potential	NS		mV	217.7			294.4			162.1			-20.3		
Turbidity	NS		NTU	9.82			15.7			25.1			37.9		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C^{o} - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

				Sample Location	MW-25			MW-25			MW-25			MW-25		
				Sample Name	MW-25			MW-25			MW-25			MW-25		
				Sample Date	1/31/2020			3/27/2020			5/19/2020			7/7/2020		
				N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U *	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U *	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U *	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U *	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	0.61	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	26.6		1.2	24.4		1.2	21.6		1.2	20.8		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2610		98.8	2640		98.8	2470		98.8	2380		22.7
Chromium	100	P	ug/L	3.3	J	2.3	< 2.3	U	2.3	< 2.3	U	2.3	3.5	J	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	1.7	J	1.6	< 1.6	U	1.6	1.3	J	0.26
Copper	1300	AL	ug/L	4.9		2	< 2	U	2	< 2	U	2	4		2.5
Iron	300	S	ug/L	607		51.1	1020		51.1	326		51.1	1530		8.5
Lead	15	AL	ug/L	1.5		0.55	0.94	J	0.55	0.62	J	0.55	1.3		0.11
Magnesium	NS		ug/L	1420		73.7	1270		73.7	1330		73.7	1390		15.4
Manganese	50	S	ug/L	11.1		2.9	13.5		2.9	11.8		2.9	13.1		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	4.4		2.4	3.2	J	2.4	2.7	J	2.4	3.5	J	0.45
Potassium	NS		ug/L	1250		86.7	1190		86.7	1130		86.7	1270		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2540		128	2170		128	2300		128	2490	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	3	J	1.1	3.1	J	1.1	1.3	J	1.1	4.6		0.37
Zinc	5000	S	ug/L	11.7	J	11.1	< 11.1	U	11.1	< 11.1	U	11.1	17.9		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	6.8		5	7.3		5	6.4		5	11		5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.5		0.014	3.33		0.014	3.23		0.014	3.3		0.014
Hardness, Calcium Carbonate	NS		mg/L	18		5	8		5	14		5	10		5
Nitrate as N	10	P	mg/L	0.073	J	0.056	< 0.056	U	0.056	0.16		0.056	0.13		0.056
Sulfate	250	S	mg/L	5		0.35	5.51		0.35	4.82		0.35	3.82		0.35
Total Dissolved Solids	500	S	mg/L	28		10	59		10	27		10	35		10
Field Data															
pH	NS		SU	4.77			4.56			4.58			4.66		
Temperature	NS		C°	11.2			14.4			16.3			22.5		
Specific Conductivity	NS		mS/cm	0.043			0.041			0.042			0.042		
Dissolved Oxygen	NS		mg/L	4.3			3.83			2.95			2.77		
Oxidation Reduction Potential	NS		mV	325.5			347.5			358.5			294.6		
Turbidity	NS		NTU	90			35.3			44.2			47.5		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not Analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-27			MW-27			MW-27			MW-27			MW-27		
			Sample Name	MW-27			MW-27			MW-27			MW-27			MW-27		
			Sample Date	2/4/2020			3/26/2020			5/22/2020			7/8/2020					
			N=Normal, FD=Field Duplicate	N			N			N			N					
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL			
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27			
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24			
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37			
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26			
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26			
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66			
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009			
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009			
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35			
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33			
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9			
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1			
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3			
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4			
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77			
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2			
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41			
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34			
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54			
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55			
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82			
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21			
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38			
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33			
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4			
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22			
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22			
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28			
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6			
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3			
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48			
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47			
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42			
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25			
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38			
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24			
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49			
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34			
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31			
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83			
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17			
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65			
Total Metals																		
Antimony	6	P	ug/L	< 0.4	U	0.4	0.63	J	0.4	0.4	J	0.4	< 0.76	U	0.76			
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89			
Barium	2000	P	ug/L	43.3		1.2	30.7		1.2	42.3		1.2	33		0.91			
Beryllium	4	P	ug/L	0.27	J	0.25	< 0.25	U	0.25	< 0.25	U	0.25	0.16	J	0.098			
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16			
Calcium	NS		ug/L	1910		98.8	1530		98.8	1740		98.8	1340		22.7			
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	1.9	J	0.69			
Cobalt	NS		ug/L	3.4	J	1.6	3.4	J	1.6	< 1.6	U	1.6	2.9	J	0.26			
Copper	1300	AL	ug/L	2.5	J	2	< 2	U	2	4.2		2	3.1	J	2.5			
Iron	300	S	ug/L	513		51.1	1110		51.1	3000		51.1	2890		8.5			
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	1.3		0.11			
Magnesium	NS		ug/L	1380		73.7	1170		73.7	960		73.7	873		15.4			
Manganese	50	S	ug/L	99.8		2.9	88.4		2.9	71.9		2.9	65.3		1.1			
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091			
Nickel	100	RE	ug/L	5.4		2.4	5.3		2.4	5.1		2.4	2.9	J	0.45			
Potassium	NS		ug/L	754		86.7	640		86.7	814		86.7	902		112			
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46			
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19			
Sodium	NS		ug/L	1690		128	1390		128	1920		128	1690	B	58.2			
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17			
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	2	J	0.37			
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	17.7		11.1	9.9	J	5.1			
General Chemistry																		
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5			
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034			
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U F1	3.3	< 3.3	U	3.3	< 3.3	U	3.3			
Chloride	250	S	mg/L	2.01		0.014	1.8	F1	0.014	1.99		0.014	1.76		0.014			
Hardness, Calcium Carbonate	NS		mg/L	12		5	6		5	12		5	10		5			
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U	0.056	1.47		0.056			
Sulfate	250	S	mg/L	21.7		0.35	20.5	F1	0.35	22.3		0.35	31.3		0.35			
Total Dissolved Solids	500	S	mg/L	40		10	40		10	65		10	45		10			
Field Data																		
pH	NS		SU	3.67			3.81			3.81			3.54					
Temperature	NS		C°	9.4			10.12			15.18			20.7					
Specific Conductivity	NS		mS/cm	0.083			0.07			0.077			0.061					
Dissolved Oxygen	NS		mg/L	5.26			3.85			0.95			0.91					
Oxidation Reduction Potential	NS		mV	428			357			314.1			355.1					
Turbidity	NS		NTU	3.57			3.71			1.51			12.2					

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	MW-28			MW-28			MW-28			MW-28		
			Sample Name	MW-28			MW-28			MW-28			MW-28		
			Sample Date	2/3/2020			3/27/2020			5/22/2020			7/7/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U*	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	0.62	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	37		1.2	43.5		1.2	41.5		1.2	38.4		0.91
Beryllium	4	P	ug/L	0.28	J	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	8050		98.8	7540		98.8	7210		98.8	7290		22.7
Chromium	100	P	ug/L	3.9	J	2.3	2.5	J	2.3	< 2.3	U	2.3	2	J	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	< 0.26	U	0.26
Copper	1300	AL	ug/L	17.6		2	4.9		2	4.2		2	3.6	J	2.5
Iron	300	S	ug/L	9940		51.1	12900		51.1	12500		51.1	12700		8.5
Lead	15	AL	ug/L	2		0.55	0.92	J	0.55	0.73	J	0.55	0.61	J	0.11
Magnesium	NS		ug/L	1350		73.7	1580		73.7	1570		73.7	1740		15.4
Manganese	50	S	ug/L	60.3		2.9	84.1		2.9	78.6		2.9	84.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	3.5	J	2.4	< 2.4	U	2.4	< 2.4	U	2.4	1.7	J	0.45
Potassium	NS		ug/L	1510		86.7	1500		86.7	1390		86.7	1450		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2280		128	2600		128	2990		128	3100	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	11.3		1.1	7.2		1.1	6.3		1.1	5.2		0.37
Zinc	5000	S	ug/L	35.1		11.1	22.6		11.1	15.7	J	11.1	21.9		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	33.4		5	34.5		5	32.9		5	32.3		5
Ammonia	NS		mg/L	< 0.034	U	0.034	0.14		0.034	0.15		0.034	0.15		0.034
Chemical Oxygen Demand	NS		mg/L	28.8		3.3	20.5		3.3	22.2		3.3	11.4		3.3
Chloride	250	S	mg/L	0.85		0.014	0.82		0.014	0.95		0.014	0.93		0.014
Hardness, Calcium Carbonate	NS		mg/L	34		5	26		5	32		5	36		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	1.4		0.056	< 0.056	U	0.056
Sulfate	250	S	mg/L	0.38	J	0.35	1.88		0.35	0.6		0.35	1.62		0.35
Total Dissolved Solids	500	S	mg/L	85		10	92		10	103		10	73		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L			NA	< 0.4	U	0.4			NA			NA
Arsenic, Dissolved	10	P	ug/L			NA	< 0.73	U	0.73			NA			NA
Barium, Dissolved	2000	P	ug/L			NA	44.6		1.2			NA			NA
Beryllium, Dissolved	4	P	ug/L			NA	< 0.25	U	0.25			NA			NA
Cadmium, Dissolved	5	P	ug/L			NA	< 0.81	U	0.81			NA			NA
Calcium, Dissolved	NS		ug/L			NA	8490		98.8			NA			NA
Chromium, Dissolved	100	P	ug/L			NA	< 2.3	U	2.3			NA			NA
Cobalt, Dissolved	NS		ug/L			NA	< 1.6	U	1.6			NA			NA
Copper, Dissolved	1300	AL	ug/L			NA	< 2	U	2			NA			NA
Iron, Dissolved	300	S	ug/L			NA	15100		51.1			NA			NA
Lead, Dissolved	15	AL	ug/L			NA	< 0.55	U	0.55			NA			NA
Magnesium, Dissolved	NS		ug/L			NA	1960		73.7			NA			NA
Manganese, Dissolved	50	S	ug/L			NA	97.6		2.9			NA			NA
Mercury, Dissolved	2	P	ug/L			NA	< 0.091	U	0.091			NA			NA
Nickel, Dissolved	100	RE	ug/L			NA	< 2.4	U	2.4			NA			NA
Potassium, Dissolved	NS		ug/L			NA	1600		86.7			NA			NA
Selenium, Dissolved	50	P	ug/L			NA	< 5.4	U	5.4			NA			NA
Silver, Dissolved	100	S	ug/L			NA	< 0.59	U	0.59			NA			NA
Sodium, Dissolved	NS		ug/L			NA	3230		128			NA			NA
Thallium, Dissolved	2	P	ug/L			NA	< 0.16	U	0.16			NA			NA
Vanadium, Dissolved	NS		ug/L			NA	4		1.1			NA			NA
Zinc, Dissolved	5000	S	ug/L			NA	< 11.1	U	11.1			NA			NA
Field Data															
pH	NS		SU	5.98			6.64			6.4			6.24		
Temperature	NS		C°	12.3			17.5			17.6			21		
Specific Conductivity	NS		mS/cm	0.104			0.108			0.116			0.108		
Dissolved Oxygen	NS		mg/L	0.22			2.28			0.26			0.22		
Oxidation Reduction Potential	NS		mV	-49.2			-96			-53.2			-63.7		
Turbidity	NS		NTU	97.5			70.3			46.5			42.7		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

				Sample Location	MW-29			MW-29			MW-29			MW-29		
				Sample Name	MW-29			MW-29			MW-29			MW-29		
				Sample Date	2/3/2020			3/24/2020			5/21/2020			7/10/2020		
				N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.0086	< 0.0086	U	0.0086	< 0.0086	U	0.0086
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.0087	< 0.0087	U	0.0087	< 0.0087	U	0.0087
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	1	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	26.1		1.2	38.6		1.2	20.7		1.2	20.3		0.91
Beryllium	4	P	ug/L	1.3		0.25	1.4		0.25	0.76	J	0.25	0.69	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	1730		98.8	1990		98.8	2950		98.8	2000		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	2.6	J	2.3	< 2.3	U	2.3	0.81	J	0.69
Cobalt	NS		ug/L	6.4		1.6	7		1.6	6		1.6	6.9		0.26
Copper	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron	300	S	ug/L	1010		51.1	763		51.1	597		51.1	1800		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	0.77	J	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium	NS		ug/L	862		73.7	919		73.7	786		73.7	871		15.4
Manganese	50	S	ug/L	24.4		2.9	26.3		2.9	22		2.9	26.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	10.9		2.4	12.7		2.4	10		2.4	12.1		0.45
Potassium	NS		ug/L	1360		86.7	1390		86.7	1110		86.7	1350		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	5080		128	5260		128	4710		128	5310		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	57.5		11.1	75.3		11.1	103		11.1	76.9		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U F1	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.26		0.014	3.93		0.014	2.75		0.014	2.86		0.014
Hardness, Calcium Carbonate	NS		mg/L	8		5	14		5	12		5	10		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	0.11	H	0.056	0.12	F1	0.056	< 0.056	U	0.056
Sulfate	250	S	mg/L	18.3		0.35	15		3.46	13.4		0.35	16.8		0.35
Total Dissolved Solids	500	S	mg/L	36		10	54		10	52		10	39		10
Field Data															
pH	NS		SU	4.09			4.11			4.46			4.46		
Temperature	NS		C°	13.5			13			14			19.7		
Specific Conductivity	NS		mS/cm	0.063			0.06			0.063			0.056		
Dissolved Oxygen	NS		mg/L	0.67			1.19			0.27			0.56		
Oxidation Reduction Potential	NS		mV	294.2			352.8			231.9			-133.2		
Turbidity	NS		NTU	11			24.5			12.9			15.9		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
The original March 2020 Nitrate data for MW-29 was rejected (R) by Advanced GeoServices. The laboratory confirmed after analysis and reporting that the sample bottle had a pH <2 resulting in a high Nitrate concentration. The sample was reanalyzed by the laboratory from a separate sample container and the reanalysis outside of the method hold time was reported.

Table 11
Groundwater Analytical Results by Well

				Sample Location	MW-30	MW-30			MW-30			MW-30			MW-30		
				Sample Name	MW-30	MW-30			MW-30			MW-30			MW-30		
				Sample Date	5/31/2013	1/31/2020			3/27/2020			5/19/2020			7/7/2020		
			N=Normal, FD=Field Duplicate		N	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U *	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U *	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U *	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U *	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals																		
Antimony	6	P	ug/L	< 0.4	U	0.4	0.7	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	0.99	J	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	0.99	J	0.89
Barium	2000	P	ug/L	22		1.2	23.7		1.2	23.9		1.2	14.5		1.2	14.5		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	3230		98.8	3600		98.8	3510		98.8	5500		98.8	5500		22.7
Chromium	100	P	ug/L	3	J	2.3	< 2.3	U	2.3	< 2.3	U	2.3	4.2		2.3	4.2		0.69
Cobalt	NS		ug/L	1.7	J	1.6	< 1.6	U	1.6	< 1.6	U	1.6	0.42	J	0.26	0.42	J	0.26
Copper	1300	AL	ug/L	3.7	J	2	< 2	U	2	2.7	J	2	5.6		2	5.6		2.5
Iron	300	S	ug/L	2260		51.1	1300		51.1	1780		51.1	1700		51.1	1700		8.5
Lead	15	AL	ug/L	0.85	J	0.55	0.59	J	0.55	1.1	J	0.55	1.6		0.55	1.6		0.11
Magnesium	NS		ug/L	2600		73.7	2520		73.7	2630		73.7	1130		73.7	1130		15.4
Manganese	50	S	ug/L	55.6		2.9	31.2		2.9	28.4		2.9	14.6		2.9	14.6		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	2.8	J	2.4	< 2.4	U	2.4	< 2.4	U	2.4	1.6	J	0.45	1.6	J	0.45
Potassium	NS		ug/L	1880		86.7	1740		86.7	1510		86.7	1290		86.7	1290		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19	< 0.19	U	0.19
Sodium	NS		ug/L	3630		128	2560		128	2760		128	1060	B	58.2	1060	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17	< 0.17	U	0.17
Vanadium	NS		ug/L	2.3	J	1.1	1.9	J	1.1	2.6	J	1.1	4.2		0.37	4.2		0.37
Zinc	5000	S	ug/L	26.3		11.1	21.6		11.1	42.8		11.1	96.9		5.1	96.9		5.1
General Chemistry																		
Alkalinity, Total	NS		mg/L	17.8		5	< 5	U	5	12.6		5	21		5	21		5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	18.6		3.3	18.6		3.3
Chloride	250	S	mg/L	1.26		0.014	1.67		0.014	1.54		0.014	0.72		0.014	0.72		0.014
Hardness, Calcium Carbonate	NS		mg/L	24		5	16		5	18		5	20		5	20		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	0.12		0.056	0.089	J	0.056	0.089	J	0.056
Sulfate	250	S	mg/L	6.17		0.35	10.7		0.35	10		0.35	1.99		0.35	1.99		0.35
Total Dissolved Solids	500	S	mg/L	26		10	65		10	48		10	48		10	48		10
Dissolved Metals																		
Antimony, Dissolved	6	P	ug/L			NA			NA			NA			NA	< 0.76	U	0.76
Arsenic, Dissolved	10	P	ug/L			NA			NA			NA			NA	< 0.89	U	0.89
Barium, Dissolved	2000	P	ug/L			NA			NA			NA			NA	10.1		0.91
Beryllium, Dissolved	4	P	ug/L			NA			NA			NA			NA	< 0.098	U	0.098
Cadmium, Dissolved	5	P	ug/L			NA			NA			NA			NA	< 0.16	U	0.16
Calcium, Dissolved	NS		ug/L			NA			NA			NA			NA	5850		22.7
Chromium, Dissolved	100	P	ug/L			NA			NA			NA			NA	< 0.69	U	0.69
Cobalt, Dissolved	NS		ug/L			NA			NA			NA			NA	0.32	J	0.26
Copper, Dissolved	1300	AL	ug/L			NA			NA			NA			NA	3.7	J	2.5
Iron, Dissolved	300	S	ug/L			NA			NA			NA			NA	126		8.5
Lead, Dissolved	15	AL	ug/L			NA			NA			NA			NA	0.23	J	0.11
Magnesium, Dissolved	NS		ug/L			NA			NA			NA			NA	1080		15.4
Manganese, Dissolved	50	S	ug/L			NA			NA			NA			NA	16.7		1.1
Mercury, Dissolved	2	P	ug/L			NA			NA			NA			NA	< 0.091	U	0.091
Nickel, Dissolved	100	RE	ug/L			NA			NA			NA			NA	0.87	J	0.45
Potassium, Dissolved	NS		ug/L			NA			NA			NA			NA	1100		112
Selenium, Dissolved	50	P	ug/L			NA			NA			NA			NA	< 0.46	U	0.46
Silver, Dissolved	100	S	ug/L			NA			NA			NA			NA	< 0.19	U	0.19
Sodium, Dissolved	NS		ug/L			NA			NA			NA			NA	1120		58.2
Thallium, Dissolved	2	P	ug/L			NA			NA			NA			NA	< 0.17	U	0.17
Vanadium, Dissolved	NS		ug/L			NA			NA			NA			NA	< 0.37	U	0.37
Zinc, Dissolved	5000	S	ug/L			NA			NA			NA			NA	88.7		5.1
Field Data																		
pH	NS		SU	5.35			5.33			5.23			5.23					
Temperature	NS		C°	10.03			13.99			17.8			20.2					
Specific Conductivity	NS		mS/cm	0.054			0.058			0.061			0.045					
Dissolved Oxygen	NS		mg/L	2.3			2.78			1.85			2.6					
Oxidation Reduction Potential	NS		mV	282			342			220.4			216.3					
Turbidity	NS		NTU	33.6			31.5			35.3			74.4					

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

Sample Location				PMW-6			PMW-6			PMW-6			PMW-6		
Sample Name				PMW-6			PMW-6			PMW-6			PMW-6		
Sample Date				1/31/2020			3/24/2020			5/19/2020			7/10/2020		
N=Normal, FD=Field Duplicate				N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U *	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U *	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U *	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U *	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	0.96	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	26.4		1.2	27.1		1.2	29.6		1.2	23.5		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2460		98.8	2700		98.8	2390		98.8	2330		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	< 0.26	U	0.26
Copper	1300	AL	ug/L	< 2	U	2	< 2	U	2	5.7		2	< 2.5	U	2.5
Iron	300	S	ug/L	100	J	51.1	< 51.1	U	51.1	138		51.1	22.5	J	8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium	NS		ug/L	2010		73.7	1890		73.7	1800		73.7	2100		15.4
Manganese	50	S	ug/L	12.4		2.9	10.5		2.9	17.7		2.9	10		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	< 2.4	U	2.4	< 2.4	U	2.4	< 2.4	U	2.4	1	J	0.45
Potassium	NS		ug/L	990		86.7	862		86.7	852		86.7	1080		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	3410		128	2820		128	3470		128	3470		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	< 5.1	U	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	5.6		5	< 5	U	5	5.9		5
Ammonia	NS		mg/L	0.086	J	0.034	< 0.034	U	0.034	< 0.034	U F1	0.034	< 0.034	U F1	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	3.49		0.014	3.18		0.014	3.16		0.014	3.06		0.014
Hardness, Calcium Carbonate	NS		mg/L	24		5	20		5	16		5	12		5
Nitrate as N	10	P	mg/L	0.37		0.056	< 0.056	U	0.056	0.15		0.056	0.12	H	0.056
Sulfate	250	S	mg/L	12.4		0.35	13.8		0.35	14.8		0.35	14.1	F1	0.35
Total Dissolved Solids	500	S	mg/L	28		10	41		10	47		10	36		10
Field Data															
pH	NS		SU	4.95			4.45			4.56			13.18		
Temperature	NS		C°	11.3			10.9			12.1			15.9		
Specific Conductivity	NS		mS/cm	0.054			0.05			0.051			0.05		
Dissolved Oxygen	NS		mg/L	5.23			3.94			3.98			3.29		
Oxidation Reduction Potential	NS		mV	293.4			314.9			378			-66.6		
Turbidity	NS		NTU	8.13			2.83			15.4			1.62		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended lev
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochlorometh
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an appr
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time
F1: MS and/or MSD exceeds control limits

Table 11
Groundwater Analytical Results by Well

			Sample Location	PMW-11			PMW-11			PMW-11			PMW-11		
			Sample Name	PMW-11			PMW-11			PMW-11			PMW-11		
			Sample Date	1/29/2020			3/26/2020			5/20/2020			7/9/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	0.98	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	3.7	J	1.2	10		1.2	3.4	J	1.2	7.9		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	613		98.8	512		98.8	529		98.8	533		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	4.9		2.3	< 2.3	U	2.3	2.3	J	0.69
Cobalt	NS		ug/L	2.6	J	1.6	2.5	J	1.6	2.6	J	1.6	2	J	0.26
Copper	1300	AL	ug/L	2.4	J	2	3.1	J	2	2.7	J	2	3.9	J	2.5
Iron	300	S	ug/L	< 51.1	U	51.1	1790		51.1	< 51.1	U	51.1	1270		8.5
Lead	15	AL	ug/L	< 0.55	U	0.55	1.5		0.55	< 0.55	U	0.55	0.67	J	0.11
Magnesium	NS		ug/L	256		73.7	266		73.7	236		73.7	262		15.4
Manganese	50	S	ug/L	6.5	J	2.9	7.5	J	2.9	5.6	J	2.9	14.6		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	4.2		2.4	6.3		2.4	4.5		2.4	4		0.45
Potassium	NS		ug/L	551		86.7	890		86.7	522		86.7	860		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	0.95	J	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1610		128	1360		128	1460		128	1470		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	< 1.1	U	1.1	4.2		1.1	< 1.1	U	1.1	2	J	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	15.3	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	1.65		0.014	1.72		0.014	1.62		0.014	1.46		0.014
Hardness, Calcium Carbonate	NS		mg/L	6		5	< 5	U	5	< 5	U	5	6		5
Nitrate as N	10	P	mg/L	0.14		0.056	0.17		0.056	0.24		0.056	0.19		0.056
Sulfate	250	S	mg/L	4.94		0.35	5.88		0.35	5.38		0.35	3.78		0.35
Total Dissolved Solids	500	S	mg/L	18		10	37		10	18		10	14		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L			NA	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic, Dissolved	10	P	ug/L			NA	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium, Dissolved	2000	P	ug/L			NA	4.3		1.2	3.5	J	1.2	4.7		0.91
Beryllium, Dissolved	4	P	ug/L			NA	< 0.25	U	0.25	< 0.25	U	0.25	0.15	J	0.098
Cadmium, Dissolved	5	P	ug/L			NA	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium, Dissolved	NS		ug/L			NA	523		98.8	484		98.8	555		22.7
Chromium, Dissolved	100	P	ug/L			NA	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt, Dissolved	NS		ug/L			NA	2.4	J	1.6	2	J	1.6	2.1	J	0.26
Copper, Dissolved	1300	AL	ug/L			NA	2.2	J	2	< 2	U	2	< 2.5	U	2.5
Iron, Dissolved	300	S	ug/L			NA	< 51.1	U	51.1	< 51.1	U	51.1	< 8.5	U	8.5
Lead, Dissolved	15	AL	ug/L			NA	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium, Dissolved	NS		ug/L			NA	238		73.7	196	J	73.7	220		15.4
Manganese, Dissolved	50	S	ug/L			NA	5.7	J	2.9	4.7	J	2.9	5.7	J	1.1
Mercury, Dissolved	2	P	ug/L			NA	< 0.091	U	0.091	< 0.091	U	0.091	0.092	J	0.091
Nickel, Dissolved	100	RE	ug/L			NA	3.8	J	2.4	3.3	J	2.4	3.6	J	0.45
Potassium, Dissolved	NS		ug/L			NA	548		86.7	471		86.7	498		112
Selenium, Dissolved	50	P	ug/L			NA	< 5.4	U	5.4	< 5.4	U	5.4	1.1	J	0.46
Silver, Dissolved	100	S	ug/L			NA	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium, Dissolved	NS		ug/L			NA	1430		128	1140		128	1380		58.2
Thallium, Dissolved	2	P	ug/L			NA	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium, Dissolved	NS		ug/L			NA	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc, Dissolved	5000	S	ug/L			NA	< 11.1	U	11.1	< 11.1	U	11.1	7.9	J	5.1
Field Data															
pH	NS		SU	4.02			3.98			4.42			4		
Temperature	NS		C°	8.4			16.7			14.6			24.9		
Specific Conductivity	NS		mS/cm	0.03			0.028			0.029			0.029		
Dissolved Oxygen	NS		mg/L	2.23			2.28			1.77			2.2		
Oxidation Reduction Potential	NS		mV	376.9			413.3			283.7			405.6		
Turbidity	NS		NTU	137			49.8			45			54.6		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	PMW-12			PMW-12			PMW-12			PMW-12		
			Sample Name	PMW-12			PMW-12			PMW-12			PMW-12		
			Sample Date	1/30/2020			3/25/2020			5/21/2020			7/7/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.58	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	0.89	J	0.73	0.77	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	40.9		1.2	37.6		1.2	20.3		1.2	22.7		0.91
Beryllium	4	P	ug/L	1.1		0.25	1.3		0.25	0.39	J	0.25	0.64	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	3860		98.8	3240		98.8	2970		98.8	2700		22.7
Chromium	100	P	ug/L	7.9		2.3	7.1		2.3	< 2.3	U	2.3	2.6	J	0.69
Cobalt	NS		ug/L	2.4	J	1.6	2.4	J	1.6	< 1.6	U	1.6	2	J	0.26
Copper	1300	AL	ug/L	8.6		2	9.6		2	< 2	U	2	4		2.5
Iron	300	S	ug/L	7670		51.1	7740		51.1	6970		51.1	5260		8.5
Lead	15	AL	ug/L	2.5		0.55	3.2		0.55	< 0.55	U	0.55	1	J	0.11
Magnesium	NS		ug/L	1170		73.7	1380		73.7	1360		73.7	1160		15.4
Manganese	50	S	ug/L	64		2.9	66.2		2.9	63.8		2.9	69.3		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	6.2		2.4	5.9		2.4	< 2.4	U	2.4	3.8	J	0.45
Potassium	NS		ug/L	2550		86.7	2120		86.7	1130		86.7	1500		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	2720		128	1490		128	1570		128	1790	B	58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	12.7		1.1	14.4		1.1	< 1.1	U	1.1	3.5	J	0.37
Zinc	5000	S	ug/L	411		11.1	52.6		11.1	31.1		11.1	213		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	5.4		5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	1		0.014	0.95		0.014	1		0.014	1.08		0.014
Hardness, Calcium Carbonate	NS		mg/L	18		5	14		5	16		5	12		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U H	0.056	< 0.056	U	0.056
Sulfate	250	S	mg/L	15.9		0.35	17.7		0.35	15.5		0.35	18.2		0.35
Total Dissolved Solids	500	S	mg/L	43		10	56		10	53		10	50		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic, Dissolved	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium, Dissolved	2000	P	ug/L	21.8		1.2	21.3		1.2	21		1.2	20.3		0.91
Beryllium, Dissolved	4	P	ug/L	0.33	J	0.25	< 0.25	U	0.25	0.35	J	0.25	0.49	J	0.098
Cadmium, Dissolved	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium, Dissolved	NS		ug/L	4140		98.8	3230		98.8	2990		98.8	2940		22.7
Chromium, Dissolved	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt, Dissolved	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	0.53	J	0.26
Copper, Dissolved	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron, Dissolved	300	S	ug/L	3650		51.1	6500		51.1	6100		51.1	4680		8.5
Lead, Dissolved	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium, Dissolved	NS		ug/L	904		73.7	1400		73.7	1200		73.7	1140		15.4
Manganese, Dissolved	50	S	ug/L	52.2		2.9	68.4		2.9	58.1		2.9	59.1		1.1
Mercury, Dissolved	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel, Dissolved	100	RE	ug/L	< 2.4	U	2.4	< 2.4	U	2.4	< 2.4	U	2.4	2.6	J	0.45
Potassium, Dissolved	NS		ug/L	1370		86.7	1180		86.7	1040		86.7	1110		112
Selenium, Dissolved	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver, Dissolved	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium, Dissolved	NS		ug/L	2180		128	1660		128	1220		128	1680		58.2
Thallium, Dissolved	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium, Dissolved	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc, Dissolved	5000	S	ug/L	315		11.1	42.1		11.1	27.9		11.1	197		5.1
Field Data															
pH	NS		SU	5.3			5.53			5.39			6.03		
Temperature	NS		C°	9.6			11			15.3			18.7		
Specific Conductivity	NS		mS/cm	0.064			0.066			0.071			0.059		
Dissolved Oxygen	NS		mg/L	0.61			0.37			0.52			0.59		
Oxidation Reduction Potential	NS		mV	110.6			97.1			79.2			47.1		
Turbidity	NS		NTU	167			279			108.8			93.4		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

				Sample Location	PMW-13			PMW-13			PMW-13			PMW-13		
				Sample Name	PMW-13			PMW-13			PMW-13			PMW-13		
				Sample Date	1/30/2020			3/25/2020			5/20/2020			7/8/2020		
				N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.97	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	0.81	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	8.5		1.2	9.3		1.2	7.9		1.2	7		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	0.51	J	0.16
Calcium	NS		ug/L	1010		98.8	984		98.8	989		98.8	1010		22.7
Chromium	100	P	ug/L	2.7	J	2.3	2.8	J	2.3	< 2.3	U	2.3	1.2	J	0.69
Cobalt	NS		ug/L	4.5		1.6	4.6		1.6	4		1.6	4.3		0.26
Copper	1300	AL	ug/L	16.7		2	3.7	J	2	6.1		2	< 2.5	U	2.5
Iron	300	S	ug/L	1170		51.1	523		51.1	293		51.1	307		8.5
Lead	15	AL	ug/L	3.3		0.55	2		0.55	1.6		0.55	1.5		0.11
Magnesium	NS		ug/L	508		73.7	518		73.7	449		73.7	547		15.4
Manganese	50	S	ug/L	11.4		2.9	7.7	J	2.9	7.4	J	2.9	8		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	10.6		2.4	10.6		2.4	9.5		2.4	9.4		0.45
Potassium	NS		ug/L	721		86.7	767		86.7	605		86.7	723		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1490		128	1510		128	1600		128	1690	B	58.2
Thallium	2	P	ug/L	0.19	J	0.16	0.19	J	0.16	0.17	J	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	2.6	J	1.1	2.9	J	1.1	1.3	J	1.1	0.63	J	0.37
Zinc	5000	S	ug/L	17.4		11.1	< 11.1	U	11.1	12.9	J	11.1	10.5	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	2.17		0.014	2.17		0.014	2.08		0.014	2.11		0.014
Hardness, Calcium Carbonate	NS		mg/L	8		5	< 5	U	5	6		5	8		5
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U	0.056
Sulfate	250	S	mg/L	18.6		0.35	26.4		0.35	17.8		0.35	18.1		0.35
Total Dissolved Solids	500	S	mg/L	13		10	40		10	28		10	40		10
Field Data															
pH	NS		SU	3.82			3.74			4.06			4.42		
Temperature	NS		C°	8.9			10.7			12.6			21		
Specific Conductivity	NS		mS/cm	0.06			0.056			0.059			0.056		
Dissolved Oxygen	NS		mg/L	0.69			0.62			0.61			0.6		
Oxidation Reduction Potential	NS		mV	345.7			393.3			223.1			236.1		
Turbidity	NS		NTU	37.1			28.8			39.2			46.5		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	PMW-18			PMW-18			PMW-18			PMW-18		
			Sample Name	PMW-18			PMW-18			PMW-18			PMW-18		
			Sample Date	2/3/2020			3/24/2020			5/21/2020			7/10/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	0.43	J	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	1.2	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	7.3		1.2	13.1		1.2	6.5		1.2	8.3		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	0.35	J	0.25	< 0.25	U	0.25	0.12	J	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	534		98.8	710		98.8	448		98.8	507		22.7
Chromium	100	P	ug/L	< 2.3	U	2.3	3.6	J	2.3	< 2.3	U	2.3	1	J	0.69
Cobalt	NS		ug/L	2.6	J	1.6	3	J	1.6	2.1	J	1.6	2.3	J	0.26
Copper	1300	AL	ug/L	5.2		2	7.9		2	4.4		2	3.8	J	2.5
Iron	300	S	ug/L	348		51.1	1150		51.1	269		51.1	391		8.5
Lead	15	AL	ug/L	0.65	J	0.55	1.8		0.55	< 0.55	U	0.55	0.32	J	0.11
Magnesium	NS		ug/L	386		73.7	507		73.7	348		73.7	432		15.4
Manganese	50	S	ug/L	10.4		2.9	19.5		2.9	9		2.9	13.2		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	3.8	J	2.4	5.8		2.4	3.2	J	2.4	4.1		0.45
Potassium	NS		ug/L	774		86.7	962		86.7	538		86.7	717		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	0.46	J	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1060		128	1150		128	1090		128	1210		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	1.9	J	1.1	4.7		1.1	1.1	J	1.1	0.7	J	0.37
Zinc	5000	S	ug/L	< 11.1	U	11.1	15.7	J	11.1	< 11.1	U	11.1	14.8	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	1.41		0.014	1.22		0.014	1.4		0.014	1.42		0.014
Hardness, Calcium Carbonate	NS		mg/L	< 5	U	5	6		5	< 5	U	5	6		5
Nitrate as N	10	P	mg/L	0.32		0.056	0.29		0.056	0.37		0.056	0.32		0.056
Sulfate	250	S	mg/L	4.44		0.35	9.54		0.35	3.98		0.35	6.55		0.35
Total Dissolved Solids	500	S	mg/L	15		10	20		10	26		10	22		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L			NA	< 0.4	U	0.4			NA			NA
Arsenic, Dissolved	10	P	ug/L			NA	< 0.73	U	0.73			NA			NA
Barium, Dissolved	2000	P	ug/L			NA	7.9		1.2			NA			NA
Beryllium, Dissolved	4	P	ug/L			NA	0.33	J	0.25			NA			NA
Cadmium, Dissolved	5	P	ug/L			NA	< 0.81	U	0.81			NA			NA
Calcium, Dissolved	NS		ug/L			NA	748		98.8			NA			NA
Chromium, Dissolved	100	P	ug/L			NA	< 2.3	U	2.3			NA			NA
Cobalt, Dissolved	NS		ug/L			NA	3.6	J	1.6			NA			NA
Copper, Dissolved	1300	AL	ug/L			NA	6		2			NA			NA
Iron, Dissolved	300	S	ug/L			NA	< 51.1	U	51.1			NA			NA
Lead, Dissolved	15	AL	ug/L			NA	< 0.55	U	0.55			NA			NA
Magnesium, Dissolved	NS		ug/L			NA	560		73.7			NA			NA
Manganese, Dissolved	50	S	ug/L			NA	11.8		2.9			NA			NA
Mercury, Dissolved	2	P	ug/L			NA	< 0.091	U	0.091			NA			NA
Nickel, Dissolved	100	RE	ug/L			NA	5.3		2.4			NA			NA
Potassium, Dissolved	NS		ug/L			NA	770		86.7			NA			NA
Selenium, Dissolved	50	P	ug/L			NA	< 5.4	U	5.4			NA			NA
Silver, Dissolved	100	S	ug/L			NA	< 0.59	U	0.59			NA			NA
Sodium, Dissolved	NS		ug/L			NA	1280		128			NA			NA
Thallium, Dissolved	2	P	ug/L			NA	< 0.16	U	0.16			NA			NA
Vanadium, Dissolved	NS		ug/L			NA	< 1.1	U	1.1			NA			NA
Zinc, Dissolved	5000	S	ug/L			NA	12.1	J	11.1			NA			NA
Field Data															
pH	NS		SU	4.16			3.97			4.28			8.54		
Temperature	NS		C^o	13.23			12.2			14			15.7		
Specific Conductivity	NS		mS/cm	0.029			0.054			0.033			0.046		
Dissolved Oxygen	NS		mg/L	6.01			0.71			5.71			6.07		
Oxidation Reduction Potential	NS		mV	403			473			294			-139.6		
Turbidity	NS		NTU	96.1			98.3			30.4			28.3		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C^o - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

				Sample Location	PMW-19			PMW-19			PMW-19			PMW-19			PMW-19		
				Sample Name	PMW-19			PMW-19			PMW-19			PMW-19			PMW-19		
				Sample Date	2/4/2020			3/27/2020			5/22/2020			7/7/2020					
				N=Normal, FD=Field Duplicate	N			N			N			N					
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL			
Volatile Organic Compounds																		
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27			
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24			
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37			
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26			
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26			
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66			
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009			
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009			
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43			
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35			
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33			
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9			
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1			
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3			
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4			
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77			
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2			
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41			
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34			
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54			
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55			
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82			
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21			
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38			
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33			
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4			
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22			
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22			
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28			
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6			
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3			
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U F2	0.48			
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47			
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42			
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25			
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38			
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24			
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49			
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34			
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31			
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32			
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83			
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17			
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65			
Total Metals																		
Antimony	6	P	ug/L	< 0.4	U	0.4	0.82	J	0.4	< 0.4	U	0.4	< 0.76	U	0.76			
Arsenic	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89			
Barium	2000	P	ug/L	16.8		1.2	15.5		1.2	17.5		1.2	14.9		0.91			
Beryllium	4	P	ug/L	0.28	J	0.25	< 0.25	U	0.25	0.25	J	0.25	0.18	J	0.098			
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16			
Calcium	NS		ug/L	1970		98.8	1920		98.8	1690		98.8	1650		22.7			
Chromium	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	0.73	J	0.69			
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	0.41	J	0.26			
Copper	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5			
Iron	300	S	ug/L	4920		51.1	4540		51.1	5260		51.1	5170		8.5			
Lead	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	0.26	J	0.11			
Magnesium	NS		ug/L	507		73.7	481		73.7	530		73.7	538		15.4			
Manganese	50	S	ug/L	36		2.9	33.7		2.9	38.4		2.9	37.8		1.1			
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091			
Nickel	100	RE	ug/L	< 2.4	U	2.4	< 2.4	U	2.4	< 2.4	U	2.4	1.5	J	0.45			
Potassium	NS		ug/L	1020		86.7	971		86.7	880		86.7	966		112			
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U F1	0.46			
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19			
Sodium	NS		ug/L	1500		128	1450		128	1780		128	1730	B	58.2			
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17			
Vanadium	NS		ug/L	2.3	J	1.1	1.2	J	1.1	1.2	J	1.1	0.97	J	0.37			
Zinc	5000	S	ug/L	70		11.1	50.7		11.1	86.7		11.1	137		5.1			
General Chemistry																		
Alkalinity, Total	NS		mg/L	12.7		5	11.1		5	5.9		5	11.9		5			
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U F1	0.034			
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	6.1	J	3.3	7.8	J	3.3			
Chloride	250	S	mg/L	1.88		0.014	1.72		0.014	1.78		0.014	1.61		0.014			
Hardness, Calcium Carbonate	NS		mg/L	12		5	6		5	8		5	12		5			
Nitrate as N	10	P	mg/L	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U	0.056	< 0.056	U	0.056			
Sulfate	250	S	mg/L	3.59		0.35	2.47		0.35	2		0.35	5.33	F1	0.35			
Total Dissolved Solids	500	S	mg/L	34		10	40		10	55		10	14		10			
Field Data																		
pH	NS		SU	4.98			5.03			5.57			4.25					
Temperature	NS		C°	15.9			15.1			15.6			18.9					
Specific Conductivity	NS		mS/cm	0.048			0.03			0.042			0.046					
Dissolved Oxygen	NS		mg/L	2.54			2.8			0.4			0.57					
Oxidation Reduction Potential	NS		mV	47.6			35.6			-135.4			126.6					
Turbidity	NS		NTU	11.6			9.21			11.79			13.7					

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	PMW-23			PMW-23			PMW-23			PMW-23		
			Sample Name	PMW-23			PMW-23			PMW-23			PMW-23		
			Sample Date	2/3/2020			3/26/2020			5/19/2020			7/9/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U *	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	2		0.73	0.84	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	31.6		1.2	12.8		1.2	4		1.2	12.4		0.91
Beryllium	4	P	ug/L	0.48	J	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	799		98.8	681		98.8	720		98.8	669		22.7
Chromium	100	P	ug/L	9.2		2.3	9.3		2.3	2.5	J	2.3	2.4	J	0.69
Cobalt	NS		ug/L	2.1	J	1.6	< 1.6	U	1.6	< 1.6	U	1.6	1.2	J	0.26
Copper	1300	AL	ug/L	11.4		2	5.2		2	< 2	U	2	2.9	J	2.5
Iron	300	S	ug/L	6020		51.1	1580		51.1	< 51.1	U	51.1	1040		8.5
Lead	15	AL	ug/L	5.5		0.55	3		0.55	< 0.55	U	0.55	0.8	J	0.11
Magnesium	NS		ug/L	529		73.7	383		73.7	316		73.7	379		15.4
Manganese	50	S	ug/L	20.8		2.9	17.7		2.9	8.5		2.9	16.4		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	4.8		2.4	7.8		2.4	4.2		2.4	2.8	J	0.45
Potassium	NS		ug/L	1840		86.7	987		86.7	529		86.7	877		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	1580		128	1690		128	1620		128	1740	B	58.2
Thallium	2	P	ug/L	0.16	J	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	15.9		1.1	4.8		1.1	< 1.1	U	1.1	2.2	J	0.37
Zinc	5000	S	ug/L	16.2		11.1	< 11.1	U	11.1	< 11.1	U	11.1	13	J	5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3
Chloride	250	S	mg/L	2.72		0.014	2.62		0.014	2.43		0.014	2.41		0.014
Hardness, Calcium Carbonate	NS		mg/L	18		5	< 10	U	10	< 5	U	5	10		5
Nitrate as N	10	P	mg/L	0.39		0.056	0.35		0.056	0.45		0.056	0.39		0.056
Sulfate	250	S	mg/L	3.46		0.35	2.91		0.35	1.85		0.35	1.76		0.35
Total Dissolved Solids	500	S	mg/L	16		10	37		10	21		10	31		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic, Dissolved	10	P	ug/L	< 0.73	U	0.73	< 0.73	U	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium, Dissolved	2000	P	ug/L	3.8	J	1.2	4.6		1.2	3.6	J	1.2	4.2		0.91
Beryllium, Dissolved	4	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	0.1	J	0.098
Cadmium, Dissolved	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium, Dissolved	NS		ug/L	650		98.8	742		98.8	632		98.8	731		22.7
Chromium, Dissolved	100	P	ug/L	< 2.3	U	2.3	< 2.3	U	2.3	< 2.3	U	2.3	< 0.69	U	0.69
Cobalt, Dissolved	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	1.2	J	0.26
Copper, Dissolved	1300	AL	ug/L	< 2	U	2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron, Dissolved	300	S	ug/L	< 51.1	U	51.1	< 51.1	U	51.1	< 51.1	U	51.1	< 8.5	U	8.5
Lead, Dissolved	15	AL	ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U	0.55	< 0.11	U	0.11
Magnesium, Dissolved	NS		ug/L	286		73.7	354		73.7	272		73.7	317		15.4
Manganese, Dissolved	50	S	ug/L	11		2.9	16.1		2.9	7.4	J	2.9	8		1.1
Mercury, Dissolved	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel, Dissolved	100	RE	ug/L	< 2.4	U	2.4	2.7	J	2.4	< 2.4	U	2.4	2.2	J	0.45
Potassium, Dissolved	NS		ug/L	463		86.7	532		86.7	466		86.7	478		112
Selenium, Dissolved	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver, Dissolved	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium, Dissolved	NS		ug/L	1610		128	1800		128	1390		128	1690		58.2
Thallium, Dissolved	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium, Dissolved	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc, Dissolved	5000	S	ug/L	< 11.1	U	11.1	< 11.1	U	11.1	< 11.1	U	11.1	< 5.1	U	5.1
Field Data															
pH	NS		SU	3.4			4.15			3.96			4.8		
Temperature	NS		C^o	11.8			16.5			14.5			20.3		
Specific Conductivity	NS		mS/cm	0.029			0.027			0.028			0.027		
Dissolved Oxygen	NS		mg/L	5.12			4.01			5.21			5.17		
Oxidation Reduction Potential	NS		mV	328.5			394.3			407.6			369.9		
Turbidity	NS		NTU	263			126			198			98.7		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C^o - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

Table 11
Groundwater Analytical Results by Well

			Sample Location	PMW-28			PMW-28			PMW-28			PMW-28		
			Sample Name	PMW-28			PMW-28			PMW-28			PMW-28		
			Sample Date	1/31/2020			3/24/2020			5/20/2020			7/10/2020		
			N=Normal, FD=Field Duplicate	N			N			N			N		
Parameter	MDE MCL Criteria	Screening Criteria Notes	Unit	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL	Result	Q	MDL
Volatile Organic Compounds															
1,1,1,2-Tetrachloroethane	NS		ug/L	< 0.27	U *	0.27	< 0.27	U	0.27	< 0.27	U	0.27	< 0.27	U	0.27
1,1,1-Trichloroethane	200	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
1,1,2,2-Tetrachloroethane	NS		ug/L	< 0.37	U *	0.37	< 0.37	U	0.37	< 0.37	U	0.37	< 0.37	U	0.37
1,1,2-Trichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,1-Dichloroethane	NS		ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,1-Dichloroethene	7	P	ug/L	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26	< 0.26	U	0.26
1,2,3-Trichloropropane	NS		ug/L	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66	< 0.66	U	0.66
1,2-Dibromo-3-chloropropane	0.2	P	ug/L	< 0.38	U	0.38	< 0.0086	U	0.009	< 0.0086	U	0.009	< 0.0086	U	0.009
1,2-Dibromoethane	0.05	P	ug/L	< 0.5	U	0.5	< 0.0087	U	0.009	< 0.0087	U	0.009	< 0.0087	U	0.009
1,2-Dichlorobenzene	600	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloroethane	5	P	ug/L	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43	< 0.43	U	0.43
1,2-Dichloropropane	5	P	ug/L	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35	< 0.35	U	0.35
1,4-Dichlorobenzene	75	P	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
2-Butanone	NS		ug/L	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9	< 1.9	U	1.9
2-Hexanone	NS		ug/L	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1	< 1.1	U	1.1
4-Methyl-2-pentanone	NS		ug/L	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3	< 1.3	U	1.3
Acetone	NS		ug/L	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4	< 4.4	U	4.4
Acrylonitrile	NS		ug/L	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77	< 0.77	U	0.77
Benzene	5	P	ug/L	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2	< 0.2	U	0.2
Bromochloromethane	NS		ug/L	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41	< 0.41	U	0.41
Bromodichloromethane	80	TTHM	ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Bromoform	80	TTHM	ug/L	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54	< 0.54	U	0.54
Bromomethane	NS		ug/L	< 0.55	U	0.55	< 0.55	U	0.55	< 0.55	U *	0.55	< 0.55	U	0.55
Carbon Disulfide	NS		ug/L	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82	< 0.82	U	0.82
Carbon Tetrachloride	5	P	ug/L	< 0.21	U *	0.21	< 0.21	U	0.21	< 0.21	U	0.21	< 0.21	U	0.21
Chlorobenzene	100	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
Chloroethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Chloroform	80	TTHM	ug/L	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33	< 0.33	U	0.33
Chloromethane	NS		ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4
cis-1,2-Dichloroethene	70	P	ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
cis-1,3-Dichloropropene	NS		ug/L	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22	< 0.22	U	0.22
Dibromochloromethane	80	TTHM	ug/L	< 0.28	U *	0.28	< 0.28	U	0.28	< 0.28	U	0.28	< 0.28	U	0.28
Dibromomethane	NS		ug/L	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6	< 0.6	U	0.6
Ethylbenzene	700	P	ug/L	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3	< 0.3	U	0.3
Iodomethane	NS		ug/L	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48	< 0.48	U	0.48
Methyl tert-Butyl Ether	NS		ug/L	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47	< 0.47	U	0.47
Methylene Chloride	5	P	ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Styrene	100	P	ug/L	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42	< 0.42	U	0.42
Tetrachloroethene	5	P	ug/L	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25	< 0.25	U	0.25
Toluene	1000	P	ug/L	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38	< 0.38	U	0.38
trans-1,2-Dichloroethene	100	P	ug/L	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24	< 0.24	U	0.24
trans-1,3-Dichloropropene	NS		ug/L	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49	< 0.49	U	0.49
trans-1,4-Dichloro-2-butene	NS		ug/L	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34	< 0.34	U	0.34
Trichloroethene	5	P	ug/L	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31	< 0.31	U	0.31
Trichlorofluoromethane	NS		ug/L	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32	< 0.32	U	0.32
Vinyl Acetate	NS		ug/L	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83	< 0.83	U	0.83
Vinyl Chloride	2	P	ug/L	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17	< 0.17	U	0.17
Xylenes, Total	10000	P	ug/L	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65	< 0.65	U	0.65
Total Metals															
Antimony	6	P	ug/L	< 0.4	U	0.4	< 0.4	U	0.4	< 0.4	U	0.4	< 0.76	U	0.76
Arsenic	10	P	ug/L	< 0.73	U	0.73	0.99	J	0.73	< 0.73	U	0.73	< 0.89	U	0.89
Barium	2000	P	ug/L	49		1.2	51.4		1.2	40.9		1.2	41.7		0.91
Beryllium	4	P	ug/L	< 0.25	U	0.25	0.31	J	0.25	< 0.25	U	0.25	< 0.098	U	0.098
Cadmium	5	P	ug/L	< 0.81	U	0.81	< 0.81	U	0.81	< 0.81	U	0.81	< 0.16	U	0.16
Calcium	NS		ug/L	2560		98.8	2670		98.8	1790		98.8	2620		22.7
Chromium	100	P	ug/L	5.9		2.3	6.3		2.3	< 2.3	U	2.3	1.2	J	0.69
Cobalt	NS		ug/L	< 1.6	U	1.6	< 1.6	U	1.6	< 1.6	U	1.6	< 0.26	U	0.26
Copper	1300	AL	ug/L	9.1		2	< 2	U	2	< 2	U	2	< 2.5	U	2.5
Iron	300	S	ug/L	1090		51.1	1330		51.1	194		51.1	130		8.5
Lead	15	AL	ug/L	1.9		0.55	2.1		0.55	< 0.55	U	0.55	0.18	J	0.11
Magnesium	NS		ug/L	1820		73.7	1940		73.7	1470		73.7	2030		15.4
Manganese	50	S	ug/L	31.8		2.9	24.1		2.9	19.6		2.9	17.3		1.1
Mercury	2	P	ug/L	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091	< 0.091	U	0.091
Nickel	100	RE	ug/L	6.5		2.4	4.1		2.4	2.7	J	2.4	2.9	J	0.45
Potassium	NS		ug/L	1330		86.7	1560		86.7	1040		86.7	1230		112
Selenium	50	P	ug/L	< 5.4	U	5.4	< 5.4	U	5.4	< 5.4	U	5.4	< 0.46	U	0.46
Silver	100	S	ug/L	< 0.59	U	0.59	< 0.59	U	0.59	< 0.59	U	0.59	< 0.19	U	0.19
Sodium	NS		ug/L	4040		128	3880		128	4270		128	4400		58.2
Thallium	2	P	ug/L	< 0.16	U	0.16	< 0.16	U	0.16	< 0.16	U	0.16	< 0.17	U	0.17
Vanadium	NS		ug/L	2.9	J	1.1	5.4		1.1	< 1.1	U	1.1	< 0.37	U	0.37
Zinc	5000	S	ug/L	59.6		11.1	62.7		11.1	26.8		11.1	44.1		5.1
General Chemistry															
Alkalinity, Total	NS		mg/L	< 5	U	5	< 5	U	5	< 5	U	5	< 5	U	5
Ammonia	NS		mg/L	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034	< 0.034	U	0.034
Chemical Oxygen Demand	NS		mg/L	< 3.3	U	3.3	< 3.3	U	3.3	< 3.3	U	3.3	4.1	J	3.3
Chloride	250	S	mg/L	6.81		0.028	6.64		0.07	4.29		0.014	6.98		0.014
Hardness, Calcium Carbonate	NS		mg/L	28		5	18		5	10		5	12		5
Nitrate as N	10	P	mg/L	0.11		0.056	0.11		0.056	0.2		0.056	0.23	H	0.056
Sulfate	250	S	mg/L	7.73		0.35	15		0.35	15		0.35	11.6		0.35
Total Dissolved Solids	500	S	mg/L	28		10	49		10	67		10	41		10
Dissolved Metals															
Antimony, Dissolved	6	P	ug/L			NA	< 0.4	U	0.4			NA			NA
Arsenic, Dissolved	10	P	ug/L			NA	< 0.73	U	0.73			NA			NA
Barium, Dissolved	2000	P	ug/L			NA	38.3		1.2			NA			NA
Beryllium, Dissolved	4	P	ug/L			NA	< 0.25	U	0.25			NA			NA
Cadmium, Dissolved	5	P	ug/L			NA	< 0.81	U	0.81			NA			NA
Calcium, Dissolved	NS		ug/L			NA	2660		98.8			NA			NA
Chromium, Dissolved	100	P	ug/L			NA	< 2.3	U	2.3			NA			NA
Cobalt, Dissolved	NS		ug/L			NA	< 1.6	U	1.6			NA			NA
Copper, Dissolved	1300	AL	ug/L			NA	< 2	U	2			NA			NA
Iron, Dissolved	300	S	ug/L			NA	< 51.1	U	51.1			NA			NA
Lead, Dissolved	15	AL	ug/L			NA	< 0.55	U	0.55			NA			NA
Magnesium, Dissolved	NS		ug/L			NA	1770		73.7			NA			NA
Manganese, Dissolved	50	S	ug/L			NA	10.9		2.9			NA			NA
Mercury, Dissolved	2	P	ug/L			NA	< 0.091	U	0.091			NA			NA
Nickel, Dissolved	100	RE	ug/L			NA	3.1	J	2.4			NA			NA
Potassium, Dissolved	NS		ug/L			NA	1060		86.7			NA			NA
Selenium, Dissolved	50	P	ug/L			NA	< 5.4	U	5.4			NA			NA
Silver, Dissolved	100	S	ug/L			NA	< 0.59	U	0.59			NA			NA
Sodium, Dissolved	NS		ug/L			NA	4020		128			NA			NA
Thallium, Dissolved	2	P	ug/L			NA	< 0.16	U	0.16			NA			NA
Vanadium, Dissolved	NS		ug/L			NA	< 1.1	U	1.1			NA			NA
Zinc, Dissolved	5000	S	ug/L			NA	55.9		11.1			NA			NA
Field Data															
pH	NS		SU	5.3			4.47			5.35			8.23		
Temperature	NS		C°	11.4			11			13.3			15.1		
Specific Conductivity	NS		mS/cm	0.048			0.05			0.051			0.079		
Dissolved Oxygen	NS		mg/L	8.16			6.12			9.47			8.61		
Oxidation Reduction Potential	NS		mV	327			416			240.6			-125.6		
Turbidity	NS		NTU	89			97.7			10.46			17.1		

Notes:
Shading indicates a value above the maximum containment level (MCL)
P - EPA Primary MCL, S - EPA Secondary MCL, AL - EPA Action Level, RE - No MCL but recommended level by EPA
TTHM - Total Trihalomethanes includes the sum of Bromodichloromethane, Bromoform, Dibromochloromethane and Chloroform
mg/L - milligrams per liter
ug/L - micrograms per liter
SU - Standard Units
C° - Celsius
mS/cm - millisiemens/centimeter
mV - Millivolts
NTU - Nephelometric Turbidity Unit
QC - Quality Control
MDL - Method detection limit
NA - Not analyzed
NS - No Standard
Q - Laboratory Qualifier
U - Indicates the compound was analyzed for but not detected above the MDL
J - result is less than the reporting limit but greater than or equal to the MDL, and the concentration is an approximate value
* LCS and/or LCSD Recoveries outside of the laboratory control limits
B - Laboratory blank contamination
H - Sample was prepped or analyzed beyond the specified holding time

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PHASE III PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

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SECTION 1

EXECUTIVE SUMMARY

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1.0 EXECUTIVE SUMMARY

National Waste Managers, Inc. (NWM) proposes to reclaim approximately 114.4 acres (measured at inside top edge of perimeter berm), formerly used for sand and gravel mining, with an engineered state-of-the-art, rubble landfill that will provide disposal airspace for Anne Arundel County rubble waste disposal for 12 years. The site consists of a 480-acre parcel located near Odenton, Maryland, as shown on Figure 1-1. The total area of disturbance is approximately 193.2 acres, as shown on Figure 1-1.

The landfill is proposed to have 21 cells, to allow sequential development. The landfill cells will be lined with a state-of-the-art, low-permeability liner system to block leachate (water which contacts the waste) from contacting groundwater. Each cell will be equipped with a leachate collection and removal system, which will convey the leachate through a force main to the on-site leachate storage tanks. The leachate will be transported to a local treatment plant for treatment and disposal. Depending on actual leachate characteristics and treatment cost, NWM may eventually propose for regulatory approval an on-site treatment plant with discharge to surface water in accordance with appropriate National Pollution Discharge Elimination System (NPDES) permit.

As the landfill achieves final grades, the closure cap will be constructed. By constructing the closure cap in a phased approach, as top of waste grades are achieved, ongoing leachate generation is reduced, and stormwater can be managed through the series of terraces, downchutes, perimeter channels; culverts, and stormwater retention basins.

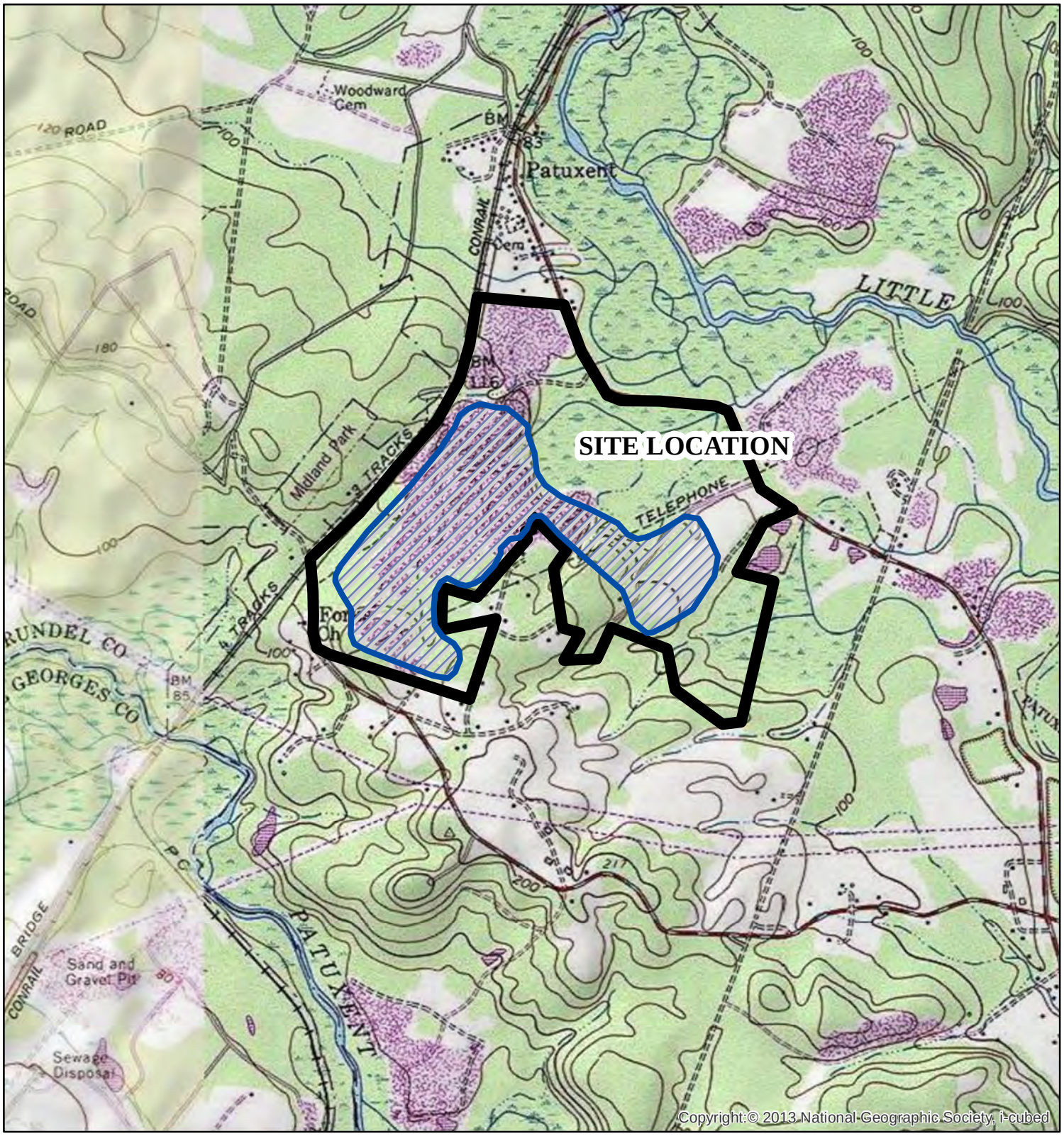
While there is a general movement in stormwater management to promote infiltration, in the case of landfills, infiltration of stormwater through the waste is undesirable. However, the on-site stormwater controls will attenuate peak runoff rates, so as not to increase the runoff rate discharge leaving the site.

The Phase II Permit Application, prepared by Advanced GeoServices Corp. (AGC Montrose) and dated June 2020, was approved by Maryland Department of the Environment (MDE) on June 17, 2020. This Phase III Permit Application was prepared in accordance with Code of Maryland (COMAR) Regulations, as required for issuance of a Refuse Disposal Permit from MDE. Landfill construction and operation will comply with Federal, State, and County Regulations pertinent to waste acceptance, sediment control, stormwater management, flood plains, wetlands, environmental protection, public health, and safety.

National Waste Managers, Inc., at the following address, will be responsible for operation and maintenance of the proposed rubble landfill.

National Waste Managers, Inc.
2900 Linden Lane, Suite 300
Silver Spring, MD 20910
Telephone: 301-495-1520

FIGURES



Legend

FILL BOUNDARY

PROPERTY BOUNDARY

Miles

0 0.1 0.2 0.4 0.6 0.8

REFERENCE

1. MAP FROM U.S.G.S. 7.5 MINUTE QUADRANGLES

CHESAPEAKE TERRACE RUBBLE LANDFILL

4TH ASSESSMENT DISTRICT
ANNE ARUNDEL COUNTY, MARYLAND

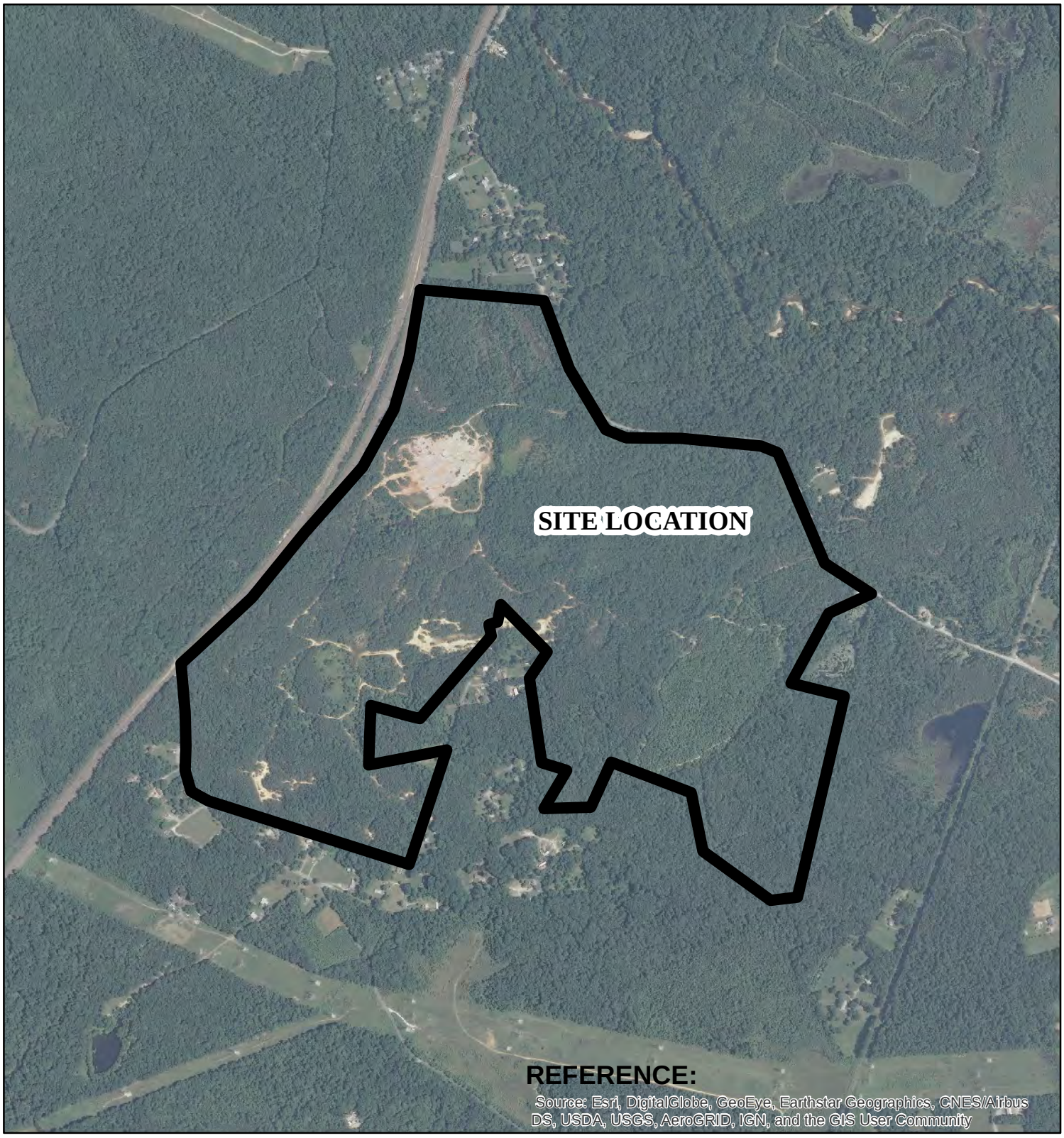
SITE LOCATION MAP

N W E S

ADVANCED GeoServices
Engineering for the Environment. Planning for People.™
1055 ANDREW DRIVE, SUITE A
WEST CHESTER, PENNSYLVANIA 19380
Tel: 610.840.9100 Fax: 610.840.9199 Web: www.advancedgeoservices.com

Scale:	
Drawn By:	GCR
Checked By:	VEF
Project Mgr.:	VEF
Originated By:	GCR
Project No.:	2018-3854
Drawing Date:	4/29/2019
Sheet No.:	1 of 2
Revision Number:	0

FIGURE 1-1



Legend

Property Boundary

Miles

0 0.075 0.15 0.3 0.45 0.6

CHESAPEAKE TERRACE RUBBLE LANDFILL

4TH ASSESSMENT DISTRICT
ANNE ARUNDEL COUNTY, MARYLAND

ORTHO LOCATION MAP

N W E S

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Project No.:	2018-3854
Drawing Date:	4/29/2019
Sheet No.:	1 of 1
Revision Number:	0

FIGURE 1-2

SECTION 2

WASTE ACCEPTANCE AND AREA TO BE SERVED

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2.3	Area and Population Served	2-3

2.0 WASTE ACCEPTANCE AND AREA TO BE SERVED

The Code of Maryland (COMAR) Regulations Title 26 Subtitle 4 Chapter 7 (herein after referenced as 26.04.07), identifies four categories of solid waste landfills in Maryland:

- Municipal Solid Waste (MSW) – defined as waste generated by a community, excluding wastes defined otherwise (COMAR 26.04.07.02). Traditionally MSW is residential and office and retail business wastes.
- Land Clearing– limited to soils, trees stumps, root mats, brush and limbs, logs, vegetation, and rock (COMAR 26.04.07.11)
- Industrial Waste – nonhazardous industrial solid wastes (COMAR 26.04.07.19)
- Rubble Waste – typically debris associated with construction demolition (see Section 2.1)

The Chesapeake Terrace Rubble Landfill will only accept wastes COMAR-approved "rubble waste."

2.1 Acceptable and Unacceptable Waste

The Chesapeake Terrace Rubble Landfill is located in Odenton, Anne Arundel County, Maryland. The rubble landfill will accept the types of rubble waste listed in the COMAR 26.04.07.13 summarized, as follows:

- Land Clearing Debris, includes the following:
  - Earth material such as clays, sands, gravels, and silts;
  - Topsoil;
  - Tree Stumps;
  - Root Mats;
  - Brush and Limbs;
  - Logs;
  - Vegetation; and,
  - Rock.

- Demolition Debris, includes the following:
  - Acceptable demolition debris associated with the razing of buildings, roads, bridges, and other structures includes structural steel, concrete, bricks (excluding refractory type), lumber, plaster and plasterboard, insulation material, cement, shingles and roofing material, floor and wall tile, asphalt, pipes and wires, and other items physically attached to the structure, including appliances if they have been or will be compacted to their smallest practical volume.
  - Unacceptable demolition debris includes industrial waste or byproducts, any waste materials contained within a structure or on the grounds of the structure being demolished that are not physically part of the structure, or which are comprised of or contain materials that pose an undue risk to public health or the environment.

- Construction Debris, includes the following:
  - Acceptable construction debris is structural building materials including cement, concrete, bricks (excluding refractory type), lumber, plaster and plasterboard, insulation, shingles, floor, wall and ceiling tile, pipes, glass, wires, carpet, wallpaper, roofing, felt, or other structural fabrics. Paper or cardboard packaging, spacing, or building materials, provided that they do not exceed 10% by volume of the waste, may be accepted at the rubble landfill. Paint containers, caulk containers, or glaze containers are acceptable, provided that they are empty and any residual material that is dried before acceptance at the rubble fill, and further provided that this waste category does not exceed 1% by volume of the waste accepted at the rubble landfill.
  - Unacceptable construction debris includes commercial, domestic, or industrial wastes or byproducts, paint, tar or tar containers, caulking compounds, glazing compounds, paint thinner or other solvents or their containers, creosote or other preservatives or their containers, tile, paneling, or carpet cement or other adhesives, and other solid waste which may contain an unacceptable waste or substance as may be determined by the approving authority to be unacceptable.

- Tires. Scrap tires may be accepted at the facility and managed in accordance with the requirements of a scrap tire collection facility license issued under COMAR 26.04.08. Disposal of tires in a landfill is prohibited.

- Asbestos Waste. Asbestos waste is acceptable provided that the material that is received is packaged and labeled as specified in COMAR 26.11.15.04, and is managed in the following manner:
  - Prior notification to the landfill supervisor is required;
  - The waste asbestos is unloaded carefully to prevent emission of fibers into the air;
  - The area used for burial of asbestos shall be restricted to the working face of the landfill, or a separate cell dedicated solely to asbestos disposal;
  - The waste shall be completely covered with earth or other rubble and may not be compacted or driven over until sufficient cover has been applied to prevent the release of asbestos fibers to the atmosphere during compaction or application of other cover material; and,
  - Operators at the landfill shall wear respiratory protection approved by the National Institute for Occupational Safety and Health for protection against asbestos fibers, and protective clothing when considered necessary.
  - Household Appliances and White Goods. Household appliances and white goods are acceptable provided that any refrigerant is removed from the appliances before burial in the landfill and is managed in accordance with §608 of the Federal Clean Air Act (42 U.S.C. §7671g).
  - Processed Debris. Processed debris is acceptable only at a rubble landfill having a liner and leachate collection system constructed to the standards as specified in Maryland Department of the Environment (MDE) COMAR Regulations 26.04.07.16.

- Other Waste Materials. Waste materials not specifically listed in this section may not be disposed of in a rubble landfill before receiving written approval of the Approving Authority.

The Chesapeake Terrace Rubble Landfill has a total gross design capacity of approximately 9.3 million cubic yards (MCY). Assuming three percent (10%) of the volume is reserved for daily/weekly cover, the net disposal capacity is 8.4 MCY..

The average daily rubble intake used for calculating the life of the Landfill is 1,602 tons per day, and an average unit weight of 0.59 tons/cubic yard. At the average daily rubble intake rate (5-day per week operation), the life of the Chesapeake Terrace Rubble Landfill facility is 12 years. The average daily rubble intake is used for estimating purposes and the actual rubble intake rate may lead to a different facility life span. Often, waste intake varies by season and day of the week. As such, some days may have higher intakes, while others may be lower. At the end of life, the landfill will be closed, maintained and monitored according to the COMAR regulations and the facility's Closure and Post-Closure Plan, included in Section 15 of the Phase III Permit Application.

2.2 Signage

To be clear on the types of wastes accepted at the site, there will be two large signs posted near the scalehouse at the main entrance listing wastes that are and wastes that are not acceptable. The details for these signs are provided on Drawing 9.

Due to the number of vehicles and the traffic expected within the property, there will also be a series of other signs controlling traffic throughout the site, including but not limited to, the list of signs below:

- Stop
- Yield
- Do Not Enter
- Speed Limit (various)
- No Shoulder
- Wrong Way
- Steep Grade
- Authorized Vehicles Only
- Back-in Parking Only

A variety of other signs will be used as needed.

2.3 Area and Population Served

The Chesapeake Terrace Rubble Landfill is located in Anne Arundel County, Maryland. Due to the cost of transporting rubble, it is a reasonable assumption that most of the rubble waste will originate within a 75-mile radius of the landfill. This area includes the following Maryland counties and their corresponding populations:

County	2020 (projected) Population
Anne Arundel	556,100
Baltimore	842,600
Calvert	100,450
Caroline	40,300
Carroll	197,400
Charles	177,200
Dorchetser	36,300
Frederick	287,900
Harford	276,500
Kent	22,200
Montgomery	1,075,000
Prince George's	921,900
Queen Anne's	55,650
Saint Mary's	130,100
Somerset	28,300
Talbot	40,050
Wicomeco	107,450

Population taken from web page https://msa.maryland.gov/msa/mdmanual/01glance/html/pop.html#county

The total population of these counties is nearly 5 million people.

SECTION 3

PROJECT DESCRIPTION

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LIST OF ATTACHMENTS

Attachment

3A - Regional Topographic Information

3.0 PROJECT DESCRIPTION

3.1 Regulatory Compliance

Table 3.1 - Phase III Application Compliance with COMAR Regulations

COMAR Regulation 26.04.07.16 Phase III	Description	Where addressed
1.	A map which designates the property boundaries, the actual area to be used for filling, and existing and proposed structures and on-site roads	Drawings
2.	A description of any vehicle weighing facilities, communications (telephone, radios), maintenance and equipment storage facilities, and water supply and sewage systems.	Section 12.0
3.	a. A description of the types of solid waste: (i) to be accepted. (ii) NOT to be accepted. b. Area and population to be served by the facility.	Section 2.0
4.	The anticipated quantities of solid waste to be accepted and the calculations used to determine the useful life of the facility	Section 5.0
5.	Proposed methods of collecting and reporting data on the quantities and types of solid waste received and for revising facility life expectancy projections.	Section 12.0
6.	The volume and type of available cover material, the calculated volume of earth needed for periodic, intermediate, and final cover, the location of earth stockpiles, and provisions for saving topsoil for use as final cover.	Section 8.4
7.	Proposed means of controlling unauthorized access to the site.	Section 12.0
8.	Proposed operating procedures including: a. Hours and days of operation b. Number and types of equipment to be used c. Number of employees and their duties d. Provisions for fire prevention and control e. Means of preventing public health hazards and nuisances from blowing paper, odors, rodents, vermin, noise, and dust f. Proposed method of daily operation including wet weather operation	Section 12.0
9.	The location and depth of solid waste cells and the sequence of filling.	Drawings
10.	Natural or artificial screening to be used.	Section 6.3
11.	Methods of controlling on-site drainage, drainage leaving the site, and drainage onto the site from adjoining areas.	Section 17.0 & Drawings

COMAR Regulation 26.04.07.16 Phase III	Description	Where addressed
12.	A contingency plan for preventing or mitigating the pollution of the waters of the State of Maryland.	Section 16.0
13.	Proposed methods for covering and stabilizing completed areas.	Section 18.0
14. & 15.	A system for monitoring the quality of the waters of the Sate around and beneath the site, including the location and types of monitoring stations, and the methods of construction of monitoring wells.	Section 16.0
16.	A schedule for implementing construction and implementation of the operation plans and engineering specifications once the refuse disposal permit has been issued.	Section 7.2
17.	A landfill closure and post-closure plan to be followed cover a period of not less than 5 years after application of final cover.	Section 15.0
18.	The name, address, and telephone number of the person or agency responsible for the maintenance and operation of the site.	Section 1.0
19.	An engineered design for a liner system and leachate collection system for the proposed rubble landfill based upon geotechnical information developed in Phase I and Phase II.	Sections 9.0 & 10.0 and Drawings
20.	A proposed method, engineering specifications, and plans for the collection, management, treatment and disposal of leachate generated at the facility, including the calculations used to determine the estimated quantities of leachate to be generated, managed, stored, treated, and disposed.	Section 10.0

3.2 Existing Site

The site of the proposed rubble landfill is located southeast of Fort Meade in Odenton, Maryland. The property is bounded by Patuxent Road to the north, CSX/Amtrak rail lines to the west, Conway Road to the south, and Patuxent River Park to the northeast. See Location Map on Drawing 2. The property, consisting of approximately 480 acres, was previously used to mine sand and gravel. Surface runoff drains across the site in a northerly direction toward a 100-year flood plain, between the proposed rubble landfill and Patuxent Road. See Site Plan on Drawing 2.

National Waste Managers, Inc. proposes to reclaim approximately 114.4 acres, formerly used for sand and gravel mining, with an engineered state-of-the-art rubble landfill that will provide air space for rubble waste disposal for 12 years. The site consists of a 480-acre parcel located near Odenton, Maryland, as shown on Drawing 2. Existing topography and mapped wetland boundaries are presented on Drawing 2. The proposed landfill limit of waste is approximately 114.4 acres, as shown on Figure 3.

The landfill is proposed to have 21 cells, to allow sequential development. The landfill cells will be lined with a state-of-the-art, low-permeability liner system to block leachate (water which contacted the waste) from contacting groundwater. Each cell will be equipped with a leachate collection and removal system, which will convey the leachate through a force main to one of the on-site leachate storage tank. Final disposition of the leachate from the storage tank is addressed under Section 10.11 Leachate Disposal, of this Phase III Report.

As the landfill achieves final grades, the closure cap will be constructed. The closure cap will also include a low-permeability barrier layer designed and constructed to prevent precipitation from infiltrating into the filled waste material. By constructing the closure cap as grades within cells or portion of cells are achieved the volume of leachate requiring management is reduced. Precipitation falling on the completed cap (i.e., stormwater runoff) is managed through the series of controls and diversion (such as terraces, down-chutes, perimeter channels and culverts) that direct the water to stormwater retention basins situated around the landfill. The stormwater retention basins provide storage and allow the water to be discharged in a limited/controlled fashion. Drawing 3 presents the conceptual layout and configuration for the proposed landfill cells and stormwater retention basins. Additional details regarding landfill layout, configuration, closure cap construction and stormwater management are presented throughout this Phase III Permit Application.

3.3 Topography, Drainage and Features

3.3.1 On-Site

A topographic base map of the site is shown on Drawing 2. This map shows natural drainage features, wetlands, the 100-year flood plain, property lines, and forested areas. Extensive surface mining for sand and gravel has taken place in the northwestern portion of the proposed landfill area. The results of this past mining activity is the surface is uneven and barren in some areas. There are no on-site structures, utility pipelines, storage tanks, or water supply wells.

A ridge with elevations up to 196 feet (ft) above mean sea level (amsl) is located on and adjacent to the southern property line. The land surface across the site slopes north from this ridge toward the Little Patuxent River which is at an elevation of approximately 60 ft amsl. The vast majority of surface water from the site drains to the northeast toward the Little Patuxent River. The extreme western corner of the property drains to the west toward the Patuxent River.

3.3.2 Localized

The topography beyond the property can be viewed on Figure 2 from the Phase II Permit Application (included here as Attachment 3A), which shows profiles in four directions through the site. These profiles are taken from GoogleEarth® so the elevations are +/-5-ft amsl. The value of these profiles is that they show the relative elevations of the site compared to the surrounding communities, from 3 to 5 miles from the site. The data shows that the site is located along a localized high-point created by the Little Patuxent and Patuxent River valleys. The areas north, west and east are at lower elevations than the southern portions of the site. The elevations beyond the southern limits of the site

generally slope downward to the Patuxent River. This means that surface water is generally not running onto the site from off-site sources.

3.4 Access/Site Entrances

Three entrances are shown for the site, as depicted on the Design Drawings. Construction of only one site entrance is required by COMAR regulations and Maryland Department of the Environment (MDE). The main entrance is intended to be the East Entrance (Drawings 4 and 5) from Conway Road, as stipulated in the special exception issued by the County. The Optional North and South Entrances, Drawings 89 and 90, respectively, are presented for approval in the permit but will only be constructed in the event that acquisition of the property, right-of-ways or easements required for the East Entrance is unsuccessful. NWM recognizes that the stipulation in the special exception must be changed or nullified before the optional entrances may be utilized.

If the Optional North Entrance is constructed in lieu of the East Entrance, stipulations under construction sequencing drawings for the Optional North Entrance are maintained. If the Optional South Entrance is designated by the Owner to be constructed in lieu of both the East and North Entrances, then a variance from MDE (as specified under Section 7.3, "Variance from Sequence of Construction for Landfill Cells") must be obtained, prior to beginning construction.

Information on Drawing 63 "Sequence and General Notes for Construction" describes criteria for landfill construction.

Primary methodology associated with landfill construction over the life of cell construction and waste placement operation is depicted on Intermediate Construction Stage Plans (see Drawings 64 through 81), which depict construction of landfill cells and appurtenances from beginning to end of landfill construction.

Contract Documents for landfill construction, per Specifications under Section 7.6, "Preparation of Contract Documents for Intermediate Stage Construction", will be prepared per Intermediate Construction Stage Plans shown on Drawings hereunder.

3.4.1 Site Entrance Infrastructure and Queue Lanes

As shown on Drawings 4and 5 for the East Entrance, and on Drawings 89 and 90 for the optional entrances, scale house and truck scales, maintenance building, and wheel wash with adjacent concrete clean-out are provided for each of the three site entrances. See "Operations Plan" in Section 12.0.

It is anticipated that the facility will accept rubble waste at the rate of approximately 1,602 tons per day. Per "Operations Plan" in Section 12.0, at this waste acceptance rate, it is expected that almost all waste will be delivered to the site by semi-trailers. Under the assumption that each semi-trailer delivers 20 tons waste to the site, 80 semi-trailers per day would be required to meet 1,602 tons per day throughput.

Per "Operations Plan" Section 12.6.2.3, approximately two minutes processing per vehicle would be required to move a vehicle from the truck scale onto the landfill

perimeter access road. During an 8-hour day, average arrival rate of semi-trailers at the site would be approximately 6 minutes. In consideration of the eventuality that peak traffic consisting of simultaneous arrival of semi-trailers at the scale house, queue lanes for each of the three site entrances are provided (per description under Sections 3.4.2 through 3.4.5). Regardless of which entrance is eventually constructed, trucks will not be permitted to queue onto public roads.

3.4.2 Assumed East Entrance

The assumed East Entrance would be constructed as shown on Drawings 4, 5, 55, and 56. The East Entrance access road from Conway Road to the scale house is approximately 5,000 feet long. Assuming the length required to queue a single tractor trailer is 60 feet, and no movement past the scale house, all of the landfill's estimated daily 80 waste trucks could be queued on the East Entrance access road. Access for emergency vehicles will be provided via a 12 feet wide lane from Patuxent Road (see Drawing 89).

The portion of the East entrance access road from Conway to the property line is a gravel-surfaced road. From the property line to the scales through the turn onto the landfill perimeter road, the road surface is paved.

3.4.3 Optional North Entrance

Optional North Entrance would be constructed as shown on Drawings 89 and 57.

Three lanes, approximately 600 feet long each, are provided. Assuming single vehicle queue length of 60 feet and no movement past the scale house, 20 of the landfill's estimated daily 80 waste trucks could be queued on two North Entrance lanes. The remaining lane would be reserved for outbound traffic. As warranted, outbound traffic would be queued on-site and the outbound lane would be used by emergency vehicles entering the site, if the main path is blocked with waste trucks.

3.4.4 Optional South Entrance

Optional South Entrance would be constructed as shown on Drawings 90 and 54. Four approximately 450 feet long lanes are provided. Assuming single vehicle queue length of 60 feet and no movement past the scale house, 22 of the landfill's estimated daily 80 waste haulers could be queued on three South Entrance lanes. The remaining lane would be reserved for outbound traffic. As warranted, outbound traffic would be queued onsite and-the outbound lane would be used by emergency vehicles.

3.4.5 Emergency Exit

Regardless of which entrance is constructed, consistent with the redundant design approach associated with landfills, so that each system has a primary and a “backup”, there will be a road for use as an “emergency exit”, in the event the Entrance is blocked (e.g., downed power lines, broken-down truck, loss of power at the automatic gates, etc.). This emergency exits will be one 12-foot wide, paved lane, as shown on Drawing 64, at the location of the Optional North Entrance.

3.5 Proposed Rubble Landfill Description

The proposed rubble landfill will consist of approximately 114.4 acres dedicated for landfill waste disposal, or airspace. Total site disturbance to construct the facility (including the access road, leachate collection and storage area, stormwater management facilities, etc.) is approximately 193.2 acres. The rubble landfill will consist of a series of excavated cells, contained within a perimeter berm (Cells 1 through 10 in the West Section and Cells 11 through 16 in the East Section, as shown on Drawings 10 and 11). A summary of cell areas is provided in the following table.

Summary of Cell Areas	
Cell	**Area (acre)**
1	13.2
2	7.5
3	4.9
4	5.5
5A	5.6
5B	3.4
5C	4.4
5D	2.9
5E	3.2
5F	1.7
6	5.2
7	6.7
8	6.0
9	4.0
10	9.6
11	7.0
12	6.7
13	3.4
14	4.3
15	4.7
16	4.5

The landfill will have a series of containment systems to protect human health and the environment from potential releases form the landfill. These containment systems include the following:

- Liner System
- Leachate Collection and Management
- Cap/Closure System
- Landfill Gas Collection and Control
- Stormwater Management

These systems are described briefly below and in greater detail throughout the Phase III Permit Application.

Site entrances are described under Section 3.4.

3.5.1 Liner System

Each landfill cell will contain a liner system. The proposed design includes a liner system configuration specifically meeting the COMAR requirements listed in 26.04.07.16C. The proposed liner system components include the following basic components, from top to bottom:

- Select Waste: A 48-inch protective layer to protect the integrity of the underlying layers;
- Leachate Collection Layer: A 24-inch leachate collection and removal system to remove leachate, precipitation that comes into contact with the waste, from the landfill;
- Barrier Layer: Layer to prevent leachate from percolating beyond the landfill liner system and into the underlying soils and groundwater; and
- Prepared Subbase: A 24-inch layer with reduced hydraulic conductivity in intimate contact with the barrier layer intended to minimize the leakage from the barrier layer, in the event the barrier layer is compromised.

As indicated by the description of the liner system, most items at a landfill have a primary system and then a backup for contingency – in the event the primary system fails. This redundancy is reflected in the liner system with the primary barrier layer and the prepared subbase backup barrier layer.

The COMAR-required liner system identifies the use of natural soil materials or synthetic materials for certain liner system components. The liner system proposed by NWM utilizes the synthetic alternatives provided for in the COMAR regulations for the barrier layer (60 mil HDPE geomembrane) and a portion of the leachate collection layer (geocomposite drainage layer (GDL) located on top of the geomembrane and at the bottom of the 24-inch thick leachate collection layer).

Geosynthetics are widely preferred and used over natural soil materials for many of the liner system components due to consistency of product, ease of installation, improved performance over natural materials relative to protection of groundwater, and their use for this purpose for more than thirty (30) years in hazardous waste, municipal solid waste, and industrial waste applications.

Landfill liner systems with properly installed geosynthetic components are viewed as superior to systems with natural soils, for a number of reasons, including but not limited to:

- Consistency of the geosynthetic products over multiple years of construction;
- Permeability being several orders of magnitude lower than the permeability of natural soils, providing more protection against leakage;
- Inert nature of the geosynthetics, averting possible chemical reactions with the leachate or waste disposed at this site;

- Proven-track record of using geosynthetics as barrier components of liner systems for more than 30 years in municipal waste landfills, hazardous waste landfills, and industrial waste landfill;
- Reduced traffic from hauling natural materials to site for construction;
- Reduced timeline for each phased construction effort; and,
- Preservation of natural soils to reducing the needing for soils mining.

More detailed discussions of materials and their selection is provided in Section 9 of this Phase III Permit Application. Liner system details are provided on Drawings 14 through 16.

The landfill cell floor grades have been designed to maintain 3 feet minimum distance (after landfill settlement) from the bottom of the prepared subbase to the Highest Predicted Groundwater Contours indicated on Phase II Permit Application, as discussed further in Section 4.0.

3.5.2 Leachate Management System

The leachate collection system has been designed in accordance with COMAR 26.04.07.16.C. The bottom limit of the leachate collection system is defined by the GDL, which will be installed directly on the geomembane liner component. The geomembrane layer will be in intimate contact with the top of the prepared subbase. Elevation control for the top of subbase grading presented on Drawings 10 and 11, is critical to ensure that 2% minimum required bottom slopes remain following any predicted long term settlement. During construction, bottom elevations shall be laid out utilizing the sump invert elevations and minimum slopes presented on Drawings 6 and 7, and 10 and 11.

Leachate collection system details are shown on Drawings 19 through 21. Leachate will be intercepted by the leachate collection layer contained within the liner system, immediately above the barrier layer. Leachate will flow within the leachate collection layer to the leachate collection sump. Within the cell sump (i.e., low spot), submersible pumps compatible with the leachate will transfer the leachate out of the cell into the leachate force mains and then to one of two Leachate Storage Facilities.

From the leachate storage tanks, the leachate will be hauled off-site for disposal.

Environmental Recovery Corporation (ERC) of Maryland, located in Baltimore, has provided written confirmation that they can process and treat the estimated leachate volume of 75,000 gallons per day. A copy of that confirmation is attached to this response to comments letter. No pre-treatment is anticipated prior to shipment.

Details and layout of the leachate management system are provided on Drawings 17 through 29. Detailed description pertinent to leachate collection system design and installation is presented in Section 10.0 "Leachate Management System" and in Section 14.0, "Construction Specifications", respectively.

Depending on the nature of the waste disposed, the levels of contaminants in the leachate, and the volume of leachate produced (which is directly linked to the amount of rainfall), the

owner may choose, in the future to develop an on-site wastewater treatment plant to treat leachate and obtain a NPDES discharge permit.

3.5.3 Cap/Closure System

3.5.3.1 Final Cover Layer

As waste grades attain the maximum permitted filling elevations presented on Drawings 30 and 31, a minimum24-inch thick Final Cover will be placed. The Final Cover Surface shall be graded to promote runoff and minimize erosion. Minimum and maximum Closure Cap slopes are four percent (4%) and twenty-five (25%), respectively. In addition, to ensure adequate flow capacity for the proposed cap drainage layer, the minimum cross-slope for the Final Cover surface across proposed terraces and haul road benches shall be 7-percent.

.

3.5.3.2 Closure Cap

The Final Cover Layer will be the supporting layer for the Closure Cap. Pursuant to COMAR 26.04.07.21G, the Closure Cap will consist of the following components, from top to bottom:

- Vegetative Stabilization – Perennial cover as recommended by the Anne Arundel County Soil Conservation District, with sufficient lime and commercial fertilizer applied to sustain vegetative growth.
- Final Earthen Cover – 24-inch thick (minimum) soil layer, including a upper 6-inch thick vegetative support layer.
- Drainage Layer - Geocomposite Drainage Layer (GDL) or 6-inch thick drainage layer with a permeability equal to or greater than 1 x 10^{-3} cm/sec. We are requesting MDE approve of the GDL in-lieu of the 6-inch thick drainage layer.
- Low Permeability Cap - 40 mil (minimum) synthetic (textured LLDPE) material with a maximum permeability of 1 x 10^{-10} cm/sec.

The purpose of the closure cap is several-fold, including to:

- Prevent infiltration of precipitation into the waste,
- Prevent contact with the waste, by people or animals, and
- Prevent burrowing animals from disturbing the waste.

More detailed discussion of the Closure Cap system and selection of materials is provided in Section 9.0. Grading plans and details associated with the final cover layer and the closure cap system are provided on Drawings 30 through 35. Materials specifications are provided in Section 14.

3.5.4 Landfill Gas Collection and Control

A byproduct of landfill disposal of waste is often gaseous emissions, as the waste decomposes, when exposed to infiltrating rainwater or the mixture of the wastes disposed. The exact character and nature of these emission, dubbed "landfill gas", varies based on the composition of the wastes disposed, but the primary component is usually methane. Depending upon the concentration of methane in the landfill gas, a passive landfill gas management system may be used. However, if concentrations are higher, so that they can sustain a landfill gas flare or even be used to produce power for on-site use, an active landfill gas collection and control system should be installed.

For municipal waste landfills, an active landfill gas (LFG) collection and control system is required. For rubble waste, the need for an active system varies with the type and volume of waste deposited. For this application NWM has included information and details for an active LFG collection and control system will be needed. This LFG system will include the following components:

- LFG monitoring probes at the property line to verify LFG is not in the soils or groundwater at the property limits.
- LFG extraction wells installed in the waste (the extraction wells will be capable of functioning in passive mode if gas generation rates cannot support an active gas system and use of a passive system is approved by MDE).
- LFG laterals and headers to convey LFG from the wells to a LFG Flare to burn the LFG.
- A blower which will impose a negative pressure on the system to "suck" the LFG out of the landfill. The blower is typically included with the flare and recommended by the flare manufacturer. (The size and configuration of the blower and flare will be a function of the volume of gas being generated/required extraction rates, methane concentrations and size and layout of the area of extraction.)

Further discussion of the LFG Collection and Control System is provided in Section 11.

3.5.5 Stormwater Management

One of the requirements of COMAR 26.04.07 and 40 CFR 257 is the management of surface water run-on from upgradient sources and the management of stormwater runoff from landfills. 40 CFR 257 and 258 list requirements for coal-combustion residual and municipal solid waste facilities. 40 CFR 258.26 (a) specifically requires

> "(1) A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm;
> (2) A run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm."

While this is a Rubble Waste facility so these federal requirements are not applicable, they are relevant and appropriate. Thus, surface water/stormwater runoff controls at the Chesapeake Terrace Rubble Landfill were designed for the 25-year, 24 hour storm event.

The stormwater management systems consists of a number of components, including the following:

- Terraces on the closure cap
- Downchutes to convey flow from the terraces, off the landfill
- Perimeter channels and swales to convey flow from the downchutes and other operational areas to the stormwater management basins
- Culverts convey flow at road or driveway crossings

Detailed design information about the stormwater management system is provided on Drawings 38 through 53 and described in Section 17.

3.6 Solid Waste Management Plan

The Chesapeake Terrace Site was included in the Anne Arundel County 10-Yr Solid Waste Management Plan 2013-2023 as a proposed facility.

ADVANCED GeoServices

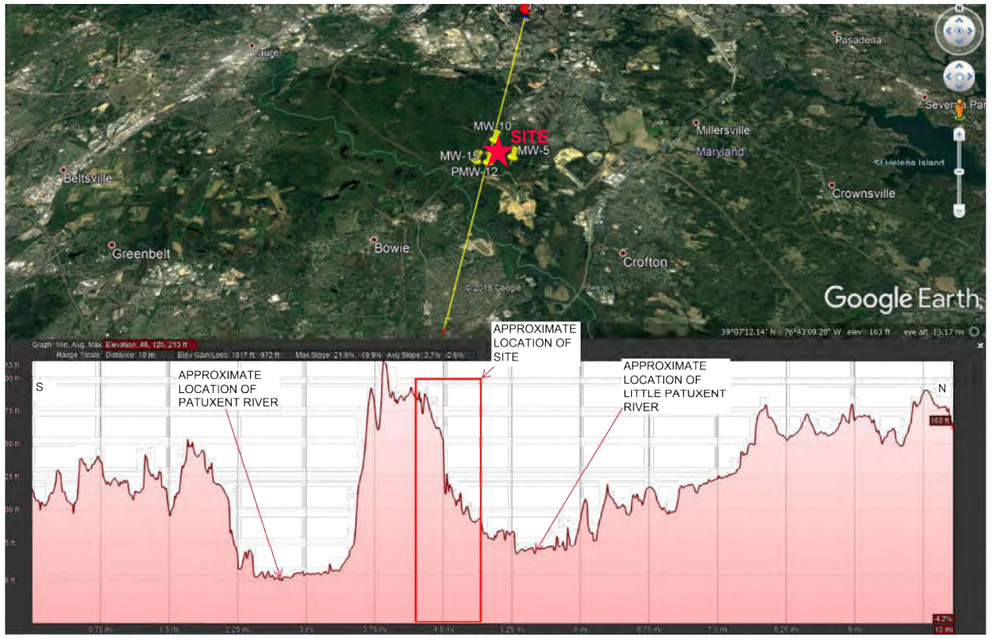
a Montrose Environmental Group company

ATTACHMENT 3A

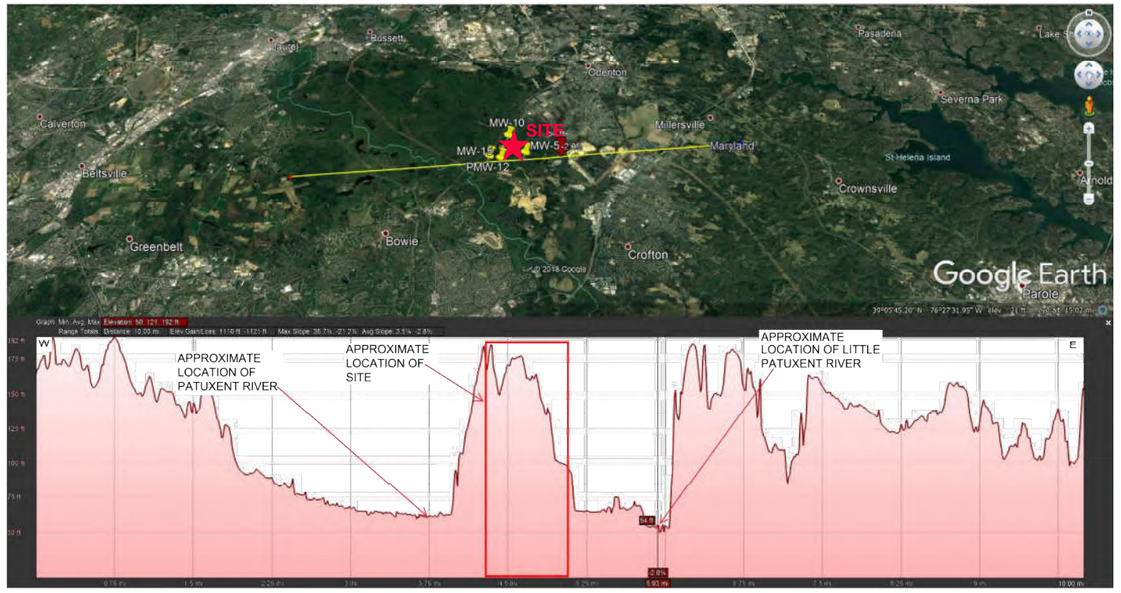
Regional Topographic Information

NOTES

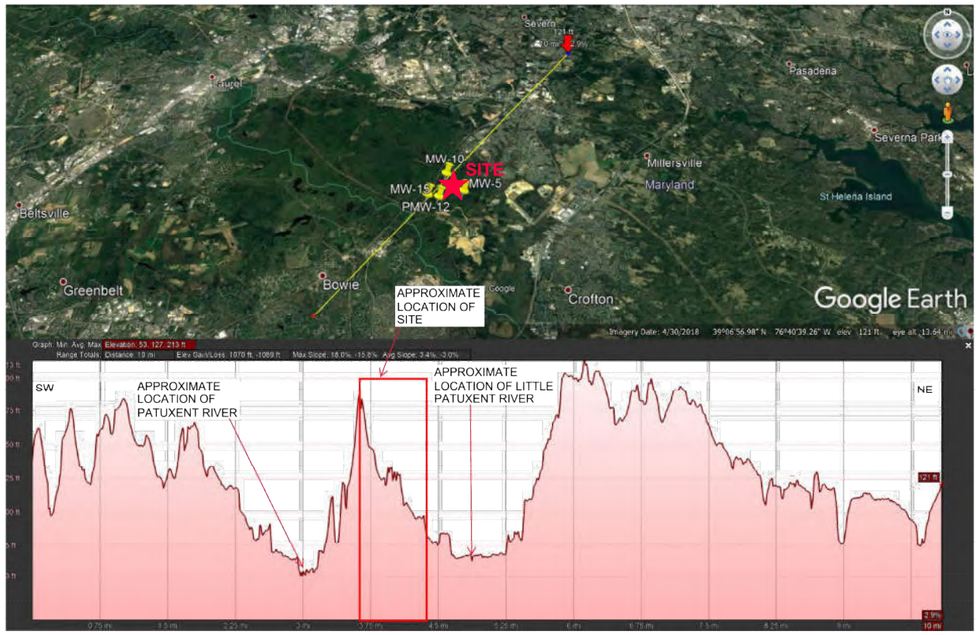
1. TOPOGRAPHIC AND MAP DATA SHOWN IS FROM GOOGLE EARTH UPDATED 4/30/2018.
2. THE PROFILES SHOWN REPRESENT THE GROUND SURFACE ELEVATIONS OF 10-MILE SECTIONS THAT ARE ROUGHLY CENTERED UPON THE PROPOSED LOCATION OF THE CHESAPEAKE TERRACE RUBBLE LANDFILL.
3. THE GROUND SURFACE ELEVATIONS SHOWN ARE NOT EXACT. ELEVATIONS SHOWN ARE INTENDED TO DEMONSTRATE THAT THE LOCATION OF THE PROPOSED CHESAPEAKE TERRACE RUBBLE LANDFILL IS ON A LOCALIZED HILL WHICH IS SEPARATED TOPOGRAPHICALLY FROM THE SURROUNDING AREAS BY THE PATUXENT AND LITTLE PATUXENT RIVERS.



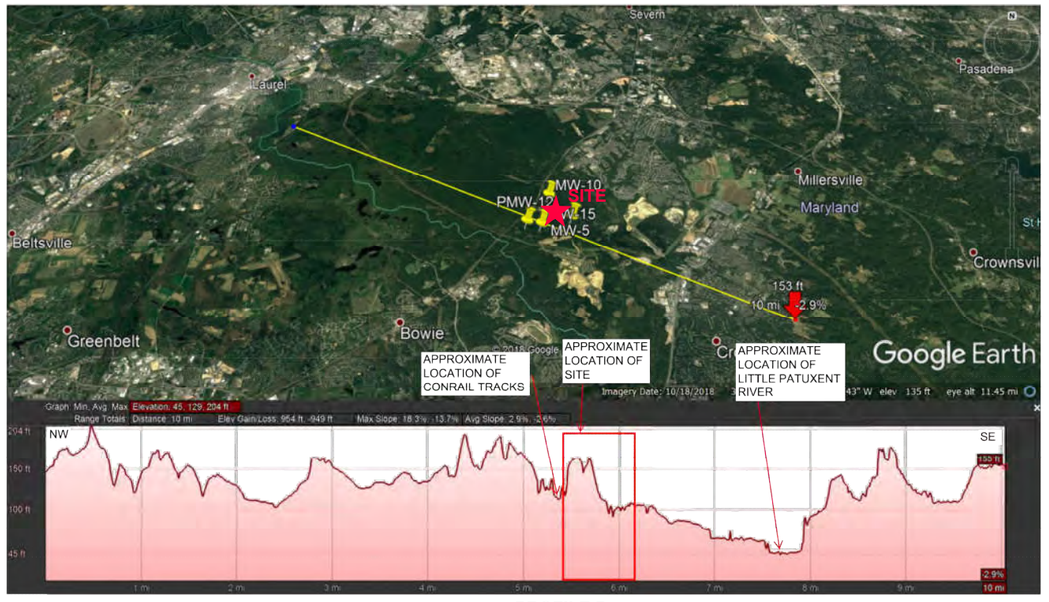
PROFILE A



PROFILE C



PROFILE B



PROFILE D

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
No. 35645
PROFESSIONAL ENGINEER

DATE:	REVISION:
4/30/2020	REVISED TO ADDRESS MDE COMMENTS (PGS/VEF)

NATIONAL WASTE MANAGERS
PHASE II PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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A Montrose Environmental Group company
105 JOHN ST., SUITE A, WEST CHESTER, PA. 19380
tel: 610.429.1020 fax: 610.429.1179 www.advancedgeoservices.com

REGIONAL TOPOGRAPHIC PROFILES

REPORT CODE: A		FILE NAME: 20183854A002	
PROJECT MANAGER:	VEF	SCALE:	N.T.S.
CHECKED BY:	VEF	PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE	DATE:	4/1/2019

FIGURE 2

N:\Projects\2018\20183854 - Chesapeake Terrace LFL\CAD\DWG\RC A_Phase II Application\20183854A002 - 4 On-site Boring and Well Locations.dwg, 6/5/2020 3:51:25 PM

SECTION 4

GROUNDWATER SEPARATION

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Figures

4-1 - Landfill Bottom Grades compared with highest Observed Groundwater Contours

LIST OF ATTACHMENTS

Attachments

4A - Highest Observed/Predicted Groundwater Condition – Unconfined Zone (from Phase II Permit Application)

4.0 GROUNDWATER SEPARATION

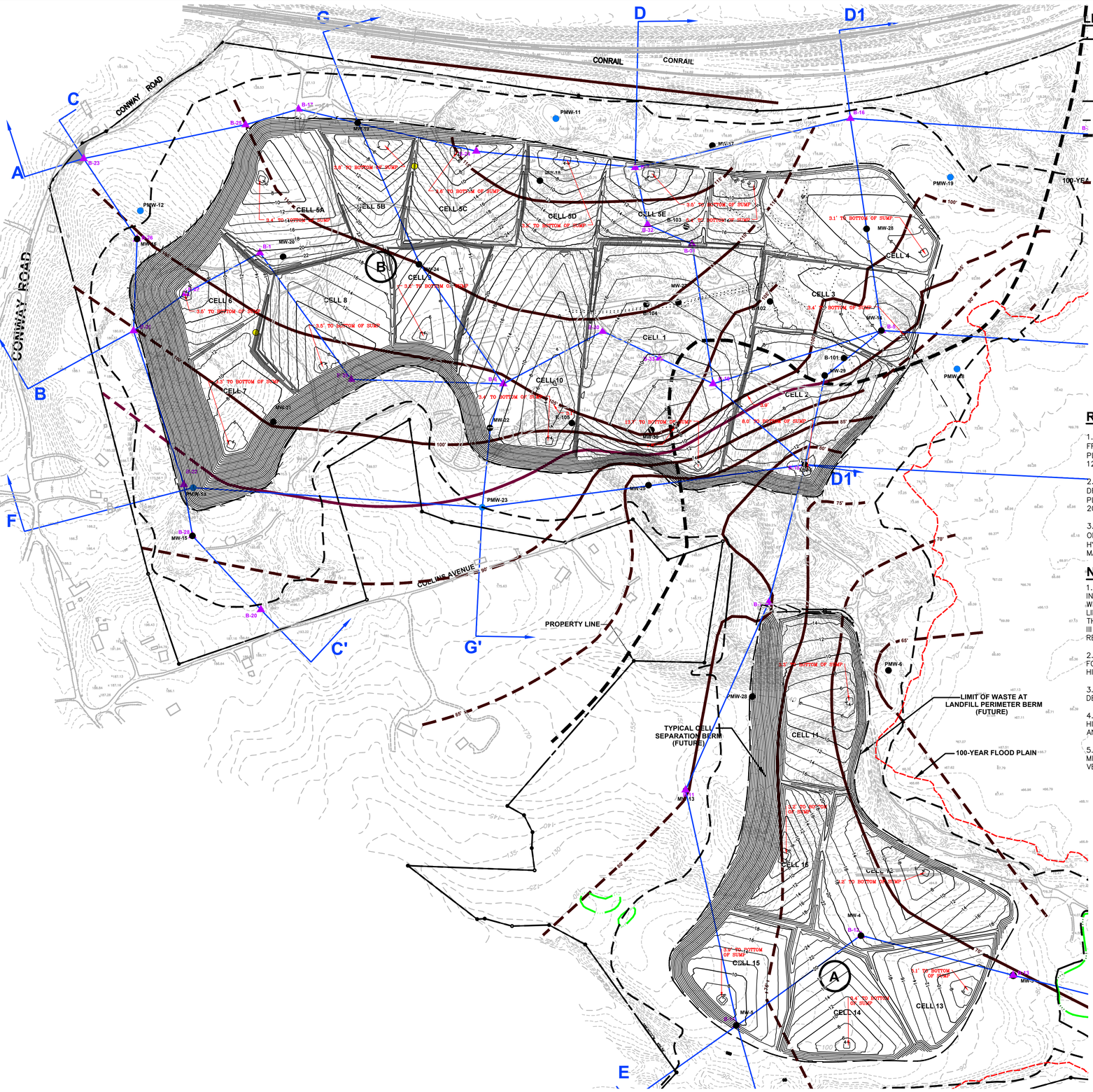
COMAR 26.04.07.16C(6)(a) specifies that “the liner system shall be located entirely above the composite high groundwater elevation.” It further requires there must be minimum 3 feet distance between “maximum expected groundwater elevation” and “bottom of the liner system, including the subbase.”

Drawings 6 and 7 present the Bottom of of Subbase grades ffor the west and east sections, respectively. Figure 12 of the Phase II Permit Application (included in Attachment 4A) represents “highest observed/predicted groundwater condition – unconfined zone.” Comparing these two surfaces provides the isopach map (Figure 4-1) representing the distance between these surface. At all locations, the isopach map shows a minimum distance of at least 3 feet.

It should be noted that the grades shown on Drawings 6 and 7have a minimum constructed slope of three percent (3%) to account for differential settlement over the life of the landfill, so that after placement of waste, minimum floor grades will remain at two percent (2%) or greater. For further discussion about differential settlement, please consult Section 9.

During construction stakeout for the bottom of the subbase beneath the sump, the bottom of subbase elevations shown in tabular form on Drawings 6 and 7 should be laid out first. All subsequent stakeout should be performed relative to the bottom of subbase beneath the sump and utilizing the leachate collection sump configuration on Drawing 19.

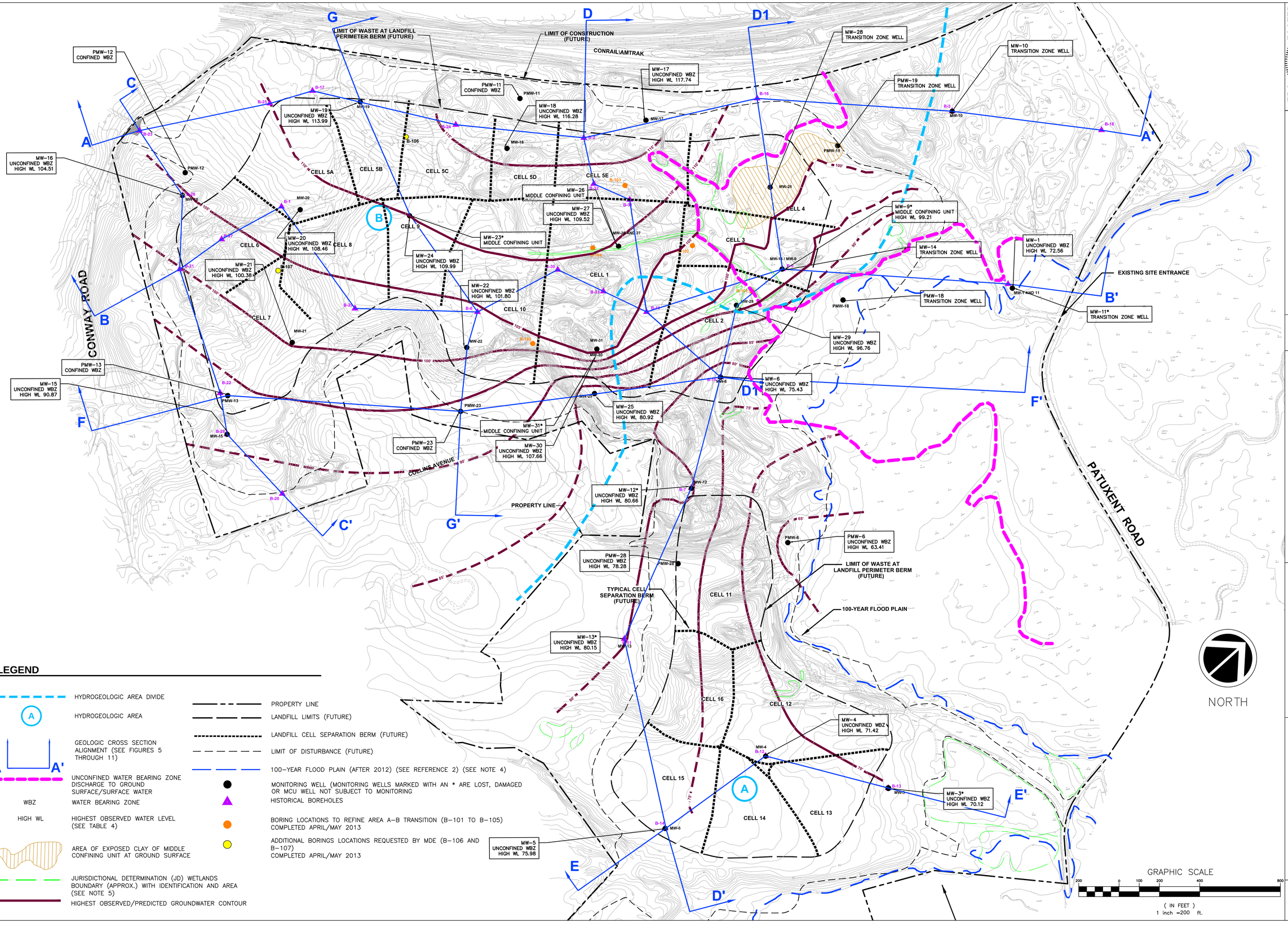
FIGURE


CONRAIL
CONWAY ROAD
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CELL 5B
CELL 5C
CELL 5D
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CELL 2
CELL 1
CELL 6
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B-103
B-104
B-105
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B
C
C'
D
D1
E
F
G'
100-YEAR
3.8' TO BOTTOM OF SUMP
3.4' TO BOTTOM OF SUMP
3.6' TO BOTTOM OF SUMP
3.5' TO BOTTOM OF SUMP
3.3' TO BOTTOM OF SUMP
3.1' TO BOTTOM OF SUMP
3.4' TO BOTTOM OF SUMP
3.2' TO BOTTOM OF SUMP
3.4' TO BOTTOM OF SUMP
3.4' TO BOTTOM OF SUMP
3.2' TO BOTTOM OF SUMP
3.4' TO BOTTOM OF SUMP
3.1

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ATTACHMENT 4A

Highest Observed/Predicted Groundwater Contour Map (from Phase II Permit Application)



LEGEND

- HYDROGEOLOGIC AREA DIVIDE
- A — HYDROGEOLOGIC AREA
- A A' — GEOLOGIC CROSS SECTION ALIGNMENT (SEE FIGURES 5 THROUGH 11)
- UNCONFINED WATER BEARING ZONE DISCHARGE TO GROUND SURFACE/SURFACE WATER
- WBZ — WATER BEARING ZONE
- HIGH WL — HIGHEST OBSERVED WATER LEVEL (SEE TABLE 4)
- AREA OF EXPOSED CLAY OF MIDDLE CONFINING UNIT AT GROUND SURFACE
- JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE NOTE 5)
- HIGHEST OBSERVED/PREDICTED GROUNDWATER CONTOUR
- PROPERTY LINE
- LANDFILL LIMITS (FUTURE)
- LANDFILL CELL SEPARATION BERM (FUTURE)
- LIMIT OF DISTURBANCE (FUTURE)
- 100-YEAR FLOOD PLAIN (AFTER 2012) (SEE REFERENCE 2) (SEE NOTE 4)
- MONITORING WELL (MONITORING WELLS MARKED WITH AN * ARE LOST, DAMAGED OR MCU WELL NOT SUBJECT TO MONITORING
- HISTORICAL BOREHOLES
- BORING LOCATIONS TO REFINE AREA A–B TRANSITION (B–101 TO B–105) COMPLETED APRIL/MAY 2013
- ADDITIONAL BORINGS LOCATIONS REQUESTED BY MDE (B–106 AND B–107) COMPLETED APRIL/MAY 2013

VERONIQUE E. FOSTER
LICENSED PROFESSIONAL ENGINEER
STATE OF MARYLAND
No. 35645
PROFESSIONAL ENGINEER

DATE:	REVISION:
4/30/2020	REVISED TO ADDRESS MDE COMMENTS (PGS/VEF)
6/5/2020	EDITORIAL REVISIONS/NEW LANDFILL BOTTOM (PGS/VEF)

NATIONAL WASTE MANAGERS
PHASE II PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
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HIGHEST OBSERVED/PREDICTED GROUNDWATER CONDITION– UNCONFINED ZONE

REPORT CODE: A		FILE NAME: 20183854A012	
PROJECT MANAGER:	VEF	SCALE:	AS NOTED
CHECKED BY:	VEF	PROJECT NUMBER:	2018–3854
DRAWN BY:	EEE	DATE:	7/31/2019

FIGURE 12

SECTION 5

LANDFILL DESIGN LIFE

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	5.1	Landfill Airspace Estimate	5-1
	5.2	Landfill Life Expectancy	5-1

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Attachment

5A	-	Landfill Airspace Estimate
5B	-	Cell Life Summary
5C	-	Waste Density

5.0 LANDFILL DESIGN LIFE

5.1 Landfill Air Space Estimate

Available area for rubble waste disposal consists of approximately 114.4 acres, as measured at the inside top of berm. AutoCAD computer software was used to estimate total landfill air space between Top of the Leachate Collection System Contours (shown on Drawings 17 and 18) and Top of Waste Contours (shown on Drawings 30and 31). The total gross volume available between these two surfaces is 9.3 million cubic yards (MCY).

5.2 Landfill Life Expectancy

Total available landfill airspace between Top of the Leachate Collection System and Top of Waste surfaces is approximately 9.3 MCY of compacted fill material. This volume includes intermediate and periodic cover. Assuming ten percent (10%) of the total waste disposal volume is intermediate and periodic cover, the net waste disposal volume is 8.38MCY.

The Owner anticipates 1,602 tons per day rubble waste placement, at an average unit rate of 44.0 lbs/cf during a 5 -day per week operational time frame. At this rate, one 8-ft thick lift over 1 acre will provide 4.8 days of disposal. The average daily waste placement rates are based on a 12 year operating life, See the calculation and summary Table A in Attachment 5B.

There will be time associated with construction of the landfill and closure of the landfill which falls outside this 12 year operating life.

We currently anticipate the initial roadways, leachate storage tanks, cells, interior roads, and stormwater management features will take up to two years to construct. After final landfill grades are achieved, COMAR 26.04.07.21C requires closure construction to begin within 24 months of the placement of the final lift of waste and completion of closure cap construction within 36 months of the placement of the final lift.

While we anticipate phased closure cap construction, as areas achieved top of waste filling grades, there may still be a substantial area (20+ acres) requiring final closure cap construction after placement of the final lift of waste. A closure cap can readily be constructed over an area of 20 acres within the required 36 months following placement of the final lift, with favorable weather and adequate borrow sources for cover soils.

Thus, the total duration of construction activities at site are anticipated to be as follows:

- Initial Construction 2 years (or less)
- Landfilling and cell construction concurrently 12 years
- Closure Cap construction 3 years (or less)

Total Construction Timeline = 17 years (or less)

ATTACHMENT 5A

Landfill Airspace Estimate

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Available Airspace (Waste Disposal Volume)		
	Job No. 2018-3854	**Made by:** VEF	**Date** 07-03-20 REV: 08-25-21
	Ref.	**Checked by:** JCA REV By PGS	**Sheet** 1 of 2

Objective: The objective of this analysis is to estimate the total waste disposal volume, or airspace.

Design Approach and Assumptions:

The volume of disposal is based primarily on the total area of the landfill and the grading plans representing the Top of Leachate Collection Layer and the Proposed Top of Waste. The total volume available between the grading plans provides the total volume.

This design was developed based on the COMAR-required liner system with geomembrane barrier layer, with a thickness of eight (8) feet.

COMAR-required Liner System	Alternate Liner System
• Four feet of Select Waste; • 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator if breached; • Two feet of leachate collection layer, comprised of locally mined sandy soils; • A geocomposite drainage net (GDN), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; • geomembrane with a permeability less than or equal to 1 x 10^{-10} cm/sec; and; • Prepared subbase with a minimum thickness of 2 feet and having a permeability less than or equal to 1.0 x 10^{-5} cm/sec.	• Eliminated from calculation
Total Thickness – 8 feet	

The final cover system is comprised of the following components, with a total thickness of 4 feet:

- 6-inch thick layer of vegetative support layer (topsoil or other material capable of supporting vegetation);
- 18-inches of protective cover soils, with a permeability not exceeding 1x10^{-5} cm/sec;
- A geocomposite drainage layer, with a tri-planar drainage net and 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; and,
- 40-mil textured on both sides, linear low density polyethylene (LLDPE) geomembrane with a permeability less than or equal to 1 x 10^{-10} cm/sec.
- 24-inch thick Final Cover Soil Layer

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Available Airspace (Waste Disposal Volume)		
	Job No. 2018-3854	**Made by:** VEF	**Date** 07-03-20 REV: 08-25-21
	Ref.	**Checked by:** JCA REV By PGS	**Sheet** 2 of 2

Calculations:

Based on the two grading plans, using the Civil3D tools in AutoCAD, determine the total volume between the final cover grading plan and the subbase grading plan for the west and east sections. Also, using the area function in AutoCAD, determine the total area of each section.

Landfill Section	**West (Cells 1-10)**	**East (Cells 11-16)**
Volume (cubic yards)	7,247,000	2,065,000
Total Volume (cubic yards)	9.31M	
Area (square feet)	3,649,585	1,335,004
Area (acres)	83.8	30.6
Waste Disposal Volume (cubic yards) (including Intermediate and Final cover)	**9,312,000 c.y.**	
Assume 10% for Int/Final Cover	**0.93 M c.y.**	
Waste Disposal Volume (tonnage)	**(8.38 M c.y. x 1188 lb/c.y.)/2000 ~ 5.0 M tons**	
Average Daily intake (assuming 5.5 days/week and 52 weeks per year operation for 12 years)	**5.0 M/(12 x 5.0 x 52) = 1,602 tons/day**	

Conclusions:

Based on the foregoing, the total waste disposal volume for the proposed Chesapeake Terrace Rubble Landfill is 8.38 M c.y., or 5.0 M tons, excluding intermediate and periodic cover.

References:

1. Advanced GeoServices Corp., "Top of Leachate Collection Layer Grading Plan – West Section," dated August 26, 2021.
2. Advanced GeoServices Corp., "Top of Leachate Collection Layer Grading Plan – East Section," dated August 26, 2021.
3. Advanced GeoServices Corp., "Top of Waste Grading Plan – West Section," dated August 26, 2021
4. Advanced GeoServices Corp., "Top of Waste Grading Plan – East Section," dated August 26, 2021.
5. Advanced GeoServices Corp, Calculation "Waste Density," dated June 23, 2020.

ATTACHMENT 5B

Cell Life Summary

Attachement 5B - Cell Life Summary

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Landfill Life		
	Job No. 2018-3084	Made by: JCA	Date 7/1/20
	Ref.	Checked by: VEF	Sheet 1 of 2

Revised by PGS 08-26-2021

1. Purpose

The purpose of these calculations is to estimate the disposal life of each cell of the landfill. This data is to be used in the leachate generation modeling.

2. Analysis Approach and Assumptions

Top of Leachate Collection Layer and Top Of Waste

The elevations of the center of the ~~cell floor and the cell top~~ were estimated. Based on the difference in these elevations, ~~and considering the thickness of the cap layers, and the liner and leachate collection system layers,~~ the average thickness of the waste layer in each cell was calculated.

The waste will be placed in each cell in 8-ft thick lifts. Therefore, the thickness of each cell was also calculated in terms of the number of 8-ft lifts.

The area of certain elevations in each cell was measured with a digital planimeter. These areas were then used in an end-area calculation to estimate the volume bounded by the top of the completed landfill (final elevations), the bottom of the cell (base grades), and the vertical division between each cell. Each cell volume was compared to its respective area, and an average height was calculated.

~~The thicknesses of the cap system, and the liner and leachate collection system were subtracted from the average height to calculate an average waste thickness of each cell.~~ Using the planned waste acceptance rate of 1,602 Tons 2,686 tons/day, and a waste density of 0.598 ton/cy (1,196 pcy), a cell life was calculated.

This data was used to estimate the total landfill life, and to establish modeling parameters for leachate generation.

The attached table entitled "Cell Life Estimates" provides a summary of this data.

3. Calculations

Notes:

1. Avg waste thickness = Avg Top of Waste contour minus top of leachate collection layer ~~avg cell height minus cap system thickness (2 ft), and liner and leachate collection system (6 ft)~~.
2. Parameters: 0.573 ton/cy; 1,602 Tons ~~2,622 tons~~/day; 5.0 ~~5.5~~ days/week; 52 weeks/year; 12 months/year.

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Objective: Estimate the life of an 8-ft lift on a unit 1-acre of cell area

Given: $\gamma = 44.0$ pcf ; ~~2686 tons~~ 1,602 Tons/day

Calculation:

$$\frac{(8\ \text{ft/lift})(43{,}560\ \text{ft}^2)(44.0\ \#/\text{ft}^3)}{2000\ \#/\text{ton}} = 7666\ \text{T/lift}$$

$$\frac{7666\ \text{T/lift}}{\text{~~2686~~ 1,602 Tons T/day}} = \text{~~2.8~~ 4.8 days/lift/ac}$$

SHEET 1	OF 1	PROJECT NO. 2018-3084	PROJECT NAME		
BY JCA		DATE 6/27/20	DESCRIPTION	Disposal life of one 8-ft lift	Revised by PGS 08-26-2021
CHK. BY VG		DATE 7/15/20			

Table A - Cell Life Estimates

Cell	Total Cell Area (ac)	Avg. Top of Waste Elevation (ft)	Avg. Top of LCL Elevation (ft)	Avg. Waste Thickness (ft)	Avg. Number of 8-ft Lifts (ea)	HELP [2] Number of 8-ft Lifts (ea)	Estimated Cell Life [3] (months)	Cell Life [4] (months)
1	13.2	236	120	116	14.5	15	24.2	24
2	7.5	184	104	80	10.0	10	8.4	8
3	4.9	206	113	93	11.6	12	5.4	5
4	5.5	170	117	53	6.6	7	4.3	4
5A	5.6	220	126	94	11.8	12	7.7	8
5B	3.4	208	128	80	10.0	10	3.6	4
5C	4.4	194	130	64	8.0	8	4.2	4
5D	2.9	186	130	56	7.0	7	2.1	2
5E	3.2	172	129	43	5.4	5	2.3	2
5F	1.7	172	128	44	5.5	6	1.6	2
6	5.2	220	118	102	12.8	13	9.7	10
7	6.7	230	112	118	14.8	15	11.8	12
8	6	220	120	100	12.5	13	9.2	9
9	4	220	120	100	12.5	13	5.7	6
10	9.6	236	122	114	14.3	14	14.8	15
11	7	144	84	60	7.5	8	7.9	8
12	6.7	140	87	53	6.6	7	5.0	5
13	3.4	138	87	51	6.4	6	2.9	3
14	4.3	156	89	67	8.4	8	3.5	4
15	4.7	166	91	75	9.4	9	4.7	5
16	4.5	178	90	88	11.0	11	5.5	6
Total	114.4					*Total Months*	144.5	144.0
						Total Years	12.0	12.0

ATTACHMENT 5C

Waste Density

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Waste Density		
	Job No. 2018-3084	Made by: JCA	Date 07-05-20
	Ref.	Checked by: VEF	Sheet 1 of 2

Revised by PGS 08-26-2021

Objective:

The objective of this analysis is to establish the density of the construction, demolition, and debris (CDD) waste for the landfill. This data is used in various other design calculations.

Design Approach and Assumptions:

The CDD density was initially estimated from the historical values of other CDD (rubble) landfills in the state based on the annual *"Maryland Solid Waste Management and Diversion Report"* (MSWDR) for the available calendar years (CY) 2011 through 2016.

The MSWDR included data associated with 5 rubble landfills in the state. Three of these landfills reported annual waste tonnage accepted for landfilling, and the volume used for landfilling. It is presumed these volumes included soil materials used for weekly cover. A fourth landfill reported data that seemed to be based on an assumed waste density. A fifth landfill reported accumulative data rather than annual data. The data from these two latter landfills was not used in this analysis.

Based on the data considered, a CDD waste density was established for this design. It is recognized this density does not include the weight of the soil used for weekly cover since only the weight of waste accepted for landfilling was reported. Therefore, the density established from the MSWDMR data will be used for life calculations only. A density that includes the weight of soil for weekly cover is calculated for use in various calculations that consider the vertical weight or stress due to the CDD waste.

Calculations:

As indicated, the CDD density was initially estimated from the proposed operational conditions, as follows:

The *"Maryland Solid Waste Management and Diversion Report"* (MSWMDR) for the available CY 2011 through CY 2016 for the Baker Rubble Landfill, the Days Cove Rubble Landfill, and the Honeygo Run Reclamation Center was reviewed. From this data, the CDD density in these three rubble landfills has ranged from 534 pcy to 1,547 pcy, with an average 1,187.7 pcy (44.0 pcf). This density is used for life calculations for each cell.

A summary table and copies of the MSWMDR data are attached.

From the cell life calculations, it is estimated a 1 acre area will be filled with one 8-ft lift of waste in 2.8 days. This would result in 2 acres of waste, 8-ft thick, would be placed in one operating week (5.5 days). It is estimated this 2-ac area and volume would total approximately 15,333 tons of waste. Weekly cover would comprise 0.5" of soil over the 2-ac area. Based on a "loose spread" density of 75

4.8 Days 1 acre 5.0 Days 1 acre 7,665 tons Ft 1 acre

817 tons

pcf, the weekly cover soil would be approximately 1,633 tons. Considering the CDD waste typically has far more void space than that of municipal solid waste, it is assumed the weekly cover soil will eventually ravel vertically downward into the underlying CDD waste. Therefore, the weekly cover soil will not affect the volume and life analysis, but will result in an increased density of the landfilled CDD waste. This increased density is estimated to be 48.7 pcf.

A calculation of the increased waste density is attached.

Conclusions:

Based on the foregoing, the following conclusions are presented:

1. A CDD waste density of 44.0 pcf can be used for the calculations of the disposal life of each cell.
2. A CDD waste density of 48.7 pcf can be used for various calculations where the vertical stress or weight of the CDD waste is considered.

References:

1. Maryland Department of the Environment; *"Maryland Solid Waste Management and Diversion Report"*; 2012 (CY 2011) through 2017 (CY 2016).

2. Project airspace and life analysis.

Summary of Maryland Solid Waste Management and Diversion Report for Calendar Years 2011 through 2016

Baker Rubble Landfill

Quantity	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	Average
Landfilled in CY (cy)	18,314	27,218	30,978	30,052	30,730	33,560	
Landfilled in CY (tons)	12,762	13,403	15,489	16,124	16,288	17,788	
Landfilled Density in CY (tcy)	*0.6968*	*0.4924*	*0.5000*	*0.5365*	*0.5300*	*0.5300*	
Landfilled Density in CY (pcy)	***1,394***	***985***	***1,000***	***1,073***	***1,060***	***1,060***	***1,095***

Days Cove Rubble Landfill

Quantity	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	Average
Landfilled in CY (cy)	199,357	204,141	208,515	146,409	325,301	321,838	
Landfilled in CY (tons)	119,891	122,022	123,717	113,219	183,123	186,566	
Landfilled Density in CY (tcy)	*0.6014*	*0.5977*	*0.5933*	*0.7733*	*0.5629*	*0.5797*	
Landfilled Density in CY (pcy)	***1,203***	***1,195***	***1,187***	***1,547***	***1,126***	***1,159***	***1,236***

Honeygo Run Reclamation Center

Quantity	CY 2011	CY 2012	CY 2013	CY 2014	CY 2015	CY 2016	Average
Landfilled in CY (cy)	172,117	205,019	167,002	194,972	248,032	315,279	
Landfilled in CY (tons)	116,111	114,988	103,541	116,983	146,339	204,773	
Landfilled Density in CY (tcy)	*0.6746*	*0.5609*	*0.6200*	*0.6000*	*0.5900*	*0.6495*	
Landfilled Density in CY (pcy)	***1,349***	***1,122***	***1,240***	***1,200***	***1,180***	***1,299***	***1,232***

Average of CDD waste density as compacted in the landfill: ***1,187.7*** ***pcy*** ***=*** ***44.0*** ***pcf***

'12 MSWMDR (CY 2011)

Construction and Demolition Debris landfills (Table 17) reported a total available capacity of 13,132,862 tons with 525,684 tons disposed in CY 2011. At the current disposal rate, there would be approximately 25 years (13,132,862 tons ÷ 525,684 tons) of available C&D landfill capacity in Maryland.

Table 17 – C&D Landfill Capacity

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2011 (CY)	Landfilled in 2011 (Tons)	Used in 2011 ^
Baker Rubble Landfill	820,000	542,754	317,999	277,246	117,001	2022	18,314	12,762	2.23%
Days Cove Rubble Landfill – Lateral Expansion	3,200,000	1,671,904	1,020,440	1,528,096	1,139,560	2018	199,357	119,891	6.23%
Honeygo Run Reclamation Center	11,723,461	3,998,393	2,785,249	7,725,068	4,381,600	2048	172,117	116,111	1.47%
Ritchie Land Reclamation Partnership Phase I & II	7,255,800	697,799	697,799	6,558,001	6,477,214	2052	276,921	276,920	3.82%
Washington County Rubble Landfill	2,201,664	166,690	83,345	2,034,974	1,017,487	2061	0	0	0.00%
TOTALS	**25,200,925**	**7,077,540**	**4,904,832**	**18,123,385**	**13,132,862**		**666,709**	**525,684**	**2.65%**

^ Equal to Landfilled in 2011 (CY) ÷ Permitted Capacity (CY)

Industrial landfills (Table 18) reported a total available capacity of 6,399,571 tons. At a current disposal rate of 39,728 tons/year (1,614,460 tons not included in the tons/year disposal rate calculation. See Industrial Waste Landfill section on Page 8, for details), there would be approximately 161 years (6,399,571 tons ÷ 39,728 tons) of available industrial landfill capacity in Maryland.

Table 18 – Industrial Landfill Capacity

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2011 (CY)	Landfilled in 2011 (Tons)	Used in 2011 ^
W.R. Grace and Co. – Davison Chemical Division	495,000	102,503	106,892	392,497	409,304	2027	23,887	24,910	4.83%
Eastalco Aluminum Company	380,000	79,517	109,256	300,483	412,864	2050	0	0	0.00%
Millennium Inorganic Chemicals – HPP Landfill	7,293,378	2,279,841	3,813,323	5,013,537	5,577,403	2019	1,013,299	1,629,278	13.89%
TOTALS	**8,168,378**	**2,461,861**	**4,029,471**	**5,706,517**	**6,399,571**		**1,037,186**	**1,654,188**	**12.70%**

^ Equal to Landfilled in 2011 (CY) ÷ Permitted Capacity (CY)

Landclearing Debris landfills (Table 19) reported a total available capacity of 152,616 tons with 2,312 tons disposed in CY 2011. At the current disposal rate, there would be approximately 66 years (152,616 tons ÷ 2,312 tons) of available landclearing debris landfill capacity in Maryland.

Table 19 – Landclearing Debris Landfill Capacity

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2011 (CY)	Landfilled in 2011 (Tons)	Used in 2011 ^
Howlin Landclearing Debris Landfill	64,120	44,184	55,230	19,936	24,920	2016	1,740	2,175	2.71%

'13 MSWMDR (CY2012)

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2012 (CY)	Landfilled in 2012 (Tons)	Used in 2012 ^
Harford Waste Disposal Center	2,980,000	2,884,800	1,114,583	95,200	85,680	2017	20,860	18,772	0.70%
Harford Waste Disposal Center (Expansion)	4,870,330	215,739	72,098	4,654,591	2,059,202	2028	142,451	58,622	2.92%
Midshore Regional Solid Waste Facility	3,924,994	3,684,695	2,032,481	240,299	126,246	2015	0	0	0.00%
Midshore II Regional Solid Waste Facility	7,800,000	506,539	246,498	7,293,461	4,433,502	2053	190,159	109,914	2.44%
Millersville Landfill & Resource Recovery Facility	14,156,000	4,898,241	3,093,579	9,257,759	5,400,021	2041	154,688	71,405	1.09%
Montgomery County Site 2**	0	0	0	0	0	N/A	0	0	0
Mountainview Sanitary Landfill	4,260,000	3,427,873	2,339,437	832,127	515,919	2022	92,936	80,991	2.18%
Newland Park Municipal Landfill	7,200,000	2,840,541	1,533,892	4,359,459	2,354,108	2038	169,455	91,506	2.35%
Northern Municipal Landfill	3,504,187	1,139,281	569,641	2,364,906	1,182,453	2059	25,700	12,850	0.73%
Quarantine Road Landfill	18,320,622	13,038,537	15,255,140	5,282,085	6,180,042	2026	295,686	153,321	1.61%
Reichs Ford/Site B Municipal Sanitary Landfill	7,326,426	3,621,309	2,036,986	3,705,117	2,084,129	2045	47,506	26,722	0.65%
St. Andrews Municipal Landfill*	1,500,000	0	0	1,500,000	750,000	2034	0	0	0
Somerset County Landfill – Fairmount Site	1,610,000	704,443	412,451	905,557	381,279	2026	41,586	24,371	2.58%
Totals	**179,180,140**	**81,430,481**	**54,558,415**	**97,749,659**	**54,841,974**		**2,637,959**	**1,510,570**	**1.47%**

* St. Andrews Landfill closed in 2001 (Permit No. 2000-WMF-0138). The current permit was issued for a new landfill that was never constructed. St. Mary's County uses permit 2005-WMF-0138 to operate the closed St. Andrews Landfill as a transfer station.

** Montgomery County Site 2 Landfill's construction is on hold until the County needs landfill space in the future.

^ Equal to Landfilled in 2012 (CY) ÷ Permitted Capacity (CY)

Construction and Demolition Debris landfills (Table 17) reported a total available capacity of 12,751,863 tons with 511,755 tons disposed in CY 2012. At the current disposal rate, there would be approximately 25 years (12,751,863 tons ÷ 511,755 tons) of available C&D landfill capacity in Maryland.

Table 17 – C&D Landfill Capacity

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2012 (CY)	Landfilled in 2012 (Tons)	Used in 2012 ^
Baker Rubble Landfill	820,000	569,972	331,402	250,028	103,598	2020	27,218	13,403	3.32%
Days Cove Rubble Landfill – Lateral Expansion	3,200,000	1,876,045	1,142,463	1,323,955	1,017,537	2019	204,141	122,022	6.38%
Honeygo Run Reclamation Center	11,723,461	4,149,626	2,900,237	7,573,835	4,266,612	2050	205,019	114,988	1.75%
Ritchie Land Reclamation Partnership Phase I & II	12,655,800	6,346,629	6,346,629	6,309,171	6,346,629	2040	261,342	261,342	2.06%
Washington County Rubble Landfill	2,201,664	166,690	83,345	2,034,974	1,017,487	2061	0	0	0.00%
TOTALS	**30,600,925**	**13,108,962**	**10,804,076**	**17,491,963**	**12,751,863**		**697,720**	**511,755**	**2.28%**

^ Equal to Landfilled in 2012 (CY) ÷ Permitted Capacity (CY)

Industrial landfills (Table 18) reported a total available capacity of 5,757,976 tons. At a current disposal rate of 392,982 tons, there would be approximately 15 years (5,757,976 tons ÷ 392,982 tons) of available industrial landfill capacity in Maryland.

'14 MSWMDR (CY 2013)

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2013 (CY)	Landfilled in 2013 (Tons)	Used in 2013 ^
Garrett County Solid Waste Disposal & Recycling Facility	2,042,927	1,075,902	632,847	967,025	589,916	2034	48,932	26,064	2.40%
Harford Waste Disposal Center	2,980,000	2,864,795	1,096,578	115,205	103,685	2017	855	767	0.03%
Harford Waste Disposal Center (Expansion)	4,870,330	399,751	169,109	4,470,579	1,952,191	2028	190,400	97,196	3.91%
Midshore Regional Solid Waste Facility	3,924,994	3,684,695	2,032,481	240,299	126,246	2015	0	0	0.00%
Midshore II Regional Solid Waste Facility	7,800,000	693,388	355,341	7,106,612	4,324,659	2053	186,849	101,927	2.40%
Millersville Landfill & Resource Recovery Facility	14,156,000	5,026,935	3,016,161	9,129,065	5,477,439	2043	142,249	66,064	1.00%
Montgomery County Site 2**	0	0	0	0	0	N/A	0	0	0
Mountainview Sanitary Landfill	4,260,000	3,525,108	2,424,204	734,892	375,796	2022	97,235	84,736	2.28%
Newland Park Municipal Landfill	7,200,000	3,017,622	1,629,516	4,182,378	2,258,484	2038	176,081	95,084	2.45%
Northern Municipal Landfill	3,504,187	1,167,576	583,788	2,336,611	1,168,306	2055	28,295	14,147	0.81%
Quarantine Road Landfill	18,320,622	13,324,343	15,589,482	4,996,279	5,845,700	2026	285,763	334,342	1.56%
Reichs Ford/Site B Municipal Sanitary Landfill	7,326,426	3,962,386	2,228,842	3,364,040	1,892,273	2045	41,082	23,108	0.56%
St. Andrews Municipal Landfill*	1,500,000	0	0	1,500,000	750,000	2034	0	0	0
Somerset County Landfill – Fairmount Site	1,610,000	741,163	436,253	868,837	357,477	2026	36,720	23,802	2.28%
Totals	**179,200,140**	**84,576,420**	**56,183,979**	**94,623,720**	**53,439,306**		**2,488,223**	**1,605,424**	**1.39%**

* St. Andrews Municipal Landfill closed in 2001 (Permit No. 2000-WMF-0138). The current permit was issued for a new landfill that was never constructed. St. Mary's County uses permit 2010-WMF-0138 to operate the closed St. Andrews Municipal Landfill as a transfer station.

** Montgomery County Site 2 Landfill's construction is on hold until the county needs landfill space in the future.

^ Equal to Landfilled in 2013 (CY) ÷ Permitted Capacity (CY)

Construction and Demolition Debris landfills (Table 17) reported a total available capacity of 12,202,688 tons with 510,354 tons disposed in CY 2013. At the current disposal rate, there would be approximately 24 years (12,202,688 tons ÷ 510,354 tons) of available C&D landfill capacity in Maryland.

Table 17 – C&D Landfill Capacity

Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2013 (CY)	Landfilled in 2013 (Tons)	Used in 2013 ^
Baker Rubble Landfill	820,000	600,950	346,891	219,050	88,109	2020	30,978	15,489	3.78%
Days Cove Rubble Landfill – Lateral Expansion	3,192,000	2,084,560	1,266,180	1,107,440	893,820	2019	208,515	123,717	6.53%
Honeygo Run Reclamation Center	11,723,461	4,330,058	3,003,778	7,393,403	4,163,071	2049	167,002	103,541	1.42%
Ritchie Land Reclamation Partnership Phase I & II	12,655,800	6,615,599	6,615,599	6,040,201	6,040,201	2040	267,607	267,607	2.11%
Washington County Rubble Landfill	2,201,664	166,690	83,345	2,034,974	1,017,487	2061	0	0	0.00%
TOTALS	**30,592,925**	**13,797,857**	**11,315,793**	**16,795,068**	**12,202,688**		**674,102**	**510,354**	**2.20%**

^ Equal to Landfilled in 2013 (CY) ÷ Permitted Capacity (CY)

'15 MSWMDR (CY2014)

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2014 (CY)	Landfilled in 2014 (Tons)	Used in 2014 ^
Forty West Municipal Landfill	24,752,000	4,087,906	1,634,537	20,664,094	7,956,863	2119	165,182	78,800	0.67%
Garrett County Solid Waste Disposal & Recycling Facility	2,568,470	1,124,191	659,419	1,444,279	831,136	2042	48,289	25,630	1.88%
Harford Waste Disposal Center	2,980,000	2,968,000	1,096,578	12,000	10,000	2017	0	0	0.00%
Harford Waste Disposal Center (Expansion)	4,870,330	540,751	252,845	4,329,579	1,991,606	2037	141,000	83,736	2.90%
Midshore Regional Solid Waste Facility	3,924,994	3,684,695	2,032,481	240,299	126,246	2010	0	0	0.00%
Midshore II Regional Solid Waste Facility	7,800,000	865,252	458,459	6,934,748	4,221,541	2055	171,864	101,911	2.20%
Millersville Landfill & Resource Recovery Facility	14,156,000	5,138,330	3,092,941	9,017,670	5,400,659	2043	146,121	76,780	1.03%
Montgomery County Site 2**	0	0	0	0	0	N/A	0	0	0
Mountainview Sanitary Landfill	3,971,631	3,559,625	2,509,536	412,006	290,364	2022	121,038	85,332	3.05%
Newland Park Municipal Landfill	7,200,000	3,383,281	1,826,972	3,816,719	2,061,028	2035	182,830	98,728	2.54%
Northern Municipal Landfill	3,504,187	1,199,391	599,696	2,304,796	1,152,398	2055	31,816	15,908	0.91%
Quarantine Road Landfill	18,320,622	13,423,921	15,928,627	4,896,701	5,506,555	2028	348,836	323,640	1.90%
Reichs Ford/Site B Municipal Sanitary Landfill	7,326,426	3,981,331	2,239,500	3,345,095	1,881,615	2045	31,073	17,479	0.42%
St. Andrews Municipal Landfill*	1,500,000	0	0	1,500,000	750,000	2034	0	0	0
Somerset County Landfill – Fairmount Site	1,610,000	782,913	458,457	827,087	335,273	2026	41,750	22,203	2.59%
Totals	**180,313,173**	**86,649,108**	**57,917,684**	**93,664,065**	**52,135,583**		**2,603,930**	**1,653,932**	**1.44%**

* St. Andrews Municipal Landfill closed in 2001 (Permit No. 2000-WMF-0138). The current permit was issued for a new landfill that was never constructed. St. Mary's County uses permit 2010-WMF-0138 to operate the closed St. Andrews Municipal Landfill as a transfer station.

** Montgomery County Site 2 Landfill's construction is on hold until the county needs landfill space in the future.

^ Equal to Landfilled in 2014 (CY) ÷ Permitted Capacity (CY)

Construction and Demolition Debris landfills (Table 17) reported a total available capacity of 11,743,963 tons with 495,757 tons disposed in CY 2014. At the current disposal rate, there would be approximately 24 years (11,743,963 tons ÷ 495,757 tons) of available C&D landfill capacity in Maryland.

Table 17 – C&D Landfill Capacity

Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2014 (CY)	Landfilled in 2014 (Tons)	Used in 2014 ^
Baker Rubble Landfill	820,000	631,002	363,015	188,998	71,985	2020	30,052	16,124	3.66%
Days Cove Rubble Landfill – Lateral Expansion	3,192,000	2,230,969	1,379,399	961,031	780,601	2020	146,409	113,219	4.59%
Honeygo Run Reclamation Center	11,723,461	4,537,762	3,120,761	7,185,699	4,046,088	2049	194,972	116,983	1.66%
Ritchie Land Reclamation Partnership Phase I & II	12,655,800	6,827,998	6,827,998	5,827,802	5,827,802	2042	249,431	249,431	1.97%
Washington County Rubble Landfill	2,201,664	166,690	83,345	2,034,974	1,017,487	2061	0	0	0.00%
TOTALS	**30,592,925**	**14,394,421**	**11,774,518**	**16,198,504**	**11,743,963**		**620,864**	**495,757**	**2.03%**

^ Equal to Landfilled in 2014 (CY) ÷ Permitted Capacity (CY)

116 MSWMDR (CY 2015)

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2015 (CY)	Landfilled in 2015 (Tons)	Used in 2015 ^
Garrett County Solid Waste Disposal & Recycling Facility	2,568,470	1,176,087	688,038	1,392,383	790,974	2041	51,896	28,619	2.02%
Harford Waste Disposal Center	2,980,000	2,864,795	1,096,578	115,205	103,685	2017	0	0	0.00%
Harford Waste Disposal Center (Expansion)	4,870,330	748,375	314,834	4,121,955	1,816,466	2043	207,624	61,989	4.26%
Midshore Regional Solid Waste Facility	3,924,994	3,684,695	2,032,481	240,299	126,266	2010	0	0	0.00%
Midshore II Regional Solid Waste Facility	7,800,000	1,073,251	570,397	6,726,749	4,109,603	2052	207,999	111,938	2.67%
Millersville Landfill & Resource Recovery Facility	14,156,000	5,260,458	3,156,275	8,895,542	5,337,325	2043	215,524	107,315	1.52%
Montgomery County Site 2**	0	0	0	0	0	N/A	0	0	0
Mountainview Sanitary Landfill	3,971,631	3,666,612	2,584,961	305,019	215,039	2022	107,025	75,426	2.69%
Newland Park Municipal Landfill	7,200,000	3,579,360	1,932,854	3,620,640	1,955,146	2035	196,079	105,882	2.72%
Northern Municipal Landfill	3,504,187	1,212,989	606,494	2,291,198	1,145,599	2071	13,597	6,799	0.39%
Quarantine Road Landfill	18,320,622	13,872,436	16,230,751	4,448,186	5,204,561	2026	258,226	302,125	1.41%
Reichs Ford/Site B Municipal Sanitary Landfill	7,326,426	3,962,386	2,197,070	3,364,040	1,924,045	2045	25,411	14,294	0.35%
St. Andrews Municipal Landfill*	1,500,000	0	0	1,500,000	750,000	2034	0	0	0
Somerset County Landfill – Fairmount Site	1,610,000	827,885	481,360	782,115	312,370	2031	44,972	22,904	2.79%
Totals	**197,113,173**	**88,384,604**	**59,420,465**	**108,728,569**	**60,499,777**		**2,748,897**	**1,691,223**	**1.39%**

* St. Andrews Municipal Landfill closed in 2001 (Permit No. 2000-WMF-0138). The current permit was issued for a new landfill that was never constructed. St. Mary's County uses permit 2015-WMF-0138 to operate the closed St. Andrews Municipal Landfill as a transfer station.

** Montgomery County Site 2 Landfill's construction is on hold until the county needs landfill space in the future.

^ Equal to Landfilled in 2015 (CY) ÷ Permitted Capacity (CY)

Construction and Demolition Debris landfills (Table 17) reported a total available capacity of 16,054,391 tons with 561,026 tons disposed in CY 2015. At the current disposal rate, there would be approximately 29 years (16,054,391 tons ÷ 561,026 tons) of available C&D landfill capacity in Maryland.

Table 17 – C&D Landfill Capacity

Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2015 (CY)	Landfilled in 2015 (Tons)	Used in 2015 ^
Baker Rubble Landfill	820,000	661,732	379,303	158,268	55,697	2020	30,730	16,288	3.75%
Days Cove Rubble Landfill – Lateral Expansion	3,192,000	2,556,270	1,562,522	635,730	597,478	2018	325,301	183,123	10.19%
Honeygo Run Reclamation Center	11,723,461	4,793,300	3,267,100	6,930,161	3,899,749	2048	248,032	146,339	2.12%
Ritchie Land Reclamation Partnership Phase I & II	12,655,800	7,186,791	7,043,274	5,469,009	3,281,405	2030	358,793	215,276	2.84%
Tolson & Associates	5,762,060	0	0	5,762,060	7,202,575	2035	0	0	0%
Washington County Rubble Landfill	2,201,664	166,690	83,345	2,034,974	1,017,487	2061	0	0	0.00%
TOTALS	**36,354,985**	**15,364,783**	**12,335,544**	**20,990,202**	**16,054,391**		**962,856**	**561,026**	**2.65%**

^ Equal to Landfilled in 2015 (CY) ÷ Permitted Capacity (CY)

17 MSWMDR (CY 2016)

Municipal Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2016 (CY)	Landfilled in 2016 (Tons)	Used in 2016 ^
St. Andrews Municipal Landfill*	1,500,000	0	0	1,500,000	750,000	2034	0	0	0
Somerset County Landfill – Fairmount Site	1,610,000	870,314	506,193	739,686	287,597	2031	42,429	24,793	2.64%
Totals	**193,507,242**	**88,668,657**	**60,159,089**	**104,838,585**	**58,861,737**		**2,937,754**	**1,710,309**	**1.39%**

* St. Andrews Municipal Landfill closed in 2001. The current permit (2016-WMF-0138) was issued for a new landfill that was never constructed. St. Mary's County uses permit 2015-WMF-0138 to operate the closed St. Andrews Municipal Landfill as a transfer station.

** Montgomery County Site 2 Landfill's construction is on hold until the county needs landfill space in the future.

^ Equal to Landfilled in 2016 (CY) ÷ Permitted Capacity (CY)

Construction and Demolition Debris landfills (Table C2) reported a total available capacity of 13,795,362 tons with 718,514 tons disposed in CY 2016. At the current disposal rate, there would be approximately 19 years (13,795,362 tons ÷ 718,514 tons) of available C&D landfill capacity in Maryland.

Table C2 – C&D Landfill Capacity

Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2016 (CY)	Landfilled in 2016 (Tons)	Used in 2016 ^
Baker Rubble Landfill	820,000	695,292	397,091	124,708	37,909	2020	33,560	17,788	4.09%
Days Cove Rubble Landfill – Lateral Expansion	3,192,000	2,878,108	1,749,088	313,892	410,912	2018	321,838	186,566	10.08%
Honeygo Run Reclamation Center	11,723,461	5,148,882	3,471,873	6,574,579	3,694,976	2042	315,279	204,773	2.69%
Ritchie Land Reclamation Partnership Phase I & II	12,655,800	7,696,515	7,349,108	4,959,285	2,975,571	2025	509,724	305,834	4.03%
Tolson & Associates	5,762,060	3553	3553	5,758,507	5,758,507	2042	3553	3553	0.06%
Washington County Rubble Landfill	2,201,664	166,690	83,345	2,034,974	917,487	2061	0	0	0.00%
TOTALS	**36,354,985**	**16,589,040**	**13,054,058**	**19,765,945**	**13,795,362**		**1,183,954**	**718,514**	**3.26%**

^ Equal to Landfilled in 2016 (CY) ÷ Permitted Capacity (CY)

Industrial landfills (Table C3) reported a total available capacity of 8,693,496 tons. At a current disposal rate of 203,689 tons, there would be approximately 43 years (8,693,496 tons ÷ 203,689 tons) of available industrial landfill capacity in Maryland.

Table C3 – Industrial Landfill Capacity

Landfill Facility Name	Permitted Capacity (CY)	Landfilled to Date (CY)	Landfilled to Date (Tons)	Remaining Capacity (CY)	Remaining Capacity (Tons)	Year Reach Capacity	Landfilled in 2016 (CY)	Landfilled in 2016 (Tons)	Used in 2016 ^
W.R. Grace and Co. – Davison Chemical Division	495,000	181,590	214,486	313,410	280,514	2029	18,936	20,789	3.83%
Eastalco Aluminum Company	380,000	152,365	184,142	227,635	300,008	2017	21,305	17,161	5.61%
Essroc Cement Corporation	273,000	0	0	273,000	273,000	N/A	0	0	0.00%
Hawkins Point Plant	3,228,044	2,288,727	3,661,736	939,317	1,503,134	2077	192	240	0.01%
Fort Armistead Road – Lot 15	6,300,000	539,237	593,160	5,760,763	6,336,840	2053	150,455	165,499	2.39%
TOTALS	**10,676,044**	**3,161,919**	**4,653,524**	**7,514,125**	**8,693,496**		**190,888**	**203,689**	**1.79%**

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Objective: Estimate an increased density of waste & weekly cover.

Given: 2.8 (days/lift)/ac ⟹ approx 2ac in one week w/ 1 lift of waste

4.8 days/lift

1 acre

Calculation:

Waste Amount: $(2ac)\left(43{,}560\frac{ft^2}{ac}\right)(8ft) = 696{,}960\ cf$

1 acre

348,480 cf

$$\frac{(696{,}960\ cf)\left(44.0\frac{lb}{cf}\right)}{2000\ lb/T} = 15{,}333\ T \checkmark$$

348,480 cf

7,667 Tons

Weekly Cover Amount: d = 0.5', assume 75 pcf

$$\frac{(2ac)(43{,}560\ sf/ac)(0.5ft)(75\ lb/cf)}{2000\ lb/T} = 1633\ T \checkmark$$

1 acre

817 Tons

Total = 16,966 T ✓

8,484 Tons

Combined Waste & Cover Density:

$$\frac{(16{,}966\ T)(2000\ lb/T)}{(2ac)(43{,}560\ sf/ac)(8ft)} = 48.7\ pcf$$

8,484 Tons

1 acre

48.7 pcf

* Use for calcs using vertical loads.

2018-

SHEET 1	OF 1	PROJECT NO. 3064		PROJECT NAME Ches. Terr.	
BY JCA		DATE 7/4/20		DESCRIPTION Waste + Cover Density	
CHK. BY JEG		DATE 7/4/20		Revised by PGS 08-26-2021	

SECTION 6

SITE ENVIRONMENTAL CONDITIONS

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LIST OF ATTACHMENTS

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6A	-	2012 FEMA Flood Plain Map near site

6.0 SITE ENVIRONMENTAL CONDITIONS

6.1 Wetlands

Wetland areas shown on Drawing 2 were provided by McCarthy & Associates. The following summary regarding the status of the Wetlands Permit for the site is provided by Mr. Milton L. McCarthy.

"The wetland areas at Chesapeake Terrace are shown on (Drawing 2) of the Chesapeake Terrace Rubble Landfill Site Plan. The wetland boundaries have been most recently verified in the field by a representative of the Baltimore District of the Corps of Engineers on May 1, 2008. The Corps issued a permit for Chesapeake Terrace in 1991 CENAB-OP-RW (Chesapeake Terrace) 91-1204-3. The Corps of Engineers reissued the non-tidal wetlands permit on May 23, 2008 (see Appendix A). Maryland Department of the Environment Water Management Administration, Non-tidal Wetland and Waterway Division reissued the water quality certification for Chesapeake Terrace on December 13, 2007. This authorization is valid until December 31, 2010."

This authorization was extended by the United States Army Corps of Engineers until December 31, 2023 in a letter dated January 3, 2019. The previous submissions and correspondence with the USACE to obtain and extend the Wetlands Permit was included in Appendix M of the Phase II Permit Application and is not repeated here for brevity.

6.2 100-Year Flood Plain

6.2.1 Historical Flood Plain Analysis

Mr. J.A. Chisholm, P.E. performed a detailed evaluation of the 100-year flood plain evaluation. His evaluation is described in a letter to the Applicant dated October 14, 2003 (see Appendix B of the Phase II Permit Application). His evaluation is summarized below:

Mr. Chisholm noted that the site is adjacent to the Little Patuxent River approximately 30,000 feet (approximately 5.7 miles) upstream from the confluence of the Little Patuxent River with the Patuxent River. The 100-year flood plain limit shown upon the exhibits submitted to the MDE with the March 1990 Phase II Report was derived from the FEMA (Federal Emergency Management Agency) Anne Arundel County FIRM Panels 24 and 25 dated May 2, 1983. These panels showed the Little Patuxent River adjacent to the Chesapeake Terrace site. The footprint of the landfill is located above elevation 80, approximately 5 feet above the influence of the 100-year floodplain. As a result there is no encroachment into the floodplain that reduces hydraulic capacity or storage volume of the floodplain.

It was concluded that the proposed elevations for Chesapeake Terrace Rubble Landfill operations are located above the influence of any 100-year FEMA flood plain limits within the adjacent Little Patuxent River.

6.2.2 Updated FEMA Maps

In 2012, FEMA updated the National Flood Insurance Program, Flood Insurance Rate Maps (FIRM) for Anne Arundel County, as a result of increase in frequency and severity of recent storm events. Map number 24003C0136E shows the extent of the site and the flood boundaries near the site. Attachment 3B includes excerpts of this map, amended to include the site boundary for the Chesapeake Terrace Rubble Landfill.

AGC Montrose reviewed this map to discern whether it merits adjustment to the historical analysis performed by Mr. Chisholm, which also served as the basis for other permitting in Maryland. Zone AE, where base flood elevations were determined, is located along Patuxent Road and Little Patuxent River beyond it. The flood elevation in the vicinity of the site is designated between 72 and 73 ft msl, downgradient of location of FEMA cross-section Section I shown on the map.

The 2012 FEMA flood plain was inserted into Drawing 2. In reviewing the flood plain line presented on FEMA Map number 24003C0136E, it did not align with the actual topography of the site, where base flood elevations were determined on the FEMA FIRM map. Inconsistencies between FEMA maps and detailed site topographic information are commonly encountered because the FEMA maps do not have access to detailed site topographic information when they are prepared. To make the flood plain boundary be consistent with the actual site topography, we adjusted the floodplain line representing the water surface for the 100-year flood event calculated in the FEMA mapping to follow the contours from the detailed site topography. The flood plain taken directly from the 2012 FEMA Map is shown as the red-line on Drawing 2, while the flood plain line adjusted to match the detailed site topography is shown in the blue line. The 2012 FEMA floodplain boundary, as adjusted for site specific topography, was repeated on many of the other plan drawings included with the Phase III Permit Application.

While the base flood elevations determined in the 2012 FEMA FIRM Map are higher than those identified in Mr. Chisholm's study, it does not affect the conclusion of his study, that the landfill is being developed at elevations above 80 ft msl in the existing conditions. In the vicinity of Patuxent Road, the proposed elevations of the landfill perimeter access road range from 80 ft msl (in the eastern limits) to 100 ft msl (near the Amtrak rail lines). Drawings 10 and 11 provide the proposed landfill perimeter road elevations, relative to the flood plain and cell floor subgrade grading.

6.3 Screening

Mr. J. A. Chisholm, P.E. prepared the natural screening/buffer provisions for the landfill. The screening/buffer concept is as follows:

> "The existing site perimeter is generally heavily wooded. A 100 feet buffer (min.) is proposed by retaining existing woodlands. There are several areas of severe erosion that encroach upon the proposed buffers. These areas are located along the southern boundary. It is proposed to fill these areas and replant with minimum 6 feet to 8 feet white pines, 15 feet on center, with rows 15 feet apart to re-establish a minimum 100 feet vegetated buffer. The existing understory within the 100-foot buffer will be enhanced with supplemental plantings if necessary."

6.4 Residential Well Monitoring

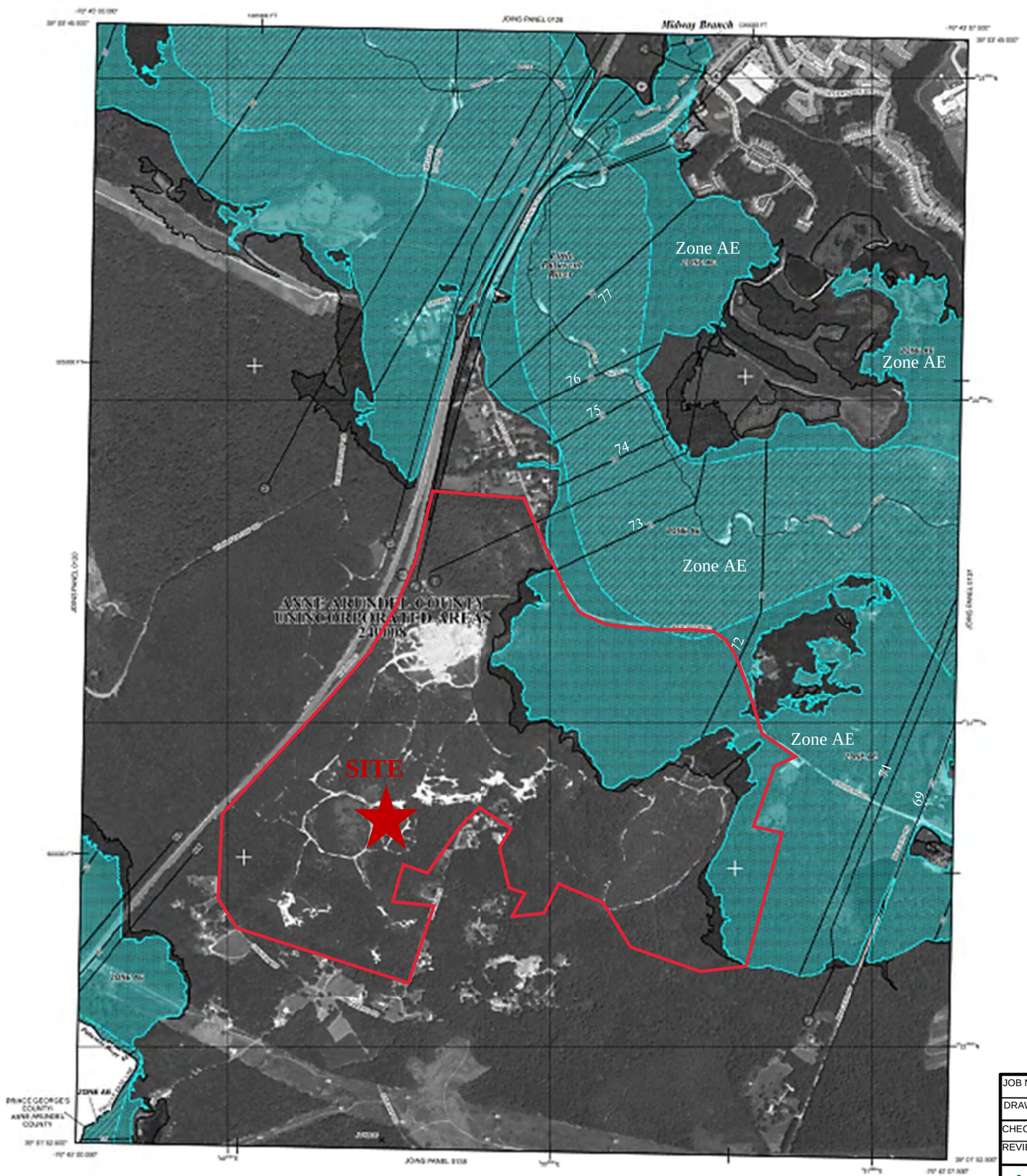
The purpose of residential well monitoring is to determine whether operations at the landfill will have an unreasonable impact on off-site residential wells through lowering of the perched water table. The Landfill will provide mitigation measures at its expense if unreasonable impacts are determined. The residential well monitoring plan is provided in Section 16.0 Attachment 16C, "Residential Well Water Level Monitoring Program."

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a Montrose Environmental Group company

ATTACHMENT 6A

Excerpt from 2021 FEMA FIRM Flood Plain Map



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0136E

FIRM

FLOOD INSURANCE RATE MAP

ANNE ARUNDEL COUNTY, MARYLAND
AND INCORPORATED AREAS

PANEL 136 OF 395

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ANNE ARUNDEL CO, MD	240008	0136	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
24003C0136E

EFFECTIVE DATE
OCTOBER 16, 2012

Federal Emergency Management Agency

JOB No.:	2018-3854	SCALE.:	Not to Scale
DRAWN BY.:	VEF	DATE.:	4/29/2019
CHECKED BY.:	VEF	FILE:	Plate 3
REVIEW BY.:	VEF		

Excerpts - 100-YEAR FLOODPLAIN (FEMA, 2012)

Advanced GeoServices

Chesapeake Terrace Rubble Landfill

Attachment 6A

SECTION 7

SEQUENCE, SCHEDULE AND CONTRACT DOCUMENTS FOR LANDFILL CONSTRUCTION

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7.0 SEQUENCE, SCHEDULE AND CONTRACT DOCUMENTS FOR LANDFILL CONSTRUCTION

7.1 Overview

7.1.1 Landfill Site Entrances

Three site entrances (i.e., East, North, and South entrances) are shown on the Drawings. Construction of only one site entrance (comprised of access road, scale house, truck scales, maintenance building, wheel wash, and cleanout) is required for rubble landfill operation. Site Entrance Description is provided in Section 3.6.

As indicated in Section 3.6, the East Entrance is required by the Anne Arundel County Special Exception Permit. Consistent with the redundancies included in landfill design, there will be an "emergency exit" road, one lane wide at the location of the Optional North Entrance, to allow exit by all at the landfill, if the entrance is blocked by some unusual circumstance (e.g., fallen tree, downed power line, etc.).

If the Optional North Entrance is constructed instead of the East Entrance, another location for this "emergency exit" will be selected in consultation with appropriate governmental agencies.

7.1.2 Landfill Cell Construction

The site for the proposed facility is comprised of areas previously mined for sand and gravel. Primary landfill areas are referenced as East Section (Cells 11-16) and West Section (Cells 1-4, 5A-5F, and 6-10) on Drawings. Each cell is lined and sloped in accordance with Code of Maryland (COMAR) Regulations, as necessary to create a sump for collection of leachate (e.g., surface water percolation through rubble waste placed in the cell).

Two leachate storage facilities will be constructed to provide temporary storage of leachate from the landfill cells. In each leachate storage facility, two 500,000-gallon tanks will be installed within an area surrounded by a secondary containment wall. There are fifteen cells/subcells (each with submersible pumps in a leachate collection sump) in the West Section and six cells (each with submersible pumps in a leachate collection sump) in the East Section.

Leachate force main #3 conveys leachate from Cells 2-4 in the West Section and all cells in the East Section will be pumped to force main trunk lines connected to Leachate Storage Facility No. 1. Leachate force mains #1 and #2 convey leachate from Cells 1, 5A-5F, and 6-10 in the West Section are connected to Leachate Storage Facility No. 2.

Five basins are designated for construction as part of this project (Basin Nos 1 through 4 and WQ_v Basin). Three (3) basins (Nos. 1 through 3) will serve as Sediment Control and Stormwater Management Structures for runoff from the proposed waste disposal areas during construction; prior to waste placement within a cell or subcell; and after placement of the Final Cover layer. (Stormwater falling within or running into a cell during active filling

operation is regulated as leachate and cannot be discharged to the basins, or any other stormwater management feature.) Basin No. 1 manages runoff from the West Section; Basin No. 2 manages runoff from a small segment of the East Section, and upgradient off-site drainage areas and upgradient on-site drainage areas outside the proposed perimeter access road and proposed limits of disturbance. Basin No. 3 manages runoff from the majority of the East Section construction. After the landfill is closed, these three basins will be converted for long-term stormwater management.

Basin No. 4 manages runoff from the proposed East Entrance and upgradient off-site drainage areas and upgradient on-site drainage areas outside the proposed perimeter access road and proposed limits of disturbance. Basin No. 4 will provide Sediment Control and Stormwater Management during construction of the East Entrance and adjacent support area. After completion of East Entrance construction and stabilization, Basin No. 4 will remain to provide stormwater management control. The WQ_v Basin receives runoff from approximately 800 feet of the East access road. The WQ_v Basin will provide Sediment Control and Stormwater Management during construction of the entrance road and operating life of the landfill.

Silt fence, check dams, erosion control mat, temporary vegetation, and other proven temporary and permanent erosion control measures ensure that sediment from disturbed areas outside basin drainage areas is contained on-site. A range of measures available to the site operations personnel are outlined in the Maryland Standards and Specifications for Soil Erosion and Sediment Control (2011, or latest edition)

.

Prior to beginning landfill construction in any given area, sediment basins and perimeter controls required for that area shall be installed as shown on plans and indicated in Section 7.2, "Sequence of Construction for Landfill Cells." As specified in the sequence, each basin shall be completely constructed (e.g., topsoil shall be cleared and stripped, cut-off trench shall be installed, spillway, excavation, and embankment construction shall be performed) before other construction activities within the associated contributing drainage area can begin. Prior to beginning basin construction, all required construction materials for the basin must be on-site. Stormwater, precipitation and groundwater entering the basins during construction will be dewatered per details on plans.

Composite view of all landfill cells at cell bottom of subgrade elevations is provided on Drawings 6 and 7. Grades on cell subgrade plans indicate that each cell will be graded to its own sump, in which a submersible pump will be installed in a sideslope riser pipe, as shown on Drawing 19. The embankment that runs perpendicular to the sump, coupled with completely constructed grades in the cell, assures positive drainage to the sump and sediment containment within a cell under construction. Storm water impounded in a cell under construction shall be pumped to an area where positive drainage to a sediment basin (e.g., perimeter channel) is provided.

Rubble waste may not be placed in any cell until the corresponding leachate storage facility and force main to the cell have been completely constructed and tested. Vehicular access to the storage tank for loading and transport of leachate must be provided and maintained. Upon completion of construction of the liner system in the cell, cell construction material testing (including leachate pump and leachate force main), and connection of the force main system to the storage tank, the construction Quality Assurance Consultant (QAC) will

provide a report documenting the construction of the liner and leachate management systems to MDE for approval. Upon approval by MDE, landfilling activities in that cell may commence.

At all times during the waste placement operation in a cell, waste shall be placed in a manner that ensures collection of leachate in the cell sump area. Routine and final cover shall be placed in accordance with MDE Refuse Disposal Permit stipulations.

To summarize and clarify events that occur chronologically (on a cell-by-cell construction basis), Section 7.2, "Sequence of Construction for Landfill Cells", stipulates conditions under which the landfill will be constructed, from beginning to end of construction. See Drawings 64 through 81 for Intermediate Construction Stage Plans, which illustrate sequence of events to construct the landfill from beginning to end of construction.

Unless otherwise approved by MDE and Anne Arundel Soil Conservation District, Landfill Cell Sequence of Construction will be per Intermediate Stage Construction Drawings, referenced under Section 7.2.2. Cells will be constructed individually or in groups, per the chronological requirements under Section 7.2.5, "Landfill Construction Chronology". Variance from Cell Sequence of Construction is referenced under Section 7.3. Time frames for construction during the life of the landfill operation are given under Section 7.5, "Estimated Cell Construction and Waste Placement Schedule".

Rubble fill operation may proceed in any given completed cell at any time throughout the life of the facility, provided that: sediment controls for the disturbed area are in place and maintained; leachate is properly collected and disposed, and all other conditions of the MDE Refuse Disposal Permit are met.

7.2 Sequence of Construction for Landfill Cells

Unless "Variance from Sequence of Construction for Landfill Cells" is obtained, per Section 7.3, the landfill will be constructed in accordance with criteria provided hereunder. "Surface Runoff/Sediment Control" shall be provided per Section 7.2.1. Section 7.2.2, "Description of Intermediate Construction Stage Plans" and Section 7.2.3, "Assumptions for Development of Landfill Sequence of Construction" describe site conditions and assumptions under which the Landfill Sequence of Construction was determined. Section 7.2.4, "Intermediate Construction Stage Plan Depiction" indicates construction requirements consistent with depiction on each Intermediate Construction Stage Plan. Section 7.2.5, "Landfill Construction Chronology", lists the Sequence of Construction specified on Drawings.

7.2.1 Surface Runoff/Sediment Control

As referenced under the Sequence of Construction Overview above, all cells will be constructed in a manner that will create a sump, and lined with material specified on Drawings. Clean surface runoff from adjacent undisturbed areas will be diverted around the cell construction area, to the extent practicable. During construction, clean surface runoff impounded in cell sumps will be pumped to a constructed permanent perimeter channel or temporary channel, as required to ensure that water from cells under construction will drain through Basin No. 1, 2 or 3.

Construction of access roads and perimeter ditches adjacent to cell areas is referenced under the Sequence of Construction on each Intermediate Stage Construction drawing. In cell construction areas where the perimeter ditch is to be created by fill, the 10-foot minimum top width perimeter berm at the top of the landfill embankment sideslope shall be part of the construction.

As practicable, to reduce sediment-laden surface runoff to sediment basins throughout the life of the construction operation, the landfill operator shall attempt to minimize un-vegetated disturbed areas that drain directly to a Sediment Basin (via existing drainage swales, constructed perimeter ditches, or temporary measures). Permanent or temporary vegetative stabilization, as applicable, shall be applied on disturbed areas, per MDE Refuse Disposal Permit stipulation, before other construction proceeds.

7.2.2 Description of Intermediate Construction Stage Plans

Intermediate Construction Stage Plans (Drawings 64 through 81) depict construction of the landfill from beginning of construction throughout construction of all landfill cells.

The following site conditions were considered in determining Sequence of Construction for Landfill Cells, illustrated on Intermediate Construction Stage Plans.

1. The East Section is constructed first as there is an excess of excavated material that can be used for road and Basin construction. Excess material can be used for intermediate cover, routine cover, or construction of perimeter roads and berms in the west section, as excess material becomes available and is appropriate for the proposed use, based on the nature of the material.

2. While the proposed grading plans provide a net cut situation in both the East and West Sections during cell construction and landfill operation, additional material may be needed for closure cap construction. The owner/operator may choose to consistently import material from off-site throughout the landfill operation to take advantage of readily available material in the area. This material may be staged on-site until used.

3. The primary means of sediment control for construction of the site is by perimeter channel drainage to sediment basins. Natural and constructed drainage swales from the former sand and gravel mining areas convey surface runoff through the site in a predominantly northern direction. Once sediment controls are in-place, as cell construction proceeds, clean surface runoff drainage will be diverted around construction areas, to the existing swales. Until precluded by cell construction, existing swales will convey clean surface runoff to perimeter channels and sediment basins, as shown on Intermediate Construction Stage Plans.

4. In order to reduce leachate generation over the life of the operations and after closure construction, it is expected that the operator will advanced

construction of the closure cap when areas typically between 5 and 10 acres have achieved maximum filling grades. These areas may span more than one cell and may close portions of multiple cells, based on maximum filling grades, not cell boundaries.

7.2.3 Assumptions for Development of Landfill Sequence of Construction

Based on the above site conditions, the following assumptions were used to develop the Landfill Sequence of Construction, depicted on Intermediate Construction Stage Plans on Permit Drawings.

1. Landfill Cells 2 through 4 and 11 through 16, whereby leachate is pumped to Leachate Storage Facility No. 1, will be constructed prior to Cells 1, 5A-5F, and 6-10. This allows construction of the Leachate Storage Facility No. 1 for the management of leachate for the first approximate 5 years of operation. Depending upon the waste volume received, this timeline could be longer or shorter. Construction of Leachate Storage Facility No. 2 should commence no later than the beginning of landfilling activities in Cells 3 and 4.

2. With respect to landfill operation, construction of Cells 11-16 are the first to be constructed and operated in light of their proximity to the East Entrance and Scalehouse. Further, construction of Landfill Cells 2 through 4 and Cells 11 through 16, prior to construction of the remaining cells, is also the most desirable sequence of construction for the landfill, due to close proximity of these cell construction to sediment basins.

3. Three site entrances to the landfill are depicted on Drawing 3. MDE requires only one entrance. South entrance is considered the least desirable of the three site entrances, because it is remote from landfill cells that should be constructed and filled with rubble waste initially.

   North and East Entrances, in close proximity to cells that should be constructed initially, are the most desirable Site Entrance Options. Shortest distance from an existing County Road to the landfill perimeter access road is via the North Entrance. Assumption used to develop the Sequence of Construction indicated on Intermediate Construction Stage Plans (Drawings 64 through 81) is that rubble waste haul to the site will be via Conway Road to the East Entrance. Site access via the East Entrance is a conservative assumption, in that construction of a long access road across off-site property is required.

4. Variance from the Sequence of Construction on Permit Drawings must be approved by AASCD and MDE, per Section 7.3. Contract Documents for Intermediate Stage Construction must be prepared and approved by MDE, per Section 7.6.

7.2.4 Intermediate Construction Stage Plan Depiction

Sequence of Construction for each Intermediate Construction Stage is provided on Drawings 64 through 81. The following list identifies construction requirements, methodology associated with depiction of features on Intermediate Construction Stage Plans, As-Built Survey and Quality Assurance requirements.

1. Perimeter Access Roads: Perimeter Access Roads initially used for construction equipment access shall have a surface sufficient for such use. Permanent perimeter road surface for waste haulers shall be per the Section on Drawing 8. Temporary access roads used for waste haulers in cell areas and on rubble waste shall have an all weather surface suitable for such use.

2. Perimeter Channels: Perimeter channels shall include lining per the tabulation on Drawing 42. Temporary berms, riprap channels and ditches adjacent to temporary roads shall be sufficient to convey surface runoff around cell construction and waste placement areas as shown.

3. Sediment Basins: Initial construction stage includes construction of sediment basins and perimeter channels construction necessary to provide surface runoff to basins, consistent with basin design criteria. Following this construction, stockpiles shall be placed within the limit of disturbance and drainage area to a sediment basin, throughout the life of landfill construction and operation.

4. Proposed Contours: For clarity, proposed contours required to implement construction of each Intermediate Construction Stage are referenced as "Proposed Contours" on Intermediate Construction Stage Plan Legends. Temporary access roads and channels for cell construction will be graded per Intermediate Construction Stage Plans and Details, per conditions specified under Section 7.2, "Sequence of Construction for Landfill Cells", Section 7.3, "Variance From Sequence of Construction for Landfill Cells" and Section 7.6, "Preparation of Contract Documents for Intermediate Stage Construction".

5. Constructed contours adjacent to temporary roads and ditches represent grading requirements for constructing cells and access on existing ground prior to landfill construction. Per Item 6 below, stockpiles and borrow areas may exist in some locations shown as existing ground on Intermediate Construction Stage Plans.

6. Stockpile Borrow Areas: all areas within the boundary of the landfill may be used for stockpile and borrow sources for landfill operation throughout the life of the facility. Stockpiles and borrow sources may be within areas adjacent to temporary access roads and ditches for cell construction (see Item 5 above) at time of construction. Sufficient space for cell access and surface runoff diversion around cell construction and waste placement shall be provided throughout the life of the facility.

7. Inter-Cell Access: Inter-cell access for cell construction or waste placement shall be via temporary access roads or over covered rubble waste in active cells, as shown on Drawing 15.

8. As-Built Survey: Throughout the life of landfill construction and operation, field run and aerial topographic as-built survey for each construction phase shall be performed in accordance with Contract Documents, to be prepared per Section 7.6, "Preparation of Contract Documents for Intermediate Stage Construction".

9. Quality Assurance: All cell construction material (including subbase and leachate collection system) shall be installed and tested in accordance with Contract Documents. Prior to beginning waste placement in any cell, approval from MDE Inspector shall be obtained.

7.2.5 Landfill Construction Chronology

Prior to beginning any waste placement and at least 12 months before the commencement of waste disposal operations, permanent groundwater monitoring wells within the respective area (West Section and East Section) shall be installed, as described in the "Groundwater Monitoring Plan" in the Phase III Report, Section 16.

Per criteria and assumptions under Sections 7.2.1, 7.2.2, 7.2.3, and 7.2.4 above, landfill construction chronology depicted on Intermediate Stage Construction Drawings 64 through 81 is as follows:

1. East Section Initial Construction (Basin Nos. 2, 3 and 4; Perimeter Channels 1, 6, 7, 9A and 10 and associated culverts; East Section perimeter road; and Leachate Storage Facility No. 1);

2. Cell 11, associated perimeter berm, and portions of Leachate Force Mains #4 and #5;

3. Cell Separation Berm for Cells 12 through 16;

4. Cell 16, associated perimeter berm and remainder of Leachate Force Main #5;

5. Cells 12 through 15, respectively, and the remainder of the East Section perimeter berm, perimeter road, perimeter channels, and remainder of Leachate Force Main # 4;

6. West Section Initial Construction (Basin No. 1; Leachate Force Main #3, perimeter road, northern portions of perimeter channels 2, 3, 4, and 5, and associated culverts);

7. Cells 2, 3 and 4, respectively;

8. Cells 1 5E and 5F (including Leachate Storage Facility No. 2 and Leachate Force Mains #1 and #2);

9. Cells 10 and 5D; and,

10. Cells 9 & 5C, 8, 5A & 5B, 6, and 7, respectively.

7.3 Variance from Sequence of Construction for Landfill Cells

As referenced under Section 7.2.3, Sequence of Construction is based on site access via the East Entrance. If the North Entrance is constructed in lieu of the East Entrance, the Sequence of Construction will be identical, except that the perimeter access road between the North and East Entrances and portions of Perimeter Channels No. 8 and 9 will not be constructed, until necessary for construction of Cells 12 through 15. If the North Entrance is constructed in lieu of the East Entrance, and Sequence of Construction for Landfill Cells is in accordance with Drawings, Variance from the Sequence of Construction herein is not required. If the South Entrance is the only site access that is ultimately constructed, the Sequence of Construction will be revised and must be approved by Anne Arundel Soil Conservation district (AASCD) and MDE.

7.4 Sequence of Rubble Waste Placement Operation

Sequence of rubble waste placement is as follows:

1. For each Intermediate Stage of Construction, prepare the cell subbase in accordance with Contract Documents (see Section 7.6) and requirements of the Refuse Disposal Permit.

2. Construct the rubble landfill per Intermediate Construction Stage Drawings 64 through 81. Place waste in individual cells in East and West Sections as shown. As rubble waste placement progresses, provide routine and intermediate cover per Refuse Disposal Permit requirements.

3. When rubble waste is elevated above the Landfill Perimeter Berm, provide cover and vegetation in a manner that promotes surface runoff from soil cover over the rubble, across the perimeter berm to a perimeter channels.

4. Continue the rubble waste placement operation until maximum waste grades are achieved. Estimated life expectancy of the rubble waste placement operation is 12 years. Final grades shown on Drawings 32 and 33 represent the top of the 24-inch thick Final Cover layer. Top of waste grades are presented on Drawings 30 and 31. Top of Closure Cap grades are presented on Drawings 36 and 37. Final Cover Layer and Closure Cap shall be installed per MDE regulations. Final Closure Cap side slopes shall be no steeper than 4H:1V, with slope benches and articulated concrete mat (aka cable-concrete mat) downchutes installed per Drawings and Details.

5. When Closure Cap has been constructed and vegetated per the Drawings, sediment basins shall be converted to permanent stormwater management structures.

7.5 Estimated Cell Construction and Waste Placement Schedule

At least 12 months prior to waste placement within a particular landfill section (West Section or East Section), the permanent groundwater monitoring wells required for that Section shall be installed, as described in the "Groundwater Monitoring Plan" in the Phase III Report, Section 16.

In accordance with all conditions specified, the landfill shall be constructed. Intermediate Construction Stage Plans (Drawings 64 through 81) depict construction of the landfill from beginning of construction throughout construction of all landfill cells. Sequence of Construction is provided on each Intermediate Construction Stage Plan. Estimated time frame for cell construction and waste placement is provided hereunder.

Prior to beginning any other on-site construction, Intermediate Construction Initial Stage, per plans on Drawing 64, shall proceed. Under initial construction, East Entrance, Sediment Basins 2 and 3, Basin 4, East Section Perimeter Access Road, Drainage Channels and Leachate Storage Facility No. 1 will be constructed. Areas outside the limit of disturbance for initial construction may be used to stockpile excavated material from the construction operation, as approved by the AASCD Sediment Control Inspector. Excluding access roads and Assumed East Entrance Infrastructure, all disturbed areas shall be stabilized with vegetation.

Based on the anticipated volume and density of rubble waste to be placed in the facility on a daily basis, during weekly operation, the estimated life expectancy of the landfill waste placement operation is 12 years.

7.5.1 Construction Requirements

The following construction requirements and assumptions were used to generate the "Sequence of Cell Construction and Waste Placement", under Section 7.5.2.

1. Duration of the landfill waste placement operation is 12 years. Initial construction of roads, Basins, and Leachate Storage Facility No. 1 require extensive time for cell construction that is excluded from the waste placement time frame.

2. Final closure of the facility (i.e., the construction activities associated with installation of Final Cover layer and Closure Cap on the final waste placement areas (Cells 6 and 7)) is not considered to be part of the 12 year operating life..

3. Construction of cell infrastructure (i.e., access roads, perimeter channels, drainage culverts, and leachate force mains) will occur as required to support ongoing landfill cell construction. Cell infrastructure construction

should be scheduled and completed as necessary to allow waste placement in any given cell, immediately following cell construction completion.

7.5.2 Sequence of Cell Construction and Waste Placement

Prior to beginning work for any Intermediate Stage of Construction (as shown on Drawings 64 through 81 and specified herein), Anne Arundel County Planning and Code Enforcement (PACE) Inspections and Permits (410-222-7780) shall be notified. All proposed stockpile areas (including temporary sediment control measures) shall be per AASCD Sediment Control Inspector's approval.

Based on individual cell air space (prorated per total landfill cell acreage) and Intermediate Construction Stage Plans on Drawings 64 through 81, the "Sequence of Cell Construction and Waste Placement" is as follows.

1. Complete Intermediate Construction Initial Stage (East Section), including East Entrance with all sediment control measures, Sediment Basin Nos. 2 and 3, Pond 4, and Leachate Storage Facility No. 1, with appurtenant road, channels, etc. See Drawings 64 for Intermediate Construction Initial Stage Sequence of Construction. Estimated Time Frame for Item 1 Completion is 2 years (not part of 12-year waste placement estimate).

2. Construction of all sediment basins shall comply with the following.

   - All materials for basin construction shall be on-site prior to commencement of work.
   - Prior to commencement of work, areas for clearing, stripping and stockpiling topsoil or any imported borrow, and any on-site borrow areas (including temporary sediment control measures, such as silt fence, etc.) shall be per approval of the AASCD Sediment Control Inspector.
   - Sediment basins will be constructed per approval by MDE and AASCD, as shown on Drawings. Construction of the cut-off trench, principal and emergency spillways, and all other aspects of dam construction, shall be inspected by a Professional Geotechnical Engineer or his authorized representative.
   - During the life of cell construction and waste placement, sediment basins will be constructed and dewatered per details on Drawing 62. Following application of permanent vegetative stabilization in contributing drainage areas, dewatering measures will be removed and basins will be converted to permanent stormwater management ponds, as specified on Drawings 53 and 54.

3. Construct East Section (approximately 30.6 acres air space) per Section 7.2.5. Complete placement of waste and Final Cover layer (i.e., 2 feet above rubble waste, which is 2 feet below closure cap). Closure Cap construction will typically be completed in 5 to 10 acre segments.

4. Construct West Section Cells 1 through 10 (approximately 83.8 acres air space) per Section 7.2.5. Construct Sediment Basin No. 1 prior to

construction of West Area perimeter access road and Cells 2, 3 and 4. Construct. Construct Leachate Storage Facility No. 2 prior to Cells 1 and 5E and 5F construction (see Drawing 73). Complete placement of waste and Final Cover in West Section. Closure Cap construction will typically be completed in 5 to 10 acre segments. Completion of remaining portions of Final Cover and Closure Cap after the end of waste placement is not considered part of 12-year waste placement estimate.

5. Phase construction of the closure cap is expected to occur in the East and West Sections as landfilling achieves maximum grades. Further, COMAR regulations require closure cap construction to be complete within 36 months of the placement of the final waste within the landfill.

6. Complete landfill Closure Cap as required and approved by MDE. With approval of AASCD Inspector, convert Basin Nos. 1, 2 and 3 to permanent stormwater management ponds, as specified on Drawings 53 and 54.

7.6 Preparation of Contract Documents for Intermediate Stage Construction

Prior to beginning construction for each Intermediate Construction Stage, Construction Drawings and Construction Specifications (i.e., Contract Documents) sealed by a Professional Engineer, registered in Maryland, shall be prepared and submitted to MDE for approval. Construction of the site's three sediment basins, temporary sediment traps, and other sediment control measures shall be as approved by MDE and AASCD, per Drawings.

Minimum requirements regarding content of Contract Documents are as follows:

1. All Construction Drawing plan views shall be prepared at minimum 1-inch = 50-foot scale.

2. Coordinate geometry shall be Anne Arundel County grid, per coordinates shown on the Drawings.

3. Site entrance road(s) and infrastructure (i.e., scale house, truck scales, maintenance building, wheel wash and cleanout) shall conform to the plans shown on Drawings 4, 5, 89 and 90, as appropriate. Minimum tractor-trailer turning radius shall be 55 feet. Minor adjustment to the layouts may be made as necessary, and additional dimensions shall be added as required to ensure proper construction, in conformance with tractor-trailer movement on truck scales and wheel wash, and operational equipment movement within and adjacent to the maintenance building.

4. Base line for construction of leachate storage facilities shall be centerline of all access roads that surround the areas, as shown on the Drawings. Each leachate storage facility includes a secondary containment berm, designed to provide 500,000 gallons containment capacity for leachate storage tank leaks, with 1-foot freeboard from liquid level to top of berm (see Drawings 28 and 29). Minor adjustment to leachate storage facility horizontal and vertical alignment (i.e., adjustments to accommodate tanker truck

movement and installation of storage tanks, secondary containment structures, etc. shall be made as necessary. Leachate storage facilities shall not be smaller than facilities depicted on the Drawings. There is ample room to increase the area of each facility in the immediate vicinity of those facilities.

5. Base line of construction for the landfill cells shall be the perimeter access road centerline, as shown on the Drawings. Precise curvilinear and vertical alignment for the road shall be computed based on proposed alignment and elevations shown. Any discrepancy between the road shown on landfill plans, and Sediment Basin Plans on Sheets 47 through 50, shall be governed by the landfill plans.

6. Perimeter access road centerline shall be used to develop road centerline profiles on construction drawings. Profiles shall be prepared at minimum 1-inch = 50-foot horizontal and 1-inch = 5-foot vertical scale. Minor adjustments to road horizontal and vertical alignment may be made as necessary. Perimeter access road shall be constructed per the base line for construction, centerline profiles, and the cross sections on the Drawings.

7. Horizontal location of landfill cell separation berms and leachate pumphouses shall be per depiction on the Drawings.

8. Landfill sideslopes and cell grades at top of prepared subgrade elevation shall be per depiction on the Drawings. Leachate collection system liner material and dimensional criteria shall be per Drawing Details for the Alternate Liner System.

9. Construction of landfill perimeter channels and drainage culverts, perimeter berm, leachate pumphouses, sideslope riser pipes, and leachate sumps shall be per dimensional criteria, as shown on Drawing Details. Baseline of construction (i.e., the perimeter access road centerline) shall be the reference for all dimensions shown.

10. Construction of leachate force main shall be per the Drawing Plans and Details. Construction Drawings shall include profiles of the force main, at minimum l-inch = 50-foot horizontal and 1-inch = 5-foot vertical scale.

11. Storm drain pipe headwalls shall be per "Anne Arundel County Standard Details for Construction". To accommodate headwall construction, perimeter channels will be widened as necessary. Details for construction of pumphouses, maintenance building, and other appurtenances (i.e., truck scales, scale house, storage tank ring walls, etc.) shall be provided on Construction Drawings.

12. Construction Specifications (including but not limited to Construction Specifications in Section 14.0) that specify materials and installation requirements (including quality assurance/quality control for leachate collection system installation and testing) for each construction item

associated with construction of landfill cells and all appurtenances shall accompany Construction Drawings for each Intermediate Stage of Construction. All items associated with landfill operation (i.e., pumps, valves, electrical wiring, monitoring devices, etc.) shall be included in Construction Specifications.

13. General Specifications (including but not limited to the following) shall be provided.

- 01050 Field Engineering/Surveying
- 01200 Project Meetings
- 01300 Submittals
- 01400 Quality Assurance
- 01410 Laboratory Testing Services
- 01500 Construction Facilities
- 01530 Job Site Security
- 01540 Dust Control
- 01560 Site Access & Traffic Plan
- 01564 Project Record Documents
- 01666 Cleaning and Testing of Piping

SECTION 8

SOILS DESCRIPTION

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LIST OF ATTACHMENTS

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8A	-	Hydrogeologic Map and Cross-Sections (from Phase II Permit Application)

8.0 SOILS DESCRIPTION

8.1 Existing Soil Types

Description and evaluation of subsurface information is presented in the site's Phase II Permit Application, prepared by AGC Montrose in July 2020, through the incorporation of new site-specific data and re-interpretation of a previous version of the document entitled "Phase 2 Addendum for Chesapeake Terrace Rubble Landfill," dated December 5, 2003, prepared by Mark Schultz Associates.

8.2 Geomorphology

The Coastal Plain deposits are unconsolidated to semi-consolidated sedimentary deposits. The Coastal Plain extends east to the Atlantic Ocean and west to the Piedmont Physiographic Province. Coastal Plain deposits are comprised of materials eroded and transported from upstream sources and typically deposited by water below sea level and along rivers. The size and gradation of the sediments comprising coastal plain deposits can range from clays to coarse gravel to boulders, depending on the energy associated with the depositional environment. The uniformity of the deposits can range from vertically and laterally significant homogeneous deposits to highly variable localized heterogeneous deposits.

The separation between the Coastal Plain and the Piedmont Physiographic Provinces ("Fall Line") is mapped as being within Howard County approximately 10 miles northwest of the site. Coastal plain deposits in the west central portion of Anne Arundel County thicken from northwest to southeast beginning at nearly zero feet thick at the border with Howard County to approximately 1,800 feet thick in the vicinity of Annapolis.

8.3 Regional Geology and Hydrogeology

The Geologic Map of Anne Arundel County (Glaser, 1976) identifies the vicinity of the site as being predominantly Lower Cretaceous sediments of the Potomac Group, with non-conforming contacts of Quaternary Terrace and Alluvial deposits. Based on MGS Investigation 46, at the site crystalline bedrock is >800 feet below ground surface (bgs). In this region the Potomac Group soils are reported to be over-consolidated as a result of the weight of a substantial thickness of overlying soils that have since been eroded away. As a result of that over-consolidation, Potomac Group soils are generally denser/stiffer-harder than the quaternary deposits.

Based on results of the subsurface investigations, site reconnaissance and a review of geologic information, no Holocene faults have been identified on or within 200 feet of the proposed landfill.

8.3.1 Potomac Group

Within Anne Arundel County the Potomac Group is described as being very complex. Because formations of the group were deposited under fluvial and lacustrine conditions sand, silt, and clay layers are commonly limited in lateral extent. Consequently, a boring log taken at a given point may very well not be applicable to sediments at the same stratigraphic level a few hundred feet in either direction (MGS, 1969). Despite that

potential for variability, as a hydrogeologic resource the Potomac Group is commonly discussed in terms of three distinct formations. These are the Patuxent Formation, Arundel Formation and Patapsco Formation, as described below:

- The Patuxent Formation represents the bottom (oldest) of the Potomac Group and has a non-conforming contact with the saprolitic surface of the underlying crystalline bedrock. Lithologically the Patuxent is comprised of white or light gray to orange-brown, moderately sorted sands and subrounded quartz gravels; silts and clays subordinate, predominantly pale gray. The Patuxent Formation yields relatively large quantities of water (MGS Administrative Report 09-02-04 (A. Staley, et. al., 2009)). Based on figures contained in Administrative Report 09-02-04, the upper surface of the Patuxent Aquifer in the vicinity of the proposed Chesapeake Terrace Landfill is on the order of elevation -450 ft amsl.

- The Arundel Formation (referred to as the Arundel Clay Formation in some publications) directly overlies the Patuxent aquifer, and functions as a hydraulic separating layer between the Patuxent and Patapsco Aquifers. MGS Administrative Report 09-02-04 (A. Staley, et. al., 2009) estimates the top of the Arundel Formation in the vicinity of the project site to be on the order of elevation -300 ft amsl, with a typical thickness on the order of 200 feet. The Arundel Formation outcrops approximately 5 miles northeast of the project site.

- The Patapsco Formation is the uppermost member of the Potomac Group, and is typically discussed in terms of the Lower Patapsco Aquifer and the Upper Patapsco Aquifer separated by a confining layer. Descriptions of each follow:

    - The Lower Patapsco Aquifer, overlies the Arundel Formation. The Lower Patapsco Aquifer is one of the primary sources of water in the Glen Burnie and Severndale areas. MGS Report of Investigation No. 46 maps (F. Mack and G. Achmad, 1986) the outcrop of the top of the Lower Patapsco Aquifer at approximately 2 miles northeast of the site. The same document shows the top of the Lower Patapsco Aquifer in the vicinity of the site on the order of elevation -50 ft. amsl.
    - A low permeability layer separates the Lower Patapsco Aquifer from the Upper Patapsco Aquifer. Where this layer is described as a “clay” (or predominantly clay) in the boring logs we have designated this layer as the Middle Confining Unit (MCU). Beginning where intervals below the MCU are described as including intervals that are predominantly “silt” or “sand” we designated all deeper deposits (even if they transitioned back to clay or predominantly clay) Based on a top of the Upper Patapsco Aquifer (see below) at elevation -50 ft. amsl, as a general expectation the top of the MCU should be on the order of elevation +30 ft. amsl.
    - The Upper Patapsco Aquifer (UPA) represents the uppermost permeable water bearing zone within the Potomac Group. The UPA is comprised of laterally and vertically significant deposits of permeable materials (primarily sand) that collectively serve as a source of potable water in the County. The Upper Patapsco Aquifer is described as one of the best water bearing formations in Anne Arundel County, but it is much more limited in areal extent than the Lower Patapsco and Patuxent Aquifers (MGS Report of Investigation No. 46). The

MGS Report of Investigation No. 46 shows the outcrop for the Upper Patapsco Aquifer on and immediately northwest of the project site. With the unit gone approximately ½ mile west of the site. Administrative Report 09-02-04 (A. Staley, et. al., 2009) shows the surface of the Upper Patapsco Aquifer on the order of elevation +120 ft. amsl. The Upper Patapsco Aquifer can be under confined conditions where an Upper Confining Layer (UCL) is still present and separating it from the overlying Magothy Formation. Based on information presented in Administrative Report 09-02-04 (A. Staley, et. al., 2009), the top of the confining layer in the vicinity of the site is encountered at or around elevation +150 ft. msl.

8.3.2 Magothy Formation

The Magothy Formation (aka Magothy Aquifer) overlies the Potomac Group, it is reported to be hydraulically connected in varying degrees from place to place with the underlying Patapsco aquifer. It consists of 40 to 60 ft. of loose, white, cross-bedded, "sugary", lignitic sands and dark gray, laminated silty clays; white to orange-brown, iron-stained, subrounded quartzose gravels (MGS Report of Investigation No. 46). The same report shows the outcrop of the Magothy Aquifer immediately southeast of the project site. The Geologic Map of Anne Arundel County (J. Glaser, 1976) shows the Magothy Formation being present in the south east area of the site, which coincides with the highest topographic surface.

8.3.3 Quarternary Deposits

Investigation activities identified quaternary terrace and alluvial deposits throughout Area A. Quaternary deposits were not present within Area B. This is consistent with the Geologic Map of Anne Arundel County (Glaser, 1976), that identifies these geologically more recent deposits along the Patuxent and Little Patuxent Rivers. The distinction between terrace deposits and alluvial deposits is made based on elevation/topography, with the older Quaternary-Pleistocene terrace deposits encountered at higher elevations and the Quaternary-Holocene alluvial deposits encountered in and near the lower flood plain areas.

Where encountered, the terrace deposits sit directly on the sand deposits associated with the UPA, except along the hydrogeologic boundary between Hydrogeologic Areas A and B (See Section 8.3.4 below), where the terrace deposits lay directly on the MCU. In most locations, the primary matrix material associated with the terrace deposits was described as sand, silt or a varying combination of both, and the deposits commonly exhibit interlayering with clay or gravel ranging from a couple of inches to about a foot. Thicknesses of the terrace deposits ranged from 4 feet (B-7) to 30 feet (B-14).

8.3.4 Hydrogeologic Areas

Based on the foregoing, the site was divided into two hydrogeologic areas based on formation and soils types. The sections below provide a description of each. Hydrogeologic Map and Cross-Sections from the Phase II Permit Application are included in Attachment 8A for reference.

8.3.4.1 Hydrogeologic Area A

Hydrogeologic Area A is located in the northern and eastern part of the site (Cells 2, 3, and 11 through 16, per Drawing 2). This area can be seen on Cross-Section D-D' from the Phase II Report, replicated in Attachment 8A. As can be seen in Cross-Section D-D', the soils types change appreciably from west to east, where the clay layer associated with the Middle Confining Unit (MCU) thins and practically disappears. The sandy soils, with interbedded silty soils, of the Upper Patapsco Aquifer and the Quarternary Deposits of sand and silt comprise the soils expected to be disturbed as part of the cell construction. There sand and silty soils extends to depths of at least 50 feet below the rubble landfill cell floor.

These materials are suitable and may be appropriate for re-use on-site as structural fill and leachate collection layer soils. Soils types should be sorted as excavated from the construction areas and classified to confirm re-use is allowed on-site.

8.3.4.2 Hydrogeologic Area B

Located in the southwestern part of the site (Cells 1,and 4 through 10, per Drawing 2), this area is underlain by a thick clay bed that extends to depths of at least 100 feet below the rubble landfill cell floor. This areas can be viewed one Hyrdogeologic Sections A-A' and B-B' from the Phase II Permit Application (replicated in Attachment 8A). As can be seen in both sections, the area has the following:

- A small area of Magothy sands in the southern western and of the site underlain by the remnants of an exposed clay area, within the limits of previous mining activities.
- The surficial clay and Magothy sands disappear after the lower third of the site, as you move further north along the sections.
- The middle third of the site has sands exposed at the surface.

As can be seen by the proposed bottom of the landfill line (blue) shown on these Cross-Sections, the current landfill grading does not penetrate the maximum predicted Unconfined Water Bearing Zone, so the majority of the soils to be excavated on-site are sands with silt.

Limited clayey soils will be available as part of the excavation of the floor for Cells 6, 7 and 8. These are among the final cells to be constructed and filled.

8.4 Soil and Aggregate Construction Materials

On-site and off-site sources of soils and aggregate will be required for rubble landfill construction and operation. These materials are characterized as follows:

8.4.1 Fill

Fill for landfill construction consists of soil materials for elevating site grades, constructing perimeter berms, perimeter roads, sediment/stormwater basins, or backfilling excavations. Most of the on-site soils may be used as fill. Unsuitable soils for use as fill are soils containing deleterious materials, highly organic materials, and/or frozen materials. The Fill

material maximum dry density shall be determined by Standard Proctor (ASTM D 698) analyses.

8.4.2 Prepared Cell Subbase Soil

The prepared subbase is the 24-inch thick layer of low permeability (<1 x 10^{-5} cm/sec) soil underlying the geosynthetic liner components. Material proposed for use as subbase soil shall meet the requirements of Specification Section 02225.

Subbase construction will require excavation and removal of soils to the bottom of the proposed subbase. The bottom of the subbase surface shall be constructed to a minimum slope of 3.0% to accommodate for potential future differential settlement. The exposed subgrade shall be proof rolled and backfilled as required by the Specifications and CQA Plan.

With the cell floor grades remaining above the unconfined (perched) groundwater, the amount of on-site soils available for the COMAR required 1 x 10^{-5} cm/sec subbase soil layer is expected to be limited and may require amending with clay soils generated on-site and/or imported clayey materials.

8.4.3 Leachate Collection Layer

Leachate Collection Layer is required to be a higher permeability soils under the COMAR-required liner system. A wide range of soils may be suitable for this layer, including a "clean" sand to a "dirty" sand, as long as the requirements listed in the Technical Specifications for this material are met. Soils removed during excavation of the disposal cells are expected to meet these requirements, although some material separation (such as screening) may be necessary to remove finer soil particles. If necessary, off-site sources can be identified and brought to the site.

The leachate collection headers and laterals in the leachate collection layer will be located in an envelope of stone wrapped with a nonwoven geotextile for layer separation from the leachate collection layer, to prevent clogging with smaller particle-size soils, and to provide additional cushion between the stone and the geosynthetic products to prevent puncture. This stone will have to be obtained from off-site.

8.4.4 Select Waste

Pursuant to COMAR Sec. 26.04.07.18. the Select Waste placed over the Leachate Collection Layer will be a minimum of 4 feet of waste containing no long pipes, boards, or other materials that could damage the liner or leachate collection system. The Select Waste shall be placed as two - 2 foot thick lifts (4 feet total thickness) over the geotextile visual barrier/separation layer covering the 2 feet thick leachate collection system layer. The purpose of the protective layer is to minimize the risk of damage to the liner and the leachate collection systems. There are requirements for the material used for this layer in the project Technical Specifications.

8.4.5 Periodic Cover Material

COMAR Sec. 26.04.07.18(F) defines periodic cover material as a uniform compacted layer of clean earth at least 6 inches in depth, or an approved cover material of a thickness specified by the Approving Authority. The cited regulation requires that periodic cover material be placed over all exposed rubble waste by the end of the third day's operation, or more frequently as may be determined by the Approving Authority. An approved cover material may not:

(1) Contain free liquids, putrescibles, or toxic materials. Moisture present in the cover material solely as a result of precipitation is not free liquid.

(2) Create a dust or odor problem.
(3) Attract or harbor vectors.
(4) Impede compaction with standard landfill equipment.

Section 12 of this Phase III Permit Application provides additional information regarding soil material, placed in 6-inch thickness over rubble waste on a regular basis during landfill operations.

8.4.6 Intermediate Cover Soil

Pursuant to COMAR Sec. 26.04.07.18(G) intermediate cover soil is a uniform compacted layer of clean earth not less than 1 foot in depth placed over each lift not later than 1 month following completion of that lift. Procedures for placement of Intermediate cover soil are provided in Section 12 of this Phase III Permit Application.

8.4.7 Final Cover Layer

Pursuant to COMAR Sec. 26.04.07.19(E)(5), the Cover layer will be a 2 feet (min) uniform compacted layer of earthen material placed over the final lift of the filled landfill, not greater than 90 days following completion of fill activities. The Final Cover layer surface will be in direct contact with the geosynthetic components of the Closure Cap. Final Cover Specifications are provided in Section 02229. The Final Cover surface shall be uniform and smooth, without sticks, stones or other objects that could damage to Closure Cap geosynthetics. The finished Final Cover surface shall be approved by the liner installer and QAC.

8.4.8 Closure Cap

The proposed Closure Cap includes a vegetative layer, protective cover soil layer and barrier layer. The barrier component is a synthetic geomembrane and geocomposite drainage layer. The Closure Cap is detailed on Drawing 34. The soil components of the Closure Cap shall be as follows:

8.4.8.1 Closure Cap Protective Cover

The Closure Cap protective cover soil layer shall be Structural Soil Fill (Specification Section 02223) with a maximum particale size of 2 inches, placed in a single 18-inch thickness over the Closure Cap geosynthetic components. Most on-site soils excavated during construction of the disposal cells are expected to meet these requirements.

8.4.8.2 Vegetative Support Layer

The 6-inch thick layer of material to be placed atop the protective cover to support growth of vegetation for permanent erosion control of the closure cap is the Vegetative Support Layer. The vegetative support layer shall meet the requirements of Specification 02235.

8.5 Soil Volume

AutoCAD computer software was utilized to determine soil excavation and fill quantities required to construct the landfill to bottom of cell subbase grade and complete grading outside the landfill footprint shown on Drawings 6 and 7. Existing soil to be removed and fill material required to achieve this construction is the following:

- West Section Cell Area (within inside top of perimeter berm)= 83.8 acres
- West Section Cell Area Excavation = 1,585,000 cy
- West Section Cell Area Fill = 392,000 cy
- West Section Perimeter Area (outside West Section Cell Area)= 27Acres
- West Section Perimeter Area Excavation = 207,000 cy
- West Section Perimeter Area Fill = 115,000 cy
- East Section Cell Area (within inside top of perimeter berm)= 30.6 acres
- East Section Cell Area Excavation = 829,000 cubic yards
- East Section Cell Area Fill = 9,000 cy
- East Section Perimeter Area (outside East Section Cell Area)= 36 Acres
- East Section Perimeter Area Excavation = 306,000 cy
- East Section Perimeter Area Fill = 257,000 cy

Amount of Excavation = 1,585,000 + 207,000 + 829,000 + 306,000
= 2,927,000 cubic yards

Amount of Fill = 392,000 + 115,000 + 9,000 + 257,000
= 773,000 cubic yards

Net Excavation/Fill Amount = 2,154,000 cubic yards of excess excavation

Drawings 36 and 37 show Landfill Cross-Sections with the existing grades, proposed top and bottom of subgrade, and top of final cover grading superimposed.

Based on the information presented on these landfill cross-sections, the majority of the West Section excavation is in Hydrogeologic Area B (Cells 5A through 9), where existing ground elevation is rising in a southerly direction and highest anticipated groundwater elevation is relatively low. Fill proposed in the West Section (at the north end of Cells 1, 2,

and 3) is attributed to a higher groundwater elevation at the transition along the Hydrogeologic Areas A and B interface.

Excavation volume for East Section landfill cells in Hydrogeologic Area A (with surface area approximately one-third of the West Section's surface area) is equivalent to approximately 35% of West Section excavation.

8.6 Total Disturbance

Disturbed area to construct the facility, including all appurtenances (i.e., perimeter access road, leachate conveyance and storage systems, sediment basins, etc.) is 60.5 in the East Section (which includes Sediment Basin Nos. 1 and 2, and Leachate Storage Area No. 1) and 132.7 acres in the West Section, which includes the remainder of the facility. Excavation and fill will be required to construct landfill appurtenances, as indicated on Sediment Control Plans (Drawings 55 through 62).

8.7 Available Soils

Initial stage construction for site infrastructure is comprised of the following components:

- Stormwater management facilities;
- Site entrance road and scales;
- Maintenance and office building;
- Perimeter access road;
- Perimeter ditches; and
- Leachate collection facilities.

Following construction of site infrastructure facilities, landfill cells will be constructed as specified on Drawing 63, "Sequence and General Notes for Construction" and Intermediate Construction Stage Drawings 64 through 81.

Throughout the life of landfill construction and operation, it is anticipated that the on-site quantity of topsoil salvaged from clearing operations will be sufficient to promote vegetative stabilization on rubble waste soil cover and other graded areas, as necessary.

The on-site quantity of soil, from excavations for cell construction and appurtenances, is anticipated to be sufficient to meet COMAR requirements for rubble waste soil cover. Rubble waste soil cover includes:

- 2-feet of prepared subbase
- 2-feet of leachate collection layer materials
- 2-feet of Final Cover; and
- 18-inch depth closure cap protective cover
- 6-inch depth vegetative support layer

From Section 5.1, total design capacity of the landfill is approximately 9.3 million cubic yards (MCY). It is estimated that approximately 10% of the design capacity (i.e., 0.93 million cubic yards) will be comprised of rubble waste soil cover.

Surface area of the landfill cells is approximately 114.4 acres. The estimated volume of soil required for the landfill's soil layers is then calculated as follows (answers are rounded to nearest thousand c.y.):

Volume of Prepared Subbase Layer	=	(114.4 acres) (43,560 cubic feet/acre) (2 feet)
	=	9,966,528 cubic feet (1 c.y./27 cubic feet)
	=	369,000 c.y.
Volume of Leachate Collection Layer	=	(114.4 acres) (43,560 cubic feet/acre) (2 feet)
	=	9,966,528 cubic feet (1 c.y./27 cubic feet)
	=	369,000 c.y.
Volume of Final Cover	=	(114.4 acres) (43,560 cubic feet/acre) (2 foot)
	=	9,966,528 cubic feet (1 c.y./27 cubic feet)
	=	369,000 c.y.
Volume of Cap Protective Cover	=	(114.4 acres)(43,560 cubic feet/acre)(1.5 feet)
	=	7,474,896 cubic feet (1 c.y./27 cubic feet)
	=	277,000 c.y.
Volume of Vegetative Support Layer	=	(114.4 acres)(43,560 cubic feet/acre)(0.5 feet)
	=	2,491,632 cubic feet (1 c.y./27 cubic feet)
	=	92,000 c.y.

Total Volume of	=	Daily/periodic cover + Final Cover + Leachate Collection Layer + material needed + Protective Layer + Intermediate Cover + Protective Cover + Vegetative Support Layer
	=	930,000 + 369,000 + 369,000+ 369,000 + 277,000 + 92,000
	=	2,406,000 c.y.

This volume exceeds the amount of material available from the excavations required to achieve cell and perimeter grading by approximately 250,000 c.y.

Other options for the periodic cover may include obtaining approval of alternate cover which may include temporary tarps, lightly impacted soils, coal combustion residuals (i.e., primarily coal ash), among others.

The Operations Plan under Section 12.7.7 specifies that each working face will have an approximate area of 1 acre and up to 3 active working faces. Stockpiles maintained to contain sufficient volume of periodic cover for continual placement on active cell working faces over a 7 day time frame will be provided. Whereas 6-inch depth periodic cover will be placed over the entire area of a 1-acre working face every three days, the quantity of periodic cover sufficient for 7 days placement over 3 working faces is calculated as follows:

Week Supply of Periodic Cover = (7 days/3 days) (43,560 square feet/acre) (0.5 feet) (3 acres) = 152,460 cubic feet

Volume of soil contained in a 20 feet high stockpile, having 2:1 side slopes and covering a 100 feet by 150 feet surface area, is calculated as follows:

Stockpile Volume = [(100 feet) (150 feet) + (60 feet) (110 feet)] (1/2) (20 feet)
= 216,000 cubic feet

Per the description of cell working faces and calculation for a single stockpile area capable of maintaining continual periodic cover provision during the life of landfill construction and operation, depiction of 100 feet by 150 feet surface area rubble waste soil cover stockpiles for landfill cells (excluding Cells 6 and 7) is shown on Drawings 64 through 81.

Because the rubble waste soil cover stockpile for Cells 6 and 7 will likely be relocated along the east side of the adjacent temporary access road during the waste placement operation in the cells, a rubble waste soil cover stockpile is not shown on those Drawings.

Dependent upon the stage of the waste placement operation, rubble waste soil cover stockpiles for periodic cover may also be used for provision of intermediate cover. Location of stockpiles shown on the Drawings is based on the following criteria:

- Proximity to active cell;
- Proximity to temporary access roads; and
- Proximity to surface runoff diversionary measures.

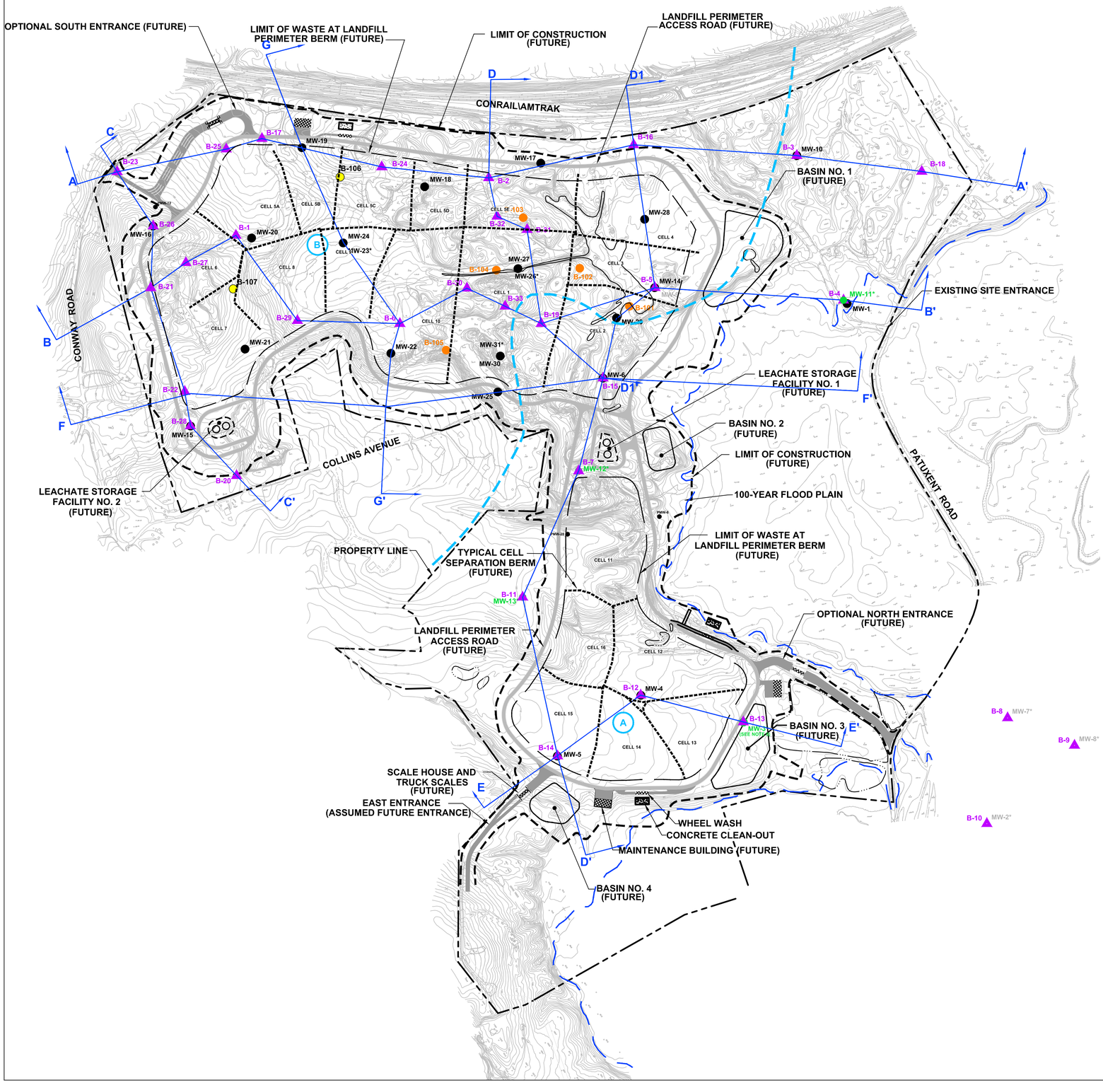
The landfill operator is not restricted to rubble waste soil cover stockpile locations shown on the Drawings.

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 8A

Plan and Hydrogeologic Cross-Sections from the Phase II Permit Application



LEGEND

- PROPERTY LINE
- LANDFILL PERIMETER ACCESS ROAD (FUTURE)
- SITE ENTRANCE (FUTURE)
- LANDFILL LIMITS (FUTURE)
- LANDFILL CELL SEPARATION BERM (FUTURE)
- LIMIT OF DISTURBANCE (FUTURE)
- 100-YEAR FLOOD PLAIN (AFTER 2012) (SEE REFERENCE 2) (SEE NOTE 4)
- JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE NOTE 5)
- MONITORING WELL (MONITORING WELLS MARKED WITH AN * ARE LOST, DAMAGED OR MCU WELL NOT SUBJECT TO MONITORING
- HISTORICAL BOREHOLES (SEE REFERENCE 3)
- BORING LOCATIONS TO REFINE AREA A–B TRANSITION (B–101 TO B–105) COMPLETED APRIL/MAY 2013
- ADDITIONAL BORINGS LOCATIONS REQUESTED BY MDE (B–106 AND B–107) COMPLETED APRIL/MAY 2013
- HYDROGEOLOGIC AREA DIVIDE (SEE NOTE 3)
- A — HYDROGEOLOGIC AREA (SEE NOTE 3)
- A A' — GEOLOGIC CROSS SECTION ALIGNMENT (SEE FIGURES 5 THROUGH 11)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

NOTES

1.) THE FUTURE RUBBLE LANDFILL DEVELOPMENT FEATURES ARE INCLUDED TO SHOW LOCATION OF THE BORINGS AND MONITORING WELLS RELATIVE TO THE PROPOSED DEVELOPMENT. THE ACTUAL LIMITS OF FUTURE DEVELOPMENT MAY BE ADJUSTED AS PART OF THE DETAILED ENGINEERING DESIGN TO BE INCLUDED IN THE PHASE III PERMIT APPLICATION, WHICH IS CURRENTLY UNDERGOING REVISION.

2.) GEOLOGIC CROSS SECTIONS ARE PRESENTED ON FIGURES 5 THROUGH 11.

3.) HYDROLOGIC AREAS AND THEIR MAPPING IS BASED ON FORMATIONS MAPPED IN FIELD BOREHOLES, SURFACE OBSERVATION, HISTORICAL AERIAL PHOTOGRAPHS, AND REGIONAL GEOLOGIC MAPS.

4.) THE 100–YEAR FLOODPLAIN LIMITS ARE BASED ON 2012 FEMA STUDY.

5.)THE CONRAIL TRACKS ARE ALSO SHARED WITH AMTRAK FOR HIGH–SPEED COMMUTER TRAINS BETWEEN BOSTON, MASSACHUSETTS, AND WASHINGTON, D.C.

6.) THE PROPERTY WAS PREVIOUSLY USED FOR SAND AND GRAVEL MINING ACTIVITIES. PORTIONS OF THE SITE CURRENTLY HAVE NO VEGETATION AND ARE BARREN.

7.) THE SITE IS NOT SECURE FROM TRESPASSERS. SEVERAL MONITORING WELLS HAVE BEEN DAMAGED BY VANDALS.

8.) ON–SITE MONITORING WELLS MW–3, 11, 12, AND 13, AND OFF–SITE WELLS MW–2, 7, AND 8 ARE NO LONGER SUITABLE/ACCESSIBLE FOR DEPTH TO WATER MEASUREMENTS AND SAMPLING

9.) THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE FEMA BASE FLOOD ELEVATIONS.

NORTH

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch =300 ft.

VERONICA M. FOSTER
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No. 35654
PROFESSIONAL ENGINEER

REVISION:	DATE:
REVISED TO ADDRESS MDE COMMENTS (PGS/VEF)	4/30/2020
EDITORIAL REVISIONS/NEW LANDFILL BOTTOM (PGS/VEF)	6/5/2020

NATIONAL WASTE MANAGERS
PHASE II PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
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ANNE ARUNDEL COUNTY, MARYLAND

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ON–SITE BORING AND WELL LOCATIONS MAP

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DRAWN BY:	EEE	DATE:	4/1/2019

FIGURE 4

REFERENCES

1.) THE SURFACE GRADES SHOWN ARE FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) BORING LOGS ARE PROVIDED IN APPENDICES E AND F IN PHASE II APPLICATION HYDROGEOLOGIC REPORT, DATED JUNE 5, 2020, PREPARED BY ADVANCED GEOSERVICES CORP.

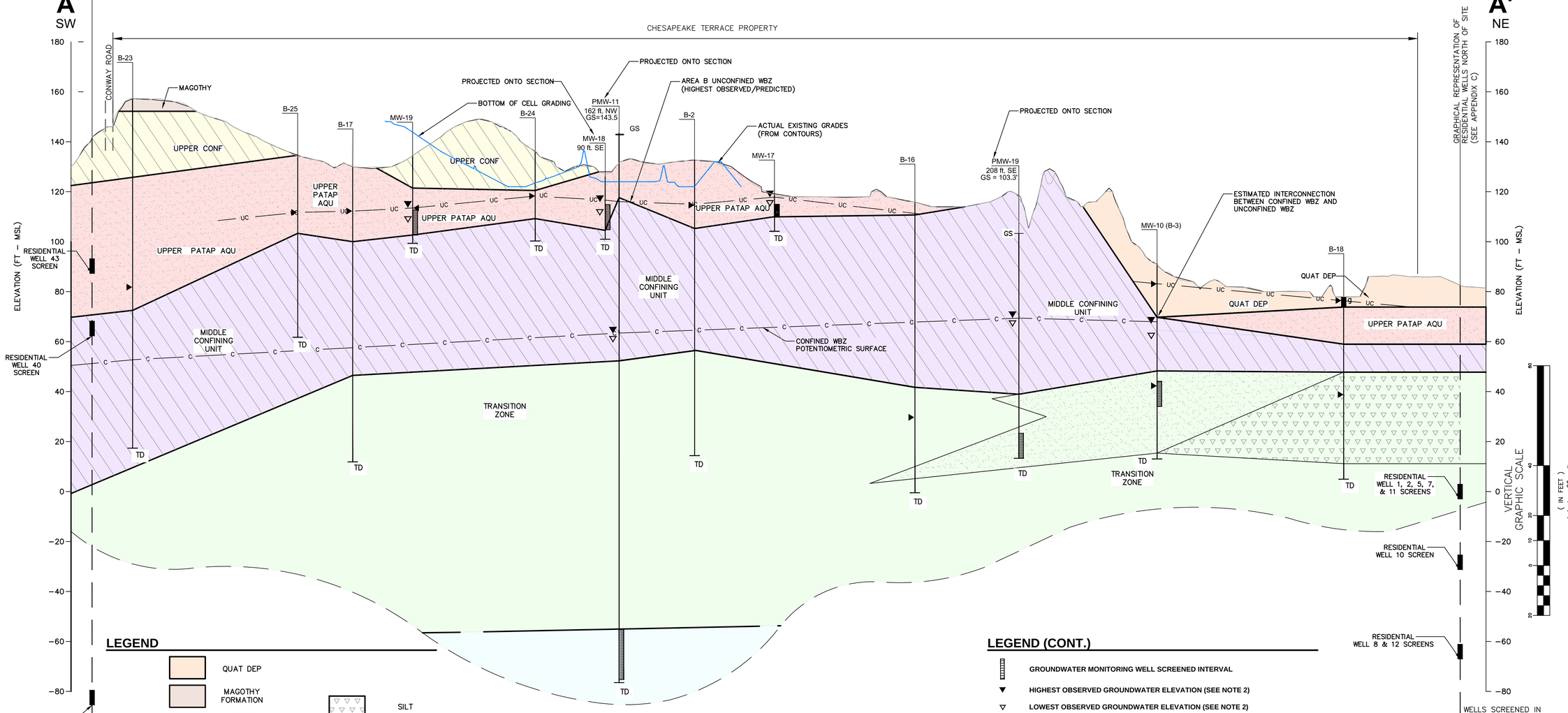
NOTES

1.) REFER TO FIGURE 4, ON-SITE BORING AND WELL LOCATIONS MAP, FOR THE GEOLOGIC CROSS SECTION LOCATIONS.

2.) REFER TO TABLE 4 FOR THE HIGHEST AND LOWEST OBSERVED GROUNDWATER ELEVATIONS. SURFACE SHOWN ON CROSS SECTION INTERPRETED FROM FIGURES 12 AND 15

3.) THE BOUNDARIES BETWEEN HYDROGEOLOGIC AREAS ARE BASED ON BORING DATA AND FIELD OBSERVATIONS. THE BOUNDARIES ARE NOT EVIDENCE OF THE END OF ONE FORMATION AND THE START OF ANOTHER, THE FORMATIONS TRANSITION ALONG THE BOUNDARIES.

4.) HYDROGEOLOGIC AREAS AND THEIR MAPPING IS BASED ON FORMATIONS MAPPED IN FIELD BOREHOLES, SURFACE OBSERVATION, HISTORICAL AERIAL PHOTOGRAPHS, AND REGIONAL GEOLOGIC MAPS.



LEGEND

- QUAT DEP
- MAGOTHY FORMATION
- UPPER CONFINING LAYER
- UPPER PATAPSCO AQUIFER
- MIDDLE CONFINING UNIT
- TRANSITION ZONE
- LOWER PATAPSCO AQUIFER
- SILT
- CLAY
- SAND
- GRAVEL

LEGEND (CONT.)

- GROUNDWATER MONITORING WELL SCREENED INTERVAL
- HIGHEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- LOWEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- PROPOSED BOTTOM OF LANDFILL
- WET/SATURATED ZONE NOTED DURING DRILLING
- c — CLAY SEAM IDENTIFIED ON LOG
- g — LAYER OF PREDOMINANTLY GRAVEL IDENTIFIED ON LOG
- C — CONFINED GROUNDWATER HIGHEST OBSERVED / PREDICTED
- UC — UNCONFINED GROUNDWATER HIGHEST OBSERVED / PREDICTED
- TD — TERMINATION DEPTH

VERONICA M. FOSTER
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PROFESSIONAL ENGINEER

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6/5/2020	EDITORIAL REVISIONS/NEW LANDFILL BOTTOM (PCS/VEF)

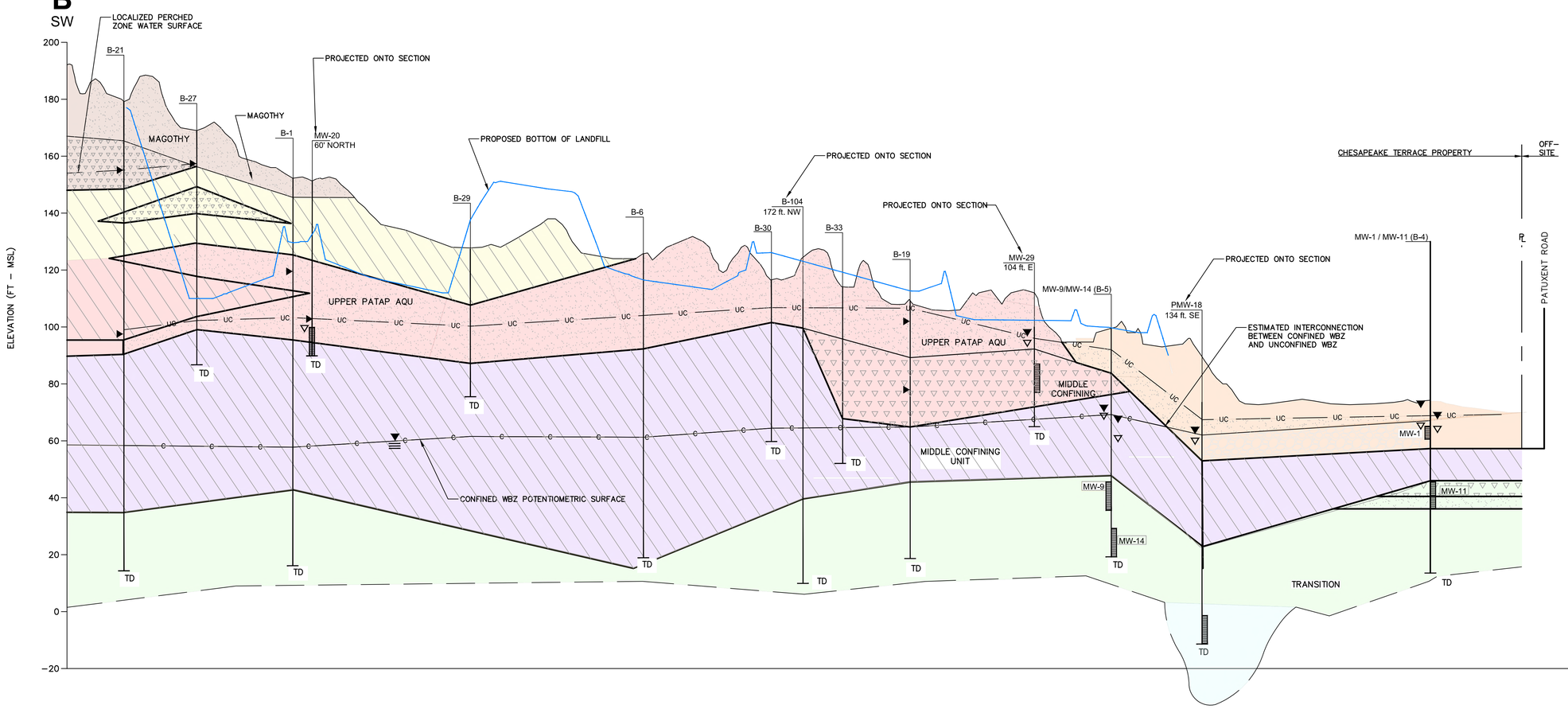
NATIONAL WASTE MANAGERS
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GEOLOGIC CROSS SECTION A-A'

REPORT CODE: A	FILE NAME: 20183854A005		
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CHECKED BY:	VEF	PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE	DATE:	4/1/2019

FIGURE 5



VERTICAL GRAPHIC SCALE
(IN FEET)
1 inch = 20 ft.

HORIZONTAL GRAPHIC SCALE
200 0 100 200 400 800
(IN FEET)
1 inch =200 ft.

LEGEND

- GROUNDWATER MONITORING WELL SCREENED INTERVAL
- HIGHEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- LOWEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- PROPOSED BOTTOM OF LANDFILL
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- SILT
- CLAY
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- QUAT DEP
- MAGOTHY FORMATION
- UPPER CONFINING LAYER
- UPPER PATAPSCO AQUIFER
- MIDDLE CONFINING UNIT
- TRANSITION ZONE
- LOWER PATAPSCO AQUIFER

REFERENCES

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2.) BORING LOGS ARE PROVIDED IN APPENDICES E AND F IN PHASE II APPLICATION HYDROGEOLOGIC REPORT, DATED JUNE 5, 2020, PREPARED BY ADVANCED GEOSERVICES CORP.

NOTES

1.) REFER TO FIGURE 4, ON–SITE BORING AND WELL LOCATIONS MAP, FOR THE GEOLOGIC CROSS SECTION LOCATIONS.

2.) REFER TO TABLE 4 FOR THE HIGHEST AND LOWEST OBSERVED GROUNDWATER ELEVATIONS. SURFACE SHOWN ON CROSS SECTION INTERPRETED FROM FIGURES 12 AND 15

3.) THE BOUNDARIES BETWEEN HYDROGEOLOGIC AREAS ARE BASED ON BORING DATA AND FIELD OBSERVATIONS. THE BOUNDARIES ARE NOT EVIDENCE OF THE END OF ONE FORMATION AND THE START OF ANOTHER, THE FORMATIONS TRANSITION ALONG THE BOUNDARIES.

4.) HYDROGEOLOGIC AREAS AND THEIR MAPPING IS BASED ON FORMATIONS MAPPED IN FIELD BOREHOLES, SURFACE OBSERVATION, HISTORICAL AERIAL PHOTOGRAPHS, AND REGIONAL GEOLOGIC MAPS.

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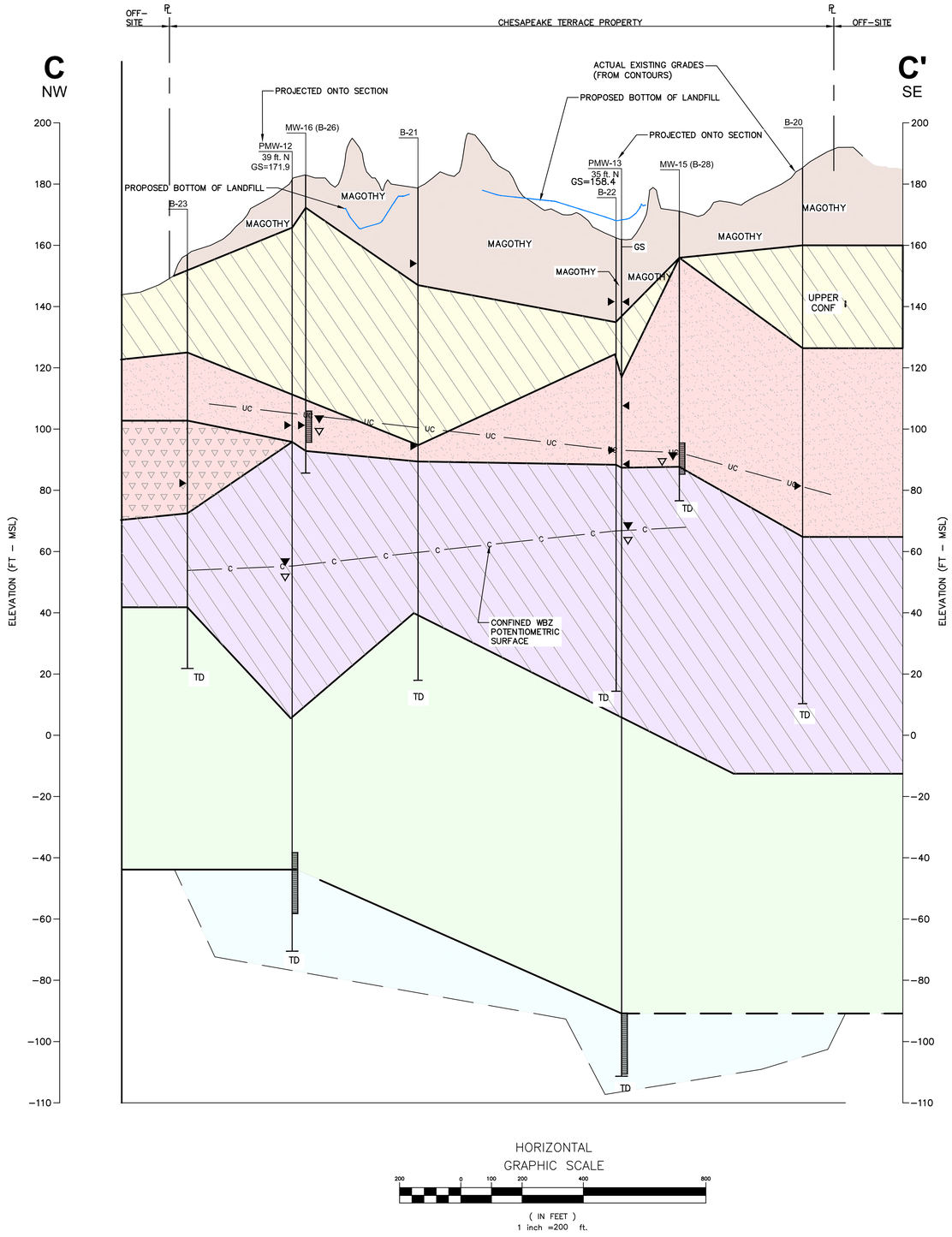
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GEOLOGIC CROSS SECTION B–B'

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CHECKED BY:	VEF	PROJECT NUMBER:	2018–3854
DRAWN BY:	EEE	DATE:	4/1/2019

FIGURE 6



LEGEND

- GROUNDWATER MONITORING WELL SCREENED INTERVAL
- HIGHEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- LOWEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- PROPOSED BOTTOM OF LANDFILL
- WET/SATURATED ZONE NOTED DURING DRILLING
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CLAY	MAGOTHY FORMATION
SAND	UPPER CONFINING LAYER
GRAVEL	UPPER PATAPSCO AQUIFER
	MIDDLE CONFINING UNIT
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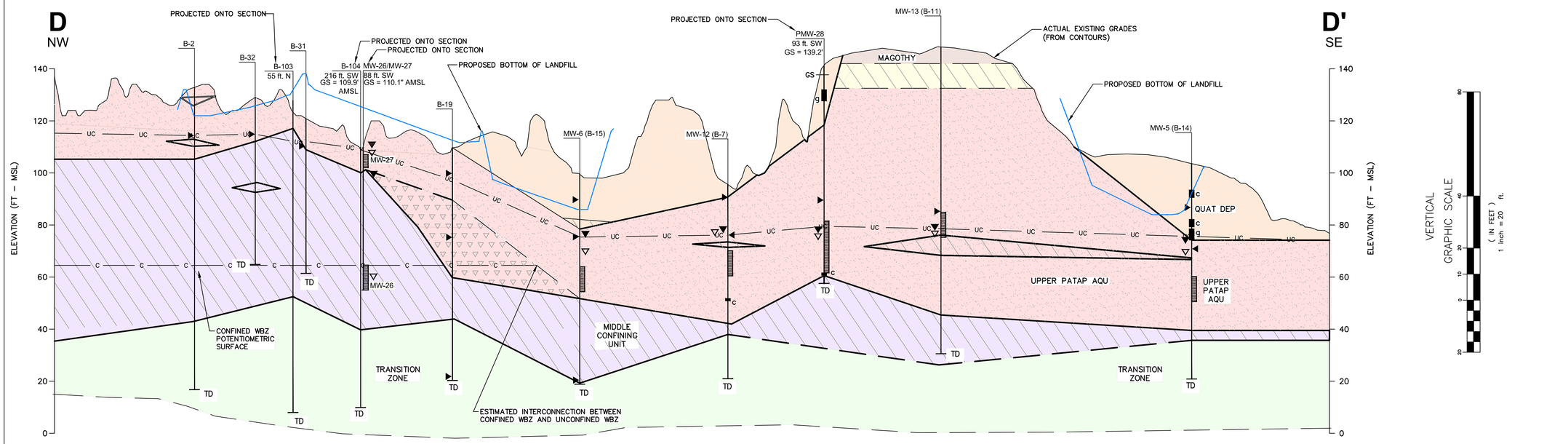
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GEOLOGIC CROSS SECTION C-C'

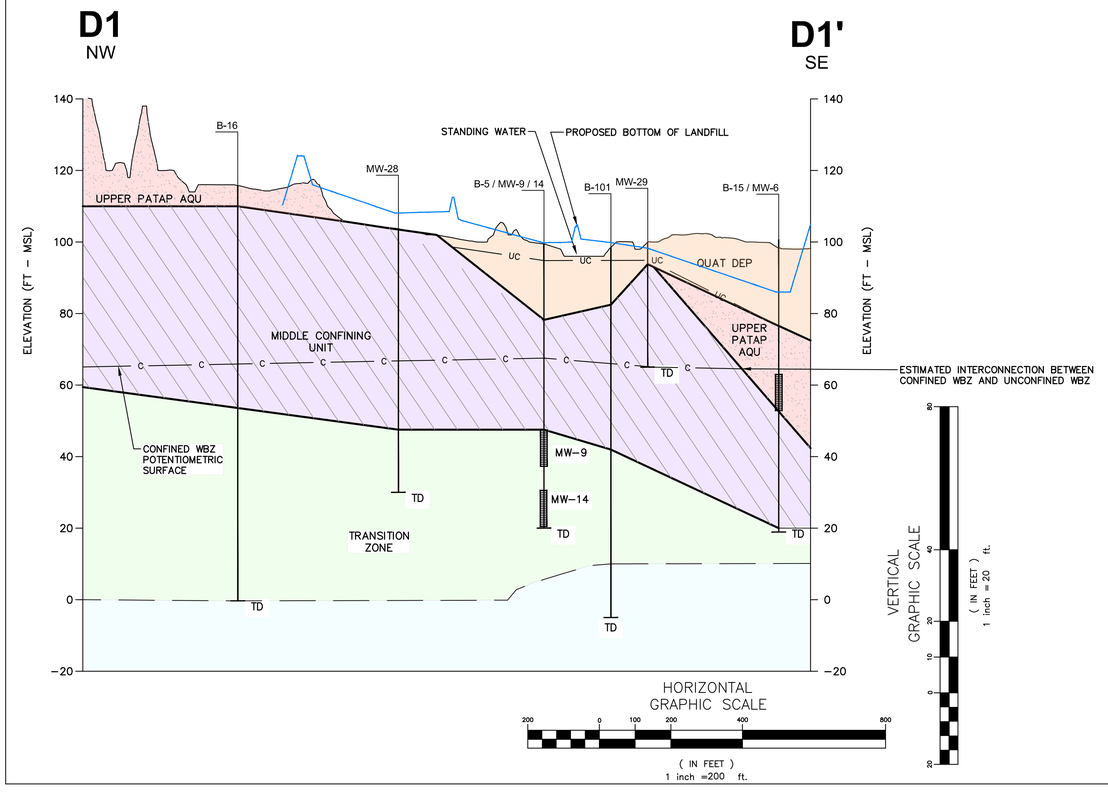
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FIGURE 7



HORIZONTAL
GRAPHIC SCALE

(IN FEET)
1 inch =200 ft.



LEGEND

- GROUNDWATER MONITORING WELL SCREENED INTERVAL
- HIGHEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
- LOWEST OBSERVED GROUNDWATER ELEVATION (SEE NOTE 2)
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SILT
CLAY
SAND
GRAVEL

QUAT DEP
MAGOTHY FORMATION
UPPER CONFINING LAYER
UPPER PATAPSCO AQUIFER
MIDDLE CONFINING UNIT
TRANSITION ZONE
LOWER PATAPSCO AQUIFER

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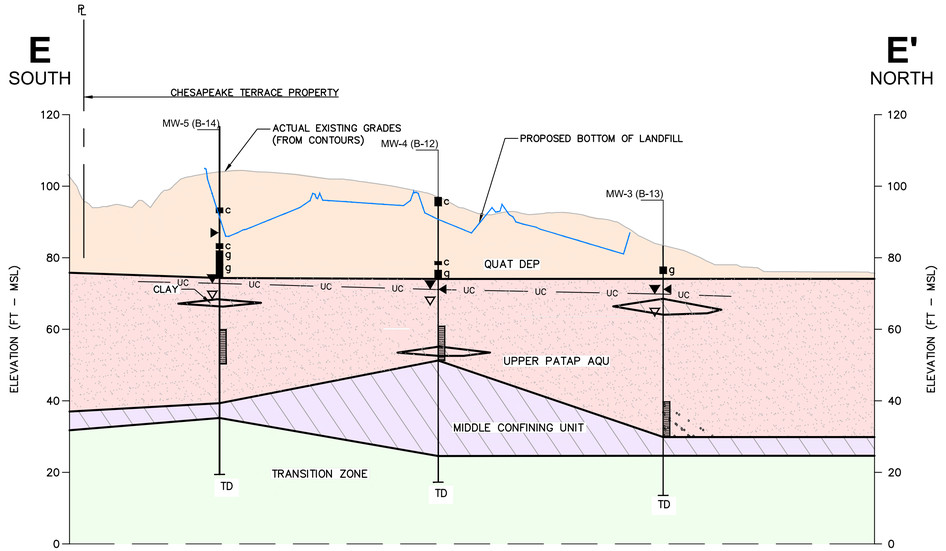
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GEOLOGIC CROSS SECTIONS
D-D' AND D1-D1'

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FIGURE 8



HORIZONTAL
GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch =200 ft.

VERTICAL
GRAPHIC SCALE

80 40 20 10 0 20

(IN FEET)
1 inch = 20 ft.

LEGEND

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GEOLOGIC CROSS SECTION E-E'

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FIGURE 9

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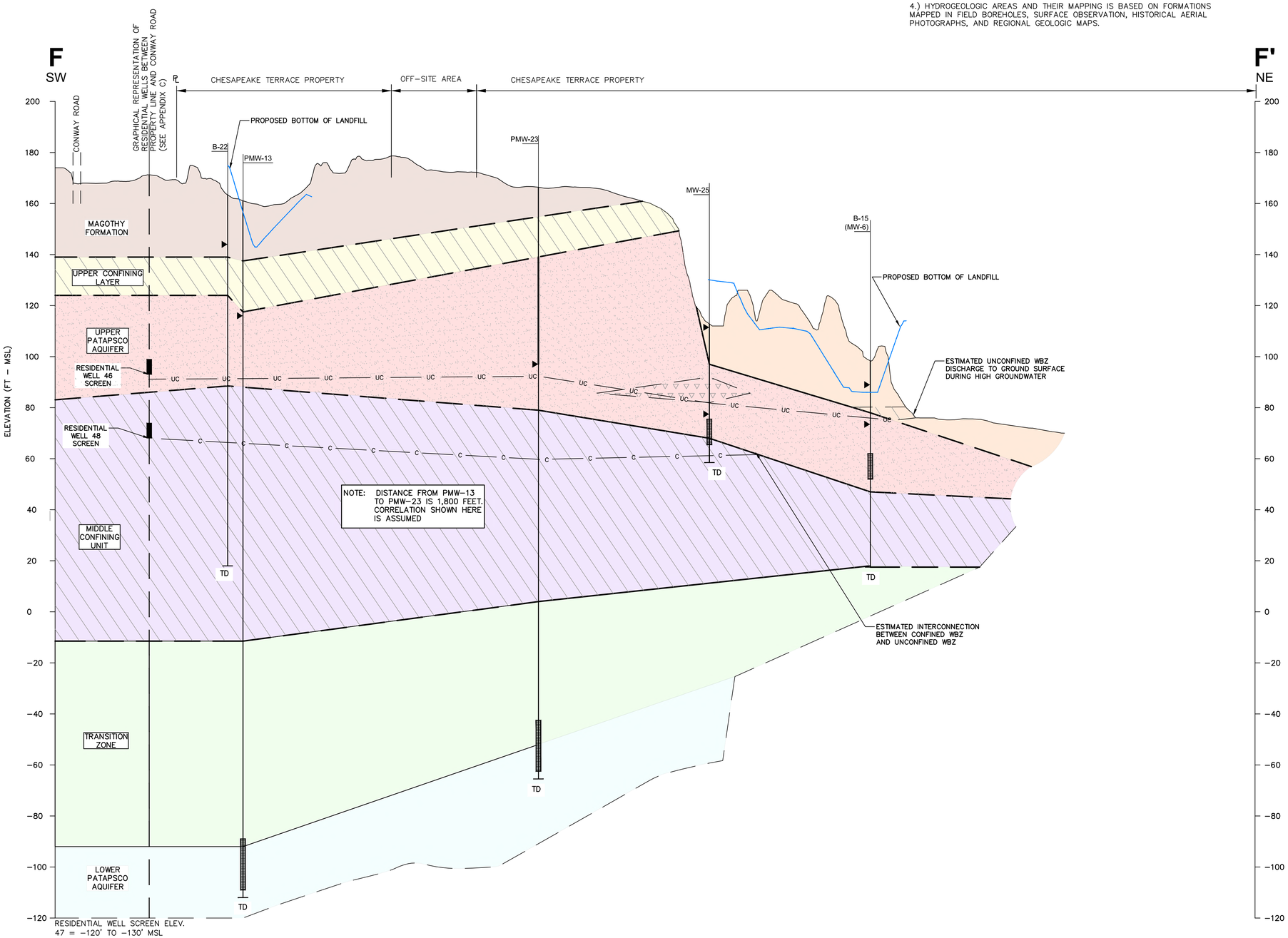
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- TD — TERMINATION DEPTH

SILT, CLAY, SAND, GRAVEL

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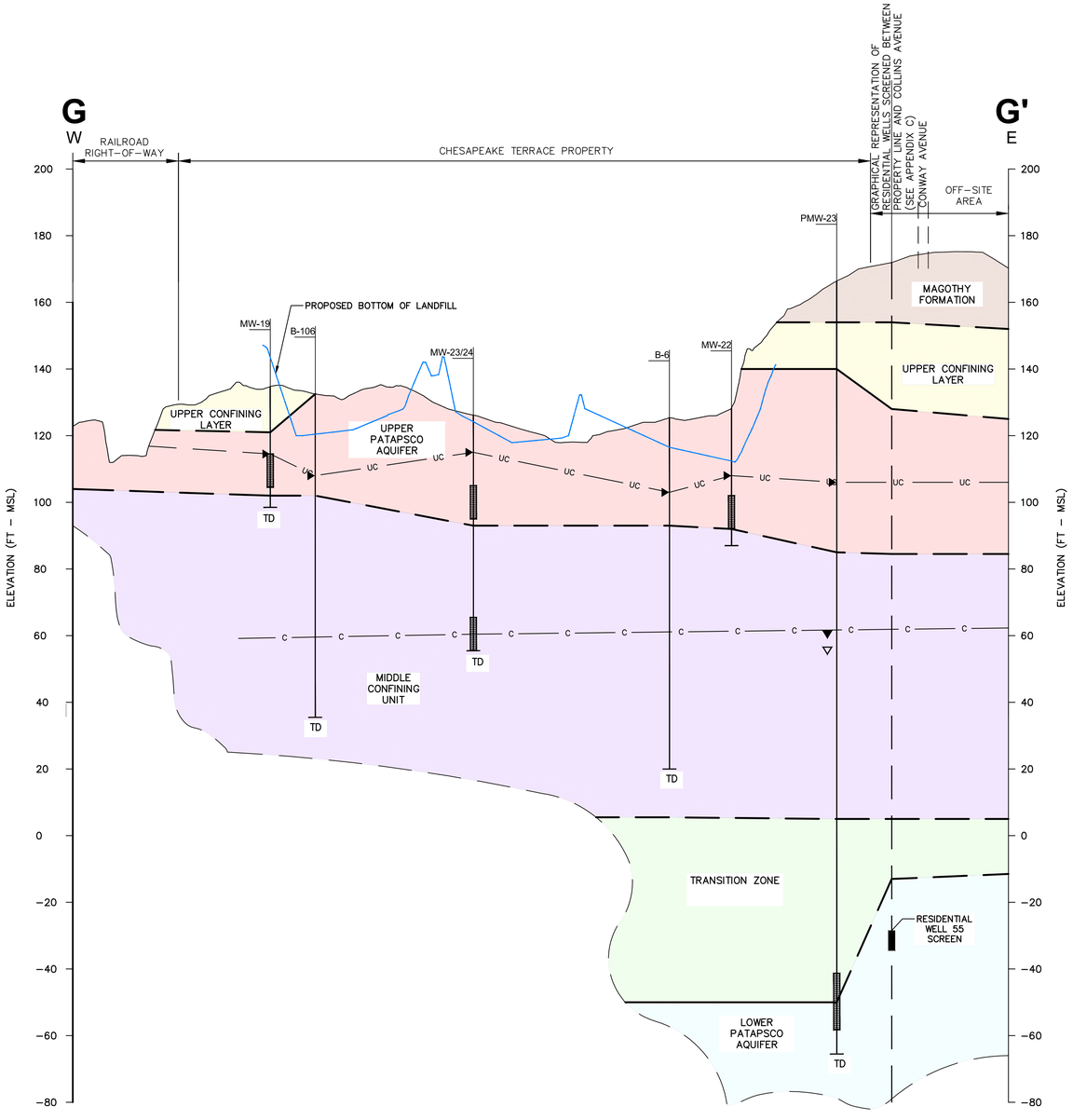
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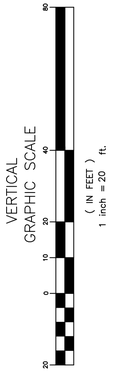
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FIGURE 10

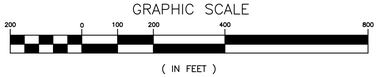


VERTICAL GRAPHIC SCALE



(IN FEET)
1 inch = 20 ft.

HORIZONTAL GRAPHIC SCALE



(IN FEET)
1 inch =200 ft.

LEGEND

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GEOLOGIC CROSS SECTION G-G'

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FIGURE 11

SECTION 9

GEOTECHNICAL CONSIDERATIONS

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LIST OF ATTACHMENTS

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9.0 GEOTECHNICAL CONSIDERATIONS

As with any landfill design, there are significant geotechnical engineering considerations to assure that the overall landfill is stable, including the various components – from the placement of waste to the liner and cap systems materials to the ability of the subgrade to support the new mass of material being placed atop it. This Section provides a brief summary of the geotechnical considerations evaluated during the course of the design of the Chesapeake Terrace Rubble Landfill.

9.1 Liner System

9.1.1 COMAR-Required Liner System

COMAR Section 26.04.07.16 (C)(3) requires the design of the liner system to include the following components, from top to bottom:

- Protective Layer: A protective layer of select waste to protect the integrity of the underlying layers;
- Two feet of "gravel or other highly permeable material" to provide for free passage of leachate and to protect the liner; and,
- A "liner constructed with a minimum thickness of 1-foot of clay or other natural material having an in-place permeability of less than or equal to $1x10^{-7}$ cm/sec or one or more unreinforced synthetic membranes with a combined minimum thickness of 50 mil or a single reinforced synthetic membrane with a 30 mil thickness which has a permeability of 1×10^{-10} cm/sec.
- Prepared subbase with a minimum thickness of 2 feet and having a permeability less than or equal to 1.0×10^{-5} cm/sec.

Other requirements of this section include:

- A minimum slope of two percent (2%);
- Adequate foundation and prepared subgrade to support the liner and the landfilling activities; and,
- Maintain a minimum 3-foot separation between bedrock or the maximum expected groundwater elevation, whichever is higher, and the bottom of the liner system (subbase).

9.1.2 Proposed Liner System

The July 2020 version of the Phase III Application proposed the use of a Geosynthetic Clay Line (GCL) as part of an "Alternative Liner System". Pursuant to comments provided by the MDE on that version of the design, we have eliminated the proposed GCL and have modified the design to the COMAR specified 24-inch thick subbase with permeability less than or equal to 1.0×10^{-5} cm/sec.

We are still specifying the use of a geomembrane barrier layer (versus the 12-inch thick clay). Use of the gemembrane is specifically allowed under the regulations (COMAR Section 26.04.07.16 (C)(3)).

We are also still proposing that the leachate collection layer include a geocomposite drainage layer (GDL) and a 24-inch thick "highly permeable material". The GDL, though not specifically required in the COMAR regulation, supports satisfying the requirement to

have a leachate collection systems to maintain head of no more than one foot (30 cm) atop the barrier layer of the liner. The GDL will work in conjunction with the two feet of natural materials, proposed to be locally mined sand, for leachate collection. Leachate collection and conveyance piping will be contained in the leachate collection layer, and will include perforated piping, in a stone envelope, wrapped in a nonwoven geotextile. Evaluation of the system for leachate collection and removal capabilities is addressed in Section 10 of this Report.

Based on the above, the proposed liner system for the Chesapeake Terrace Rubble Landfill includes the following, from top to bottom:

- Four feet of Select Waste;
- 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator if breached;
- Two feet of leachate collection layer, comprised of locally mined sandy soils;
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides;
- 60-mil high density polyethylene geomembrane with a permeability less than or equal to 1×10^{-10} cm/sec; and,
- Prepared subbase with a minimum thickness of 2 feet and having a permeability less than or equal to 1.0×10^{-5} cm/sec.

The landfill subgrade is in an excavated condition in most instances, with few locations requiring fill for constructing the cell floor subgrade. The perimeter berm for the landfill will be constructed of existing, excavated soils, and is supported by the perimeter drainage channels and perimeter access road. Minimum and maximum proposed grades of the landfill cell floors is two percent (2%) (post settlement) and thirty-three percent (33%), respectively. The subgrade will be prepared by proof-rolling after removal of any deleterious materials and observation of proof-rolling to confirm no pumping or rolling of the subgrade.

Information supporting the selection of the critical liner system components are as follows:

9.1.2.1 Leachate Collection Layer

The COMAR 26.04.07.16(C)-required leachate collection layer shall be covered with a minimum of 2 feet of sized gravel or other highly permeable material to provide for the free passage of leachate to the liner and to serve as a protective layer for the liner and leachate collection systems. The same regulations specify that the leachate collection must be constructed of materials that are a) chemically resistant to the waste managed in the landfill and the leachate expected to be generated; b) Of sufficient strength and thickness to prevent collapse or failure from loadings applied by overlying wastes, waste cover materials, and equipment used for landfilling operations; c) Designed and operated to function without clogging; d) Designed and operated to ensure that the depth of leachate over the liner does not exceed 30 centimeters (1 foot); and e) Designed to operate solely by the force of gravity in all areas where the system will directly underlie solid waste. The Site has significant amounts of sand that with little or no processing (i.e. screening) can meet the identified material requirements.

The leachate collection piping (headers and laterals) will be bedded in a stone envelope, with a nonwoven geotextile to "wrap" the stone and protect the underlying geosynthetic. The geotextile wrap also provides layer separation from the surrounding leachate collection materials.

9.1.2.2 Geocomposite Drainage Layer

Due to significant advances in GDLs, the permeability of the products is higher than can be achieved with a gravel or sand layer. The geocomposite drainage layer (GDL) works in conjunction with the leachate collection layer to quickly convey leachate from the cell floor to the leachate collection sump. A benefit of this quick action is the reduction of the maximum head that can buildup atop the barrier layer, which regulations limit to no more than 12 inches (30 cm).

9.1.2.3 Geomembrane

While COMAR allows the replacement of the 12-inch layer of clay with a 50 mil unreinforced geosynthetic, the Applicant recognizes that, at this time, a 60-mil thickness HDPE product is more readily available year-round, as it is more commonly specified and is continuously being manufactured. The 60-mil HDPE geomembrane is also commonly used for municipal solid waste (MSW) landfills, which have more stringent requirements than the rubble landfills. This product has been in use for municipal waste landfills for more than 30 years and has a long-established history of use as the barrier liner for the MSW landfills.

The permeability of the 60 mil HDPE geomembrane is 1 x 10^{-10} cm/sec – three orders of magnitude LOWER than the value specified in COMAR for this barrier layer. Further, the product is consistent over time and the installation is relatively straight-forward.

The construction of lower permeability natural soil barrier can prove problematic for consistency of material and source; may require importing a large volume of material, and can be problematic constructing on steeper slopes. These considerations make the geomembrane a superior product for this application.

9.1.2.4 Subbase

The subbase is the prepared surface upon which the liner system will be constructed, and the component that is intimate contact with the geomembrane that is intended to function as a secondary liner against vertical migration of liquids from the cell in the event the geomembrane layer (the primary liner) is compromised. The subbase will be at least 24-inches thick and have a permeability equal to or less than 1.0 x 10^{-5} cm/sec. This bottom of the subbase will be the excavated grades shown on Drawings 6 and 7., The bottom of the subbase will be the grades show on Drawings 10 and 11. The subgrade surface for the Subbase will be prepared by removal of any deleterious materials and proof-rolled to demonstrate a firm and unyielding subgrade. Details for subgrade preparation and Subbase construction are include in the Technical Specifications in Section 14 and the CQA Plan in Section 13.

9.1.3 Engineering Analysis

In order to select the material associated with this liner system, a series of engineering analyses were conducted, including the following:

- Liner anchor trench;
- Liner system veneer stability under various conditions;
- Puncture protection of the geomembrane liner;
- Subgrade bearing capacity; and,
- Settlement.

The following sections describe the evaluation of the liner system.

9.1.3.1 Liner Anchor Trench

The purpose of a liner system anchor trench is to hold the liner system geosynthetic components in-place during liner system construction and landfilling activities. The current approach recommended by Koerner, et al, is that the holding capacity of the anchor trench not exceed the maximum allowable yield stress of the geomembrane, as it is preferable for the geosynthetics to "pullout" of the anchor trench before the geosynthetic components yield and/or tear. Based on the analysis included in Attachment 9B, the anchor trench shall meet the following criteria:

- A minimum runout length of four feet (from the crest of the cell slope to the trench); and,
- A minimum trench depth of 2 feet.

9.1.3.2 Liner Puncture Protection

While the leachate collection layer (LCL) is proposed to include sandy soils, the LCL works in conjunction with the geocomposite drainage net during periods of higher leachate generation. Additionally, as indicated above, leachate conveyance piping will also be located in the LCL in a stone envelope wrapped in a nonwoven geotextile. The cell sump is the lowest point in each cell to which the leachate is directed. From this sump, leachate is pumped from the cell to a force main. In the cell sump, the sandy soils of the leachate collection layer are replaced with the same stone enveloping the leachate conveyance piping.

While geomembrane puncture is not anticipated to be an issue with the sandy soils comprising the LCL, the stone envelope around the leachate conveyance piping and in the cell sump are evaluated for puncture since the particle size is much larger. Koerner, et al, developed methods to evaluate the amount of protection required between the stone and the geomembrane to prevent puncture from occurring. The analysis considers the maximum stone diameter, the proposed maximum load, and the thickness of the nonwoven geotextile cushion, between the stone and geomembrane. The analysis is provided in Attachment 9C.

9.1.3.3 Liner Stability

The liner system must remain stable during construction and landfilling operations. The floor of the cell, with a relatively flat slope of 3% (min.), does not raise concern or merit evaluation. The liner system on the steeper (33%) slopes are the point of concern.

The method prescribed by Koerner evaluates the geosynthetics and the soils layers based on the interface friction angles of adjacent materials, and the wedge of soil comprising the leachate collection layer. While the interface friction angles used in the analyses are based on published data from manufacturers or Koerner, our analysis considered actual laboratory testing of the interface friction angles of materials selected for this project, based on another landfill project. This real laboratory testing data shows that the values included in our analysis are conservative.

The analysis was also evaluated for a variety of conditions including the following:

- Liner system in-place prior to landfilling occurring;
- Liner system placed on cohesive soils versus granular soil;
- Placement of the liner system leachate collection layer, with the bulldozer pushing the soils;
    - Up the slope; and,
    - Down the slope.
- Liner system with leachate buildup in the leachate collection layer;
    - 10% buildup;
    - 50% buildup; and,
    - 100% buildup.
- Seismic condition.

Some of these conditions did not satisfy minimum factors of safety. In particular, the placement of the LCL soils must occur by pushing the soils up the slope, not downslope. Thus, the specifications prohibit pushing the soils down the slope.

Also, a head build-up of more than 10% compromises the liner system on the steep slope. For this reason the geocomposite drainage layer has been included in the liner system. The evaluation of the geocomposite to perform as the LCL is described in Section 10.

Stability between the textured HDPE geomembrane and the Subbase soil layer is determined by the type of soil used for the subbase. A soil with lower soil HDPE-T interface friction angle (i.e. cohesive soils) will require placement of the leachate collection layer and the Select Waste layer as waste placement progresses to limit the difference in elevation between the waste surface and the highest point of the leachate collection layer to 12 feet. If a Subbase soil with and interface friction angle equal to or greater 24 degrees is utilized (and meets the permeability requirements), then the entire leachate collection layer and Select Waste can be constructed on any interior ell side slope.

The liner stability analysis is included in Attachment 9D.

9.1.3.4 Subgrade Bearing Capacity

Any discussion of bearing capacity invariably starts with a discussion of the work by Terzaghi and Peck. Terzaghi's bearing capacity formulae form the basis for nearly every treatise on foundation design and analysis. The initial application of Terzaghi's bearing capacity work was to the design of shallow foundations (strip or continuous, square, circular, etc.). It has become acceptable to apply Terzaghi's work to the bearing

capacity of the subsoils beneath a landfill as one of the considerations needed in evaluating its stability.

The approach used in this analysis is that used by Szypcio and Dolzyk (2006). Szypcio and Dolzyk calculated bearing capacity of layered subsoils based on Terzaghi's formula, and treated the layered subsoil as a homogenous layer with average parameters. For this analysis, the average parameters are weighted averages based on soil layer thicknesses and the depth below the landfill that would be expected to influence bearing capacity. The applied bearing pressures due to the landfill were taken from the settlement analysis for this project (see Section 9.3 for discussion). To be conservative, this analysis considers the minimum factor of safety for bearing capacity to be three (3).

The locations evaluated were specifically selected as they represent the locations with the highest proposed loading due to the landfilling activities, to consider worst case scenarios. Under the scenarios evaluated, the actual factor of safety exceeded the minimum factor of safety of three. The detailed analysis is included in Attachment 9E.

9.1.3.5 Settlement

As a result of the proposed landfilling activities, the existing soils will be loaded with as much as 102 feet of rubble waste (includes select waste), plus the liner system subbase (2 feet), the leachate collection system (2 feet), and closure cap system (4 feet). The resulting loads could induce settlement of the landfill floor due to consolidation of the underlying soils. Settlement on the whole is not problematic if the entire area has the same new load added and the same subsurface conditions.

Differential settlement occurs when you have different loads imposed on foundations soils with differing geotechnical properties. For example, having a portion of a cell loaded with 150 feet of waste undergoing a settlement of 1.5 feet while another portion of the sell, near the sump, loaded with 20-feet of waste may only settle 0.3 feet. With a higher settlement at the upgradient end of a cell and the lower settlement at the downgradient end of a cell, the minimum slope of the cell may no longer meet the required two percent (2%) minimum after these differing settlement conditions are factored in. By estimating potential differential settlement of the cells floor prior to construction, the floor grades can be adjusted to provide a steeper initial construction, so that after differential settlement, a minimum floor slope of two percent is maintained.

Obviously, with the complex subsurface conditions described in great detail in the Phase II Report (Advanced GeoServices, June 2020) combined with the varying waste depth across the floor of the landfill, differential settlement analyses were performed for several proposed cells. The detailed calculations are provided in Attachment 9F. The conclusion of the analyses is that a minimum constructed slope of three percent (3%) will satisfy the minimum two percent (2%) slope after differential settlement.

9.1.3.6 Cell Grades Relative to High Water Table

COMAR 26.04.07.16 (C) (6) requires a "minimum vertical buffer distance between the bedrock elevation or the maximum expected groundwater elevation, whichever is higher, and the bottom of the liner system." Please refer to Section 4 of the Phase II Permit Application for further discussion of this item. As shown on Figure 4-1 in that Section, the minimum distances as measured at the bottom of the subbase layer beneath the

sump and the top of the highest observed/highest predicted groundwater levels is equal to or greater than 3 feet.

9.2 Cap and Closure System

COMAR 26.04.07.21 requires the closure cap for rubble landfills to match the requirements for municipal landfills, by providing the following, from top to bottom:

- Earthen cover with a minimum thickness of 2 feet;
- Drainage layer with a minimum thickness of 6-inches and an in-place permeability of 1 x 10^{-3} cm/sec; and,
- A low permeability cap comprised of a synthetic material with a minimum thickness of 20 mils and a permeability less than or equal to 1 x 10^{-10} cm/sec or a 12-inch layer of soils with an in-place permeability of 1x10^{-5} cm/sec.

A 12-inch thick layer of intermediate cover is required in locations with no activity for more than 30 days, as part of normal operations. The closure cap construction is expected to occur as areas of 6 or more acres have achieved maximum filling grades, to allow the operation to realize economies of scale with construction efforts. Thus, it is reasonable that all areas ready to receive the closure cap will have this layer of intermediate cover in-place by the time the closure cap construction commences.

Further, the closure cap must be constructed with a minimum slope of four percent (4%). Vegetative stabilization must be in-place within 30 days of the final earthen cover soils being installed.

Based on the foregoing, the closure cap for the Chesapeake Terrace Rubble Landfill will have the following components, from top to bottom:

- 6-inch thick layer of vegetative support layer (topsoil or other material capable of supporting vegetation);
- 18-inches of protective cover soils, with a permeability not exceeding 1x10^{-5} cm/sec;
- A geocomposite drainage layer, with a triplanar drainage net and 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; and,
- 40-mil textured on both sides, linear low density polyethylene (LLDPE) geomembrane with a permeability less than or equal to 1 x 10^{-10} cm/sec.

While the regulations specify a 6-inch thick drainage layer, such a thin layer of soil cannot be safely placed atop a geomembrane without risking puncture or damage from the construction equipment placing the soils. Further, a geocomposite drainage layer can provide a much higher permeability, on the order of two or three orders of magnitude higher compared to a permeability of 0.001 cm/sec for naturally occurring sandy soils. The cover soil can then be deployed in one 18-inch thick layer atop the geocomposite drainage layer, using low-ground pressure equipment, and maintaining a minimum of 12 inches of soil between the tracks of the equipment and the geosynthetic components.

To support the selection of the closure system and the properties of the materials, a series of analyses were conducted as follows:

- Veneer Stability;

- Isolated Settlement; and,
- Drainage Layer permeability

The sections below provide a summary of each of these analyses.

9.2.1 Closure Cap Veneer Stability

The closure cap system must remain stable during construction and the closure/post-closure period. The crown of the landfill, with slopes of at least 4%, does not raise concern or merit evaluation. The closure cap system on the steeper (25%) slopes are the point of concern.

The method prescribed by Koerner evaluates the geosynthetics and the soils layers for the liner system stability, described in Section 9.1.3, is the same method used to evaluate the closure cap veneer stability. While the interface friction angles used in the analyses are based on published data from manufacturers or Koerner, our analysis considered actual laboratory testing of the interface friction angles of materials selected for this project, based on another landfill project. This real laboratory testing data shows that the values includes in our analysis are conservative (i.e., lower than real conditions).

Similar to the liner system stability analysis, the analysis was also evaluated for a variety of conditions including the following:

- Closure cap system in-place after construction;
- Placement of the cover soil, with the bulldozer pushing the soils;
  - Up the slope; and,
  - Down the slope.
- Closure system with leachate buildup in the leachate collection layer;
  - 10% buildup;
  - 50% buildup; and,
  - 100% buildup.
- Seismic Condition.

Some of these conditions did not satisfy minimum factors of safety. In particular, the placement of the soils must occur by pushing the soils upslope, not downslope. Thus, the specifications prohibit pushing the soils down the slope.

Also, a head building of more than 10% compromises the closure cap system on the steep slope. For this reason the geocomposite drainage layer has been included in the closure cap system in lieu of a 6-inch thick layer of higher permeability soils and the cover soils have a permeability requirement. The evaluation of the geocomposite to perform as the closure cap drainage layer is described in Section 9.2.3.

The closure cap stability analysis is included in Attachment 9H.

9.2.2 Isolated Settlement

The closure cap system will experience some settlement due to waste consolidation. Due to the nature of the waste, some decomposition is expected to occur. With most materials not undergoing decomposition, it is possible that there may be isolated locations of settlement, where a low-spot or small depression may develop.

The concern for having isolated settlement areas is two-fold: (1) the potential for water to pond and saturate that area of the cap, and (2) maintaining the integrity of the geomembrane component of the cap. If this occurs on the steep slopes, this will be a non-issue relative to reducing the potential for ponding. The more critical locations are on the flatter slopes.

The isolated, or localized, settlement analysis indicates that the geomembrane in the closure system can withstand differing isolated settlement, depending on the geometry. The analysis includes a table that the operator can use to evaluate a variety of field measurements to discern whether a more robust repair is required or whether some regrading of the area is an acceptable solution.

The isolated settlement analysis is provided in Attachment 9I.

9.2.3 Closure Cap Drainage Layer

As indicated previously, the placement of a 6-inch thick cap drainage layer immediately atop the geomembrane component of the closure cap system is a constructability issue on flatter slopes, and even more challenging on steeper slopes. This is challenging because the tracks of a bulldozer typically have a 5-inch relief, and the blade of the bulldozer used to push the soil up the slope could readily puncture or nick the geomembrane without being observed or noticed.

To avoid this risk altogether, a geocomposite drainage layer is proposed for use as the closure cap drainage layer. A triplanar drainage net with an 8 oz./s.y. nonwoven geotextile heat bonded to both sides is proposed. To evaluate the adequacy of this product, methods outlined by Richardson, et al, were used. The methods rely heavily on Darcy's equation relative to transmission of water through the geocomposite drainage layer and the permeability of the overlying soil layer, assuming that the layer can convey all water passing through the overlying cover soil layer minimizing head buildup atop the geomembrane.

This condition was evaluated for the steep slopes between the stormwater terraces, where this drainage layer will be daylighted, and for the shallow slopes where longer drainage lengths could cause head buildup. For conservatism, the analysis considers the flow from the shallow crown area remains in the geocomposite drainage net on the steep slope above the upper-most terrace.

The analysis, included in Attachment 9J, shows that a readily-available triplanar geocomposite drainage net product will perform adequately for both minimum and maximum slope conditions, as long as the cover soils have a permeability less than or equal to $1x10^{-5}$ cm/sec.

9.3 Global Stability

A slope stability analysis was performed to evaluate the factor of safety under static seismic conditions. Circular and non-circular slip surfaces were evaluated using the software Slope/W module of the GeoStudio by GEO-SLOPE International, Ltd., (copyright 2004-2017). The Spencer and Bishop methods were utilized.

Cells 10, 5D, 13 and 16 were the focus of the computer analysis. Cells 5D and 16 were included since they align with Cells 10 and 13, respectively, along the cell long axis. Subsoil profiles were taken from the settlement and bearing analyses. Additional information was added to represent subsoil conditions in Cells 5D and 16.

From USGS information, the maximum horizontal acceleration for the site area is 0.065g. USEPA seismic design guidance suggests the use of 50% of this value for design based on work by Hynes and Franklin (1984). A value of 0.0325 was used as the coefficient of horizontal acceleration, Kh.

Circular Slip Surfaces: Factors of safety of at least 1.6 were calculated for the pseudo-static condition by both the Bishop and Spencer Methods. It is noted that in all cases, the minimum factor of safety was associated with a very shallow veneer slip surface within the cap system. Other potential slip surfaces evaluated extended into the waste, and others also extended through the waste and into the underlying subsoils. These slip surfaces all had higher factors of safety.

When the horizontal seismic coefficient, Kh, of 0.0325 was added, the minimum factor of safety was reduced to 1.4. Again, this was associated with a very shallow veneer slip within the cap system.

Detailed information is included in Attachment 9J.

Non-Circular Slip Surfaces: A minimum factor of safety of 1.7 was calculated by the Bishop Method. This was associated with a shallow veneer slip surface. Slip surfaces that extended into the waste or deeper were associated with factors of safety of at least 2.6. Other potential slip surfaces evaluated extended into the waste, and others also extended through the waste and into the underlying subsoils. These slip surfaces all had higher factors of safety.

When the horizontal seismic coefficient, Kh, of 0.0325 was added, the minimum factor of safety was reduced to 1.4. Again, this was associated with a very shallow veneer slip within the cap system.

Detailed information is included in Attachment 9J.

Sliding Wedge Analysis: A sliding wedge analysis was performed for Cells 10, 5D, 13, and 11. Cell 16 was not included since it was believed the overall geometry of Cell 16 would render acceptable results compared to the other cells analyzed. Cell 11, however, is the only cell to have the potential slip surface (GCL to underlying subsoil) located on all three general areas of the cell – the sideslope at the sump, the floor, and the sideslope on the upgradient end of the cell.

For this analysis, each cell has three “blocks”. The mass on the floor of the cell is called the “central block”. Upgradient, the mass is called the “active block. The sliding surface of this block is defined by either the presence of the specific interface of concern, or a projected active wedge slip based on earth pressure theory.

Down gradient of the central block, the mass on the sideslope is called the “passive block”. It is defined as a sliding wedge because the specific interface of concern is present.

The horizontal seismic force is added by multiplying the horizontal factor by the weight of each block, and using that as an additional force in the horizontal direction. This force is presumed to act towards the downslope direction.

Based on this analysis, the following tables summarize the factors of safety calculated.

Factors of Safety Sliding Wedge Slip Surface, Static		
Cell	**Static Factor of Safety**	**Dynamic Factor of Safety**
1. Cell 13	13.8	6.3
2. Cell 11	3.9	1.6
3. Cell 5D	4.8	3.3
4. Cell 10	12.3	6.0

Detailed information is included in Attachment 9J.

ATTACHMENT 9A

Liner System Equivalency

Reviewed by PGS 09/01/2021

The GCL layer has been removed from the design as required by MDE. Therefore, this calculation is no longer required.

1. Purpose

The purpose of these calculations is to evaluate the COMAR-required liner system to the alternate liner system proposed for use at this site, using the program *"The Hydrologic Evaluation of Landfill Performance"* (HELP) to evaluate the ability of each option to prevent leakage through the liner system. Obviously, zero leakage is the objective.

2. Analysis Approach

2.1 General: The HELP computer program is a quasi-two dimensional hydrologic model of water movement across, into, through, and out of landfills. The program was developed to conduct water balance analyses of landfills, liner systems, cover systems, and solid waste disposal and containment facilities. The model accepts weather, soil, and design data, and accounts for the effects of surface storage, snowmelt, runoff, infiltration, evapotranspiration, vegetative growth, soil moisture storage, lateral subsurface drainage, leachate recirculation, unsaturated vertical drainage, and leakage through soil, geomembrane or composite liners. Various combinations of vegetation, waste cells, lateral drain layers, low permeability soil barriers, and synthetic geomembrane liners may be modeled.

The design approach uses a modeled 1 acre area to evaluate the effectiveness of the liner system to prevent leakage through the liner system to the soils and groundwater beneath the landfill.

2.2 Weather and Climate Data: The model contains weather and climate-related data for a number of locations around the US. Climate data for Baltimore, MD, contained in the model were enhanced by using the average monthly temperature and precipitation for Odenton, MD, as shown in Table 1.

TABLE 1 – Odenton, Maryland
Average Climate Data

Month	Average Temperature (°F)	Average Precipitation (in)
January	32.4	3.47
February	35.5	3.02
March	43.7	3.93
April	53.2	3.00
May	62.8	3.89
June	71.7	3.43
July	76.5	3.85
August	74.5	3.74
September	67.4	3.98
October	55.3	3.16
November	45.5	3.12
December	36.6	3.35
	Total	**41.94**

Reviewed by PGS 09/01/2021

This Equivalency Evaluation is no longer required.

Additionally, the 25-year 24-hour precipitation event was determined to be 6.16". As discussed in later sections of this narrative, this daily precipitation value was strategically inserted into the precipitation data to further enhance the simulations.

2.3 Soil and Material Data: HELP contains default soil and material data that were used to model the materials in the proposed landfill. Soil types and materials were selected as close as possible to match project conditions. Some parameters were modified to better simulate the local soils and project material requirements. This data is summarized in Table 2.

TABLE 2 – Soil and Material Data

Layer	COMAR-required Description	HELP Default Soil	ATLERNATE 1 Description	HELP Default Soil	ALTERNATE 2 Description	HELP Default Soil
1	12 inches weekly cover	6	12 inches weekly cover	6	12 inches weekly cover	6
2	96 inches of waste	19	96 inches of waste	19	96 inches of waste	19
3	48 inches of protective layer	6	48 inches of protective layer	6	48 inches of protective layer	6
4	24 inches of gravel/course sand	1	24 inches of gravel/course sand	1	24 inches of gravel/course sand	6
5	12 inches clay @ $k=1x10^{-7}$cm/sec	29	Tri-planar geocomposite drainage layer (GDL)	34	Tri-planar GDL	34
6	24 inches clay @ $k=1x10^{-7}$cm/sec	23	60 mil HDPE geomembrane	35	60 mil HDPE geomembrane	35
7	36 inches natural soils	5	Geosynthetic clay liner (GCL)	17	GCL	17
8	N/A	N/A	36 inches natural soils	5	36 inches natural soils	5

Note:

1. *CDD = construction, demolition, and debris waste; modeled as municipal solid waste with channeling and dead zones.*
2. *HDPE = high density polyethylene*
3. *The GCL and Soil Subgrade layers were not included in the modeling since the 60-mil GM was modeled as a perfect installation with no defects and no pinholes.*
4. *Default Soil Type 29, was modified to provide a k = 1.0 x 10-7 cm/sec*
5. *Default soil type 34 was modified for a k = 4.4 cm/sec*
6. *While a good or excellent installation of the geosynthetics is required, we modeled a "poor" installation with leaks to try to impose leakage through the geomembrane and show that the geosynthetic clay liner would perform well.*

Reviewed by PGS 09/01/2021
This Equivalency Evaluation is no longer required.

2.4 Design Data: Various desig data are input by the program user. This data includes layer thicknesses, slopes, geomembrane quality, etc. Table 3 summarizes these data.

TABLE 3 – Design Data

Parameter	Value
Cell floor slope	3%
Maximum flow length in leachate collection layer	250 feet
Landfill top slope	2%
Geomembrane quality and installation	3 defects; 3 pinholes; Poor installation
Runoff Curve Number, CN, during filling	86
1st lift, area allowing runoff	0%

2.5 HELP Models: The three liner systems were simulated for a five years, under first lift conditions, with the following results:

TABLE 4 – Model Results Summary

Liner system	Peak Daily Head (inch)	Peak Daily Leakage (inch/day)	Average Annual Head (inch)	Average Annual Leakage (inch/yr)
COMAR-Required	24.9	0.007496	6.414	1.61555
Alternate 1	0.388	0.000101	0.016	0.00001
Alternate 2	0.400	0.000101	0.016	0.00001

4. Conclusions

Based on the foregoing, the following conclusions are offered:

1. The lower permeability of the geomembrane combined with the GCL over the natural soils, reduces the leakage through the liner system.
2. The higher permeability of the geocomposite drainage layer (GDL) reduces the head atop the liner system, because it drains the water to the sump more quickly.
3. Whether the 24 inches leachate collection layer (immediately above the GDL) is gravel/coarse sand (Alternate 1) or "dirty sand" (Alternate 2), the GDL quickly drains whatever gets through this layer from the overlying waste.
4. Alternate 1 and Alternate 2 liner systems provide a higher level of protection against leakage through the liner to the underlying soils and groundwater.

Reviewed by PGS 09/01/2021
This Equivalency Evaluation is no longer required.

5. References

Schroeder, Paul R., *et al*; *"The Hydrologic Evaluation of Landfill Performance, Version 3"*; EPA/600/R-94/168a; September 1994.

NOAA data for Odenton, MD.

Various project design calculations.

ADVANCED GeoServices
a Montrose Environmental Group company

ATTACHMENT 9B

Liner Anchor Trench

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Liner Anchorage		
	Job No. 2018-3854	Made by: JCA	Date 06/19/20
	Ref.	Checked by: VEF	Sheet 1 of 1

Reviewed by PGS 08/26/2021

Objective:

Design the liner anchorage to hold the geosynthetics against applied loads.

Design Approach and Assumptions:

1. The anchorage system includes a flat runout length at the top of the slope with a short drop into a trench. The trench is backfilled with compacted soil.
2. The layer of drainage sand terminates at the top of the landfill sideslopes, and does not extend into the anchorage system.
3. The holding capacity of the anchorage system is developed by the combination of the vertical load of the cover soils placed on top of the runout length, and the lateral load from the anchor trench backfill.
4. Interface friction values vary based on the materials as layered. For design purposes, the lowest interface friction value between layers is used. (References 2 and 5)
5. An imaginary frictionless pulley is positioned at the crest of the anchor trench, allowing the frictional forces to be summed along the plane of the geosynthetic layers. (Reference 1)
6. It is preferred to design the anchorage system such that the geosynthetic layers pull out before the geomembrane yields. Consequently, a factor of safety against yield of 1.5 is used.

Calculation:

From the attached calculation sheet, the proposed anchorage configuration that includes a 4-ft runout length, and 2-ft deep anchor trench, would have a capacity of approximately 861 lb. (presuming a unit 1-ft width of layered geosynthetics). Applying a factor of safety of 1.5 to the textured HDPE geomembrane (HDPE-T) yield stress of 1,512 lb. (Reference 3), a maximum allowable capacity of the anchorage system would be 1,008 lb.

Conclusion:

Since the anchorage system capacity is less than the maximum allowable capacity, the anchorage system should pullout before the HDPE-T yields.

References:

1. Qian, X., Koerner, R.M., Gray, D.H., (2002). *"Geotechnical Aspects of Landfill Design and Construction"*; Prentice Hall; Upper Saddle River, NJ; 1st Ed., Sect. 4.7.2.
2. Koerner, G., and Narejo,D.; Geosynthetic Research Institute; GRI Report #30- *"Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces"*; 2005.
3. Manufacturer's data, various.
4. Site specific data, estimated.
5. Calculation to estimate interface friction between GDN w/GT-NW to Cohesive Soil.

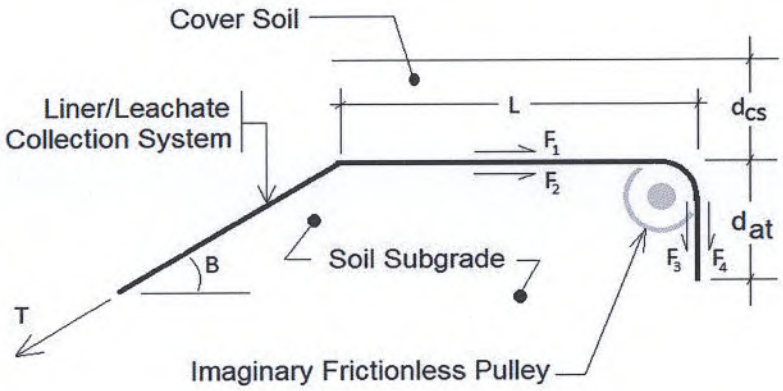
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Checked:	VEF	**Date:**	07/15/20
Subject:	Liner Anchorage		

Reviewed by PGS 08/26/2021

Geomembrane Anchor Trench Design

Description
Design of the Geomembrane Anchor Trench



(Reference 1)

General Data

Slope horizontal, H =	3.0	
Slope Vertical, V =	1	
Slope Angle, B =	18.4	deg

Cover Soil and Prepared Subgrade

Depth of cover soil, d_{cs} =	2.0	ft
Density of cover soil, γ_{cs} =	115.0	pcf
Length of anchor runout, L =	4.0	ft
Cover soil pressure on GM-T, q_B =	230.0	psf

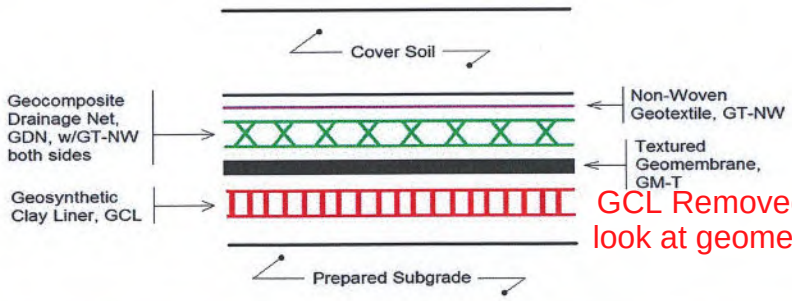
Anchor Trench

Depth of anchor trench, d_{at} =	2.0	ft
Average depth of anchor trench, $d_{avg} = (d_{at}/2)$ =	1.0	ft
Density of anchor trench backfill soil, γ_{at} =	115.0	pcf
Anchor trench backfill soil internal friction angle, ϕ_{at} =	28.0	deg
Anchor trench backfill soil coef of earth pressure at rest, Ko-at =	0.53	

Average vertical pressure in anchor trench, $\sigma_{v\text{-}avg}$

$\sigma_{v\text{-}avg} = (\gamma_{cs})(d_{cs}) + (\gamma_{at})(d_{avg})$ = 345.0 psf

Geosynthetics



GCL Removed from Design
look at geomembrane to subbase

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Geosynthetics Data *(Reference 3)*

Non-woven Geotextile, GT-NW =	10	oz/sf
Textured Geomembrane, GM-T =	HDPE-T 60	mil
Textured Geomembrane Yield Stress, Ty =	1,512	lb/ft
Geosynthetic Clay Liner, GCL =	Bentonite w/2 layers of Non-Woven Needle Punched Geotextile (NW-NP-GT).	

Estimated Interface Friction Angles *(References 2 and 5)*

GT-NW to GDN w/GT-NW, δ_4 =	27	deg	
GDN w/GT-NW to GM-T, δ_7 =	26	deg	δ_{des} = 16
GCL Removed from Design ~~*GM-T to GCL,* δ_8 =~~	~~23~~	deg	~~23.0~~ deg
GM-T to Granular Subbase ~~*GCL to prepared Granular subgrade,* δ_8 =~~	~~27~~	deg 31	
GM-T to Granular Subbase ~~*GCL to prepared Cohesive subgrade,* δ_8 =~~	~~24.5~~	deg 16(saturated)	

Anchor Trench Capacity and Factors of Safety *(Reference 1)*

Geomembrane anchor trench capacity, T

$$T = \frac{(q_B)(L)(\tan \delta_{des}) + 2(K_{o\text{-}at})(\sigma_{v\text{-}avg})(d_{at})(\tan \delta_{des})}{\cos B - (\sin B)(\tan \delta_{des})}$$

T =	~~861~~552	lb/ft
Minimum Factor of Safety Against Ty, MFS =	1.5	
Allowable stress in the geomembrane, Tall = (Ty)/(MFS) =	1,008	lb/ft

Results still OK

Since T < Tall, the anchor trench should pull out before the HDPE-T yields.

References:

1 *Qian, X., Koerner, R.M., Gray, D.H., (2002). "Geotechnical Aspects of Landfill Design and Construction"; Prentice Hall; Upper Saddle River, NJ; 1st Ed., Sect. 4.7.2.*

2 *Koerner, G., and Narejo,D.; Geosynthetic Research Institute; GRI Report #30- "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces"; 2005.*

3 *Manufacturer's data, various.*

4 *Site specific data, estimated.*

5 *Calculation to estimate interface friction between GDN w/GT-NW to Cohesive Soil.*

Appendix Table 1. Summary of interface shear strengths.

Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R^2	Fig. No.	δ (deg)	Ca (kPa)	Points	R^2
DPE-S	Granular Soil	1a	21	0	162	0.93	1b	17	0	128	0.92
DPE-S	Cohesive Soil										
	Saturated	1c	11	7	79	0.94	1d	11	0	59	0.95
	Unsaturated	1c	22	0	44	0.93	1d	18	0	32	0.93
DPE-S	NW-NP GT	1e	11	0	149	0.93	1f	9	0	82	0.96
DPE-S	Geonet	1g	11	0	196	0.90	1h	9	0	118	0.93
DPE-S	Geocomposite	1i	15	0	36	0.97	1j	12	0	30	0.93
DPE-T	Granular Soil	2a	34	0	251	0.98	2b	31*	0	239	0.96
DPE-T	Cohesive Soil										
	Saturated	2c	18	10	167	0.93	2d	16 *	0	150	0.90
	Unsaturated	2c	19	23	62	0.91	2d	22	0	35	0.93
DPE-T	NW-NP GT	2e	25	8	254	0.96	2f	17	0	217	0.95
DPE-T	Geonet	2g	13	0	31	0.99	2h	10	0	27	0.99
DPE-T	Geocomposite	2i	26	0	168	0.95	2j	15	0	164	0.94
LDPE-S	Granular Soil	3a	27	0	6	1.00	3b	24	0	9	1.00
LDPE-S	Cohesive Soil	3c	11	12.4	12	0.94	3d	12	3.7	9	0.93
LDPE-S	NW-NP GT	3e	10	0	23	0.63	3f	9	0	23	0.49
LDPE-S	Geonet	3g	11	0	9	0.99	3h	10	0	9	1.00
LDPE-T	Granular Soil	4a	26	7.7	12	0.95	4b	25	5.2	12	0.95
LDPE-T	Cohesive Soil	4c	21	5.8	12	1.00	4d	13	7.0	9	0.98
LDPE-T	NW-NP GT	4e	26	8.1	9	1.00	4f	17	9.5	9	0.96
LDPE-T	Geonet	4g	15	3.6	6	0.97	4h	11	0	6	0.98
VC-S	Granular Soil	5a	26	0.4	6	0.99	5b	19	0	6	0.99
VC-S	Cohesive Soil	5c	22	0.9	11	0.88	5d	15	0	9	0.95
VC-S	NW-NP GT	5e	20	0	89	0.91	5f	16	0	83	0.74
VC-S	NW-HB GT	5g	18	0	3	1.00	5h	12	0.1	3	1.00
VC-S	Woven GT	5i	17	0	6	0.54	5j	7	0	6	0.93
VC-S	Geonet	5k	18	0.1	3	1.00	5l	16	0.6	3	1.00

Appendix Table 1. (continued)

Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R^2	Fig. No.	δ (deg)	Ca (kPa)	Points	R^2
PVC-F	NW-NP GT	6a	27	0.2	26	0.95	6b	23	0	26	0.95
PVC-F	NW-HB GT	6c	30	0	8	0.97	6d	27	0	8	0.90
PVC-F	Woven GT	6e	15	0	6	0.78	6f	10	0	6	0.76
PVC-F	Geonet	6g	25	0	11	1.00	6h	19	0	11	0.99
PVC-F	Geocomposite	6i	27	1.1	5	1.00	6j	22	4.7	6	1.00
CSPE-R	Granular Soil	7a	36	0	3	1.00	7b	16	0	3	1.00
CSPE-R	Cohesive Soil	7c	31	5.7	6	0.71	7d	18	0	6	0.99
CSPE-R	NW-NP GT	7e	14	0	6	0.97	7f	10	0	6	0.98
CSPE-R	NW-HB GT	7g	21	0	3	1.00	7h	10	0	3	1.00
CSPE-R	Woven GT	7i	11	0	6	0.92	7j	11	0	3	1.00
CSPE-R	Geonet	7k	28	0	9	0.87	7l	16	0	9	0.80
NW-NP GT	Granular Soil	8a	33	0	290	0.97	8b	33	0	117	0.96
NW-HB GT	Granular Soil	8c	28	0	6	0.99	8d	16	0	6	0.91
Woven GT	Granular Soil	8e	32	0	81	0.99	8f	29	0	28	0.98
NW-NP GT	Cohesive Soil	9a	30	5	79	0.96	9b	21	0	28	0.79
NW-HB GT	Cohesive Soil	9c	29	0.9	15	0.71	9d	10	0	15	0.83
Woven GT	Cohesive Soil	9e	29	0	34	0.94	9f	19	0	16	0.86
GCL Reinforced (internal)	N/A	10a	16	38	406	0.85	10b	6	12	182	0.91
GCL (NW-NP GT) 8	HDPE-T	11a	23*	8	180	0.95	11b	13	0	157	0.90
GCL (W-SF GT)	HDPE-T	11c	18	11	196	0.96	11d	12	0	153	0.92
Geonet	NW-NP GT	12a	23	0	52	0.97	12b	16	0	32	0.97
Geocomposite 1,4,5, (NW-NP GT) 6,9	Granular Soil	13a	27*	14	14	0.86	13b	21	8	10	0.92

REFERENCE 2 PG 2/2

REFERENCE 3

pg 1/1

PRODUCT DATA SHEET

GSE HD Textured Geomembrane

GSE HD Textured is a co-extruded textured high density polyethylene (HDPE) geomembrane available on one or both sides. It is manufactured from the highest quality resin specifically formulated for flexible geomembranes. This product is used in applications that require increased frictional resistance, excellent chemical resistance and endurance properties.

[*]

AT THE CORE:
An HDPE geomembrane used in applications that require increased frictional resistance, excellent chemical resistance and endurance properties.

Product Specifications

These product specifications meet GRI GM13

Tested Property	Test Method	Frequency	Minimum Average Value				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm³	ASTM D 1505	200,000 lb	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lb	 45 63 100 12	 60 84 100 12	 90 126 * 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lb	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lb	45	60	90	120	150
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note(1)	Note(1)	Note(1)	Note(1)	Note(1)
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notched Constant Tensile Load(2), hr	ASTM D 5397, Appendix	200,000 lb	500	500	500	500	500
Oxidative Induction Time, mins	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lb	>100	>100	>100	>100	>100
TYPICAL ROLL DIMENSIONS							
Roll Length(3), ft	Double-Sided Textured Single-Sided Textured		830 1,010	700 780	520 540	400 410	330 330
Roll Width(3), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft²	Double-Sided Textured Single-Sided Textured		18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

NOTES:
- (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2)NCTL for GSE HD Textured is conducted on representative smooth membrane samples.
- (3)Roll lengths and widths have a tolerance of ±1%.
- GSE HD Textured is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- *Modified.

$* (126\ lb/in)(12\ in/ft) = 1512\ lb/ft$

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

GSE ENVIRONMENTAL™

DURABILITY RUNS DEEP For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

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REFERENCE 5 Pg 1/1

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Engineering for the Environment. Planning for People.™

Ref: "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interface"; GRI Report #30; June 14, 2005.

Geocomposite (NW-NP-GT) to granular soil $\delta = 27°$

NW-NP-GT to granular soil $\delta = 33°$

$$\text{ratio} = \frac{27°}{33°} = 0.818$$

NW-NP-GT to cohesive soil $\delta = 30°$

For Geocomposite (NW-NP-GT) to cohesive soil, use:

$$\delta_g = (0.818)(30°) = 24.5°$$

SHEET 1 OF 1	PROJECT NO.	PROJECT NAME	Chesapeake Terrace Landfill
BY JCA	DATE 10/21/19	DESCRIPTION	Est. δ for geocomposite-to-cohesive soil interface
CHK. BY	DATE		

ATTACHMENT 9C

Liner Puncture Protection

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Geomembrane Liner, Puncture Analysis		
	Job No. 2018-3854	Made by: JCA	Date 07/15/20
	Ref.	Checked by: VEF	Sheet 1 of 2

Reviewed by PGS 08/26/2021

Objective:

The objective of this analysis is to determine the factor of safety against the puncture of the geomembrane liner by large diameter stones used in the leachate collection system. Puncture protection is provided by one or more layers of nonwoven, needle-punched geotextile.

Design Approach:

This analysis is based on Dr. Robert Koerner's work as published in References 1 and 2, and as slightly modified by Reference 7. The general design steps for this analysis are as follows:

1. Determine the point of greatest waste depth. At this point, estimate the maximum expected vertical pressure (MEP) due to the various layers and thicknesses of leachate collection system, waste, and cap system.
2. Based on the maximum diameter of the coarse aggregate bedding for the leachate collection piping, estimate the protrusion height of the stone against the geomembrane liner.
3. Based on various design parameters, select modification factors and reduction factors to be used in calculating the maximum allowable pressure on the geotextile.

   In August 2013, the author of this analysis corresponded with Dr. Robert Koerner, and inquired about the change to the maximum allowable pressure design equation as compared between Reference 1 (1996), and his 6th edition of *"Designing with Geosynthetics"* (2012), which is identical on this subject to that in Reference 2, (2008). Note the following figures:

$$P'_{all} = \left(450\left(\frac{M}{H^2}\right)\right)\left(\frac{1}{MF_s \times MF_{pd} \times MF_a}\right)\left(\frac{1}{RF_{cbd} \times RF_{cr}}\right) \geq 50$$

Reference 1 (H has units "mm").

$$P'_{all} = \left(50 + 0.00045\left(\frac{M}{H^2}\right)\right)\left(\frac{1}{MF_s \times MF_{pd} \times MF_a}\right)\left(\frac{1}{RF_{cbd} \times RF_{cr}}\right)$$

Reference 2 (H has units "m").

Dr. Koerner indicated the "50 +" was added to the Reference 2 equation to allow the use of the puncture resistance provided by a 60-mil HDPE geomembrane. It is concluded that removing the "50 +" term from the Reference 2 equation would be conservative. Therefore, this analysis subsequently uses the following equation from Reference 2, as modified:

Reviewed by PGS 08/26/2021

$$P'_{all} = \left(0.00045\left(\frac{M}{H^2}\right)\right)\left(\frac{1}{MF_s \times MF_{pd} \times MF_a}\right)\left(\frac{1}{RF_{cbd} \times RF_{cr}}\right)$$

Reference 2 (H has units "m"), as modified.

4. Calculate a factor of safety defined as FS = (P'_{all} / MEP), and compare this to a minimum FS of 1.5.
5. Repeat this analysis for the greatest waste thickness over a leachate collection pipe.

Calculation:

For the greatest waste depth over the geomembrane liner, a FS against puncture for the given conditions described was calculated to be 3.0. For the greatest waste depth over a leachate collection sump, a FS against puncture for the given conditions described was calculated to be 3.4. Detailed calculations are attached.

Conclusion:

Based on the foregoing, the proposed design provides a FS of at least 3.0 against puncture of the geomembrane liner against the large diameter aggregate to be used in the leachate collection system.

References:

1. Wilson-Fahmy, Ragui, and Koerner, Robert M., et al, *"A Design Methodology for the Puncture Protection Design of Geomembranes"*; GRI Report #13; Geosynthetics Research Institute, Drexel University; September 26, 1994
2. Koerner, Robert M., *"Modification to the "GRI Method" for the RFCR Factor Used in the Design of Geotextiles for Puncture Protection of Geomembranes"*, GRI White Paper #14; Geosynthetic Institute; Nov 24, 2008.
3. General project design.
4. Leachate Collection Pipe Detail (not used for sump calculation).
5. Maryland Department of Transportation, State Highway Administration, *"Standard Specifications for Construction and Materials"*, July 2018, Table 901 A.
6. Leachate Sump Detail (not used for floor calculation).
7. Personal correspondence with Dr. Robert Koerner.

2021 Phase 3 Design Revision

ADVANCED GeoServices
a Montrose Environmental Group company

Project:			
P.N.:	2018-3854	**Page:**	1 of 1
By:	JCA	**Date:**	07/15/20
Checked:	VEF	**Date:**	07/15/20
Subject:	Liner Puncture Protection - Floor		

Reviewed by PGS 08/26/2021

Liner Puncture Protection

Description

Determine the minimum weight of a non-woven geotextile needed for puncture protection for the geomembrane liner based on the greatest thickness of waste across the floor of the landfill.

Include 24" Subbase at 125 pcf = 250 psf

General Data

Cap Layer Thickness =	3.0	ft	4.0 ft=460 psf		
Cap Layer Density =	115	pcf			
Waste Layer Thickness =	144.0	ft	use 120.0 max=5,844 psf		
Waste Density =	48.7	pcf			
Leachate Collection Layer Thickness =	4.0	ft			
Leachate Collection Layer Density =	115	pcf			
Leachate Collection Stone Thickness =	2.0	ft			
Leachate Collection Stone Density =	125	pcf			
Maximum Expected Pressure, MEP =	7,264 8,068	psf	=	348 386	kPa
Stone Designation =	#57				
Maximum Stone Diameter, MSD =	1.50	in	=	0.0381	m
Estimated Protrusion, H = 0.5 x MSD	0.0191	m			
Geotextile Weight, M =	1,151	g/m^2	=	34.0	oz/sy

Select Waste

Modification and Reduction Factors (Reference 2)

Shape; MFs =	1.00
Packing Density, MFpd =	0.83
Soil Arching, MFa =	0.75
Chemical/Biological Degradation, RFcbd =	1.50
Creep, RFcr =	1.30
Product of Modification and Reduction Factors, PMRF =	1.21

Design Equations (References 1 and 2)

$$P'_{all} = \left(0.00045\left(\frac{M}{H^2}\right)\right)\left(\frac{1}{MF_s \times MF_{pd} \times MF_a}\right)\left(\frac{1}{RF_{cbd} \times RF_{cr}}\right)$$

Reference 2 (H has units "m"), as modified.

Design Allowable Pressure, P'all =	1,175.8	kPa
Global Factor of Safey, FS (P'all)/(MEP) =	3.0 3.4	
Minimum Global Factor of Safety, FS =	3.0	(Reference 1)

References:

1 *Wilson-Fahmy, Ragui, and Koerner, Robert M., et al, "A Design Methodology for the Puncture Protection Design of Geomembranes"; GRI Report #13; Geosynthetics Research Institute, Drexel University; Sept 26, 1994.*
2 *Koerner, Robert M., "Modification to the "GRI Method" for the RF_{CR} Factor Used in the Design of Geotextiles for Puncture Protection of Geomembranes", GRI White Paper #14; Geosynthetic Institute; Nov 24, 2008.*
3 *General project design.*
4 *Leachate Collection Pipe Detail.*
5 *Maryland Department of Transportation, State Highway Administration, "Standard Specifications for Construction and Materials", July 2018, Table 901 A.*
6 *Leachate Sump Detail (not used for floor calculation).*
7 *Personal correspondence with Dr. Robert Koerner.*

ADVANCED GeoServices
a Montrose Environmental Group company

Project:	2021 Phase 3 Design Revision		
P.N.:	2018-3854	**Page:**	1 of 1
By:	JCA	**Date:**	07/15/20
Checked:	VEF VEF	**Date:**	07/15/20
Subject:	Liner Puncture Protection - Sump		

Reviewed by PGS 08/26/2021

Liner Puncture Protection

Description

Determine the minimum weight of a non-woven geotextile needed for puncture protection for the geomembrane liner based on the deepest sump in the landfill.

General Data

Cap Layer Thickness =	~~3.0~~	ft	4.0 ft=460 psf	
Cap Layer Density =	115	pcf		
Waste Layer Thickness =	~~122.0~~	ft	use 120.0 max =5,844 psf	
Waste Density =	48.7	pcf		
Select Waste ~~*Leachate Collection*~~ *Layer Thickness =*	4.0	ft		
Leachate Collection Layer Density =	115	pcf		
Leachate Collection Stone Thickness =	3.0	ft		
Leachate Collection Stone Density =	125	pcf		
Maximum Expected Pressure, MEP =	7,139 ~~7,121~~	psf	= ~~341~~ 342kPa	kPa
Stone Designation =	#57			
Maximum Stone Diameter, MSD =	1.50	in	= 0.0381	m
Estimated Protrusion, H = 0.5 x MSD	0.0191	m		
Geotextile Weight, M =	1,151	g/m^2	= 34.0	oz/sy

Modification and Reduction Factors *(Reference 2)*

Shape; MFs =	1.00
Packing Density, MFpd =	0.83
Soil Arching, MFa =	0.75
Chemical/Biological Degradation, RFcbd =	1.50
Creep, RFcr =	1.30
Product of Modification and Reduction Factors, PMRF =	1.21

Design Equations *(References 1 and 2)*

$$P'_{all} = \left(0.00045\left(\frac{M}{H^2}\right)\right)\left(\frac{1}{MF_s \times MF_{pd} \times MF_a}\right)\left(\frac{1}{RF_{cbd} \times RF_{cr}}\right)$$

Reference 2 (H has units "m"), as modified.

Design Allowable Pressure, P'all =	1,175.8	kPa
Global Factor of Safey, FS (P'all)/(MEP) =	~~3.4~~ 3.4	
Minimum Global Factor of Safety, FS =	3.0	(Reference 1)

References:

1 *Wilson-Fahmy, Ragui, and Koerner, Robert M., et al, "A Design Methodology for the Puncture Protection Design of Geomembranes"; GRI Report #13; Geosynthetics Research Institute, Drexel University; Sept 26, 1994.*
2 *Koerner, Robert M., "Modification to the "GRI Method" for the RF_{CR} Factor Used in the Design of Geotextiles for Puncture Protection of Geomembranes", GRI White Paper #14; Geosynthetic Institute; Nov 24, 2008.*
3 *General project design.*
4 *Leachate Collection Pipe Detail (not used for sump calculation).*
5 *Maryland Department of Transportation, State Highway Administration, "Standard Specifications for Construction and Materials", July 2018, Table 901 A.*
6 *Leachate Sump Detail.*
7 *Personal correspondence with Dr. Robert Koerner.*

REFERENCE 2

pg 1/2

Table 1. Modification factors and reduction factors for geotextile protection material design using Equation 2, i.e., the "GRI-Method".

(a) Modification factors (all ≤ 1.0)

MF_s		MF_{PD}		MF_A	
Angular	1.0	Isolated	1.0	Hydrostatic	1.0
Subrounded	0.5	Dense, 38 mm	0.83	Geostatic, shallow	0.75
Rounded	0.25	Dense, 25 mm	0.67	Geostatic, mod.	0.50
		Dense, 12 mm	0.50	Geostatic, deep	0.25

(b) Reduction factors (all ≥ 1.0)

		RF_{CR}			
		Mass per unit area	Protrusion height (mm)		
RF_{CBD}		(gm/m^2)	38	25	12
Mild leachate	1.1	Geomembrane alone	N/R	N/R	N/R
Moderate leachate	1.3	270	N/R	N/R	>1.5
Harsh leachate	1.5	550	N/R	1.5	1.3
		1100	1.3	1.2	1.1
		>1100	≅ 1.2	≅ 1.1	≅ 1.0

Abbreviation: N/R = Not recommended

The design situation can be approached by using a given mass per unit area geotextile to determine the unknown FS-value, or from using a given FS-value to determine the unknown mass per unit area geotextile. Koerner (2005) gives numeric examples, and Valero and Austin (1999) present design charts for the many variables contained in the design equation. It might be noted that this method is the only design method that allows for direct selection of a geotextile protection material without the need for large scale trail-and-error experimental testing.

In Equation 2 the two terms "RF_{CBD}" and "RF_{CR}" are intended to extend the short term test results into a simulated long term performance behavior. Since HDPE is quite resistant to chemical and biological degradation, the term RF_{CBD} is comparatively small. The term RF_{CR}, however, is not small and in many cases a "not recommended" decision is suggested. Due to its importance in the overall design, a series of long term creep tests using this same methodology,

REFERENCE 2.
P9 2/2

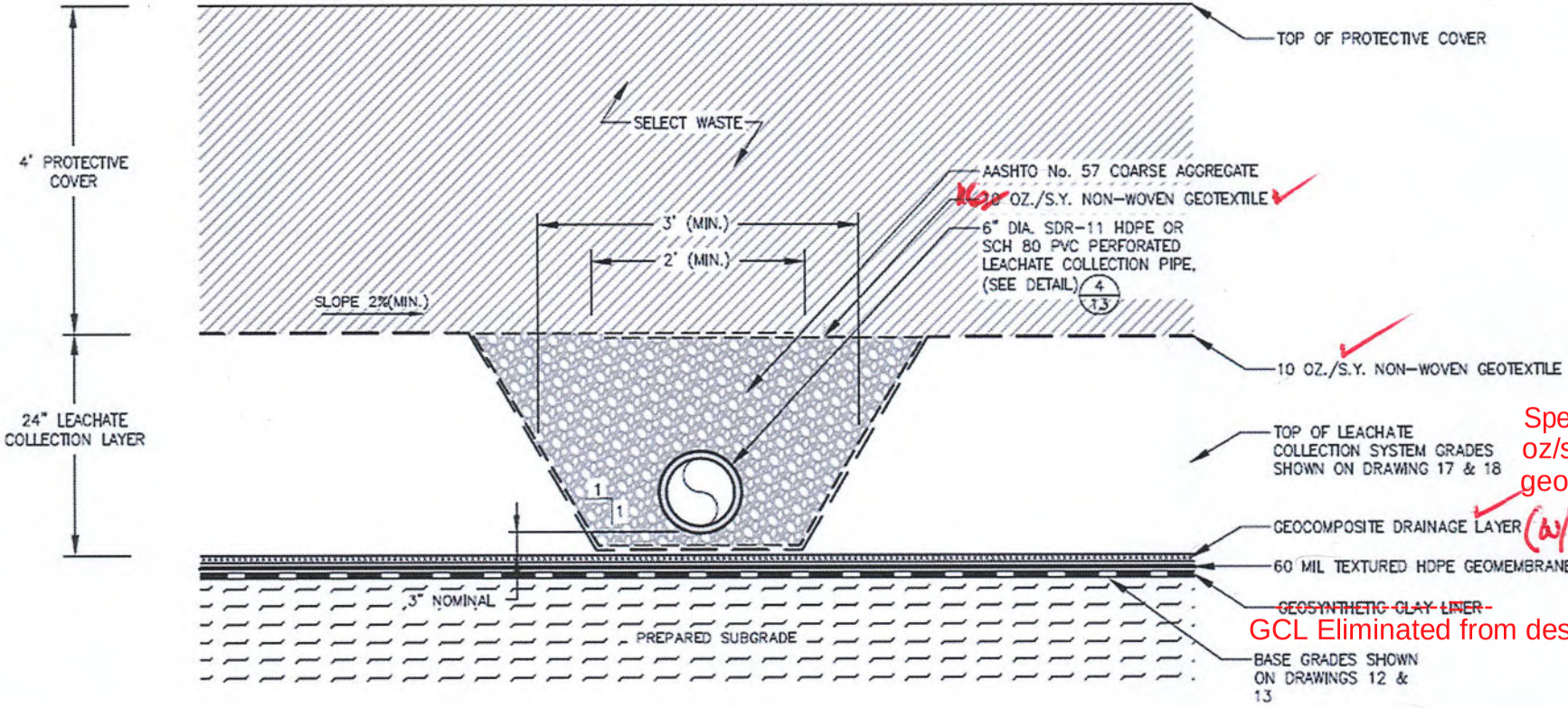
Table 3. Revised values for "RF_{CR}" to be used in Equation 2 for geotextile protection materials design.

Mass per unit area (g/m^2)	"RF_{CR}"-Values Protrusion Height (mm)		
	38	25	12
Geomembrane alone	N/R	N/R	N/R
270	N/R	N/R	N/R
550	N/R	N/R	>1.5
1100	N/R	1.5	1.3
>1100	1.3	1.2	1.1

Abbreviation: N/R = Not recommended

Lastly, the entry of ">1.5" for a 12 mm cone height associated with a 550 g/m^2 geotextile is felt to be appropriate considering the following items.

- The geotextiles used at present are made from polypropylene fibers versus the tested geotextiles which were made from polyester fibers. Since the specific gravity of PP is 0.91 and that of PET is between 1.22 and 1.38, one has from 25% to 34% more filaments in an equivalent mass per unit area geotextile using polypropylene fibers. This provides for considerably greater protection capability.
- The area of yield for the six $\simeq$ 12 mm cone heights was extremely small and the thicknesses of the remaining geomembrane was such that considerable deformation could still be sustained before break is even close to occurring.
- The ">1.5" recommendation is precisely for additional conservatism and safety and if a designer wishes to be more conservative than the new recommended table suggests he/she is free to do so.



Spec says 6 oz/sy min NW for geocomposite

(w/ 80z/sy NW)

GCL Eliminated from design

Reference 4

Reviewed by PGS 08/26/2021 PJ

1/20 **LEACHATE COLLECTION PIPE**

NOT TO SCALE

TOTAL NON-WOVEN GEOTEXTILE DIRECTLY BENEATH THE #57 STONE = (16 + 10 + 8) oz/sy = 34 oz/sy

REFERENCE 5
Pg 1/2

901 Aggregate

901.01

This Section includes the material details, quality requirements, and test methods applicable to aggregates. Grading requirements are outlined in Tables 901 A and 901 C; physical properties in 901 B and 901 D. Force drying may be used in the preparation of samples for grading tests conducted in the field.

TABLE 901 A
AGGREGATE GRADING REQUIREMENTS - T 27

MATERIALS	SIEVE SIZE															
	2-1/2"	2"	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 8	No. 10	No. 16	No. 30	No. 40	No. 50	No. 100	No. 200
	63 mm	50 mm	37.5 mm	25 mm	19 mm	12.5 mm	9.5 mm	4.75 mm	2.36 mm	2.0 mm	1.18 mm	600 µm	425 µm	300 µm	150 µm	75 µm
CRUSHER RUN AGGREGATE CR-6 (f)(g)	—	100	90-100	—	60-90	—	—	30-60	—	—	—	—	—	—	—	0-15
BANK RUN GRAVEL — SUBBASE	100	—	—	90-100	—	60-100	—	—	—	35-90	—	—	20-55	—	—	5-25
GRADED AGGREGATE — BASE DESIGN RANGE (a)	—	100	95-100	—	70-92	—	50-70	35-55	—	—	—	12-25	—	—	—	0-8
TOLERANCE (b)	—	(-)2	±5	—	±8	—	±8	±8	—	—	—	±5	—	—	—	±3 (c)
BANK RUN GRAVEL — BASE	100	—	—	85-100	—	60-100	—	—	—	35-75	—	—	20-50	—	—	3-20

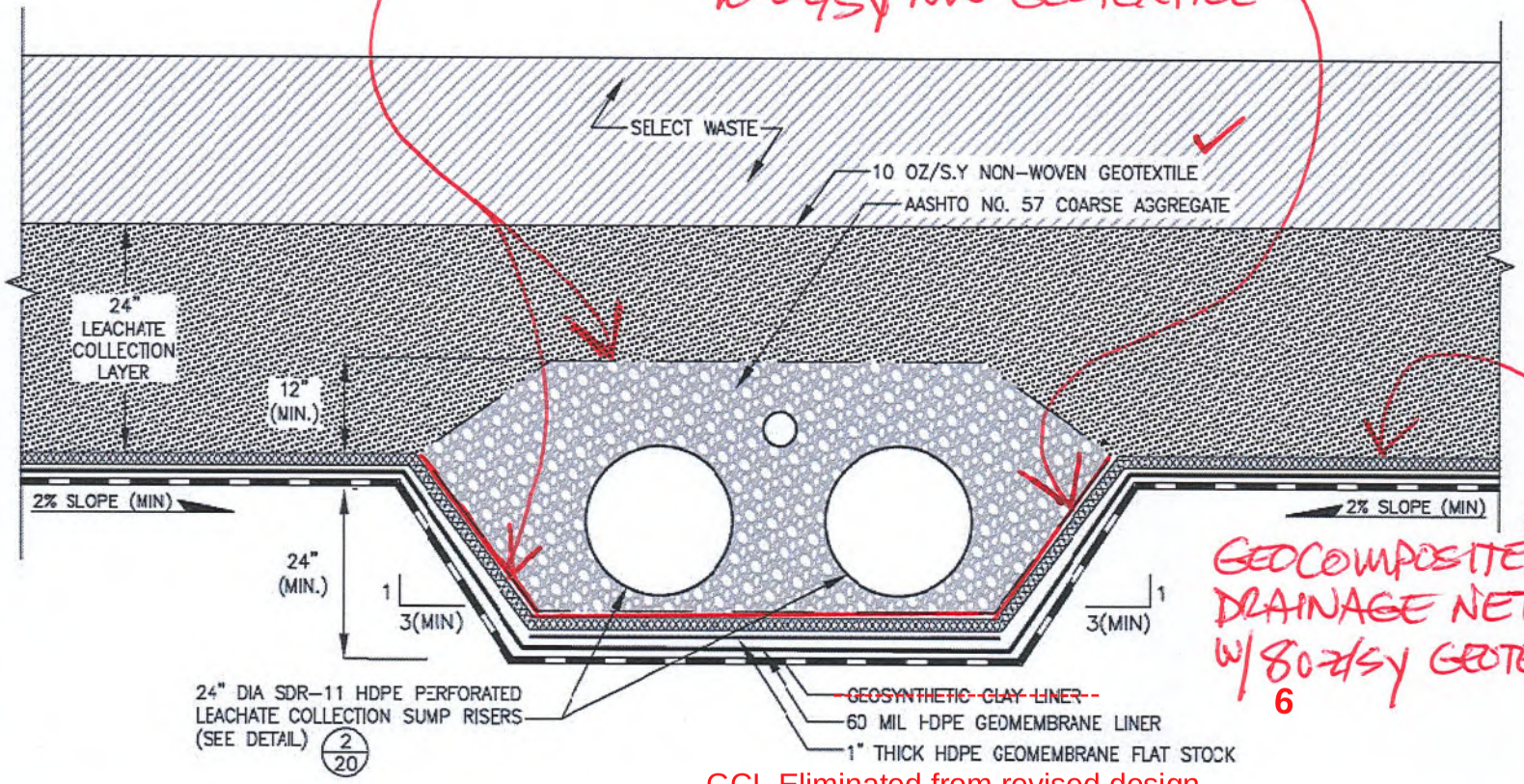
REFERENCE 5

pg 2/2

		1½"	1"	¾"	½"	⅜"	#4	#8	#10	#16	#30	#40	#50	#100	#200
COARSE AGGREGATE - PORTLAND CEMENT CONCRETE	57 and UNDER DRAIN (h)	—	—	100	95-100	—	25-60	—	0-10	0-5	—	—	—	—	—	—	—
	67	—	—	—	100	90-100	—	20-55	0-10	0-5	—	—	—	—	—	—	—
	7	—	—	—	—	100	90-100	40-70	0-15	0-5	—	—	—	—	—	—	—
FINE AGGREGATE — PORTLAND CEMENT CONCRETE, UNDERDRAIN, and PNEUMATIC MORTAR (d)		—	—	—	—	—	—	100	95-100	—	—	45-85	—	—	5-30	0-10	—
COARSE AGGREGATE — LIGHTWEIGHT PORTLAND CEMENT CONCRETE		—	—	—	100	90-100	—	10-50	0-15	—	—	—	—	—	—	—	—
FINE AGGREGATE — LIGHTWEIGHT PORTLAND CEMENT CONCRETE (d)		—	—	—	—	—	—	100	85-100	—	—	40-80	—	—	10-35	5-25	—
FINE AGGREGATE/SAND MORTAR and EPOXIES (d)		—	—	—	—	—	—	—	100	95-100	—	—	—	—	—	0-25	0-10
MINERAL FILLER		—	—	—	—	—	—	—	—	—	—	—	100	—	95-100	—	70-100

(a) To establish target values for design.

(b) Production tolerance.



GCL Eliminated from revised design.

B/20 **SECTION B-B' (LEACHATE COLLECTION SUMP)**

NOT TO SCALE

LEACHATE COLLECTION SUMP RISERS (SEE DETAIL) 2/20

60 MIL HDPE GEOMEMBRANE LINER
1" THICK HDPE GEOMEMBRANE FLAT STOCK

REFERENCE 6 PG 1/1

Reviewed by PGS 08/26/2021

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 9D

Liner System Stability

Revised by PGS 09/01/2021

Objective: **Note: Calcs. rerun by PGS 09/01/2021 to eliminate GCL**

The objective of this analysis is to evaluate the veneer stability of the liner and leachate collection system on the 3H: 1V (33%) interior sideslopes under drained conditions for static and dynamic loading. Undrained conditions were not evaluated as the design provides for open, free-drainage at the toe of bottom sideslopes along the perimeter of the landfill.

Design Approach and Assumptions:

1. Undrained conditions were not evaluated here as the design provides for open, free-drainage at the toe of interior sideslopes along the perimeter of the landfill.

2. The proposed liner and leachate collection system consists of the following components:

   4 ft Select Waste;
   Separation Geotextile (10 oz/sy NW-NP-GT);
   2 ft Leachate Collection Sand (SM);
   Geocomposite Drainage Layer (GDL) with NW-NP-GT both sides;
   Textured (on both sides) High Density Polyethylene (HDPE-T) Geomembrane; and
   Prepared Earthen Subgrade.

3. It was assumed that the soils and leachate collection sand have uniform properties: unit weight of 115 pcf, and internal friction angle of 28 degrees.

4. The following interface friction angle (δ) values were considered based on Reference 5:

   Protective Layer to NW-NW-GT: 27 deg;
   NW-NP-GT to SM soil: 27 deg;
   SM soil to GDN w/NW-NP-GT: 27 deg;
   GDN w/NW-NP-GT to HDPE-T: 26 deg;
   HDPE-T to GCL: 23 deg; and,
   HDPE-T to prepared Earthen Subgrade: 18 deg. Assumed cohesive soil Subbase saturated.
   HDPE-T to prepared Earthen Subgrade: 24 deg. Assumed granular soil Subbase.

   For design, a δ value of 18 deg was used. Interface friction testing must be performed for the actual subbase soil proposed to be utilized on the interior cell side slopes.

   Additionally, soil cohesion (c) was ignored to be conservative. Interface adhesion (c_a) was considered since the soil cover loading is great enough to expect interface contact between geosynthetic layers to be good. Reference 5 indicates a c_a value of 10 kPa (209 psf) could be

Revised by PGS 09/01/2021

associated with the HDPE-T to GCL interface. This analysis used a c_a value of 1 kPa (20.9 psf).

5. The target factors of safety (FS) against veneer instability are 1.5 for static and construction loading, and 1.0 for seismic loading. The target FS of 1.5 was adopted based on the assumption the site is for non-hazard waste and high in importance ranking.

6. From the USGS seismic map, the seismic coefficient (C_s, peak ground acceleration) at the site is approximately 0.065g. Reference 6 advocates the use of 0.5(C_s) for design.

7. Low ground pressure equipment is typically used for landfill construction over geosynthetics. This analysis assumes the CAT D6N LGP dozer, or similar, to be used in the construction.

8. Interface friction angles were taken from GRI Report #30 (Reference 5).

9. The analyses were performed following Koerner and Soong 2005 (Reference 1). Only drained conditions were considered as the leachate collection system is designed with key points of collection piping and GDL to prevent undrained conditions. The undrained conditions of horizontal seepage build up and parallel slope seepage buildup were not considered.

Calculations:

The summary of the calculated FS values is shown the following table:

Scenario	Target Factor of Safety, FS_{min}	8-ft Slope (Cohesive) Calculated Factor of Safety, FS	12-ft Slope (Cohesive) Calculated Factor of Safety, FS	68-ft Slope (Cohesive) Calculated Factor of Safety, FS	68-ft Slope (Granular) Calculated Factor of Safety, FS
Case 1. Static, Drained	1.5	**3.6**	**2.0**	**1.1**	**1.5**
Case 2. Dynamic, Drained, CAT D6N LGP Pushing Upslope	1.5	**2.1**	**1.7**	**1.1**	**1.5**
Case 3. Dynamic, Drained, CAT D6N LGP Pushing Downslope	1.5	**1.7**	**1.4**	**1.1**	**1.4**
Case 6. Dynamic, Drained, Seismic Loading	1.0	**1.5**	**1.5**	**0.7**	**1.0**

Color legend: **green** = acceptable; red = not acceptable.

Revised by PGS 09/01/2021

CONCLUSIONS:

Based on the foregoing, the following conclusions are presented:

1. The analysis indicates acceptable FS values at the proposed interior slope of the landfill with heights equal to or less than 12 feet ft. (1.5 lifts) for cohesive or granular soils. For all conditions except pushing waste down slope.

2. Slopes will be unstable for a cohesive soil Subbase at any height greater than 12 feet. This means that placement of the 2 ft. thick leachate collection layer and 4 ft. thick layer of select waste on the side slopes must be performed as waste placement progresses. Never allowing the difference in elevation between the top of the placed leachate collection and Select Waste layers, and the height of waste to be greater than 12 feet.

3. If permeability and interface friction testing between the textured HDPE and Subbase soil can produce a value of 24 degrees or greater while still meeting the permeability requirements, then the leachate collection layer and Select Waste layers on the side slopes in any of the proposed cells can be can be completed without the need for sequencing the construction with filling.

4. FS values under seismic loading were acceptable for each of the conditions evaluated except the 68 feet high slope constructed with cohesive subbase materials.

5. To successfully accomplish the construction and operation of the landfill with respect to the stability of the liner and leachate collection system, the materials used should meet or exceed the parameters used in this analysis.

References:

1. Koerner, R.M., and Soong, T.Y.; *"Analysis and Design of Veneer Cover Soils"*; Geosynthetics International, 2005, Vol. 12, No.1, p28-49.

2. Soong, T.Y, and Koerner, R.M.; *"Cover Soil Slope Stability Involving Geosynthetic Interfaces"*, GRI Report #18, 1996.

3. Koerner, R.M., and Daniel, D.; *"Final Covers for Solid Waste Landfills and Abandoned Dumps"*, 1997.

4. Soong, T.Y, and Koerner, R.M.; *"The Design of Drainage Systems over Geosynthetically Lined Slopes"*, GRI Report #19, 1997.

Revised by PGS 09/01/2021

5. Koerner, G.R., Narejo, D.; *"Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces"*; GRI Report #30, 2005.

6. U.S.E.P.A.; *"RCRA Substitute D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities"*; EPA/600/R-95/051, April, 1995.

7. United States Geologic Survey (USGS); *"Map of Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years"*, Oct. 2002.

ADVANCED GeoServices
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Project:	Chesapeake Terrace Design Revisions		
P.N.:	2018-3854	**Page:**	1 of 3
By:	PGS	**Date:**	09/01/21
Checked:		**Date:**	
Subject:	Liner System - Finite (Veneer) 68-ft Slope Analysis		

Description

Perform a finite (veneer) slope length analysis of the liner and leachate collection system. To estimate minimum inteface friction required to construct all side slopes layers (leachate collection and Select Waste) in any height cell without need for filling in sections.

Slope Information

Slope, β =	3	H to 1V =	18.4	deg	2β =	36.87	deg
Maximum Slope Length, L =	215	ft					
Height of Slope, H =	68	ft					

Materials

Cover Soil =	USCS Silty Sand, SM	
Cover soil thickness, h =	6	ft
Moist unit weight, γ_{moist} =	115	pcf
Saturated unit weight, γ_{sat} =	130	pcf
Internal friction angle, ϕ =	28	deg
Soil cohesion, c =	209	psf
Water unit weight, γ_w =	62.4	pcf
Textured Geomembrane =	60-mil HDPE-T	
Subbase =	Subbase	

Interface Friction Angles

Protective Cover Soil to NW-NP-GT, δ_4 =	27	deg
NW-NP-GT to Leachate Collection Layer, δ_5 =	27	deg
Leachate Collection Layer to GDN, δ_6 =	27	deg
GDN to HDPE-T, δ_7 =	26	deg
HDPE-T to Subbase Soil, δ_8 =	24	deg
All interface adhesion, c_a =	1	kPa

Use δ = 24 deg

Calc performed for δ_8 = 24, C=0.0 psf = 20.9 psf

Case 1: Static, Drained

sin β =	0.32	W_A =	135,972	lb/ft
tan β =	0.33	W_P =	6,900	lb/ft
cos β =	0.95	N_A =	128,995	lb/ft
$\sin^2\beta$ =	0.10	C_a =	4,096	lb/ft
sin 2β =	0.60	C =	0	lb/ft
tan ϕ =	0.53	a =	12,899	lb/ft
tan δ =	0.45	b =	-21,905	lb/ft
		c =	3,271	lb/ft

Minimum Factor of Safety, FSmin = 1.5

Factor of Safety, FS = 1.53

Case 2: Dynamic, Drained, Equipment Pushing Upslope

$\sin\beta$ =	0.32	W_A =	135,972	lb/ft	q =	685	lb/ft
$\tan\beta$ =	0.33	W_P =	6,900	lb/ft	We =	6,565	lb/ft
$\cos\beta$ =	0.95	N_A =	128,995	lb/ft	Ne =	6,228	lb/ft
$\sin^2\beta$ =	0.10	C_a =	4,096	lb/ft			
$\sin 2\beta$ =	0.60	C =	0	lb/ft			
$\tan\phi$ =	0.53	a =	42,761	lb/ft			
$\tan\delta$ =	0.45	b =	-72,249	lb/ft			
		c =	10,812	lb/ft			

Weight of Equipment, W_b =	39,112		
Length of Equipment Track, w =	10.2		
Width of Equipment Track, b =	2.8	Minimum Factor of Safety, FSmin =	1.5
Width-to-Thickness Ratio, b/h =	0.5	Factor of Safety, FS =	1.52
Influence Factor, I =	0.94		

Case 3: Dynamic, Drained, Equipment Pushing Downslope

$\sin\beta$ =	0.32	W_A =	135,972	lb/ft	q =	685	lb/ft
$\tan\beta$ =	0.33	W_P =	6,900	lb/ft	We =	6,565	lb/ft
$\cos\beta$ =	0.95	N_A =	128,995	lb/ft	Ne =	6,228	lb/ft
$\sin^2\beta$ =	0.10	C_a =	4,096	lb/ft	Fe =	985	lb/ft
$\sin 2\beta$ =	0.60	C =	0	lb/ft			lb/ft
$\tan\phi$ =	0.53	a =	43,695	lb/ft			
$\tan\delta$ =	0.45	b =	-72,414	lb/ft			
		c =	10,812	lb/ft			

Dozer-to-Gravity Acceleration Ratio, a/g =	0.15			
Acceleration of Dozer, a_d =	4.827	ft/s^2		
Anticipated speed =	15	mi/hr	Minimum Factor of Safety, FSmin =	1.5
=	24.1	km/h	Factor of Safety, FS =	1.49
Time to speed =	4	s		

Case 4: Static, Undrained, Horizontal Seepage Build-up to 1-ft Depth

$\sin\beta$ =	0.32	W_A =	140,859	lb/ft	Uv =	3,370	lb/ft
$\tan\beta$ =	0.33	W_P =	7,800	lb/ft	Uh =	1,123	lb/ft
$\cos\beta$ =	0.95	N_A =	136,414	lb/ft	Un =	-2,429	lb/ft
$\sin^2\beta$ =	0.10	C_a =	4,096	lb/ft			
$\sin 2\beta$ =	0.60	C =	0	lb/ft			
$\tan\phi$ =	0.53	a =	42,370	lb/ft			
$\tan\delta$ =	0.45	b =	-71,170	lb/ft			
		c =	10,901	lb/ft			

Height from Toe to Water, Hw =	1.0	ft		
Saturated Soil Unit Weight, γ_{sat} =	130	pcf	Minimum Factor of Safety, FSmin =	1.5
Horizontal Submergence Ratio, $HSR = Hw/H$ =	0.015		Factor of Safety, FS =	1.51

Case 6: Dynamic, Drained, Seismic Loading

$\sin \beta$ =	0.32	W_A =	135,264	*lb/ft*	
$\tan \beta$ =	0.33	W_P =	6,900	*lb/ft*	
$\cos \beta$ =	0.95	N_A =	128,323	*lb/ft*	
$\sin^2 \beta$ =	0.10	C_a =	4,096	*lb/ft*	
$\sin 2\beta$ =	0.60	C =	0	*lb/ft*	
$\tan \phi$ =	0.53	a =	46,624	*lb/ft*	482
$\tan \delta$ =	0.45	b =	-58,776	*lb/ft*	-459
Seismic coefficient, Cs =	0.065	c =	9,767	*lb/ft*	135
(0.5)Cs =	0.0325 *>>>Use (Reference 6)*				

Minimum Factor of Safety, FSmin = 1.0

Factor of Safety, FS = 1.06

References:

1 *Koerner, R.M., and Soong, T.Y.; "Analysis and Design of Veneer Cover Soils"; Geosynthetics International, 2005, Vol. 12, No.1, p28-49.*

2 *Soong, T.Y, and Koerner, R.M.; "Cover Soil Slope Stability Involving Geosynthetic Interfaces", GRI Report #18, 1996.*

3 *Koerner, R.M., and Daniel, D.; "Final Covers for Solid Waste Landfills and Abandoned Dumps", 1997.*

4 *Soong, T.Y, and Koerner, R.M.; "The Design of Drainage Systems over Geosynthetically Lined Slopes"; , GRI Report #19, 1997.*

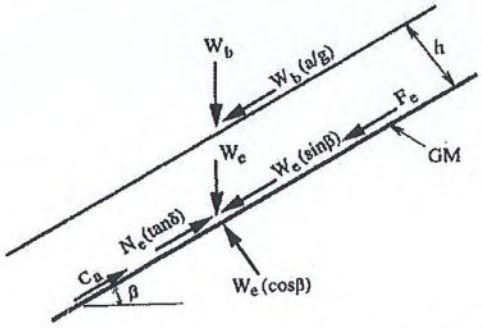
5 *Koerner, G.R., Narejo, D.; "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces"; GRI Report #30, 2005.*

6 *U.S.E.P.A.; "RCRA Substitute D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities"; EPA/600/R-95/051, April, 1995.*

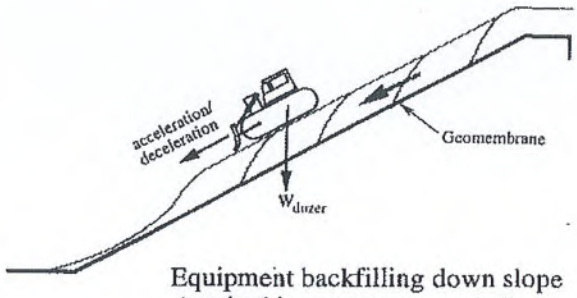
7 *Map of Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years, USGS Map, Oct. 2002.*

REFERENCE 1 pg 3/6

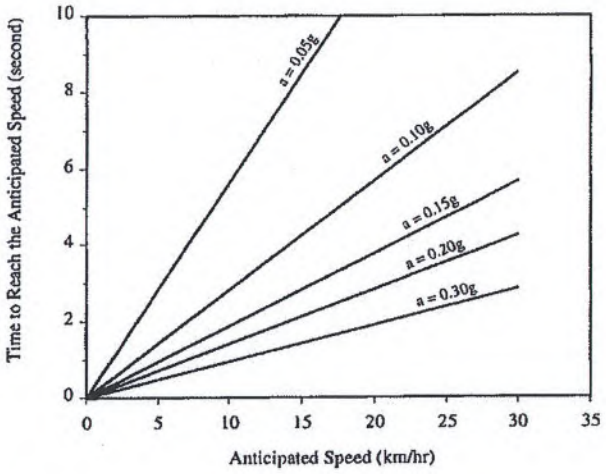
Case 3: Drained, Equipment Pushing Downslope



Equipment moving down slope
(load plus acceleration or deceleration)



Equipment backfilling down slope
(method is not recommended)



- W_A, W_P, N_A, Ca, C, and FS same as Case 1

- We, q, and Ne same as Case 2

$$F_e = W_e \cdot \left(\frac{a}{g}\right)$$

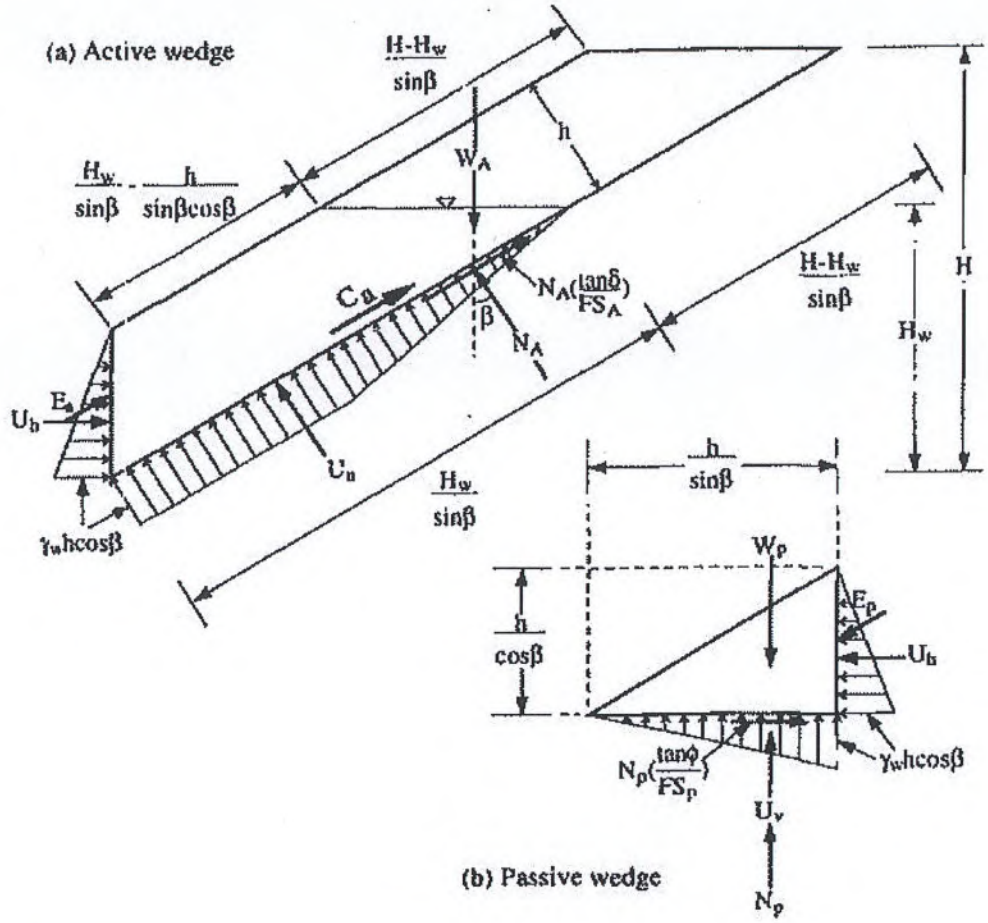
$$a = [(W_A + W_e) \cdot \sin\beta + F_e] \cdot \cos\beta$$

$$c = [(N_e + N_A) \cdot \tan\delta + C_a] \cdot \sin\beta \cdot \tan\phi$$

$$b = -\{[(N_e + N_A) \cdot \tan\delta + C_a] \cdot \cos\beta + [(W_A + W_e) \cdot \sin\beta + F_e] \cdot \sin\beta \cdot \tan\phi + (C + W_P \cdot \tan\phi)\}$$

REFERENCE1
pg 4/6

Case 4: Horizontal Seepage Build-up



$$W_A = \gamma_{sat} \cdot h \cdot \left(\frac{2 \cdot Hw \cdot \cos\beta - h}{\sin 2\beta} \right) + \gamma_{moist} \cdot h \cdot \left(\frac{H - Hw}{\sin\beta} \right)$$

$$W_P = \frac{h^2 \cdot \gamma_{sat}}{\sin 2\beta}$$

$$U_v = \frac{h^2 \cdot \gamma_w}{2 \tan\beta}$$

$$U_h = \frac{h^2 \cdot \gamma_w}{2}$$

$$U_N = \gamma_w \cdot h \cdot \cos\beta \cdot \left(\frac{2 \cdot Hw \cdot \cos\beta - h}{\sin 2\beta} \right)$$

$$N_A = W_A \cdot \cos\beta + U_h \cdot \sin\beta - U_N$$

- Ca, C, and FS same Case 1

$$a = W_A \cdot \sin\beta \cdot \cos\beta - U_h \cdot \cos^2\beta + U_h$$

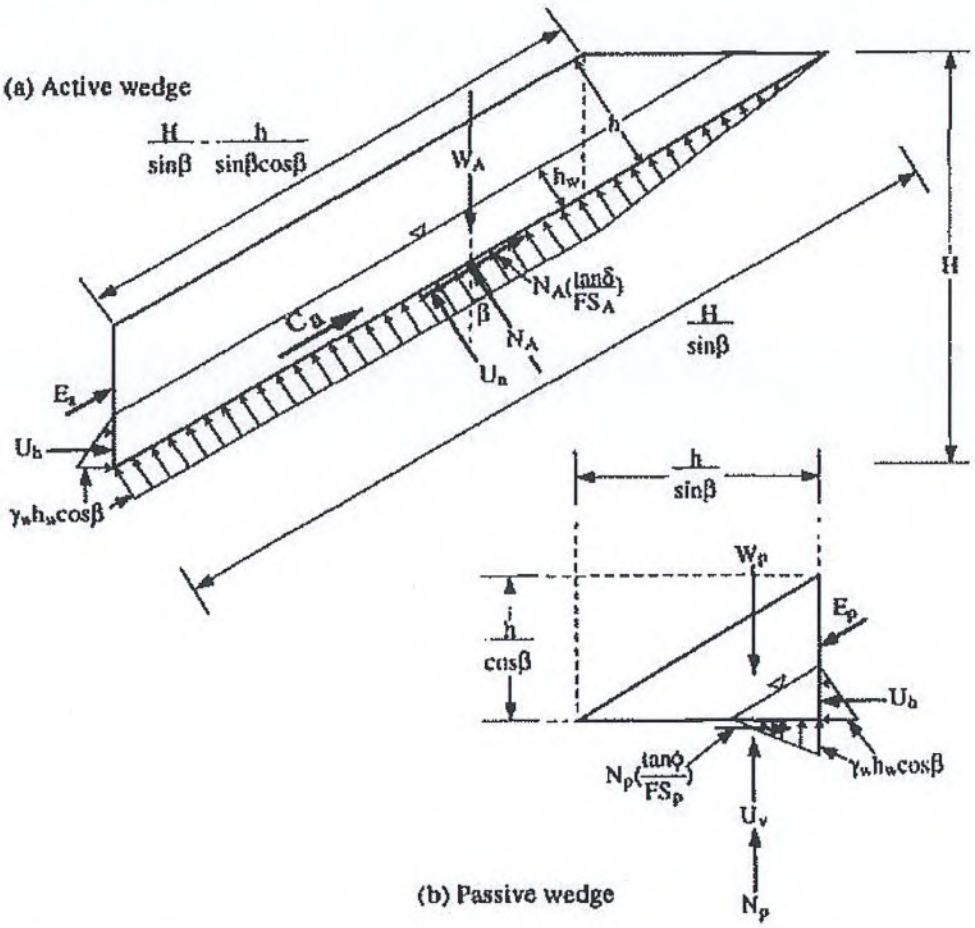
$$c = (N_A \cdot \tan\delta + C_a) \cdot \sin\beta \cdot \tan\phi$$

$$b = -W_A \cdot \sin^2\beta \cdot \tan\phi + U_h \cdot \cos\beta \cdot \sin\beta \cdot \tan\phi - (N_A \cdot \tan\delta + C_a) \cdot \cos\beta - [(W_P - U_v) \cdot \tan\phi]$$

- Koerner and Soong equations for a, b, and c are modified to include Ca.

REFERENCE 1 P95/6

Case 5: Parallel Seepage Build-up



$$W_A = \frac{\gamma_{moist} \cdot (h - h_w) \cdot \left[2H \cdot \cos\beta - (h + h_w) \right]}{\sin 2\beta} + \frac{\gamma_{sat} \cdot h_w \cdot (2H \cdot \cos\beta - h_w)}{\sin 2\beta}$$

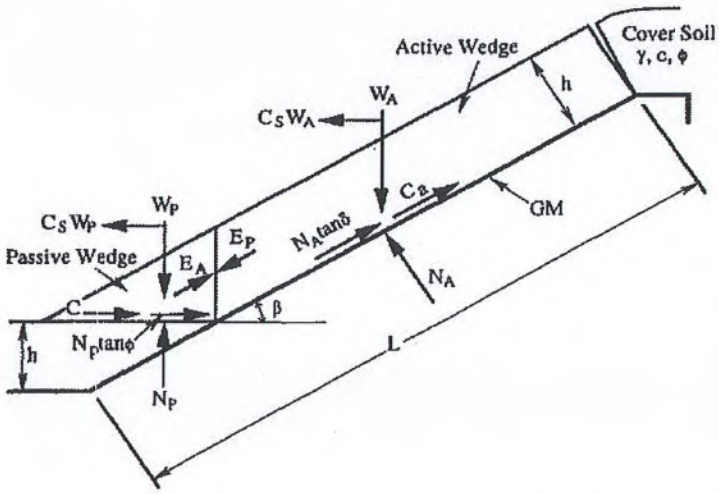
$$W_P = \frac{\gamma_{moist} \cdot (h^2 - h_w^{\,2}) + h_w^{\,2} \cdot \gamma_{sat}}{\sin 2\beta}$$

- Ca, C, and FS same as Case 1
- a, b, c, Uv, and NA same as Case 4

$$U_N = \frac{\gamma_w \cdot h_w \cdot \cos\beta \cdot (2H \cdot \cos\beta - h_w)}{\sin 2\beta}$$

$$U_h = \frac{\gamma_w \cdot h_w^{\,2}}{2}$$

Case 6: Drained, Seismic Affect



- Wa, Wp, Na, Ca, C, and FS same as Case 1

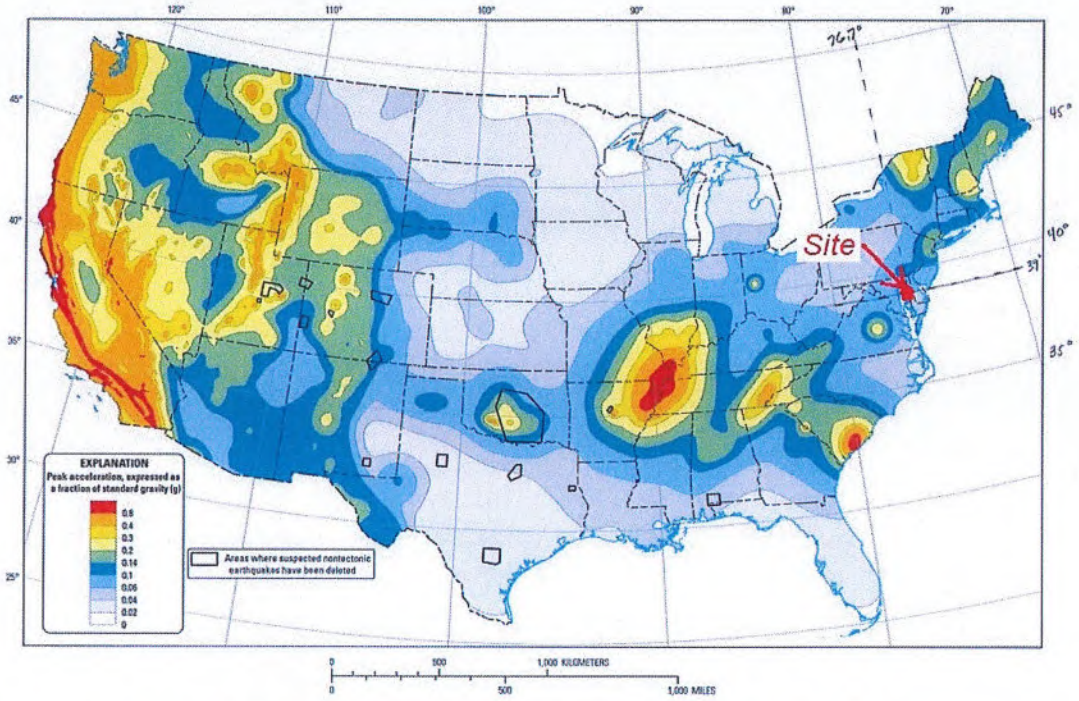
$$a = (C_s \cdot W_A + N_A \cdot \sin\beta) \cdot \cos\beta + C_s \cdot W_P \cdot \cos\beta$$

$$c = (N_A \cdot \tan\delta + C_a) \cdot \cos\beta \cdot \sin\beta \cdot \tan\phi$$

$$b = -[(C_s \cdot W_A + N_A \cdot \sin\beta) \cdot \sin\beta \cdot \tan\phi + (N_A \cdot \tan\delta + C_a) \cdot \cos^2\beta + (C + W_P \cdot \tan\phi) \cdot \cos\beta]$$

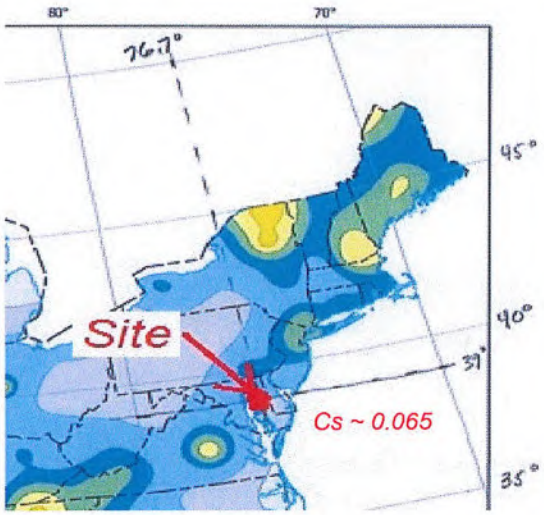
REFERENCE 7 Pg 1/2

Case 6: Drained, Seismic Affect (cont.)



Two-percent probability of exceedance in 50 years map of peak ground acceleration

https://earthquake.usgs.gov/hazards/hazmaps/



Approximate Site Location

Two-percent probability of exceedance in 50 years map of peak ground acceleration

https://earthquake.usgs.gov/hazards/hazmaps/

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Project: Chesapeake Terrace
P.N.: 2018-3854 **Page:** 1 of 1
By: JCA **Date:** 10-Oct-19
Checked: VEF **Date:** 7/14/20
Subject: Finite (Veneer) Slope Analysis -Equipment Data

Caterpillar Performance Handbook (Edition 32, October 2001)

Model	Unit	D4G LGP Hystat	D6R	D6R LGP	D7R LGP Series II	D8R	D9R	D10R	***D6N LGP*** [1]
Weight of Equipment, W_b	lb	17,877	40,400	45,600	60,300	82,850	107,670	144,200	***39,112***
Length of Equipment Track, w	in	80.9	103	128	125	126	137	153	***122.7***
	ft	6.7	8.6	10.7	10.4	10.5	11.4	12.8	***10.2***
Width of Equipment Track, b	in	25	22	36	36	22	24	24	***33.07***
	ft	2.1	1.8	3.0	3.0	1.8	2.0	2.0	***2.8***
Ground contact area, calculated	in^2	4,045	4,532	9,216	9,000	5,544	6,576	7,344	***8,115***
	ft^2	28.1	31.5	64.0	62.5	38.5	45.7	51.0	***56.4***
Ground contact area, from book	in^2	4,045	4,518	9,194	9,029	5,565	6,569	7,321	***8,122***
	ft^2	28.1	31.4	63.8	62.7	38.6	45.6	50.8	***56.4***
Ground pressures, from book	psi	4.11	8.82	4.94	6.55	14.67	16.08	19.63	***4.8***
	psf	592	1270	711	943	2112	2316	2827	***691***
Ground pressures, calculated	psi	4.42	8.91	4.95	6.70	14.94	16.37	19.64	***4.82***
	psf	636	1,284	713	965	2,152	2,358	2,827	***694***

Reference

1 *D6N track-type tractor product literature; www.cat.com.*

Appendix Table 1. Summary of interface shear strengths.

Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R^2	Fig. No.	δ (deg)	Ca (kPa)	Points	R^2
HDPE-S	Granular Soil	1a	21	0	162	0.93	1b	17	0	128	0.92
HDPE-S	Cohesive Soil										
	Saturated	1c	11	7	79	0.94	1d	11	0	59	0.95
	Unsaturated	1c	22	0	44	0.93	1d	18	0	32	0.93
HDPE-S	NW-NP GT	1e	11	0	149	0.93	1f	9	0	82	0.96
HDPE-S	Geonet	1g	11	0	196	0.90	1h	9	0	118	0.93
HDPE-S	Geocomposite	1i	15	0	36	0.97	1j	12	0	30	0.93
HDPE-T	Granular Soil	2a	34	0	251	0.98	2b	31	0	239	0.96
HDPE-T	Cohesive Soil										
	Saturated	2c	18	10	167	0.93	2d	16	0	150	0.90
	Unsaturated	2c	19	23	62	0.91	2d	22	0	35	0.93
HDPE-T	NW-NP GT	2e	25	8	254	0.96	2f	17	0	217	0.95
HDPE-T	Geonet	2g	13	0	31	0.99	2h	10	0	27	0.99
HDPE-T	Geocomposite	2i	26	0	168	0.95	2j	15	0	164	0.94
LLDPE-S	Granular Soil	3a	27	0	6	1.00	3b	24	0	9	1.00
LLDPE-S	Cohesive Soil	3c	11	12.4	12	0.94	3d	12	3.7	9	0.93
LLDPE-S	NW-NP GT	3e	10	0	23	0.63	3f	9	0	23	0.49
LLDPE-S	Geonet	3g	11	0	9	0.99	3h	10	0	9	1.00
LLDPE-T	Granular Soil	4a	26	7.7	12	0.95	4b	25	5.2	12	0.95
LLDPE-T	Cohesive Soil	4c	21	5.8	12	1.00	4d	13	7.0	9	0.98
LLDPE-T	NW-NP GT	4e	26	8.1	9	1.00	4f	17	9.5	9	0.96
LLDPE-T	Geonet	4g	15	3.6	6	0.97	4h	11	0	6	0.98
PVC-S	Granular Soil	5a	26	0.4	6	0.99	5b	19	0	6	0.99
PVC-S	Cohesive Soil	5c	22	0.9	11	0.88	5d	15	0	9	0.95
PVC-S	NW-NP GT	5e	20	0	89	0.91	5f	16	0	83	0.74
PVC-S	NW-HB GT	5g	18	0	3	1.00	5h	12	0.1	3	1.00
PVC-S	Woven GT	5i	17	0	6	0.54	5j	7	0	6	0.93
PVC-S	Geonet	5k	18	0.1	3	1.00	5l	16	0.6	3	1.00

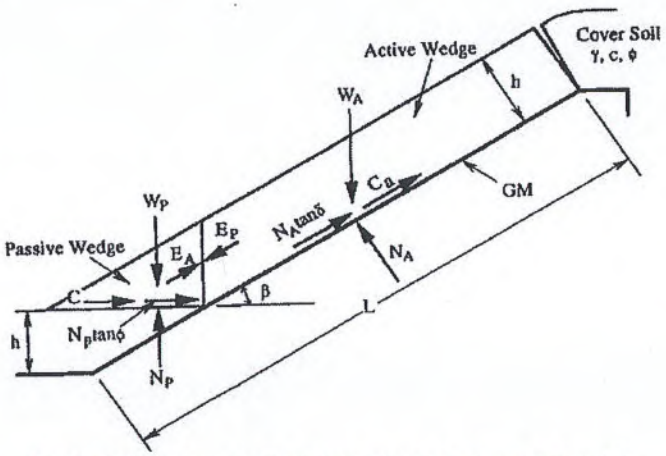
REFERENCE 5 pg 1/2

Appendix Table 1. (continued)

Interface 1*	Interface 2*	Peak Strength					Residual Strength				
		Fig. No.	δ (deg)	Ca (kPa)	Points	R^2	Fig. No.	δ (deg)	Ca (kPa)	Points	R^2
PVC-F	NW-NP GT	6a	27	0.2	26	0.95	6b	23	0	26	0.95
PVC-F	NW-HB GT	6c	30	0	8	0.97	6d	27	0	8	0.90
PVC-F	Woven GT	6e	15	0	6	0.78	6f	10	0	6	0.76
PVC-F	Geonet	6g	25	0	11	1.00	6h	19	0	11	0.99
PVC-F	Geocomposite	6i	27	1.1	5	1.00	6j	22	4.7	6	1.00
CSPE-R	Granular Soil	7a	36	0	3	1.00	7b	16	0	3	1.00
CSPE-R	Cohesive Soil	7c	31	5.7	6	0.71	7d	18	0	6	0.99
CSPE-R	NW-NP GT	7e	14	0	6	0.97	7f	10	0	6	0.98
CSPE-R	NW-HB GT	7g	21	0	3	1.00	7h	10	0	3	1.00
CSPE-R	Woven GT	7i	11	0	6	0.92	7j	11	0	3	1.00
CSPE-R	Geonet	7k	28	0	9	0.87	7l	16	0	9	0.80
NW-NP GT	Granular Soil	8a	33	0	290	0.97	8b	33	0	117	0.96
NW-HB GT	Granular Soil	8c	28	0	6	0.99	8d	16	0	6	0.91
Woven GT	Granular Soil	8e	32	0	81	0.99	8f	29	0	28	0.98
NW-NP GT	Cohesive Soil	9a	30	5	79	0.96	9b	21	0	28	0.79
NW-HB GT	Cohesive Soil	9c	29	0.9	15	0.71	9d	10	0	15	0.83
Woven GT	Cohesive Soil	9e	29	0	34	0.94	9f	19	0	16	0.86
GCL Reinforced (internal)	N/A	10a	16	38	406	0.85	10b	6	12	182	0.91
GCL (NW-NP GT) 8	HDPE-T	11a	23*	8	180	0.95	11b	13	0	157	0.90
GCL (W-SF GT)	HDPE-T	11c	18	11	196	0.96	11d	12	0	153	0.92
Geonet	NW-NP GT	12a	23	0	52	0.97	12b	16	0	32	0.97
Geocomposite 1,4,5, (NW-NP GT) 6,9	Granular Soil	13a	27*	14	14	0.86	13b	21	8	10	0.92

REFERENCE 5 PG 2/2

Case 1: Drained



Limit equilibrium forces in a finite length slope analysis for a uniformly thick cover soil.

$$W_A = \gamma_{moist} \cdot h^2 \cdot \left[\frac{L}{h} - \frac{1}{\sin\beta} + \frac{\tan\beta}{2} \right]$$

$$W_P = \frac{h^2 \cdot \gamma_{moist}}{\sin 2\beta} \qquad N_A = W_A \cdot \cos\beta$$

$$C_a = c_a \cdot \left(L - \frac{h}{\sin\beta} \right) \qquad C = \frac{c \cdot h}{\sin\beta}$$

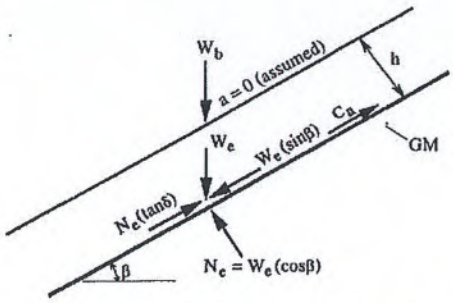
$$a = (W_A - N_A \cdot \cos\beta) \cdot \cos\beta$$

$$c = (N_A \cdot \tan\delta + C_a) \cdot \sin^2\beta \cdot \tan\phi$$

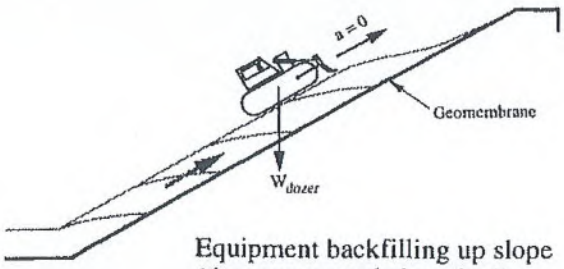
$$b = -[(W_A - N_A \cdot \cos\beta) \cdot \sin\beta \cdot \tan\phi + (N_A \cdot \tan\delta + C_a) \cdot \sin\beta \cdot \cos\beta + \sin\beta \cdot (C + W_P \cdot \tan\phi)]$$

$$FS = \frac{-b + \sqrt{b^2 - 4a \cdot c}}{2a}$$

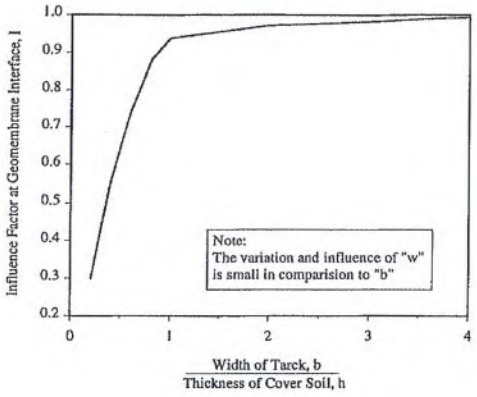
Case 2: Drained, Equipment Pushing Upslope



Equipment moving up slope
(load with no assumed acceleration)



Equipment backfilling up slope
(the recommended method)



- W_A, W_P, N_A, Ca, C, and FS same as Case 1

$$q = \frac{W_b}{(2 \cdot w \cdot b)}$$

$$W_e = q \cdot w \cdot I$$

$$N_e = W_e \cdot \cos\beta$$

$$a = [(W_A + W_e) \cdot \sin\beta] \cdot \cos\beta$$

$$c = [(N_e + N_A) \cdot \tan\delta + C_a] \cdot \sin\beta \cdot \tan\phi$$

$$b = -\{[(N_e + N_A) \cdot \tan\delta + C_a] \cdot \cos\beta + [(W_A + W_e) \cdot \sin\beta] \cdot \sin\beta \cdot \tan\phi + (C + W_P \cdot \tan\phi)\}$$

ADVANCED GeoServices

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ATTACHMENT 9E

Subgrade Bearing Capacity

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Bearing Capacity		
	Job No. 2018-3854	Made by: JCA	Date: 07/15/20
	Ref.	Checked by: VEF	Sheet 1 of 8

Reviewed by PGS 09/01/2021

These calculations were prepared for the maximum fill levels proposed in the July 2020 design submission. They are still acceptable for the reduced top of cap elevations because the load will be equal to or less than the previous calculated values.

1. Purpose

The purpose of this analysis is to estimate the bearing capacity of the soils beneath the landfill, and estimate the factor of safety when compared to the anticipated landfill loads.

2. Analysis Approach

Any discussion of bearing capacity invariably starts with a discussion of the work by Terzaghi and Peck. Terzaghi's bearing capacity formulae form the basis for nearly every treatise on foundation design and analysis. The initial application of Terzaghi's bearing capacity work was to the design of shallow foundations (strip or continuous, square, circular, etc.). It has become acceptable to apply Terzaghi's work to the bearing capacity of the subsoils beneath a landfill.

The approach used in this analysis is that used by Szypcio and Dolzyk (2006). Szypcio and Dolzyk calculated bearing capacity of layered subsoils based on Terzaghi's formula, and treated the layered subsoil as a homogenous layer with average parameters. For this analysis, the average parameters are weighted averages based on soil layer thicknesses and the depth below the landfill that would be expected to influenced bearing capacity. The applied bearing pressures due to the landfill were taken from the settlement analysis for this project. To be conservative, this analysis considers the minimum factor of safety for bearing capacity to be 3.

3. Bearing Capacity Points of Interest

Locations of approximate greatest waste thickness were chosen for the settlement analysis. Therefore, these locations were chosen for bearing capacity analysis. For Cell 13, this location is in close proximity to the upgradient end of the main leachate collection pipe in the cell. This location is designated as "Cell 13, Point 3" in the settlement analysis. In Cell 10, the location of greatest waste thickness is located along the main leachate collection pipe, between the sump and the upgradient end of the pipe. This location is designated as "Cell 10, Point 4" in the settlement analysis. These points were chosen for bearing capacity analysis.

The following table summarizes general data for these locations.

Cell and Point	Top of Landfill Elev. (ft)	Bottom of Landfill Elev. (ft)	Waste Depth [(a)] (ft)
Cell 10, Point 4	270	118	143
Cell 13, Point 3	202	94	99

Note (a): Cap and Cover thickness = 3 ft; Liner and Leachate Collection thickness = 6 ft.

At these locations, the soil profiles developed for the settlement analysis were used.

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4. Correlation of Soil Properties

a. Soil Unit Weight

The soil unit weight was correlated with the N-value from the Standard Penetration Tests (SPT) performed in the various borings at the site, as described in the settlement analysis. This correlation was defined as:

$$\text{Non-Cohesive Soils:} \quad \gamma = 0.001(N^3) - 0.0695(N^2) + 2.0802(N) + 89.265$$
$$\text{Cohesive Soils:} \quad \gamma = 0.0027(N^3) - 0.1536(N^2) + 3.8139(N) + 90.869$$

b. Cohesion

Cohesion for cohesive soils was estimated using the correlation presented by Kumar 2016 (after Karol 1960), as follows:

78 INAE Lett (2016) 1:77–84

Table 1 Ranges of SPT *N* value with cohesion for cohesive soils

SPT *N* value	>30	15–30	8–15	4–8	2–4	<2
Cohesion, kPa	192	96–192	48–96	24–48	12–24	12
Soil conditions	Hard	Very stiff	Stiff	Firm	Soft	Very soft

Data from Karol (1960)

This data was used in an Excel spreadsheet to develop the following equation:

$$c = 134.41(N) - 26.51$$

Where:

c = cohesion, psf; and,
N = resistance N-value from the SPT

A cohesion value was not calculated for non-cohesive soils.

c. Angle of Internal Friction

The angle of internal friction (phi angle), was estimated using the correlation presented by Kumar 2016 (after Terzaghi and Peck 1967), as follows:

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Table 3 Ranges of SPT *N* value with angle of friction

SPT N value	>50	30–50	10–30	4–10	0–4
Angle of friction, degree	>41	36–41	30–36	28–30	<28
Soil conditions	Very good	Good	Fair	Poor	Very poor

Data from Terzhagi and Peck (1967)

This data was used in an Excel spreadsheet to develop the following equation:

$$\phi = 0.2827(N) + 27.106$$

Where:

ϕ = angle of internal. Friction, deg; and,
N = resistance N-value from the SPT

An angle of internal friction value was not calculated non-cohesive soils.

5. Bearing Capacity

As indicated previously, this analysis follows Szypcio and Dolzyk (2006) in that bearing capacity of the layered subsoils is calculated based on Terzaghi's formula. The layered subsoil beneath the bottom of the landfill is treated as a homogenous layer with average unit weight, cohesion, and phi angle parameters. Furthermore, since groundwater is located relatively close to the bottom of the landfill, the unit weight was adjusted for the presence of groundwater.

a. Terzaghi's Formula

Terzaghi's formula for bearing capacity of a square footing was chosen since the shape of the landfill cells is approximately square and rectangular. The formula is given as:

$$q_u = 1.3cN_c + qN_q + 0.4\gamma BN_\gamma$$

Where:

q_u = ultimate bearing capacity of the soil below the foundation (landfill);
c = cohesion;
N_c , N_q , N_γ = bearing capacity factors for cohesion, overburden pressure, and unit weight;
q = overburden pressure;
γ = soil unit weight; and,
B = foundation (landfill cell) width.

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The bearing capacity factors Nc, Nq, and Nγ are taken from the following nomograph (Das 1990, after Terzaghi 1967):

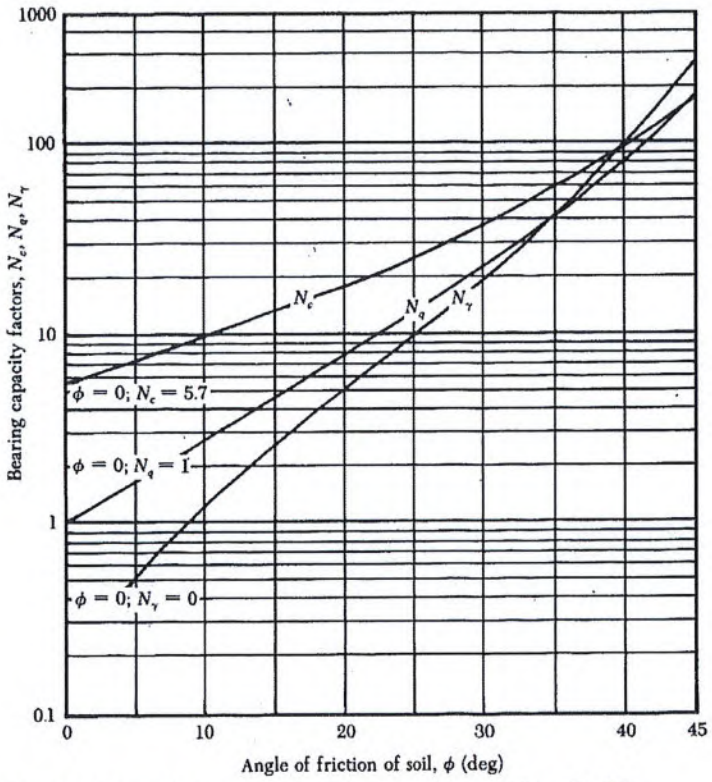


Figure 3.4 Terzaghi's bearing capacity factors for general shear failure—Eq. (3.3)

b. Multi-Layered Subsoils

For this analysis, the multi-layered subsoils within the soil thickness H were converted to a single, homogeneous soil layer having average parameters. The average parameters were weighted based on the thickness of the various soil layers. The parameters γ, c, and ϕ were averaged as follows:

$$\bar{x} = (t_1x_1 + t_2x_2 + \ldots + t_ix_i)/H$$

Where:

$\bar{x}$ = weighted average parameter;
$t_1, t_2, \ldots t_i$ = individual soil layer thicknesses;
$x_1, x_2, \ldots x_i$ = individual soil layer parameter; and,
H = summation of the individual soil layer thicknesses = $(t_1 + t_2 + \ldots + t_i)$.

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As a result of this weighted averaging, the soil beneath each landfill cell considered is modeled with single values for thickness (H), unit weight ($\overline{\gamma}$), cohesion ($\overline{c}$), and phi angle ($\overline{\phi}$).

c. Soil Thickness, H

In calculating the weighted average soil parameters, the total soil thickness under consideration must be established. The soils in the region are generally unconsolidated sediments that increase in thickness to more than 8,000 feet at the Atlantic Coastline.

Since this analysis treats the landfill cell as a "foundation", albeit flexible, the Boussinesq and Westergaard analyses of contours of equal vertical stress beneath a foundation on a semi-infinite, homogeneous substrata are chosen to provide guidance on the determination of the variable H. These analyses are presented by Sowers (1979), and consist of portions of the uniform foundation pressure at lateral and vertical locations relative to the center of the foundation, normalized as a function of the foundation width, B. The Boussinesq analysis considers an isotropic elastic solid. The Westergaard analysis considers thinly stratified material.

In theory, the depth an increase in vertical pressure influences is mathematically infinite. However, for purposes of this analysis, a depth where the increase in vertical pressure reduces to 10% of the applied pressure at the ground surface ($0.1q_o$) was considered a limit. The Boussinesq analysis suggests a depth of 2.1B, and the Westergaard analysis suggests a depth of 1.7B. A value of 2B was chosen for this analysis.

The widths of landfill Cells 10 and 13 are approximately 480 feet, and 500 feet, respectively. Depths equal to 2B would be 960 feet and 1,000 feet. The soil borings performed at the site extend vertically to, at most, about 200 feet below the ground surface. Therefore, the soil documented at the bottom of the boring(s) that were chosen to correspond with the bearing capacity points of interest was assumed to extend to the depth 2B.

The overburden pressure, q_o, is defined as:

$$q_o = \gamma D_f$$

Where:

D_f = embedment depth of the foundation (landfill cell); the depth below the surrounding ground elevation of the landfill bottom was used here.

d. Unit Weight Correction for Groundwater Presence

Vesic (1973), and others, prescribe correcting the soil unit weight for the presence of groundwater water at a depth z_w, when $z_w \leq B$. This indeed applies to this analysis. Therefore, effective unit weights were used when calculating the weighted average unit weight. The effective unit weight, γ', is given by:

$$\gamma' = \gamma - \gamma_w$$

Where:

γ = unit weight of soil; and,

γ_w = unit weight of water = 62.4 pcf.

6. Actual Bearing Pressures

Actual bearing pressures, q_{act}, (pressures at the bottom of the landfill) were taken from the settlement analysis. These values were calculated using the Osterberg (1957) nomograph for *Influence Values for Embankment Loading* (Das 1990, and many others). The following table summarizes the actual bearing pressures due to the landfill at the bearing capacity points of interest:

Cell and Point	Applied Bearing Pressure, q_{act} (psf)
Cell 10, Pt 4	8,003
Cell 13, Pt 3	5,828

7. Factor of Safety

The minimum factor of safety, FS_{min}, is defined as:

$$FS_{min} = q_u/q_{all}$$

Where:

q_u = ultimate bearing capacity, and,

q_{all} = maximum allowable bearing pressure.

Similarly, the actual factor of safety, FS_{act} is defined as:

$$FS_{act} = q_u/q_{act}$$

Where:

q_{act} = actual bearing pressure.

For this analysis:

$$FS_{act} \geq FS_{min} \qquad \text{and,} \qquad FS_{min} = 3$$

Reviewed by PGS 09/01/2021

8. General Analysis Steps

Based on the foregoing, the general analysis steps used are as follows:

a. Select the bearing point(s) of interest, and the associated soil profile(s);
b. Based on the cell dimensions, determine B;
c. Based on B, determine H;
d. Based on the design elevations, calculate Df;
e. Based on the N-value of each soil layer in the soil profile, estimate values for γ, c, and ϕ;
f. Based on the depth to groundwater in the soil profile, and the design elevations of the bottom of the landfill cell, calculate z_w;
g. Correct values if $z_w < B$;
h. Calculate weighted averages based on soil depth for γ, c, and ϕ;
i. Based on ϕ, estimate Nc, Nq, and Nγ;
j. Calculate q_u;
k. From the settlement analysis, determine q_{act}; and,
l. Determine FS_{act}, and confirm $FS_{act} > FS_{min}$.

9. Summary of Calculations

Based on the foregoing, the following table summarizes the bearing capacity-related calculations:

Cell, Pt	Cell 10 Pt 4	Cell 13 Pt 3
B (ft)	480	500
D_f (ft)	36	27
H (ft)	960	1,000
$\overline{\gamma}$ (pcf)	82.6	144.7
$\overline{c}$ (psf)	7,674	12,335
$\overline{\phi}$ (deg)	0.6	6.4
q_u (psf)	73,134	38,981
q_{act} (psf)	8,003	5,828
FS_{act}	8.1	7.4
FS_{min}	3	3

10. Evaluation and Conclusions

Based on the summary table in Section 9, all of the calculated FS_{act} values are greater than FS_{min}. Therefore, it is concluded that the subsoils beneath the landfill will provide adequate support for bearing.

11. References

1. Terzaghi, Karl, and Peck, Ralph B.; *"Soil Mechanics in Engineering Practice"*; John Wiley & Sons, Inc.; Ed. 2, 1967.

2. Szypcio, Zenon, and Dolzyk, Katarzyna; *"The Bearing Capacity of Layered Subsoil"*; Studia Geotechnica et Mechanica, Vol. XXVIII, No.1 , 2006; ; Wybrzeże Wyspiańskiego 27 Poland.

3. Kumar, Ranjan, *et al*; *"Estimation of Engineering Properties of Soils from Field SPT Using Random Number Generation"*; Indian National Academy of Engineering, 2016; Tables 1 and 3 (p 78 and 79).

4. Das, Braja M.; *"Principles of Foundation Engineering"*; PWS-Kent Publishing Company; Ed. 2, 1990; Fig. 3.4, p 125.

5. Sowers, George F.; *"Introductory Soil Mechanics and Foundations: Geotechnical Engineering"*, 4th Ed., 1979, Macmillan Publishing Co., Inc.; Figures 10.11 and 10.12 (p 457 and 458).

6. Vesic, Aleksander S.; *"Analysis of Ultimate Loads of Shallow Foundations"*; Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, Vol. 99, No. SM1, January 1973.

7. Project settlement analysis.

8. Project design information.

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Project:			
P.N.:	2018-3854	**Page:**	1 of 2
By:	JCA	**Date:**	7/12/2020
Checked:	USB	**Date:**	7/15/20
Subject:	Bearing Analysis - Cell 10, Point 4		

Description Analyze the ultimate bearing capacity, and the factor of safety against the actual bearing pressure beneath the landfill.

Soil Profile - Cell 10, Point 4

B = 480 ft ***Df =*** 36 ft

BOL	Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness t, (ft)	Average SPR (N_a)	Estimated Unit Weight γ (pcf)	Unit Weight of Water γ_w (pcf)	Estimated Effective Unit Weight γ' (pcf)	Estimated Cohesion c (psf)	Estimated Phi Angle ϕ (deg)
GW	1	Sand w/trace fines	116	110	6	37	121.7	0.0	121.7		37.6
	2	Sand w/trace fines	110	101	9	37	121.7	62.4	59.3		37.6
	3	Clay w/trace silt to Clay	101	-844	945	58	145.0	62.4	82.6	7,796	
				Total Depth =	***960***						

Weighted Average γ, c, and ϕ Values for Single Soil Layer

BOL	Soil Layer	Soil Description	Unit Weight t x γ	Cohesion t x c	Phi Angle t x ϕ
GW	1	Sand w/some silt and clay	730 ✓	0 ✓	225
	2	Sand w/some silt and clay	534 ✓	0 ✓	338
	3	Silt w/some clay	78,057 ✓	7,367,012 ✓	0
		Total Sum	*79,321*	*7,367,012*	*563*

Weighted Average Values for Design	
Weighted Average Effective Unit Weight, γ_{av} (pcf) =	82.6 ✓
= (t x γ total sum/total depth)	
Weighted Average Cohesion, c_{av} (psf) =	7,674 ✓
= (t x c total sum/total depth)	
Weighted Average Phi Angle, ϕ_{av} (deg) =	0.6 ✓
= (t x ϕ total sum/total depth)	

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Project:			
P.N.:	2018-3854	**Page:**	2 of 2
By:	JCA	**Date:**	7/12/2020
Checked:	DBJ	**Date:**	7/15/20
Subject:	Bearing Analysis - Cell 10, Point 4		

Bearing Capacity and Factor of Safety

Weighted Average Cohesion, c =	7,674	psf
Bearing Capacity Factor, N_c =	5.9	
Overurden Stress due to Df, q = γ x Df =	2,975	psf
Bearing Capacity Factor, N_q =	1.1	
Weighted Average Effective Unit Weight, γ =	82.6	pcf
Foundation Width, B =	480	ft
Bearing Capacity Factor N_γ =	0.16	
Ultimate Bearing Capacity, q_u (psf) =	64,670	psf
$q_u = 1.3cN_c + qN_q + 0.4\gamma BN_\gamma$		
Actual Bearing Pressure, q_{act} (psf) =	8,003	psf
Minimum Factor of Safety, FS_{min} =	3	
Actual Factor of Safety, FS_{act} =	8.1	

References

1 Terzaghi, Karl, and Peck, Ralph B.; *"Soil Mechanics in Engineering Practice"*; John Wiley & Sons, Inc.; Ed. 2, 1967.

2 Szypcio, Zenon, and Dolzyk, Katarzyna; *"The Bearing Capacity of Layered Subsoil"*; Studia Geotechnica et Mechanica, Vol. XXVIII, No.1 , 2006; ; Wybrzeże Wyspiańskiego 27 Poland.

3 Kumar, Ranjan, *et al*; *"Estimation of Engineering Properties of Soils from Field SPT Using Random Number Generation"*; Indian National Academy of Engineering, 2016.

4 Das, Braja M.; *"Principles of Foundation Engineering"*; PWS-Kent Publishing Company; Ed. 2, 1990.

5 Sowers, George F.; *"Introductory Soil Mechanics and Foundations: Geotechnical Engineering"*, 4th Ed., 1979, Macmillan Publishing Co., Inc.; Figures 10.11 and 10.12 (p 457 and 458).

6 Vesic, Aleksander S.; *"Analysis of Ultimate Loads of Shallow Foundations"*; Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, Vol. 99, No. SM1, January 1973.

7 project settlement analysis

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Project:			
P.N.:	2018-3854	**Page:**	1 of 2
By:	JCA	**Date:**	7/15/2020
Checked:	VEJ	**Date:**	7/15/20
Subject:	Bearing Analysis - Cell 13, Point 3		

Description Analyze the ultimate bearing capacity, and the factor of safety against the actual bearing pressure beneath the landfill.

Soil Profile - Cell 13, Point 3

B = 500 ft ***Df =*** 7 ft

BOL	Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight γ (pcf)	Unit Weight of Water γ_w (pcf)	Estimated Effective Unit Weight γ' (pcf)	Estimated Cohesion c (psf)	Estimated Phi Angle ϕ (deg)
	1	Sand w/silt & clay	90	85	5	5	99.8	0.0	99.8		28.5
	2	Silt w/sand, some gravel	85	81	4	29	138.1	0.0	138.1	3,871	
	3	Clay w/silt lenses	81	79	2	21	128.2	0.0	128.2	2,796	
	4	Sand w/clay lenses	79	75	4	53	145.0	0.0	145.0		42.1
GW	5	Clay w/sand & silt	75	71	4	28	136.5	0.0	136.5	3,737	
	6	Clay w/sand & silt	71	70	1	28	136.5	62.4	74.1	3,737	
	7	Sand w/thin clay layers	70	35	35	81	145.0	62.4	82.6		50.0
	8	Clay w/little silt & trace sand	35	-910	945	97	145.0	62.4	82.6	13,011	
				Total Depth =	***1000***						

Weighted Average γ, c, and ϕ Values for Single Soil Layer

BOL	Soil Layer	Soil Description	Unit Weight t x γ	Cohesion t x c	Phi Angle t x ϕ
	1	Sand w/silt & clay	499.0	0.0	142.6
	2	Silt w/sand, some gravel	552.6	15,485.5	0.0
	3	Clay w/silt lenses	256.5	5,592.2	0.0
	4	Sand w/clay lenses	580.0	0.0	2,230.7
GW	5	Clay w/sand & silt	546.0	14,947.9	0.0
	6	Clay w/sand & silt	136.5	3,737.0	0.0
	7	Sand w/thin clay layers	5,075.0	0.0	4,050.4
	8	Clay w/little silt & trace sand	137,025.0	12,295,640.7	0.0
		Total Sum	*144,671*	*12,335,403*	*6,424*

Weighted Average Values for Design	
Weighted Average Effective Unit Weight, γ_{av} (pcf) =	144.7
= (t x γ total sum/total depth)	
Weighted Average Cohesion, c_{av} (psf) =	12,335
= (t x c total sum/total depth)	
Weighted Average Phi Angle, ϕ_{av} (deg) =	6.4
= (t x ϕ total sum/total depth)	

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Project:			
P.N.:	2018-3854	**Page:**	2 of 2
By:	JCA	**Date:**	7/15/2020
Checked:		**Date:**	7/15/20
Subject:	Bearing Analysis - Cell 13, Point 3		

Bearing Capacity and Factor of Safety

Weighted Average Cohesion, c =	12,335	psf
Bearing Capacity Factor, N_c =	7.8	
Overurden Stress due to Df, q = γ x Df =	1,013	psf
Bearing Capacity Factor, N_q =	1.9	
Unit Weight, adjusted, γ =	144.7	pcf
Foundation Width, B =	81	ft
Bearing Capacity Factor N_γ =	0.67	
Ultimate Bearing Capacity, q_u (psf) =	37,346	psf
$q_u = 1.3cN_c + qN_q + 0.4\gamma BN_\gamma$		
Actual Bearing Pressure, q_{act} (psf) =	5,851	psf
Minimum Factor of Safety, FS_{min} =	3	
Actual Factor of Safety, FS_{act} =	6.4	

References

1 Terzaghi, Karl, and Peck, Ralph B.; *"Soil Mechanics in Engineering Practice"* ; John Wiley & Sons, Inc.; Ed. 2, 1967.

2 Szypcio, Zenon, and Dolzyk, Katarzyna; *"The Bearing Capacity of Layered Subsoil"* ; Studia Geotechnica et Mechanica, Vol. XXVIII, No.1 , 2006; ; Wybrzeże Wyspiańskiego 27 Poland.

3 Kumar, Ranjan, *et al* ; *"Estimation of Engineering Properties of Soils from Field SPT Using Random Number Generation"* ; Indian National Academy of Engineering, 2016.

4 Das, Braja M.; *"Principles of Foundation Engineering"* ; PWS-Kent Publishing Company; Ed. 2, 1990.

5 Sowers, George F.; *"Introductory Soil Mechanics and Foundations: Geotechnical Engineering"* , 4th Ed., 1979, Macmillan Publishing Co., Inc.; Figures 10.11 and 10.12 (p 457 and 458).

6 Vesic, Aleksander S.; *"Analysis of Ultimate Loads of Shallow Foundations"* ; Journal of the Soil Mechanics and Foundations Division, Proceedings of the American Society of Civil Engineers, Vol. 99, No. SM1, January 1973.

7 project settlement analysis

8 project drawings, and geotechnical data

GENERAL SOIL PROFILE: CELL 10 **, POINT** 4

REFERENCE 7 1/5

(NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
	270 (Top of Landfill)
Boring Profile: B-30	2' cap
	144' COD Waste
	6' Liner & Leachate collection system
	118 (Floor of Landfill)
TOG 116	2' fill Navg = 40
Sand w/ trace fines Navg = 37	▽ 110
101	
Clay w/ trace silt to clay Navg = 58	
56	

REFERENCE 7 2/5

65 EL. 116 ±

BORING NUMBER: B-30

DATE INSTALLED: 4-25-91
PROJECT: CHESAPEAKE RUBBLE FILL
SAMPLE METHOD: SPLIT SPOON DRILLING METHOD: HOLLOW STEM AUGER AND MUD
LOGGED BY: MARK SCHULTZ DRILLER: HARDIN-HUBER, INC

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
1	0 - 2	2-3-4-5 (10) (7)		SAND, med, little fn, tr clay, yellow-brown, moist
2	5 - 7	15-23-25-30 (15) (46)	5	SAND, as above
	Navg=37		10	
3	10-12	9-24-32-30 (24) (56)		SAND, med, little fn and little clay, yellow-brown, wet[a]
4	15-17	11-17-23-28 (22) (40)	15	CLAY, tr silt, red, moist
5	20-22	10-18-22-26 (24) (40)	20	CLAY, tr silt, gray-purple, moist
6	25-27	9-15-22-30 (24) (37)	25	CLAY, tr silt, red-gray, moist
7	30-32	15-17-19-25 (24) (36)	30	CLAY, tr silt, gray w/red, moist
	Navg=58		35	
8	35-37	10-14-18-20 (20) (32)		CLAY, tr silt, red w/gray mottles, slightly moist
9	40-42	30-45-70 (18) (100+)	40	CLAY (no silt), gray w/red mottles, slightly moist
10	45-47	50-60-65 (18) (100+)	45	CLAY, brown-red, slightly moist
11	50-52	14-35-45-51/5 (18) (80)	50	CLAY, brown, slightly moist
12	55-57	8-20-35-45 (20) (55)	55	CLAY, brown w/red, slight to tr moist
			60	

a. Rods wet at 10 feet.

REFERENCE 7 3/5

GENERAL SOIL PROFILE: CELL 13 **, POINT** 3

(NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
	202 Top of Landfill
Boring Profile: B-12	2' Cap
	100' CDD Waste
	6' Liner & Leachate Collection System
95	94 Floor of Landfill
Clay, Silt & clay w/ sand Navg = 11	
90	
Sand w/ some silt & clay Navg = 39	
85	
Sand w/ silt & clay Navg = 18	
73	
Sand w/ silt & few thin clay layers Navg =	▽ 72
52	
Clay w/ some sand Navg =	
23	
Clay & silt w/ sand Navg =	
15	

REFERENCE 7 4/5

TOP OF GROUND ≃ 97.0

BORING NUMBER: B-12

MONITOR WELLS: MW-4

DATE INSTALLED: 7-22-89
PROJECT: CHESAPEAKE RUBBLE FILL
SAMPLE METHOD: SPLIT SPOON DRILLING METHOD: HOLLOW STEM AUGER and MUD
LOGGED BY: GREG ADAMSON DRILLER: HARDIN-HUBER, INC

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches) (N)	Graphic Log	Description
1	0 - 2	3-3-4-6 (7) (16)		CLAY, little silt and sand, red-br-yellow
2	2.5-4.5	3-7-9-11 (16) (21)		16" SAND, fn & vf, tr silt & clay, rd-br-yellow 5" SILT and CLAY, little sand, yellow-red
	5'	(38)	5	
3	5 - 7	9-19-19-30 (17)		SAND, med, some fn, tr silt and clay, red-brown-lt tan
4	7.5-9.5	6-18-21-26 (40) (20)		8" SAND, as above 12" SAND, fn to vf, some silt, tr clay, lt tan-red-brown
	10'		10	
5	10-12	7-13-13-16 (26) (19)		SAND, med, some fn, tr silt, lt tan-red-brown
6	12.5-14.5	6-10-11-13 (21) (21)		SAND, fn and vf, little med, tr silt and clay, lt tan-red-brown
			15	
7	15-17	3-3-5-3 (8) (20)		SAND, as above, gray and red-brown, with 2" clay layer
8	17.5-19.5	3-5-11-24 (16) (18)		5" SAND, as above 13" CLAY, some silt, tr sand, gray
			20	
9	20-22 22'	3-5-16-24 (21) (17)		SAND, med, some fn, some silt and clay stringers, gray-red-brown-yellow
10	22.5-24.5	30-33-27-18 (60) (17)		8" GRAVEL, some sand, tr silt, red-brown 9" SAND, fn to vf, tr silt & clay, red-br-gray
			25	▽
11	25-27	5-20-41-51/5" (92) (24)		6" SAND, as above 6" CLAY, ltl silt, thin sand lenses, gray 8" SAND, med-fn, gray-rd-br, saturated
12	27.5-29.5	20-24-30-38 (54) (20)		10" CLAY, ltl sand and silt, gray-rd-br 10" SAND, med, ltl fn, tr silt & clay, gray
			30	
13	30-32	22-28-36-40 (64) (20)		SAND, as above, saturated
14	32.5-34.5	27-38-43-51 (81) (24)		SAND, as above
			35	
15	35-37	33-51/6" (100) (12)		SAND, as above
16	37.5-39.5	15-51/6" (100) (12)		SAND, as above
			40	

REFERENCE 7
5/5

BORING NUMBER: B-12 continued

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
			40	
17	40-42	4-14-51/5" (65) (8)		SAND, as above
18	42.5-44.5	45-51/3" (100) (8)		CLAY, little silt and sand, with thin sand lenses, mottled red-gray
			45	
19	45-47	14-45-48 (93) (18)		11" SAND, med and coarse, tr silt & clay, gray 7" CLAY, tr silt and sand, dense, gray
20	47.5-49.5	35-47-51/4" (98) (16)		CLAY, as above
			50	
21	50-52	33-51/4" (100) (0)		No recovery - drilled like clay
22	52.5-54.5	29-51/6" (100) (12)		CLAY, as above, mottled gray-red-br-purple
			55	
23	55-57	43-51/5" (100) (11)		CLAY, as above
24	57.5-59.5	34-51/5" (100) (0)		No recovery, drilled like clay
			60	
25	60-62	36-51/5" (100) (11)		CLAY, as above
26	62.5-64.5	41-33-42-47 (75) (21)		6" CLAY, as above 15" CLAY and SILT, little sand, gray
			65	
27	65-67	45-51/5" (100) (0)		No recovery
28	67.5-69.5	37-45-47-51/5" (96) (15)		CLAY, some silt, tr sand, red-br-gray
29	70-72	19-29-33-42 (62) (21)	70	10" CLAY, as above 5" CLAY & SILT, tr sand, mottled red-br-gray 6" SAND, vf, some silt, tr clay, gray
30	72.5-74.5	10-27-36-49 (63) (0)		No recovery
			75	
31	75-77	19-29-38-51/5" (67) (21)		7" SILT & vf SAND, tr clay, mott rd-br-gray 14" SILT & CLAY, little vf sand, red-br-gray
32	77.5-79.5	21-28-51/5" (79) (17)		SILT and CLAY, as above
			80	

Groundwater on the drill rods at 34 feet.

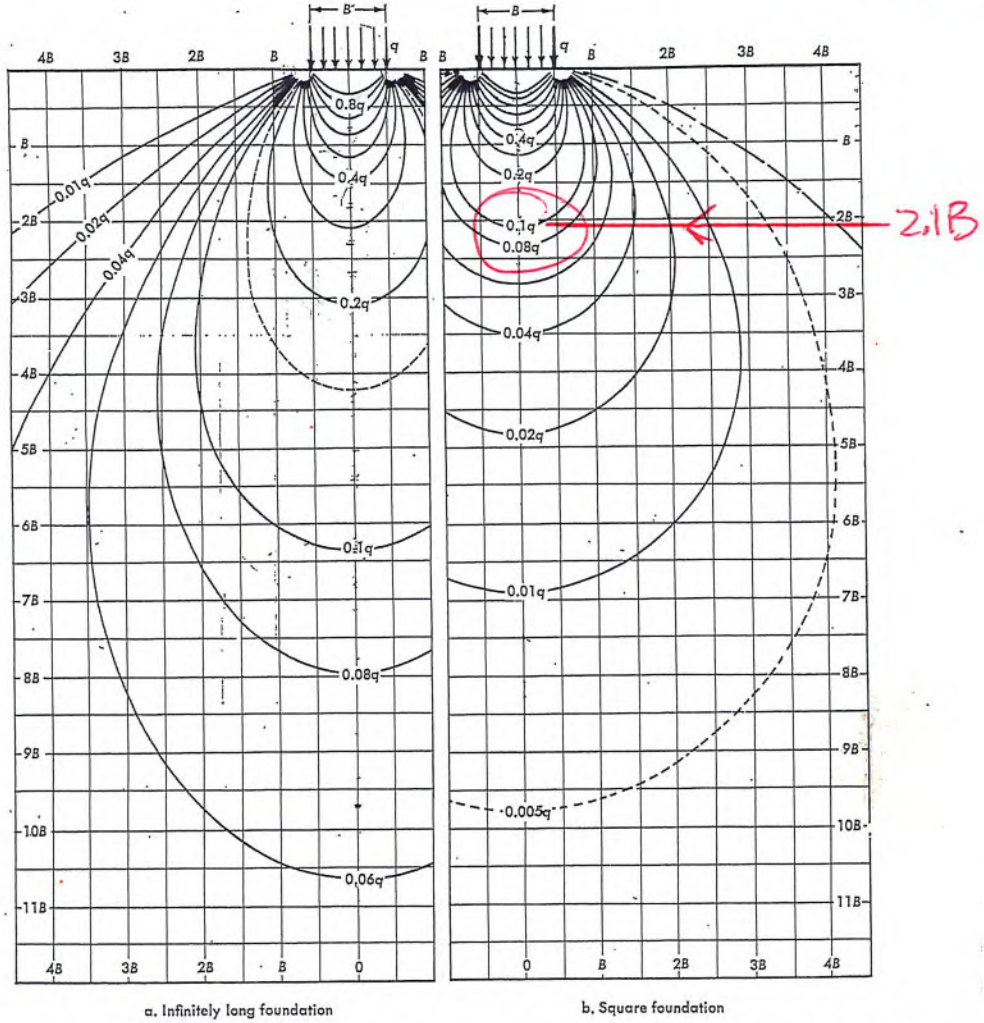


Figure 10.11 *Contours of equal vertical stress beneath a foundation on a semiinfinite, homogeneous, isotropic elastic solid—the Boussinesq analysis. Stresses are given as proportions of the uniform foundation pressure, q; distances and depths in terms of the foundation width, B.*

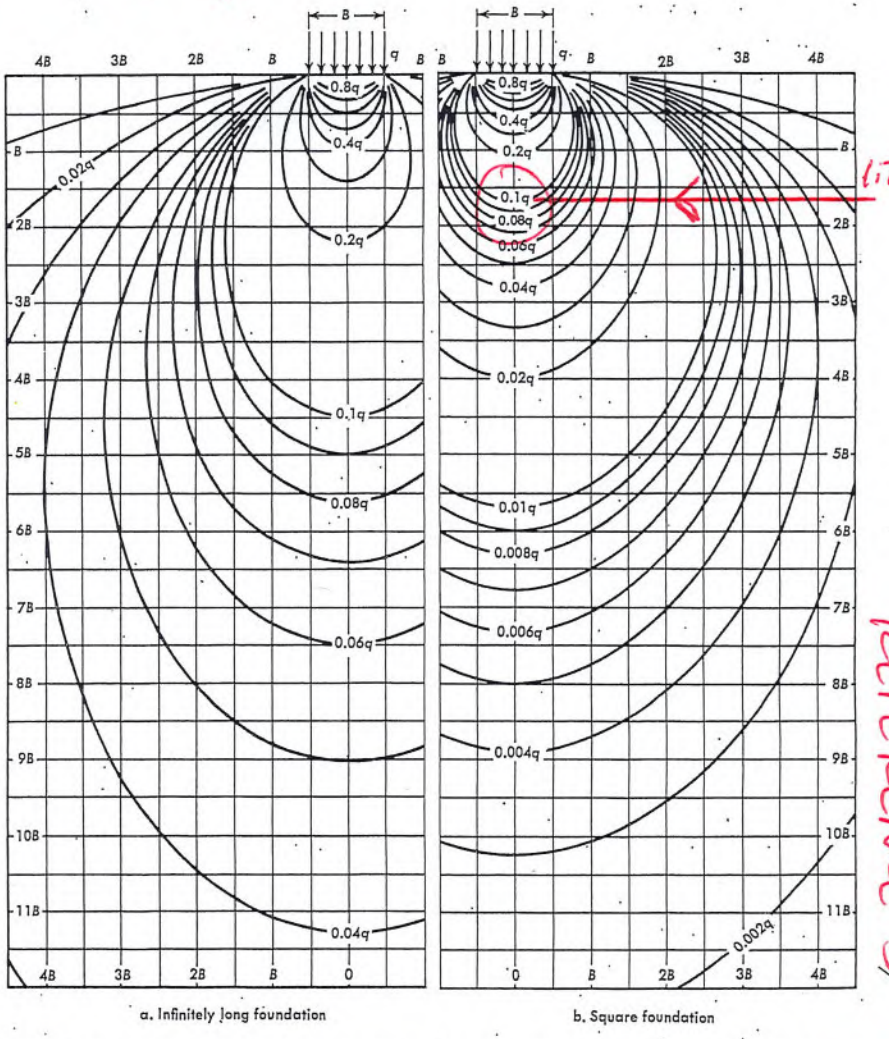


Figure 10.12 *Contours of equal vertical stress beneath a foundation on a semiinfinite, homogeneous, thinly stratified material—the Westergaard analysis. Stresses are given as proportions of the uniform surface pressure, q; distances and depths in terms of the foundation width, B.*

REFERENCE 4

1/1

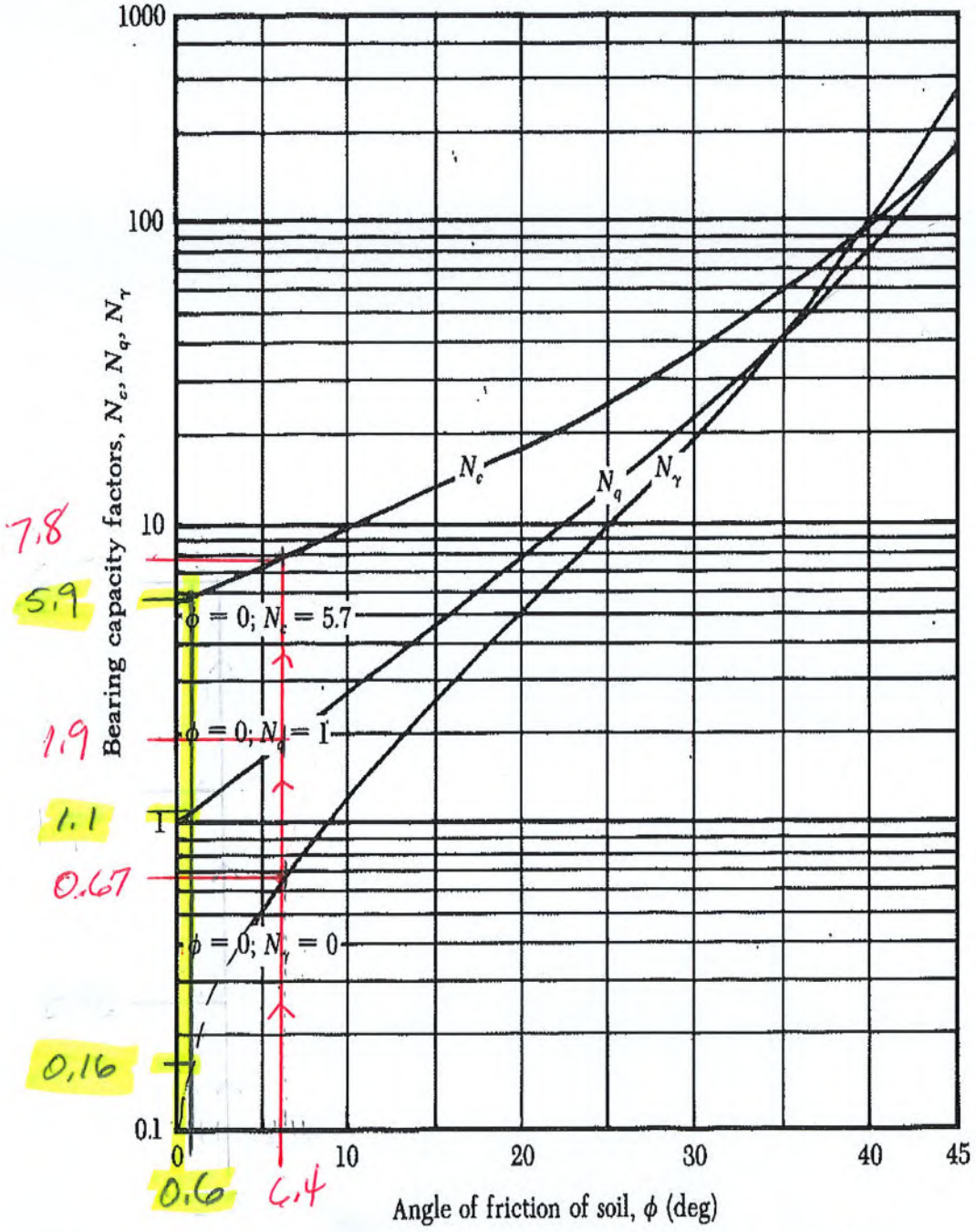


Figure 3.4 Terzaghi's bearing capacity factors for general shear failure—Eq. (3.3)

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ATTACHMENT 9F

Settlement

Reviewed by PGS 09/01/2021

Note: The revised design included lowering the maximum top of landfill elevations by from approximatly 272 ft to 226 ft, and reducing the top of cap side slopes from 3:1 to 4:1. As a result, these calculations over estimate the differential settlement and are considered more conservative.
Therefore these calculations are not being revised and the construction design slopes for the bottom of the landfill should still be constructed with 3% slopes

1. Purpose

The purpose of this analysis is to estimate the settlement of the constructed landfill due to consolidation of the underlying soils. Total and differential settlements are considered.

2. Analysis Approach

Settlement is commonly considered in design where structural foundation loads are expected to cause relative immediate and long-term consolidation of underlying compressible soils. Elastic (immediate) settlement occurs due to the rearrangement of soil particles due to the applied load, and is considered a relatively "immediate" response to an applied load. Consolidation settlement occurs over a longer period of time, and is due to the progressive relieving of pore water pressure and the reduction of void space. Elastic theory is applied to both cohesive and non-cohesive soils. Consolidation theory is applied only to cohesive soils.

In general, this analysis uses site-specific data and published empirical formulas to extrapolate soil characteristics across the site. Empirical formulas were modified slightly to more closely approximate site-specific soil characteristics. Two landfill cells were chosen for analysis - Cells 10 and 13. These cells have the greatest waste depth in each of the two waste disposal areas.

3. Laboratory Consolidation Tests

Three, one-dimensional consolidation tests were performed on relatively undisturbed samples of on-site clay soils. One sample was obtained from an area near boring MW-28 where the targeted clay soil was exposed at the ground surface due to past mining excavation. Two samples were obtained from clay soil layers in borings PMW-13 and PMW-23.

a. Discussion of Laboratory Consolidation Tests

1. Boring MW-28: This sample was cut from the clay soil exposed at the ground surface near MW-28. A bulk block sample was cut at a depth of approximately 2 to 4 feet below the ground surface. Due to the past surface mining activities in the area of MW-28, it is believed the clay layer sampled just at the ground surface was once at a similar depth below the ground surface as that occurring in Boring PMW-23. The soil exhibited the following characteristics:

    a. Void ratio = 0.499;
    b. Unit weight = 136.8 pcf; and,
    c. Standard Penetration Test (SPT) N-value (presumed from Boring MW-28) = 30.

    From the *e-log p* curve developed from the test data, and using Cassagrande's graphical

method (Holtz and Kovacs), the approximate likely effective pre-consolidation stress, α_p', was estimated to be 10.8 ksf. Additionally, the Compression Index (C_C) and Recompression Index (C_R), were estimated to be 0.039, and 0.028, respectively.

Based on a correlation of unit weight and N-value for cohesive soils (Terzaghi and Peck, University of Massachusetts, Sowers, others), an estimated unit weight of 139.9 pcf is suggested. This compares closely to the laboratory-measured unit weight of 136.8 pcf. See section 4.a for a discussion of relationship between N-value and soil unit weight.

2. Boring PMW-13: This sample was obtained in a clay layer at a depth of approximately 105' to 107' below the ground surface, and exhibited the following characteristics:

   a. Void ratio = 0.795; and,
   b. Unit weight = 125.1 pcf.

From the *e-log p* curve developed from the test data, and using Cassagrande's graphical method (Holtz and Kovacs), the approximate likely effective pre-consolidation stress was determined to be 9.5 ksf. Additionally, the Compression Index (C_C) and Recompression Index (C_R), were estimated to be 0.204, and 0.032, respectively.

Some inconsistencies were noted when comparing the field data, the laboratory data, and the suggested values from the N-value correlation, as follows:

a. SPT N-values of 58 and 46 were observed in Boring PMW-13 just above and below the sample depth. Based on a published correlation of unit weight and N-value for cohesive soils, estimated unit weights well in excess of 140+ pcf are suggested. This does not compare well with the laboratory-measured unit weight of 125.1 pcf.
b. Based on the N-value correlation and the laboratory unit weight of 125 pcf, an N-value of approximately 18 is suggested. This does not compare well with the N-values observed just above and below the sample of 58 and 46, respectively.
c. Based on the N-value correlation, the qualitative description of the consistency of cohesive soils having N-values of 46 and greater is "hard". A qualitative description of "very stiff" corresponds to an N-value of 18. However, the qualitative description of the sample consistency from the laboratory test is "soft (thumb will penetrate)".

Although field data and laboratory data are not expected to exactly match various empirical correlations, the magnitude of these inconsistencies suggest the sample tested was not representative of the targeted soil. Therefore, the PMW-13 test results were set aside, and not used in this analysis.

3. Boring PMW-23: This sample was obtained in a clay layer at a depth of approximately 128' to 130' below the ground surface, and exhibited the following characteristics:

   a. Void ratio = 0.574;
   b. Unit weight = 134.5 pcf; and,
   c. SPT N-Value = 27.

   From the *e-log p* curve developed from the test data, and using Cassagrande's graphical method (Holtz and Kovacs), the approximate likely effective pre-consolidation pressure, α_p', was determined to be 11.0 ksf. This is consistent with the value estimated for the sample tested from the ground surface near MW-28. Additionally, the Compression Index (C_C) and Recompression Index (C_R), were estimated to be 0.211, and 0.073, respectively.

   Based on a correlation of unit weight and N-value for cohesive soils, an estimated unit weight of 135.0 pcf is suggested. This compares very closely with the laboratory-measured unit weight of 134.5 pcf.

b. Overconsolidation Ratio

The Overconsolidation Ratio, OCR, is defined as the ratio of the estimated pre-consolidation stress to the estimated existing effective vertical stress, α_p'/α_{vo}' (Holtz and Kovacs). Soils that have OCR=1 are considered "normally consolidated" – that is, the existing vertical effective stress is the greatest stress the soil has ever experienced. Soils that have OCR >1 are considered "overconsolidated" – that is, the existing vertical effective stress is less than the greatest stress the soil has ever experienced.

Using the boring data, and the N-value correlation, the MW-28 soil profile suggests the existing vertical effective stress, α_{vo}', at that sample location is 274 psf. The overconsolidation ratio, OCR, is calculated to be (10,800/274) = 39.4. Similarly, using the boring data, and the N-value correlation, the soil PMW-23 soil profile suggests the existing vertical effective stress, α_{vo}', at that sample location is 14,910 psf. The overconsolidation ratio, OCR, is calculated to be (11,000/14,910) = 0.7.

*"... it is not impossible to find a soil that has an OCR < 1, in which case the soil would be **underconsolidated**. Underconsolidation can occur, for example, in soils that have only recently been deposited, either geologically or by man. Under these conditions, the clay layer has not yet come to equilibrium under the weight of the overburden load."*

Holtz and Kovacs, page 294

Recent geologic deposition and resulting underconsolidation is implied by the description of the soils in the Atlantic Coastal Plain Province by the Maryland Geological Survey, as follows:

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"The Atlantic Coastal Plain Province is underlain by a wedge of unconsolidated sediments including gravel, sand, silt, and clay, which overlaps the rocks of the eastern Piedmont along an irregular line of contact known as the Fall Zone. Eastward, this wedge of sediments thickens to more than 8,000 feet at the Atlantic coast line." (see http://www.mgs.md.gov/geology/)

Additionally, it is common knowledge that the property has been mined for sand and gravel in the past. Therefore, much earthwork has occurred which could very well have resulted in some soils experiencing an *underconsolidated* condition.

4. Correlation of Soil Properties

Various correlations of soil properties are used to extrapolate known site-specific data to soils across the site. The following sections describe the various correlations, and, if applicable, how they were modified for this analysis.

a. Standard Penetration Test Resistance and Unit Weight

The correlation between the Standard Penetration Test Resistance (N) and soil consistency was first given by Terzaghi and Peck (1948). Many geotechnical engineering texts have referenced this correlation, and have expanded on it by adding unit weight and other parameters. In general, each consistency category has a range of suggested N-values and a range of suggested unit weights. Some of the range of suggested unit weights "overlap" between consistency categories. Therefore, for this analysis, the correlation provided by the University of Massachusetts at Lowell (Ref. 6) was modified slightly so that each consistency category has a unique range of suggested soil unit weights. This correlation was modified to be defined as follows:

Description	N-Value	Unit Weight (pcf)
Non-Cohesive Soils – Relative Density		
Very Loose	0 – 4	90 - 95
Loose	5 – 10	96 – 105
Firm	11 – 20	106 – 110
Medium Dense	21 – 30	111 - 115
Dense	31 – 50	116 – 140
Very Dense	50+	140+
Cohesive Soils – Consistency		
Very Soft	0 – 2	90 – 100
Soft	3 – 4	101 – 105
Firm	5 – 8	106 - 110
Stiff	9 – 15	111 - 125
Very Stiff	16 – 30	126 – 140
Hard	30+	140+

This correlation was used to develop the following equations to calculate soil unit weight based on N-value:

$$\text{Non-Cohesive Soils:} \quad \gamma_s = 0.001N^3 - 0.0695N^2 + 2.0802N + 89.265$$
$$\text{Cohesive Soils:} \quad \gamma_s = 0.0027N^3 - 0.1536N^2 + 3.8139N + 90.869$$

The specific gravity, G_s, of soil is given by $G_s = \gamma_s/\gamma_w$, where γ_w is the unit weight of water (62.4 pcf). The soil unit weight, γ_s, can then be defined as:

$$\gamma_s = G_s(\gamma_w)$$

The laboratory consolidation test data indicate G_s values of 2.65 and 2.80 were assumed for non-cohesive and cohesive soils, respectively. These are indeed typical values.

The soil unit weight calculated using G_s is a "solid volume" unit weight - that is, the unit weight of soil with zero air voids. For non-cohesive soils, the solid volume unit weight is (2.65)(62.4)=165.4 pcf. Similarly, for cohesive soils, the solid volume unit weight is (2.80)(62.4)=174.7 pcf.

It is recognized these unit weights are not likely to exist for soil. However, there are many N-values from the standard penetration tests that would result in values of unit weights even greater than these if used in this 3rd order polynomial correlation. Noting that the upper value of unit weight from the N-value is designated as "140+", the unit weights calculated in this analysis from the N-value formulas were set to maximum values of 145.0 pcf for all soils.

b. Unit Weight and Void Ratio

Soils are presumed saturated for this analysis. The void ratio, e, is given by Das (1990):

$$e = (G_s(\gamma_w) - \gamma_s) / (\gamma_s - \gamma_w)$$

Considering the boring MW-28 data, a G_s value of 2.80, and a γ_s of 136.8, an e value of 0.510 is calculated. The actual void ratio, e_o, of this sample was 0.499. Similarly, using the boring PMW-23 data, a G_s value of 2.80, and a γ_s of 134.5, an e value of 0.558 is calculated. The actual void ratio, e_o, of this sample is 0.574. The e value of soils in this analysis is calculated from this equation, based on soil unit weight.

c. Void Ratio and Coefficient of Compression

As indicated in Section 3.a, the soil samples used in the laboratory consolidation tests exhibited the following characteristics:

1. MW-28 (N=27, depth = 2'-4', OCR=39.4):
   Void ratio = 0.499
   Compression Index, C_C = 0.039

2. PMW-23 (N=30, depth = 128'-130', OCR=0.7)
   Void ratio = 0.574
   Compression Index, C_C = 0.211

Several empirical formulas (Al-Khafaji, *et al*) were compared to this laboratory data to assess the correlation between void ratio and compression index, as follows:

Equation	Applicability	Reference
$C_c = 0.40(e_o - 0.25)$	All natural soils	Azzouz *et al.* 1976
$C_c = 1.15(e_o - 0.35)$	All clays	Nishida 1956 (a)
$C_c = 0.54(e_o - 0.35)$	All natural soils	Nishida 1956 (b)
$C_c = 0.75(e_o - 0.50)$	Soils of very low plasticity	Sowers 1970
$C_c = 0.156e_o + 0.0107$	All clays	Bowles 1989

Sample	Void Ratio	C_C Lab	C_C Azzouz 1976	C_C Nishida (a) 1956	C_C Nishida (b) 1956	C_C Sowers 1970	C_C Bowles 1989
MW-28	0.499	0.039	0.100	0.171	0.080	-0.001	0.588
PMW-23	0.574	0.211	0.130	0.258	0.121	0.056	0.674

This comparison indicates the Nishida (b) 1956 formula gives the closest calculated value based on void ratio for the overconsolidated sample (MW-28). Similarly, the Nishida (a) 1956 formula gives the closest calculated value based on void ratio for the underconsolidated sample (PMW-23). The only mathematical difference in the two Nishida equations is the multiplier of 1.15 or 0.54. This analysis used an average multiplier of 0.875, so that the void ratio to compression index is given as:

$$C_C = 0.875(e_o - 0.35)$$

Note that as void ratio decreases, C_C also decreases. It is mathematically possible the calculated C_C value could be equal to or less than zero. In this instance, the soil layer will be interpreted as being incompressible.

d. Coefficient of Compression and Coefficient of Recompression

As indicated in Section 3.a, the soil samples used in the laboratory consolidation tests exhibited the following characteristics:

1. MW-28 (N=27, depth = 2'-4', OCR = 39.4)
   Compression Index, $C_C = 0.039$
   Recompression Index, $C_R = 0.028$

2. PMW-23 (N=30, depth = 128'-130', OCR = 0.7)
   Compression Index, $C_C = 0.211$
   Recompression Index, $C_R = 0.073$

The recompression index, C_R, is compared to the compression index, C_C, to assess the correlation between them. For the overconsolidated sample (MW-28), the ratio of C_C to C_R is given as (0.039/0.028) = 1.39. Similarly, for the underconsolidated sample (PMW-23), the ratio of C_C to C_R is given as (0.211/0.073) = 2.89. For this analysis, an average value of 2.14 was used so that the C_C to C_R ratio is written as:

$$C_C/2.14 = C_R = 0.47C_C$$

It is noted that when C_C is equal to or less than zero C_R is also equal to or less than zero. In this instance, the soil layer will be interpreted as being incompressible.

e. Summary of Soil Property Correlations

Based on the foregoing, the formulas used to estimate soil characteristics for this settlement analysis are as follows:

Non-Cohesive Soils: $\gamma_s = 0.001N^3 - 0.0695N^2 + 2.0802N + 89.265$
$G_S = 2.65$ $\gamma_{smax} = 145$ pcf

Cohesive Soils: $\gamma_s = 0.0027N^3 - 0.1536N^2 + 3.8139N + 90.869$
$G_S = 2.80$ $\gamma_{smax} = 145$ pcf
$C_C = 0.875(e_o - 0.35)$
$C_R = 0.47C_C$

5. Settlement Locations and Points of Interest

a. Locations - Cells

The landfill comprises 20 disposal cells. Cells 10 and 13 were chosen for the settlement analysis.

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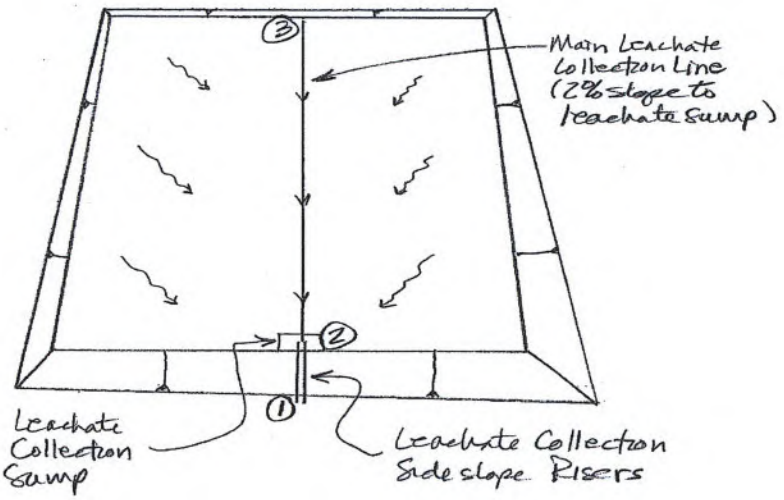
These cells have the greatest waste thickness in each of the west and east landfill areas, respectively.

b. Points of Interest

The settlement points of interest are located at three to four places in each cell:

1. Top of ground at the landfill edge;
2. Toe of interior slope at the leachate collection sump;
3. Highest point along the main leachate collection line in the cell; and,
4. An additional location if the point of greatest waste thickness is not located over Point 3.

Total and differential settlement are calculated and evaluated for the impact they may have on the constructed facility. As an example, the following schematic shows the general location of these points of interest.



c. Soil Profiles

For each settlement point of interest, an existing boring was chosen to represent the underlying soil profile. In some cases, settlement points of interest shared the same soil profile due to the proximity to each other.

The following is a list of the borings chosen for each settlement point of interest:

Cell / Point	Boring	Cell / Point	Boring
10/1	B-105	13/1	B-13
10/2	B-105	13/2	B-13
10/3	B-104/MW-18	13/3	B-12
10/4	B-30		

Each boring generally had many soil layers identified from the field activities. For the purpose of this analysis, the soil layers in each boring were grouped to reduce the number of layers needed for analysis. For each layer group, a general description was chosen, and the N-values were averaged. This allowed the grouped layers to be modeled with a total layer thickness, average N-value, and average unit weight.

d. Effective Pre-consolidation Stress

Since the soils are generally and broadly considered to be underconsolidated, and recent mining activities have likely changed the vertical stresses across most of the site, this analysis assumes the existing conditions are "normally consolidated". This sets the estimated existing effective vertical stresses as the effective pre-consolidation stresses.

6. Load Application

The loads applied are structural fill and the construction demolition and debris (CDD) waste.

a. Structural Fill

In some areas, structural fill is needed to achieve the desired final grades. For the purposes of this analysis, this was incorporated as an additional soil layer in the soil profile with an N-value of 40, and a unit weight of 145 pcf. The effect of the applied load, however, is taken into account in the settlement calculations.

b. CDD Waste

The landfilling of the CDD waste is modeled as an embankment fill. The effect on the underlying soil profile was modeled using the Osterberg 1957 (Das) nomograph for *Influence Values for Embankment Loading*. The following figures depict the Osterberg nomograph and the embankment loading diagram.

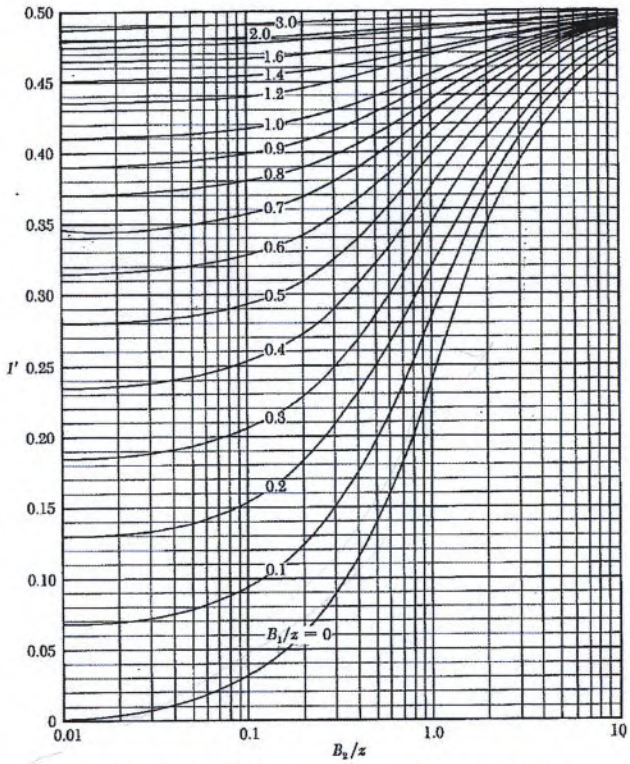


Figure 3.40 Influence value of I' for embankment loading (after Osterberg, 1957)

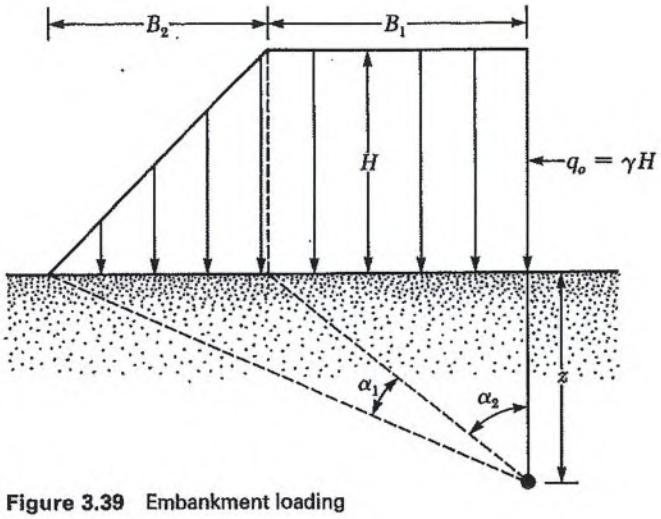


Figure 3.39 Embankment loading

In the nomograph, the I' value is a function of B_1/z and B_2/z, and the increase in vertical stress is given by $p_o = q_o I'$. Das (1990) provides equations for using the Osterberg nomograph that allow the efficient use of a spreadsheet for repetitive calculations, as follows:

$$\Delta p = \frac{q_o}{\pi}\left[\left(\frac{B_1 + B_2}{B_2}\right)(\alpha_1 + \alpha_2) - \frac{B_1}{B_2}(\alpha_2)\right] \quad (3.97)$$

where $q = \gamma H$
γ = unit weight of the embankment soil
H = height of the embankment

$$\alpha_1 \text{ (radians)} = \tan^{-1}\left(\frac{B_1 + B_2}{z}\right) - \tan^{-1}\left(\frac{B_1}{z}\right) \quad (3.98)$$

$$\alpha_2 = \tan^{-1}\left(\frac{B_1}{z}\right) \quad (3.99)$$

Since the original Osterberg nomograph is a semi-log relationship, Das' equations require B_1 and B_2 to be greater than zero. Therefore, for instances where these values are indeed equal to zero, a value of 0.01 was used.

c. Landfill Components

Landfill Component	Value
Cap and Cover Soil Thickness (ft)	3
Unit Weight, γ (pcf)	115
CDD Waste Unit Waste Thickness (ft)	varies
CDD Waste Unit Weight, γ (pcf)	48.7
Protective Cover Layer Thickness (ft)	4
Unit Weight, γ (pcf)	115
Leachate Collection Layer Thickness (ft)	2
Unit Weight, γ (pcf)	115

7. Settlement Calculations

As indicated in Section 2, elastic (immediate) settlement occurs due to the rearrangement of soil particles due to the applied load, and is considered a relatively "immediate" response to an applied load. Consolidation settlement occurs over a longer period of time, and is due to the progressive relieving of pore water pressure and the reduction of void space. The analysis approach is to use elastic theory for both non-cohesive soils and cohesive soils, and consolidation theory for cohesive soils.

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a. Elastic Settlement

Elastic settlement is calculated by (Bowles):

$$S = H_o(\Delta\sigma_v)/E_s$$

Where:

S = settlement (ft);
H_o = initial height or thickness of soil layer (ft);
$\Delta\sigma_v$ = Change in vertical stress (ksf); and,
Es = Young's modulus of elasticity (ksf).

From Das (1990) after Schmertmann (1970), E_s for sand is defined as:

$$E_s = 8N \text{ (tsf)} \qquad \text{or} \qquad E_s = 16N \text{ (ksf)}$$

Where:

N = standard penetration resistance N-value;
tsf = tons per ft^2;
ksf = kips per ft^2; and,
kips = units of 1,000 lbs.

Das (1990) additionally defines E_S for clays as:

	Used here:
Normally consolidated: E_S = 250c to 500c	Average = 375c
Overconsolidated: E_S = 750c to 1,000c	Average = 875c

Where:

c = undrained cohesion of clayey soil (psf).

The undrained cohesion, c, is calculated as half of the unconfined compression, q_u (Terzaghi and Peck, 1967). Terzaghi also provides a relationship between N and q_u, as follows:

Table 45.2
Relation of Consistency of Clay, Number of Blows N on Sampling Spoon, and Unconfined Compressive Strength

	q_u in tons/ ft²					
Consistency	Very Soft	Soft	Medium	Stiff	Very Stiff	Hard
N	<2	2–4	4–8	8–15	15–30	>30
q_u	<0.25	0.25–0.50	0.50–1.00	1.00–2.00	2.00–4.00	>4.00

This data was used to develop an equation to calculate q_u based on N for clayey soils, as follows:

$$q_u = 2(0.0053N^2 + 0.0458N + 0.2031) \quad \text{(ksf)}$$

b. Consolidation Settlement

Consider the following:

α_p' = effective pre-consolidation stress;
α_{vo}' = effective existing or initial vertical stress; and,
α_{vf}' = effective final vertical effective stress.

Consolidation settlement is calculated by (Holtz and Kovacs):

$$S = C_R'H_o(\log(\sigma_p'/\sigma_{vo}') + C_C'H_o(\log(\sigma_{vf}'/\sigma_p')$$

Where:
S = settlement;
C_R' = corrected coefficient of recompression = $C_R/(1+e_o)$;
H_o = initial height or thickness of the soil layer;
σ_p' = effective vertical preconsolidation stress;
σ_{vo}' = effective initial or interim vertical stress, as appropriate;
C_C' = corrected coefficient of compression = $C_C/(1+e_o)$; and,
σ_{vf}' = effective final vertical stress.

Note:

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1. In cases of only recompression where $\sigma_{vf}' < \sigma_p'$, σ_{vf}' is substituted for σ_p' in the C_R' term, and the C_C' term = 0; and,
2. In cases where excavation is proposed prior to landfill construction, the σ_p' value is determined prior to the excavation, and the σ_{vo}' value is determined after the excavation.

c. General Analysis Steps

The general analysis steps are:

1. Determine which cells and points of interest are to be analyzed;
2. At each point of interest, determine the boring that is used for the soil profile;
3. Generalize the soil profile at each point of interest to minimize the number of soil layers needed for analysis;
4. As discussed in the settlement analysis, to establish the soil depth to which this analysis considers, extend the generalized soil profile to a depth equal to twice the width of the cell;
5. Average the N-values for the soil layers, and determine the unit weigh of each soil layer;
6. Determine the initial effective vertical stress and the effective preconsolidation stress at the center of each soil layer, taking into account the groundwater elevation;
7. Establish an interim soil profile, if needed, to account for the addition of structural fill, or the excavation of soils to the desired grades for landfilling, and determine interim effective vertical stresses;
8. Determine the applied loads for the soil profile and the landfill cross-section at each point of interest;
9. Determine the final effective vertical stress for each soil layer after the landfill loads are applied;
10. Using the elastic settlement formula, calculate the estimated settlement for each soil layer;
11. Using the consolidation settlement formula(s), calculate the estimated settlement for each cohesive soil layer;
12. Sum the estimated settlement values for each soil layer at each point of interest;
13. Calculate the differential settlement between points of interest;
14. Evaluate the effect of the differential settlement between points of interest; and,
15. Determine if changes in the design are needed to account for the estimated differential settlements.

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d. Calculation Results

The attachments provide a detail presentation of the calculations described. A summary follows:

Cell 10 Settlement	
Point	Calculated Settlement (in)
1	1.72
2	2.32
4	20.13
3	13.18

Cell 13 Settlement	
Point	Calculated Settlement (in)
1	0.78
2	1.14
3	14.29

8. Evaluation and Conclusions

Distances and elevations were scaled and estimated from the design drawings. Inherent to that is some effect of rounding. This is noted for the initial slope values calculated for both cells between Points 1 and 2. Although these slopes were designed to be 33% (3H to 1V), the slope calculated here is slightly different. This has no impact on the evaluation since the difference between initial slope and final slope is the focus.

a. Cell 10 Evaluation

Variable	Point 1	» ↓ «	Point 2	» ↓ «	Point 4	» ↓ «	Point 3
Calculated S (in)	1.72		2.32		20.13		13.18
Differential S (in)		0.60		17.81		6.98	
Distance (ft)		104		510		260	
Initial Elevation (ft)	137		104		118		126
Initial Slope Length (ft)		109.11		510.19		260.12	
Initial Slope (%)		31.73		2.75		3.08	
Final Elevation (ft)	136.86		103.81		116.32		124.90
Final Slope length (ft)		109.13		510.15		260.14	
Final Slope (%)		31.78		2.45		3.30	
Estimated Strain (%)		0.014		-0.008		0.007	

Final Slope(s): Final slope values (%) between Points 2 and 4, and between Points 4 and 3 are displayed in red font. These are locations of the leachate collection header pipe where a minimum 2% slope is required. In both cases, a minimum 2% slope is maintained.

Estimated Strain: Estimated strain values (%) between Points 1 and 2, and between Points 4 and 3 are displayed in red font. These are locations where the geomembrane liner could experience an increase in length. Information from a geomembrane manufacturer (Ref. 9) indicates the 60-mil textured HDPE geomembrane experiences 12% elongation (strain) at yield. The estimated strains calculated here are less than that for material yield.

b. Cell 13 Evaluation

Variable	Point 1	» ↓ «	Point 2	» ↓ «	Point 3
Calculated S (in)	0.78		1.14		14.29
Differential S (in)		0.36		13.15	
Distance (ft)		21		440	
Initial Elevation (ft)	87		80		94
Initial Slope Length (ft)		22.14		440.22	
Initial Slope (%)		33.33		3.16	
Final Elevation (ft)	86.94		79.91		92.81
Final Slope length (ft)		22.15		440.19	
Final Slope (%)		33.48		2.93	
Est. Strain (%)		0.043		-0.008	

Final Slope: Final slope values (%) between Points 2 and 3 are displayed in red font. This is the location of the leachate collection header pipe where a minimum 2% slope is required. A minimum 2% slope is maintained.

Estimated Strain: Estimated strain values (%) between Points 1 and 2 are displayed in red font. This location is where the geomembrane liner could experience an increase in length. Information from a geomembrane manufacturer (Ref. 9) indicates the 60-mil textured HDPE geomembrane experiences 12% elongation (strain) at yield. The estimated strain calculated here is less than that for material yield.

c. Conclusions

Based on the foregoing, the following conclusions are offered:

1. The settlement experienced by the landfill will affect the slope of the floor of the landfill. The main leachate collection headers should maintain the minimum required 2% slope.
2. The geomembrane will experience some strain induced by an increase in length due to the differential settlement between points. However, the strain should be less than that required for the material to yield.

9. References

1. Project Laboratory Test Data.

2. Project Soil Boring Logs.

3. Project Design Information.

4. Holtz, Robert D., and Kovacs, William D.; *"An Introduction to Geotechnical Engineering"*; 1981, Prentice-Hall, Inc., Fig. 8.6 and p 296.

5. Terzaghi, Karl, and Peck, Ralph B.; *"Soil Mechanics in Engineering Practice"*; 2nd Ed., 1967, John Wiley and Sons, Inc.; Table 45.1 (p 341), Table 45.2 (p 347).

6. University of Massachusetts at Lowell; *"14.485 Capstone Design, Module 4 – Geotechnical Engineering"*, Table 1 (Slide 16 of 43).

7. Das, Braja M.; *"Principles of Geotechnical Engineering"*; 2nd Ed., 1990, PWS-KENT Publishing Company.

8. Sowers, George F.; *"Introductory Soils Mechanics and Foundations: Geotechnical Engineering"*; 1979, Macmillan Publishing Co., Inc.

9. Manufacturer's information on HDPE textured geomembrane.

REFERENCE 4

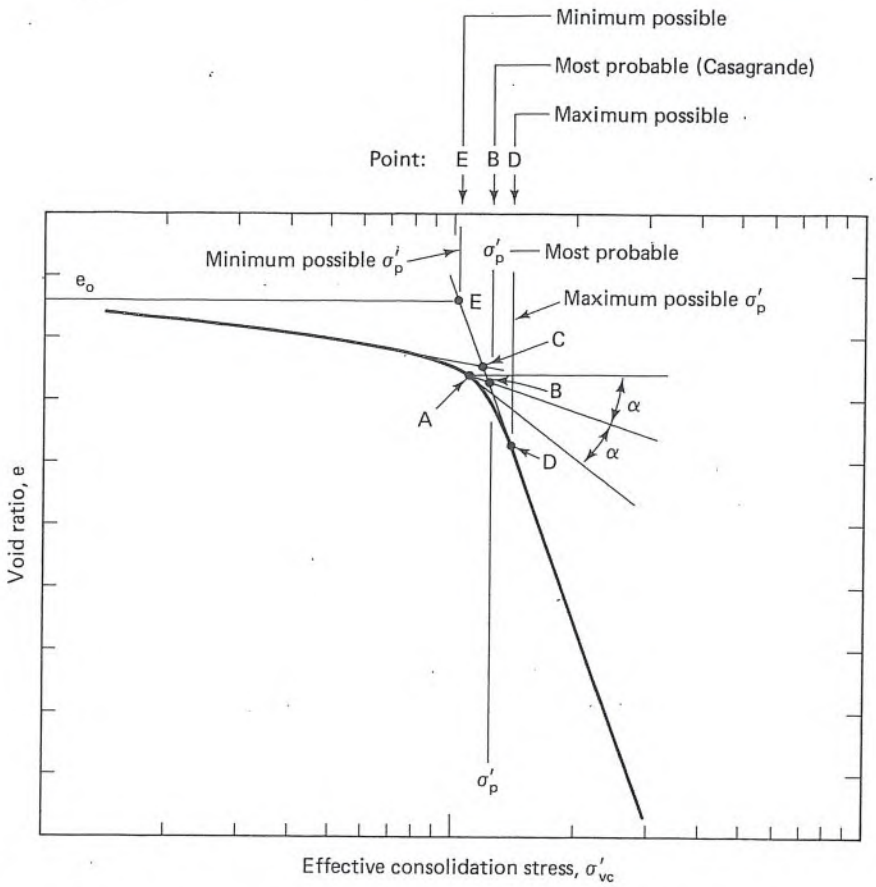


Fig. 8.6 The Casagrande (1936b) construction for determining the preconsolidation stress. Also shown are the minimum possible, the most probable, and the maximum possible preconsolidation stresses.

Casagrande procedure is as follows:

1. Choose by eye the point of minimum radius (or maximum curvature) on the consolidation curve (point *A* in Fig. 8.6).
2. Draw a horizontal line from point *A*.
3. Draw a line tangent to the curve at point *A*.
4. Bisect the angle made by steps 2 and 3.
5. Extend the straight line portion of the *virgin* compression curve up to where it meets the bisector line obtained in step 4. The point of intersection of these two lines is the preconsolidation stress (point *B* of Fig. 8.6).

REFERENCE 1
MW-28
depth = 2'

CONSOLIDATION

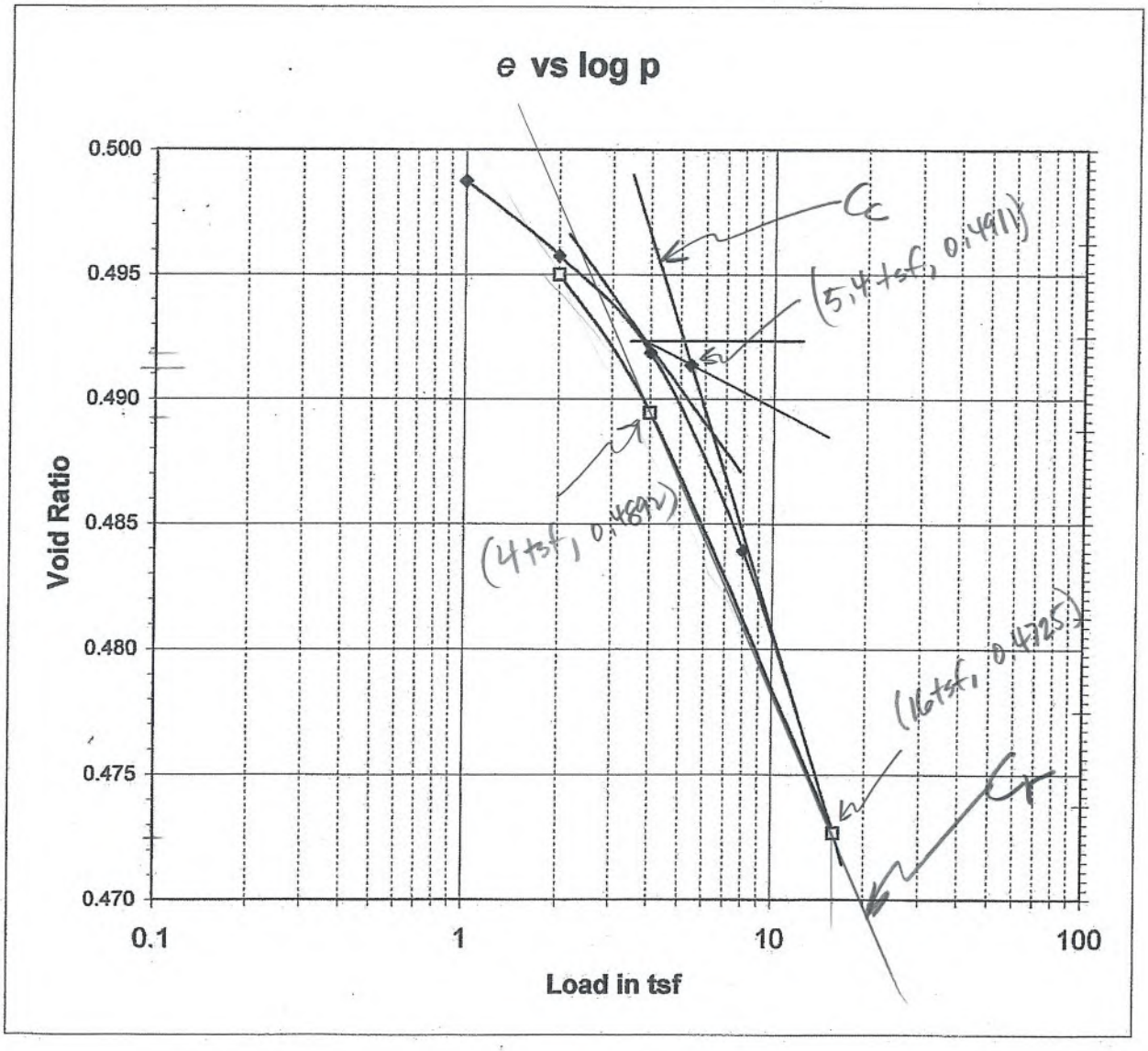
Project: Chesapeake Rubble Landfill
Job #: 02231
Lab #: 030081
Sample Location: On Site
Sample Description: Maroon & Gray Clay

Date: Apr-03

Specific Gravity: 2.8
Moisture Content: 17.3%
Sample Dia: 2.500"
Initial Sample Len: 1.000"

Unit Wt. Wet: 136.8 pcf
Unit Wt. Dry: 116.6 pcf
Initial Void Ratio: 0.499

Preconsolidation Pressure: 5.4 tsf

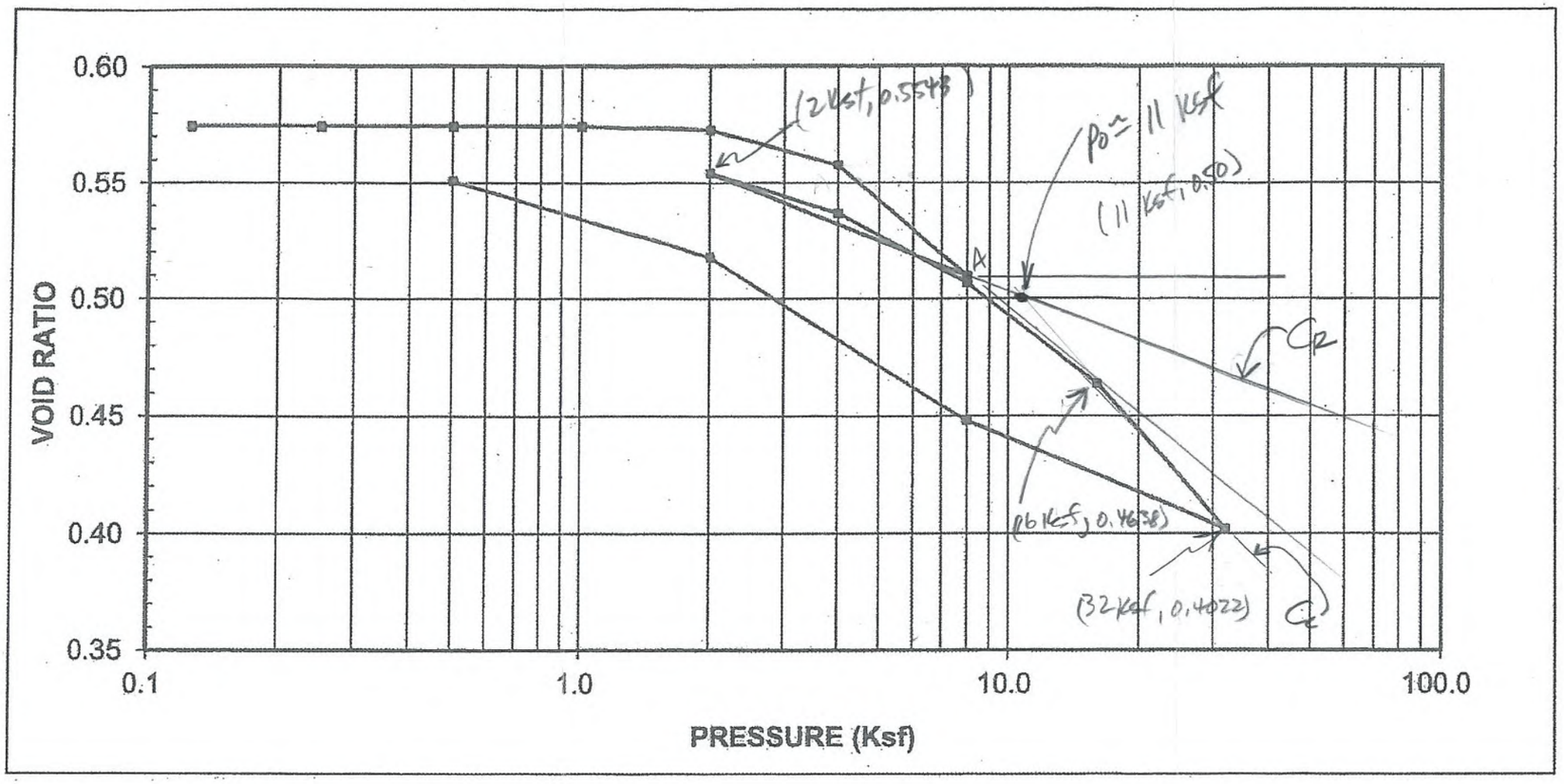


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Phone: 410 553-0802
Fax: 410 553-0808
Emial: HKAI@Erols.com

REFERENCE1

ONE - DIMENSIONAL CONSOLIDATION
ASTM D 2435 Method B



SAMPLE ID	PMW - 23
SAMPLE TYPE	UD
SAMPLE DEPTH	128.0 - 130.0'

LL	-
PL	-
PI	-
Gs	2.80

	Initial	Final
Dry Unit Weight (pcf)	111.1	111.1
Wet Unit Weight (pcf)	134.5	138.6
Moisture Content	21.0%	24.8%
Void Ratio	0.574	0.574
Degree of Saturation	100%	100%

DESCRIPTION: CLAY; dark reddish brown and gray; Hard (can indent with thumb nail); dry to moist.

USCS: (CH)

NWM/CHESAPEAKE TERRACE SFI/MD
063-1431-003

TECH	PWM
DATE	10/17/13
CHECK	
REVIEW	
APPROVE	

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MW-28

$$C_c = \frac{\Delta e}{\log\left(\frac{\sigma_2'}{\sigma_1'}\right)} = \frac{(0.4911 - 0.4725)}{\log\left(\frac{16}{5.4}\right)} = 0.039$$

$$C_R = \frac{\Delta e}{\log\left(\frac{\sigma_2'}{\sigma_1'}\right)} = \frac{(0.4892 - 0.4725)}{\log\left(\frac{16}{4}\right)} = 0.028$$

PMW-23

$$C_c = \frac{\Delta e}{\log\left(\frac{\sigma_2'}{\sigma_1'}\right)} = \frac{(0.5000 - 0.4022)}{\log\left(\frac{32}{11}\right)} = 0.211$$

$$C_R = \frac{\Delta e}{\log\left(\frac{\sigma_2'}{\sigma_1'}\right)} = \frac{(0.5543 - 0.5000)}{\log\left(\frac{11}{2}\right)} = 0.073$$

Ref: Holtz & Kovacs (1981) pg 313, eqn 8-7.

SHEET 1 OF 1	PROJECT NO.	PROJECT NAME	Clos. Terr LF
BY JCA	DATE 11/20/19	DESCRIPTION	Cc & Cr
CHK. BY	DATE		

REFERENCE 1

UNCONFINED COMPRESSION OF COHESIVE SOIL

Project: Chesapeake Rubble Fill
Job #: 02231
Lab #: 030081
Sample Location: On Site
Sample Description: Maroon & Gray Clay
Method: ASTM D2166

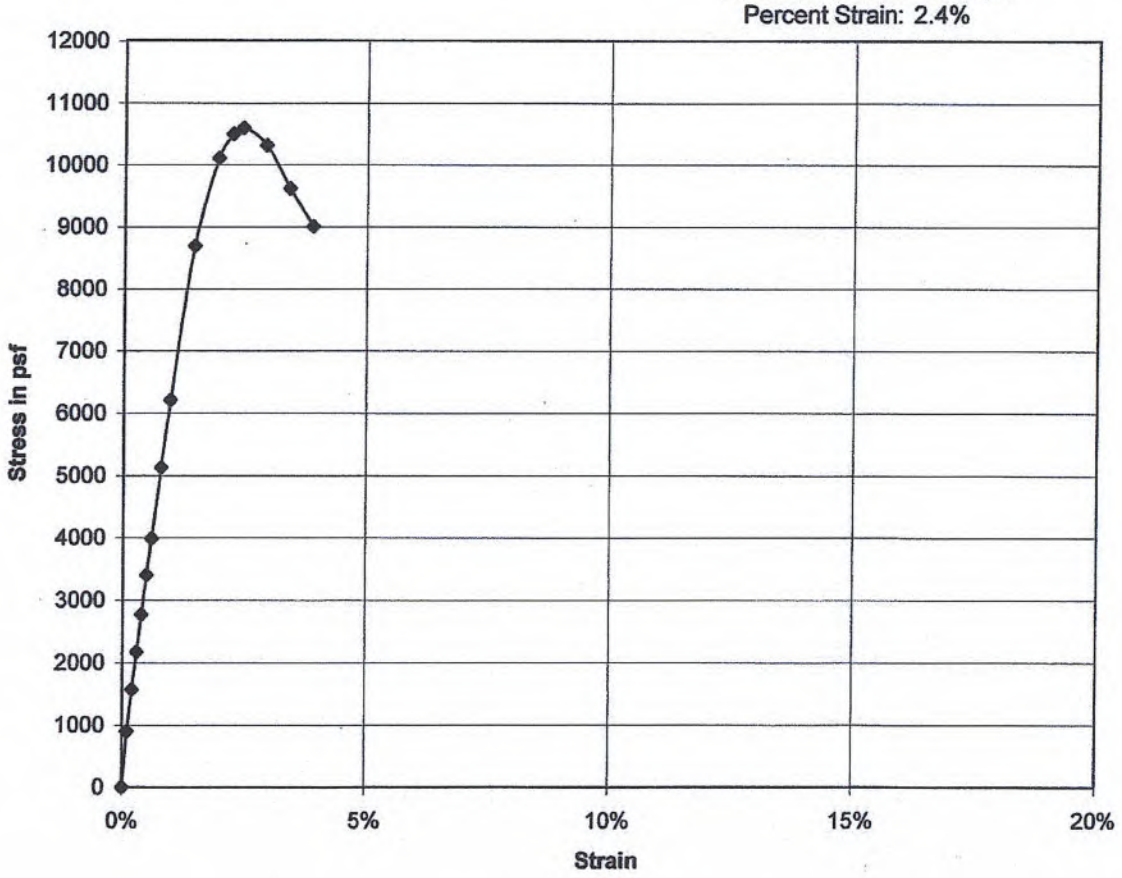
Date: 4/17/2003

Length:	5.140"	Initial Wet Wt.:	1138.47g	Initial Wet Unit Wt.:	132.4pcf
Diameter:	2.848"	Final Wet Wt.:	1136.48g	Final Wet Unit Wt.:	132.2pcf
Area:	6.371in^2	Dry Wt:	1083.46g	Dry Unit Wt.:	115.1pcf
Volume:	32.750in^3	Initial Moisture:	15.0%	L/D:	1.8

Load Rate: .045"/min

Stress-Strain Curve

Maximun Stress: 10594psf
Percent Strain: 2.4%



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Email: HKAI@Erols.com

REFERENCE 5

was secured concerning the geology of the site, a list of the index properties of all the spoon samples that were taken, and a record of the results of the standard penetration tests. On the basis of this report it can be decided whether or not supplementary investigations are required concerning the relative density and permeability of the sand strata and the shearing resistance and compressibility of the clay strata.

Relative Density of Sand Strata

The relative density of sand strata has a decisive influence on the angle of internal friction of the sand (Article 17), on the ultimate bearing capacity (Article 33), and on the settlement of footings resting on the sand. If a submerged sand is very loose, a sudden shock may transform it temporarily into a sand suspension with the properties of a thick viscous liquid (Article 17). In a dense state the same sand is insensitive to shock and is perfectly suitable as a base for even very heavy structures. For this reason the relative density of a sand is far more important than any of its other properties, except possibly its permeability.

Table 45.1
Relative Density of Sands according to Results of Standard Penetration Test

No. of Blows N	Relative Density
0–4	Very loose
4–10	Loose
10–30	Medium
30–50	Dense
Over 50	Very dense

While the exploratory borings are being made, some information regarding the relative density of the sand strata encountered in the drill holes can be obtained by performing the standard penetration test (page 304) whenever a spoon sample is taken. Considering the outstanding importance of the relative density, the standard penetration test should be considered an essential part of the boring operation. Table 45.1 gives an approximate relation between the number of blows N and the relative density.

The relation, Table 45.1, should be used with caution, and only if the penetration tests are carried out conscientiously. If the sand

REFERENCES

Table 45.2
Relation of Consistency of Clay, Number of Blows N on Sampling Spoon, and Unconfined Compressive Strength

	q_u in tons/ ft²					
Consistency	Very Soft	Soft	Medium	Stiff	Very Stiff	Hard
N	<2	2–4	4–8	8–15	15–30	>30
q_u	<0.25	0.25–0.50	0.50–1.00	1.00–2.00	2.00–4.00	>4.00

routine tests on the spoon samples, listed in Table 9.1, are also obligatory because their results are required for comparing the clay with others previously encountered on similar jobs. The values of q_u obtained by means of compression tests are likely to be somewhat too low because spoon samples are appreciably disturbed. The supplementary investigations required on important jobs depend on the character of the soil profile.

If the soil profile is simple and regular, it is commonly possible to evaluate the average shearing resistance of the clay strata on the basis of the results of laboratory tests. The samples are secured by means of tube sample borings (Article 44) which furnish continuous cores. To obtain fairly reliable average values, the spacing between the sample borings should not exceed 100 ft. If it is known in advance that the soil profile is fairly regular and that tube sample borings will be required, continuous samples are taken in all those sections of the exploratory holes that are located within clay strata. In the sections located between clay strata spoon samples are extracted, and standard penetration tests are made.

The samples are delivered to the laboratory in sealed tubes commonly 30 or 36-in. long. Preferably, all the clay samples from one hole should be tested in the sequence in which they followed each other in the drill hole in a downward direction. Each sample is ejected from its tube by means of a close-fitting plunger in such a manner that the sample continues to move with respect to the tube in the same direction as it entered; if excessive side friction causes too much disturbance during ejection, the tube is cut into 6-in. sections, the soil itself is cut by means of a wire saw, and each section is ejected.

For routine testing each sample is cut into sections with lengths equal to about three times the diameter; that is, 2-in. tube samples

SOIL ENGINEERING PROPERTY CORRELATIONS FROM IN-SITU TESTING (TABLE 1)

Soil	Density/Consistency	N	q_t (MPa)	γ_t (pcf)	ϕ' (°)
SANDS	V. Loose	0-4	0-2	90-105	<30
	Loose	5-10	2-5	95-110	30-35
	Medium Dense	11-30	5-15	105-120	35-38
	Dense	31-50	15-25	115-130	38-41
	Very Dense	>50	>25	125-140	41-44
COHESIVE SOILS	Very Soft	0-2	0-0.5	90-100	NA
	Firm	2-8	0.5-1.5	90-110	
	Stiff	9-15	1.5-3	105-125	
	Very Stiff	15-30	3-6	115-135	
	Hard	>30	>6	120-140	

after Fang et al. (1991) and EM 1110-1-1905.

NOTE: 1 MPa = 10.44 tsf

REFERENCE

REFERENCE 7

Table 2.1 Various Forms of Relationships for γ, γ_d, and γ_{sat}

Unit-weight relationship	Eq. no.
$\gamma = \dfrac{(1+w)G_s\gamma_w}{1+e}$	(2.15)
$\gamma = \dfrac{(G_s+Se)\gamma_w}{1+e}$	(2.26)
$\gamma = \dfrac{(1+w)G_s\gamma_w}{1+\dfrac{wG_s}{S}}$	(2.27)
$\gamma = G_s\gamma_w(1-n)(1+w)$	(2.28)
Dry unit weight	
$\gamma_d = \dfrac{\gamma}{1+w}$	(2.12)
$\gamma_d = \dfrac{G_s\gamma_w}{1+e}$	(2.16)
$\gamma_d = G_s\gamma_w(1-n)$	(2.22)
$\gamma_d = \dfrac{G_s}{1+\dfrac{wG_s}{S}}\gamma_w$	(2.29)
$\gamma_d = \dfrac{eS\gamma_w}{(1+e)w}$	(2.30)
$\gamma_d = \gamma_{sat} - n\gamma_w$	(2.31)
$\gamma_d = \gamma_{sat} - \left(\dfrac{e}{1+e}\right)\gamma_w$	(2.32)
Saturated unit weight	
$\gamma_{sat} = \dfrac{(G_s+e)\gamma_w}{1+e}$	(2.18) ✓
$\gamma_{sat} = [(1-n)G_s+n]\gamma_w$	(2.24)
$\gamma_{sat} = \left(\dfrac{1+w}{1+wG_s}\right)G_s\gamma_w$	(2.33)
$\gamma_{sat} = \left(\dfrac{e}{w}\right)\left(\dfrac{1+w}{1+e}\right)\gamma_w$	(2.34)
$\gamma_{sat} = \gamma_d + n\gamma_w$	(2.35)
$\gamma_{sat} = \gamma_d + \left(\dfrac{e}{1+e}\right)\gamma_w$	(2.36)

The proofs of some of these relationships are left to the students.

(Equation 2.18)

$$\gamma = \frac{(G_s+e)\gamma_w}{(1+e)}$$

$$\gamma(1+e) = (G_s+e)\gamma_w$$

$$\gamma + \gamma e = G_s\gamma_w + e\gamma_w$$

$$\gamma e - e\gamma_w = G_s\gamma_w - \gamma$$

$$e(\gamma-\gamma_w) = G_s\gamma_w - \gamma$$

$$e = \frac{(G_s\gamma_w-\gamma)}{(\gamma-\gamma_w)}$$

GENERAL SOIL PROFILE: CELL 10 **, POINT** 1 (NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
Boring Profile : B-105 ▽	
TOG = 161	
Sand w/fines, some gravel Navg = 8	
146	
Silty Clay to Clay w/trace sand Navg = 42	137 (Edge of Landfill)
116	
Silty Clay to Clay w/trace sand ▽ 97 Navg = 66	
61	

RECORD OF BOREHOLE B-105

SHEET 1 of 2

PROJECT: Chesapeake Terrace SFI
PROJECT NUMBER: 063-1431-003
DRILLED DEPTH: 100.0 ft
AZIMUTH: N/A
LOCATION: Odenton, MD

DRILL METHOD: Mud Rotary- 3 in.
DRILL RIG: Simco 2800
DATE STARTED: 5/2/13
DATE COMPLETED:
WEATHER: Partly Cloudy

DATUM:
COORDS: N: 500,589.1 E: 1,386,809.5
GS ELEVATION: 115.7 ft
TOC ELEVATION: NA
TEMPERATURE: 50 F

INCLINATION: -90
DEPTH W.L.: NA

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE: DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES: NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT	COMMENTS
0	115								(6)		
		3.0 - 5.0 SAND; fine to medium, well-graded, subrounded; trace plastic fines, trace fine gravel; light brown; noncohesive; moist; loose.	SW		110.7	S1	DO	2-3-3-3	6	0.6/2.0	
5	110								(7)		Sa
		8.0 - 10.0 SAND; fine, poorly graded, subrounded; some plastic fines, trace coarse subangular gravel, lenses of soft red and white clay; light brown; noncohesive; moist; loose.	SP		105.7	S2	DO	2-3-4-3	7	1.0/2.0	Nav=8
10	105								(12)		
		13.0 - 15.0 SAND; fine to medium, well-graded, subrounded; some nonplastic fines, trace subangular coarse gravel, seams of light grey clay, lenses of clayey sand; light grey to light brown; trace organics; noncohesive; moist; compact.	SW		100.7	S3	DO	3-4-8-14	12	1.5/2.0	
15	100								(41)		
		18.0 - 20.0 SILTY CLAY; medium plasticity; seams of fine dark grey sand; dark red, slightly shiny; cohesive; w<PL; stiff.	CL		95.7	S4	DO	11-19-22-23	41	1.6/2.0	
20	95								(84)		
		23.0 - 25.0 SILTY CLAY; medium plasticity; mottled dark grey and brownish red, slightly shiny; cohesive; w<PL; very stiff.	CL		90.7	S5	DO	17-39-45-45	84	1.8/2.0	Si Cl to Cl
25	90								(32)		
		28.0 - 30.0 CLAY; high plasticity; grey mottled dark red and maroon, shiny; thinly laminated; trace black material: possibly organics; cohesive; w~PL; stiff.	CH		85.7	S6	DO	12-16-16-32	32	1.9/2.0	Nav=42
30	85								(28)		
		33.0 - 35.0 CLAY; high plasticity; grey mottled dark red and maroon, shiny; thinly laminated; trace black material: possibly organics; cohesive; w~PL; stiff.	CH		80.7	S7	DO	11-13-15-25	28	2.0/2.0	
35	80								(35)		
		38.0 - 40.0 SILTY CLAY; medium plasticity; some fine sand; light grey mottled dark red, slightly shiny; thinly laminated; cohesive;, w~PL; stiff.	CL		75.7	S8	DO	12-15-20-22	35	1.0/2.0	
40	75								(33)		
		43.0 - 44.0 CLAYEY SILT, low to medium plasticity; some fine sand, trace of fine gravel; light grey, dull; cohesive; stiff.	ML CH		71.7 44.0 70.7	S9	DO	12-15-18-23	33	2.0/2.0	
45	70	44.0 - 45.0 CLAY; medium to high plasticity; brown and purple mottled yellowish brown, shiny; thinly laminated; cohesive; stiff.									
									(64)		Sa Cl to Cl Nav=66
		48.0 - 50.0 SILTY CLAY; medium to high plasticity; trace fine sand, pockets of fine yellow-brown sand; light grey, slightly shiny; cohesive; w~PL; stiff.	CL		65.7	S10	DO	17-26-38-40	64	0.7/2.0	
50	65										

Log continued on next page

LOG SCALE: 1 in = 6.5 ft
DRILLING COMPANY: Earth Matters Inc.
DRILLER: D. Taylor

GA INSPECTOR: KMC
CHECKED BY: VEF
DATE: 8/8/13

Golder Associates

AA GEOTECH LOG NO PID CHESAPEAKE SFI.GPJ GOLDER NJ-PA 05-24-06.GDT 9/27/13

RECORD OF BOREHOLE B-105

SHEET 2 of 2

PROJECT: Chesapeake Terrace SFI
PROJECT NUMBER: 063-1431-003
DRILLED DEPTH: 100.0 ft
AZIMUTH: N/A
LOCATION: Odenton, MD

DRILL METHOD: Mud Rotary- 3 in.
DRILL RIG: Simco 2800
DATE STARTED: 5/2/13
DATE COMPLETED:
WEATHER: Partly Cloudy

DATUM:
COORDS: N: 500,589.1 E: 1,386,809.5
GS ELEVATION: 115.7 ft
TOC ELEVATION: NA
TEMPERATURE: 50 F

INCLINATION: -90
DEPTH W.L.: NA

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT	COMMENTS
55	60	53.0 - 55.0 SILTY CLAY; medium plasticity; seams of fine sand; reddish brown mottled light grey, slightly shiny; cohesive; w~PL; stiff.	CL		60.7	S11	DO	21 -37 -47 -50/5"	84	1.2 2.0	
60	55	58.0 - 60.0 SILTY CLAY; medium to high plasticity; trace fine sand; light grey mottled reddish brown, lightly shiny; cohesive; w~PL; firm.	CL		55.7	S12	DO	16 -18 -22 -30	40	1.7 2.0	
65	50	63.0 - 65.0 SILTY CLAY; low to medium plasticity; light grey mottled reddish brown, slightly shiny; cohesive; w~PL; stiff.	CL		50.7	S13	DO	21 -33 -36 -42	99	0.7 2.0	
70	45	68.0 - 70.0 CLAY; high plasticity; purplish grey mottled dark red, shiny; cohesive; w<PL; very stiff.	CH		45.7	S14	DO	18 -24 -27 -30	51	2.0 2.0	
75	40	73.0 - 75.0 CLAY; high plasticity; some nonplastic fines, pockets of fine sand; grey and purple mottled dark red, shiny; thinly laminated; cohesive; w~PL; stiff to very stiff.	CH		40.7	S15	DO	17 -21 -31 -34	52	2.0 2.0	
80	35	78.0 - 80.0 SILTY CLAY; low to medium plasticity; trace fine sand, pockets of fine sand; light grey mottled dark red, slightly shiny; thinly laminated; cohesive; w~PL; stiff to very stiff.	CL		35.7	S16	DO	24 -26 -40 -50	76	1.9 2.0	
85	30	83.0 - 83.8 SILTY CLAY; medium to high plasticity; trace of fine sand; mottled light grey and dark red; cohesive; w~PL; stiff to very stiff.	CL CH		31.9 30.9	S17	DO	22 -22 -23 -35	45	1.8 2.0	
		83.8 - 84.8 CLAY; medium to high plasticity; some nonplastic fines, trace of fine sand; dark red mottled light grey; cohesive; w~PL; firm to stiff.									
90	25	88.0 - 90.0 CLAYEY SILT and SAND; low to medium plasticity; ~35% fine sand, pockets of fine sand, lens of soft red clay; light grey mottled dark red and brown, slightly shiny; cohesive; w<PL; stiff.	MH		25.7	S18	DO	15 -22 -38 -39	60	2.0 2.0	
95	20	93.0 - 95.0 CLAYEY SILT; low to medium plasticity; some fine sand, pockets of fine sand, seams of clay and fine sand; light grey mottled dark red and brown, slightly shiny; cohesive; w<PL; stiff.	MH		20.7	S19	DO	30 -40 -50/5"	N/A	1.5 2.0	Drilled w/o sampling. (94.4'-95')
100	15	98.0 - 100.0 SILTY CLAY; medium to high plasticity; lenses of fine clayey sand; purplish brown, slightly shiny; cohesive; w<PL; stiff.	CL		15.7	S20	DO	19 -22 -37 -42	59	1.6 2.0	
		Boring completed at 100.0 ft									

LOG SCALE: 1 in = 6.5 ft
DRILLING COMPANY: Earth Matters Inc.
DRILLER: D. Taylor

GA INSPECTOR: KMC
CHECKED BY: VEF
DATE: 8/8/13

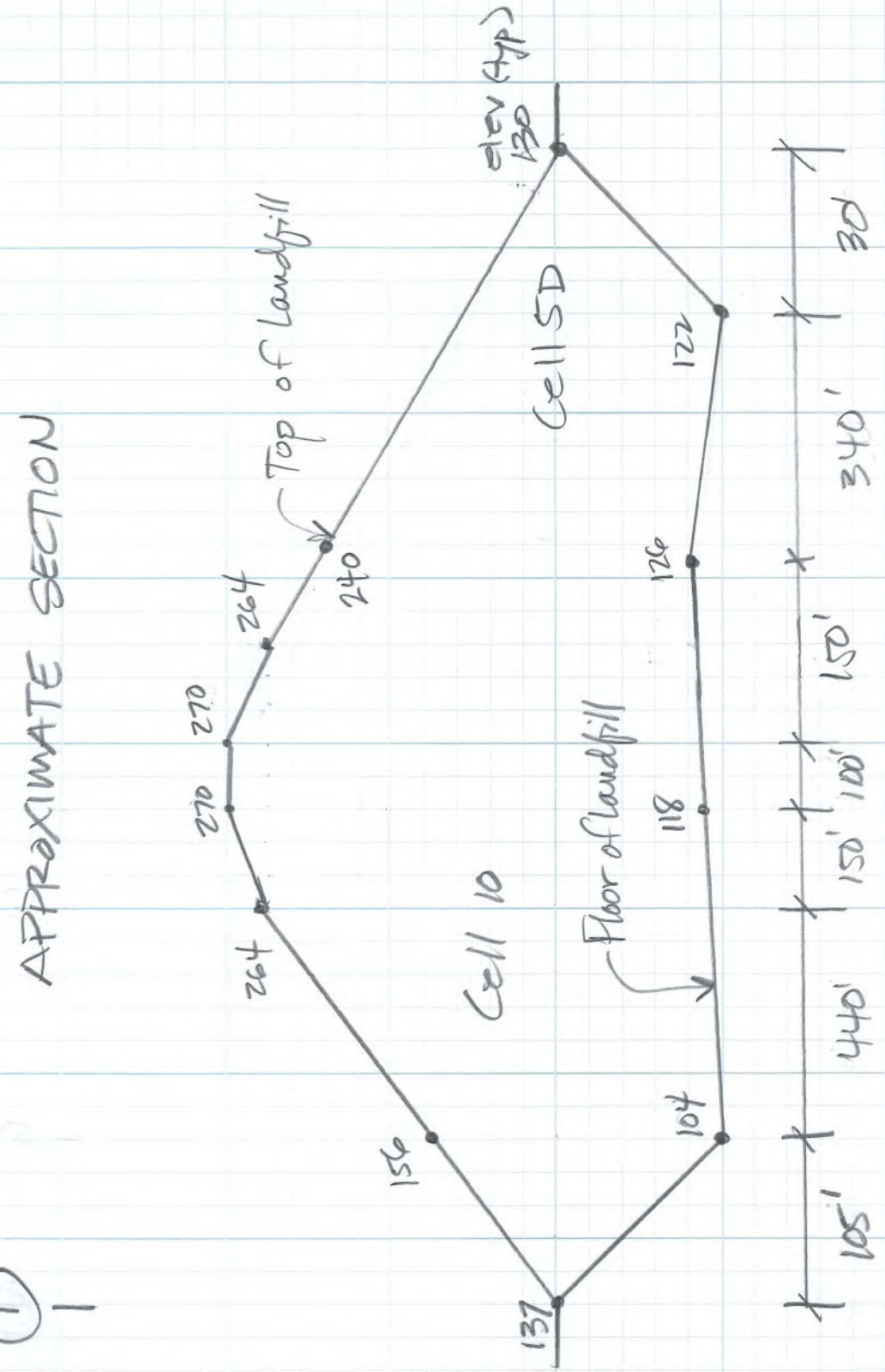
Golder Associates

AA GEOTECH LOG NO PID CHESAPEAKE SFI.GPJ GOLDER NJ-PA 05-24-06.GDT 9/27/13

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APPROXIMATE SECTION



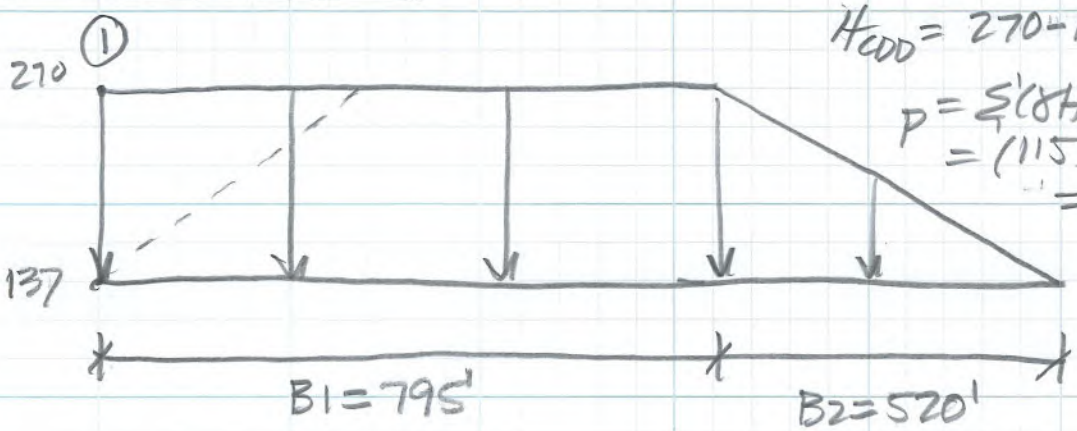
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2018-

SHEET 1	OF 1	PROJECT NO. 3084	PROJECT NAME	Chestnut	
BY JCA		DATE 7/5/20	DESCRIPTION	Cell 10, Point 1 Settlement	
CHK. BY		DATE			

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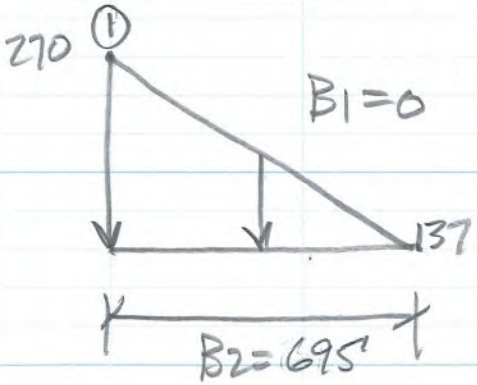
Waste Load U1



$H_{COD} = 270 - 137 - 3 = 130$

$p = \Sigma(\gamma H)$
$= (115)(3) + (130)(48.7)$
$= 6676$ psf

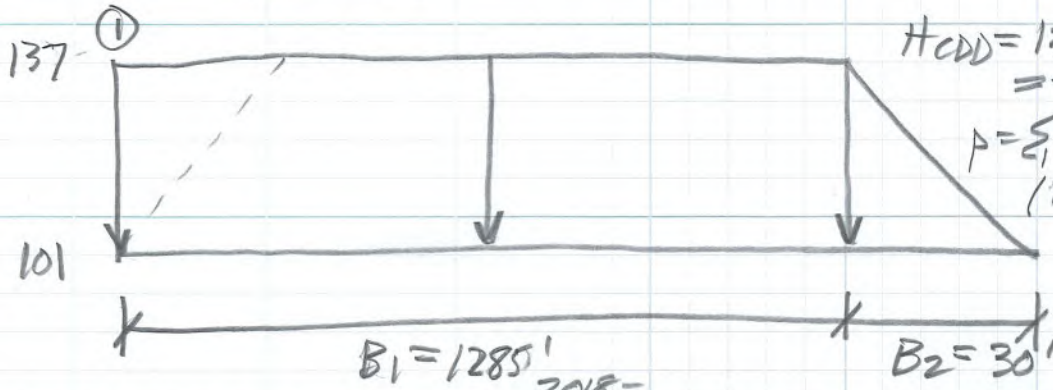
Waste Load U2



$H_{COD} = 270 - 137 - 3 = 130$

$p = \Sigma(\gamma H) = (3)(115) + (130)(48.7)$
$= 6676$ psf

Waste Load L1



$H_{COD} = 137 - 104 - 6$
$= 27'$

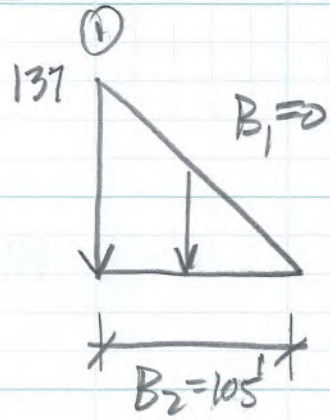
$p = \Sigma(\gamma H) =$
$(27)(48.7) + (6)(115)$
$= 2005$ psf

2018-

SHEET 1	OF 2	PROJECT NO. 3064	PROJECT NAME		
BY JCA		DATE 7/5/20	DESCRIPTION	Cell 10, Point 1 Loads	
CHK. BY		DATE			

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Waste Load L_2



$H_{CDD} = 137 - 104 - 6 = 27'$

$p = \xi(\gamma H) = (27)(48.7) + 6(115) = 2005$ psf

Net load $= U_1 - U_2 + L_1 - L_2$

2018-

SHEET 2	OF 2	PROJECT NO. 308F		PROJECT NAME	
BY	CA	DATE 7/5/20		DESCRIPTION	Cell 10, Point Loads
CHK. BY		DATE			

Settlement Analysis

Cell 10 ***Point*** 1

Boring Profile: B-105

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	*Soil Description*	*Top Elev (ft)*	*Bottom Elev (ft)*	*Thickness (ft)*	*Average SPR (N_a)*	*Estimated Soil Unit Weight (pcf)*	*Unit Weight Water (pcf)*	*Effective Soil Unit Weight (kcf)*	*Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)*	*Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)*	*Initial Effective Vertical Stress at Bottom of Soil Layer (psf)*	*Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)*
1	Sand w/some fines, gravel	161	146	15	8	101.5	0	101.5	761	0.761	1,523	761
2	Silty Clay to Clay w/trace sand	146	116	30	42	145.0	0	145.0	3,698	3.698	5,873	3,698
3	Clay w/some silt, w/trace sand	116	97	19	42	145.0	0	145.0	7,250	7.250	8,628	7,250
4	Clay w/some silt, w/trace sand	97	-822	919	66	145.0	62.4	82.6	46,582	46.582	84,537	46,582
			Total:	*983*								

Intermediate Profile >>>> With excavation, soil is now over-consolidated.

Soil Layer	*Soil Description*	*Top Elev (ft)*	*Bottom Elev (ft)*	*Thickness (ft)*	*Average SPR (N_a)*	*Estimated Soil Unit Weight (pcf)*	*Unit Weight Water (pcf)*	*Effective Soil Unit Weight (kcf)*	*Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)*	*Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)*	*Intermediate Effective Vertical Stress at Bottom of Soil Layer (psf)*
2	Silty Clay to Clay w/trace sand	138	116	22	42	145.0	0	145.0	1,595	1.595	3,190
3	Clay w/some silt, w/trace sand	116	97	19	42	145.0	0	145.0	4,568	4.568	5,945
4	Clay w/some silt, w/trace sand	97	-822	919	66	145.0	62.4	82.6	43,900	43.900	81,854

Waste Load U1 ***B1 =*** 795 ***B2 =*** 520 ***Po =*** 6,676 ***psf***

Soil Layer	*Soil Description*	*Top Elev (ft)*	*Bottom Elev (ft)*	*Thickness ft*	*z ft*	*y ft*	*α_1 (radians)*	*α_2 (radians)*	*Influence Factor I'*	*Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)*
2	Silty Clay to Clay w/trace sand	138	116	22	11	22	0.005	1.557	0.500	3,340
3	Clay w/some silt, w/trace sand	116	97	19	31.5	41	0.016	1.531	0.500	3,340
4	Clay w/some silt, w/trace sand	97	-822	919	500.5	960	0.198	1.009	0.481	3,211

Cell 10, Point 1, pg 1/3

Waste Load U2 B1 = 0.01 B2 = 695 Po = 6,676 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
2	Silty Clay to Clay w/trace sand	138	116	22	11	22	1.554	0.001	0.495	3,306
3	Clay w/some silt, w/trace sand	116	97	19	31.5	41	1.525	0.000	0.486	3,243
4	Clay w/some silt, w/trace sand	97	-822	919	500.5	960	0.947	0.000	0.301	2,013

Waste Load L1 B1 = 1285 B2 = 30 Po = 2,005 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
2	Silty Clay to Clay w/trace sand	138	116	22	11	22	0.000	1.562	0.500	1003
3	Clay w/some silt, w/trace sand	116	97	19	31.5	41	0.001	1.546	0.500	1003
4	Clay w/some silt, w/trace sand	97	-822	919	500.5	960	0.008	1.199	0.490	982

Waste Load L2 B1 = 0.01 B2 = 105 Po = 1,761 2005

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
2	Silty Clay to Clay w/trace sand	138	116	22	11	22	1.466	0.001	0.467	822
3	Clay w/some silt, w/trace sand	116	97	19	31.5	41	1.279	0.000	0.407	718
4	Clay w/some silt, w/trace sand	97	-822	919	500.5	960	0.207	0.000	0.066	116

Load Totals

Soil Layer	Soil Description	Waste Load U1 (psf)	Waste Load U2 (psf)	Waste Load L1 (psf)	Waste Load L2 (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
2	Silty Clay to Clay w/trace sand	3,340	(3,306)	1003	(822)	214
3	Clay w/some silt, w/trace sand	3,340	(3,243)	1003	(718)	382
4	Clay w/some silt, w/trace sand	3,211	(2,013)	982	(116)	2,064

Cell 10, Point 1, pg 3/3

Final Profile

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Final Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)
2	Silty Clay to Clay w/trace sand	138	116	22	42	145.0	0	145.0	1,595	214	0.214	1,809
3	Clay w/some silt, w/trace sand	116	97	19	42	145.0	0	145.0	4,568	382	0.382	4,949
4	Clay w/some silt, w/trace sand	97	-822	919	66	145.0	62.4	82.6	43,900	2,064	2.064	45,964

Elastic Settlement

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_a)	Estimated Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
2	Silty Clay to Clay w/trace sand	22	42	22.9518	10,041	0.214	0.000	0.01
3	Clay w/some silt, w/trace sand	19	42	22.9518	10,041	0.382	0.001	0.01
4	Clay w/some silt, w/trace sand	919	66	52.6254	23,024	2.064	0.082	0.99

Recompression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Initial Unit Weight (pcf)	Initial Void ratio e_o	Recompression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
2	Silty Clay to Clay w/trace sand	22	2.80	145.0	0.360	0.004	0.003	3,698	1,595	1,809	0.00	0.04
3	Clay w/some silt, w/trace sand	19	2.80	145.0	0.360	0.004	0.003	7,250	4,568	4,949	0.00	0.02
4	Clay w/some silt, w/trace sand	919	2.80	145.0	0.360	0.004	0.003	46,582	43,900	45,964	0.05	0.65

Compression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Effective Unit Weight (pcf)	Initial Void ratio e_o	Compression Index C_c	Corrected Compression Index C_{cc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Compression Settlement (ft)	Calculated Compression Settlement (in)
2	Silty Clay to Clay w/trace sand	22	2.80	145.0	0.360	0.009	0.006	3,698	1,595	1,809	0.00	0.00
3	Clay w/some silt, w/trace sand	19	2.80	145.0	0.360	0.009	0.006	7,250	4,568	4,949	0.00	0.00
4	Clay w/some silt, w/trace sand	919	2.80	145.0	0.360	0.009	0.006	46,582	43,900	45,964	0.00	0.00

Summary

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Calculated Elastic Settlement (in)	Calculated Recompression Settlement (in)	Calculated Compression Settlement (in)	Total Calculated Settlement (in)
2	Silty Clay to Clay w/trace sand	146	116	22	0.01	0.04	0.00	**0.05**
3	Clay w/some silt, w/trace sand	116	97	19	0.01	0.02	0.00	**0.03**
4	Clay w/some silt, w/trace sand	97	-822	919	0.99	0.65	0.00	**1.64**
							Total	**1.72**

Cell 10, Point 1, pg 3/3

GENERAL SOIL PROFILE: CELL 10, POINT 2 (NOT TO SCALE)

General Existing Profile (el/ev)	General Final Profile (el/ev)
Boring Profile: B-105	
	156 (Top of Landfill)
TOG = 153	
Sand w/ fines, some gravel Navg = 8	3' Cap & Cover
138	46' CDD Waste
Silty Clay to clay w/ trace sand Navg = 42	6' Liner & Leachate Collection System
108	101 (Floor of Landfill)
Silty clay to clay w/ trace sand ▽ 97 Navg = 66	
53	

RECORD OF BOREHOLE B-105

SHEET 1 of 2

PROJECT: Chesapeake Terrace SFI
PROJECT NUMBER: 063-1431-003
DRILLED DEPTH: 100.0 ft
AZIMUTH: N/A
LOCATION: Odenton, MD

DRILL METHOD: Mud Rotary- 3 in.
DRILL RIG: Simco 2800
DATE STARTED: 5/2/13
DATE COMPLETED:
WEATHER: Partly Cloudy

DATUM:
COORDS: N: 500,589.1 E: 1,386,809.5
GS ELEVATION: 115.7 ft
TOC ELEVATION: NA
TEMPERATURE: 50 F

INCLINATION: -90
DEPTH W.L.: NA

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT	COMMENTS
0	115								(6)		
		3.0 - 5.0 SAND; fine to medium, well-graded, subrounded; trace plastic fines, trace fine gravel; light brown; noncohesive; moist; loose.	SW		110.7	S1	DO	2-3-3-3	6	0.6/2.0	
5	110								(7)		Sa
		8.0 - 10.0 SAND; fine, poorly graded, subrounded; some plastic fines, trace coarse subangular gravel, lenses of soft red and white clay; light brown; noncohesive; moist; loose.	SP		105.7	S2	DO	2-3-4-3	7	1.0/2.0	Nav=8
10	105								(12)		
		13.0 - 15.0 SAND; fine to medium, well-graded, subrounded; some nonplastic fines, trace subangular coarse gravel, seams of light grey clay, lenses of clayey sand; light grey to light brown; trace organics; noncohesive; moist; compact.	SW		100.7	S3	DO	3-4-8-14	12	1.5/2.0	
15	100								(41)		
		18.0 - 20.0 SILTY CLAY; medium plasticity; seams of fine dark grey sand; dark red, slightly shiny; cohesive; w<PL; stiff.	CL		95.7	S4	DO	11-19-22-23	41	1.6/2.0	
20	95								(84)		
		23.0 - 25.0 SILTY CLAY; medium plasticity; mottled dark grey and brownish red, slightly shiny; cohesive; w<PL; very stiff.	CL		90.7	S5	DO	17-39-45-45	84	1.8/2.0	Si Cl to Cl
25	90								(32)		
		28.0 - 30.0 CLAY; high plasticity; grey mottled dark red and maroon, shiny; thinly laminated; trace black material: possibly organics; cohesive; w~PL; stiff.	CH		85.7	S6	DO	12-16-16-32	32	1.9/2.0	Nav=42
30	85								(28)		
		33.0 - 35.0 CLAY; high plasticity; grey mottled dark red and maroon, shiny; thinly laminated; trace black material: possibly organics; cohesive; w~PL; stiff.	CH		80.7	S7	DO	11-13-15-25	28	2.0/2.0	
35	80								(35)		
		38.0 - 40.0 SILTY CLAY; medium plasticity; some fine sand; light grey mottled dark red, slightly shiny; thinly laminated; cohesive;, w~PL; stiff.	CL		75.7	S8	DO	12-15-20-22	35	1.0/2.0	
40	75								(33)		
		43.0 - 44.0 CLAYEY SILT, low to medium plasticity; some fine sand, trace of fine gravel; light grey, dull; cohesive; stiff.	ML / CH		71.7 / 44.0 / 70.7	S9	DO	12-15-18-23	33	2.0/2.0	
45	70	44.0 - 45.0 CLAY; medium to high plasticity; brown and purple mottled yellowish brown, shiny; thinly laminated; cohesive; stiff.							(64)		
		48.0 - 50.0 SILTY CLAY; medium to high plasticity; trace fine sand, pockets of fine yellow-brown sand; light grey, slightly shiny; cohesive; w~PL; stiff.	CL		65.7	S10	DO	17-26-38-40	64	0.7/2.0	Si Cl to Cl Nav=64
50	65										

Log continued on next page

LOG SCALE: 1 in = 6.5 ft
DRILLING COMPANY: Earth Matters Inc.
DRILLER: D. Taylor

GA INSPECTOR: KMC
CHECKED BY: VEF
DATE: 8/8/13

Golder Associates

AA GEOTECH LOG NO PID CHESAPEAKE SFI.GPJ GOLDER NJ-PA 05-24-06.GDT 9/27/13

RECORD OF BOREHOLE B-105

SHEET 2 of 2

PROJECT: Chesapeake Terrace SFI
PROJECT NUMBER: 063-1431-003
DRILLED DEPTH: 100.0 ft
AZIMUTH: N/A
LOCATION: Odenton, MD

DRILL METHOD: Mud Rotary- 3 in.
DRILL RIG: Simco 2800
DATE STARTED: 5/2/13
DATE COMPLETED:
WEATHER: Partly Cloudy

DATUM:
COORDS: N: 500,589.1 E: 1,386,809.5
GS ELEVATION: 115.7 ft
TOC ELEVATION: NA
TEMPERATURE: 50 F

INCLINATION: -90
DEPTH W.L.: NA

DEPTH (ft)	ELEVATION (ft)	DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT	COMMENTS
55	60	53.0 - 55.0 SILTY CLAY; medium plasticity; seams of fine sand; reddish brown mottled light grey, slightly shiny; cohesive; w~PL; stiff.	CL		60.7	S11	DO	21 -37 -47 -50/5"	84	1.2/2.0	
60	55	58.0 - 60.0 SILTY CLAY; medium to high plasticity; trace fine sand; light grey mottled reddish brown, lightly shiny; cohesive; w~PL; firm.	CL		55.7	S12	DO	16 -18 -22 -30	40	1.7/2.0	
65	50	63.0 - 65.0 SILTY CLAY; low to medium plasticity; light grey mottled reddish brown, slightly shiny; cohesive; w~PL; stiff.	CL		50.7	S13	DO	21 -33 -36 -42	99	0.7/2.0	
70	45	68.0 - 70.0 CLAY; high plasticity; purplish grey mottled dark red, shiny; cohesive; w<PL; very stiff.	CH		45.7	S14	DO	18 -24 -27 -30	51	2.0/2.0	
75	40	73.0 - 75.0 CLAY; high plasticity; some nonplastic fines, pockets of fine sand; grey and purple mottled dark red, shiny; thinly laminated; cohesive; w~PL; stiff to very stiff.	CH		40.7	S15	DO	17 -21 -31 -34	52	2.0/2.0	
80	35	78.0 - 80.0 SILTY CLAY; low to medium plasticity; trace fine sand, pockets of fine sand; light grey mottled dark red, slightly shiny; thinly laminated; cohesive; w~PL; stiff to very stiff.	CL		35.7	S16	DO	24 -26 -40 -50	76	1.9/2.0	
85	30	83.0 - 83.8 SILTY CLAY; medium to high plasticity; trace of fine sand; mottled light grey and dark red; cohesive; w~PL; stiff to very stiff.	CL CH		31.9 83.8 30.9	S17	DO	22 -22 -23 -35	45	1.8/2.0	
		83.8 - 84.8 CLAY; medium to high plasticity; some nonplastic fines, trace of fine sand; dark red mottled light grey; cohesive; w~PL; firm to stiff.									
90	25	88.0 - 90.0 CLAYEY SILT and SAND; low to medium plasticity; ~35% fine sand, pockets of fine sand, lens of soft red clay; light grey mottled dark red and brown, slightly shiny; cohesive; w<PL; stiff.	MH		25.7	S18	DO	15 -22 -38 -39	60	2.0/2.0	
95	20	93.0 - 95.0 CLAYEY SILT; low to medium plasticity; some fine sand, pockets of fine sand, seams of clay and fine sand; light grey mottled dark red and brown, slightly shiny; cohesive; w<PL; stiff.	MH		20.7	S19	DO	30 -40 -50/5"	N/A	1.5/2.0	Drilled w/o sampling. (94.4'-95')
100	15	98.0 - 100.0 SILTY CLAY; medium to high plasticity; lenses of fine clayey sand; purplish brown, slightly shiny; cohesive; w<PL; stiff.	CL		15.7	S20	DO	19 -22 -37 -42	59	1.6/2.0	
		Boring completed at 100.0 ft									

LOG SCALE: 1 in = 6.5 ft
DRILLING COMPANY: Earth Matters Inc.
DRILLER: D. Taylor

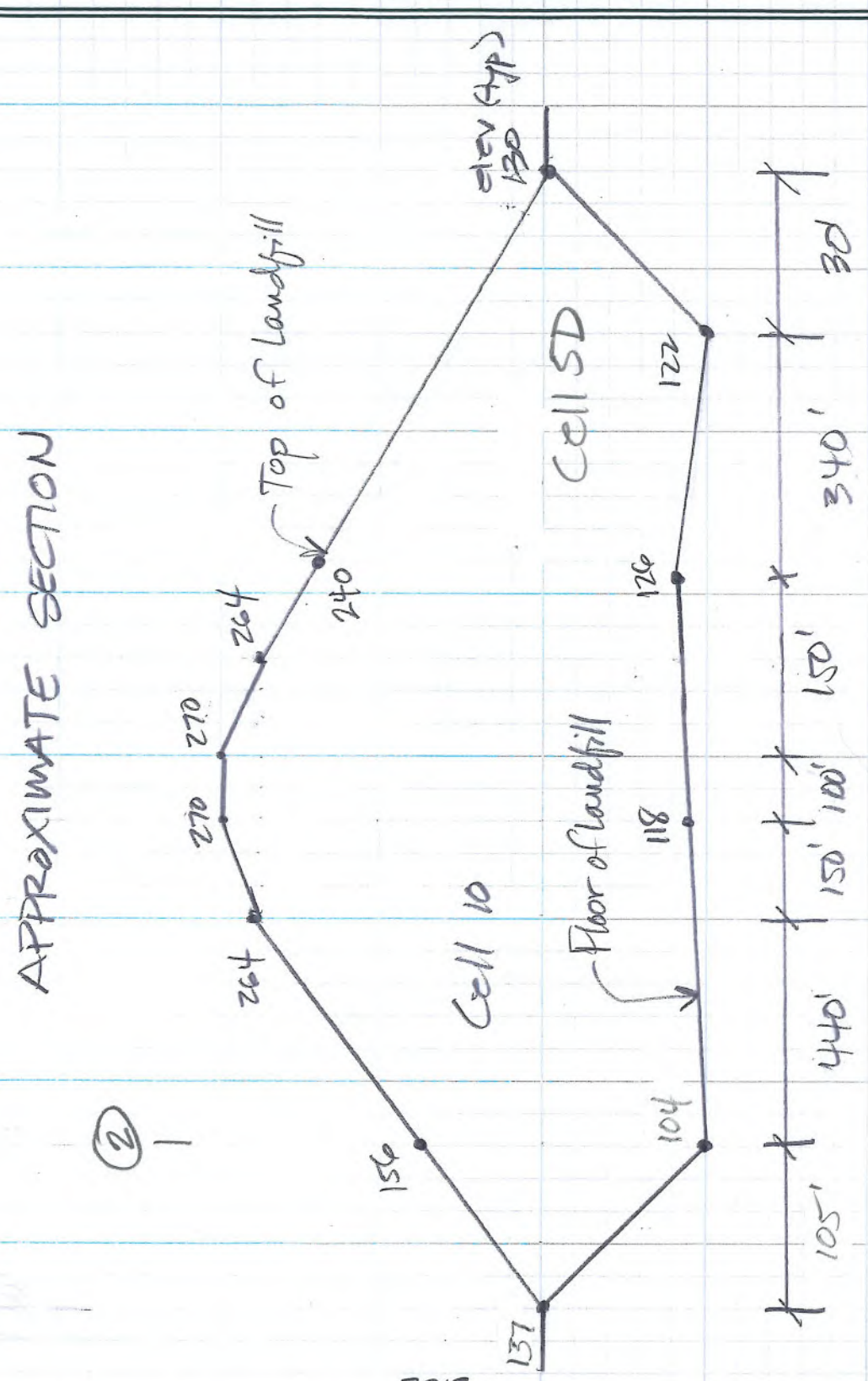
GA INSPECTOR: KMC
CHECKED BY: VEF
DATE: 8/8/13

Golder Associates

AA GEOTECH LOG NO PID CHESAPEAKE SFI.GPJ GOLDER NJ-PA 05-24-06.GDT 9/27/13

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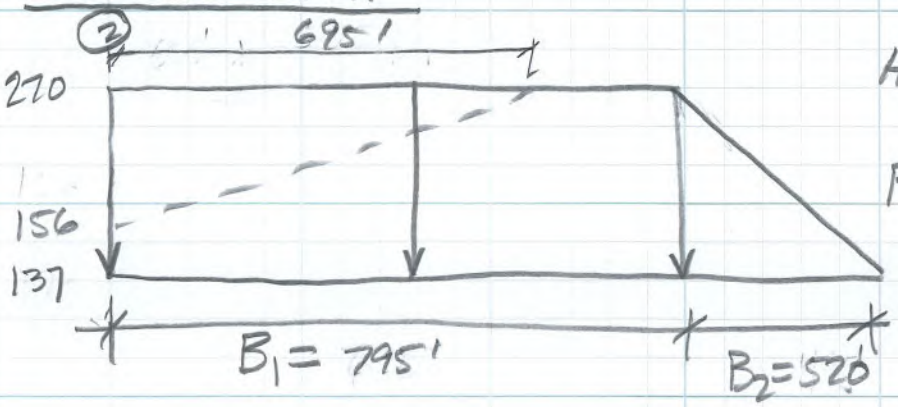


2018-

SHEET 1	OF 1	PROJECT NO. 3084		PROJECT NAME	Chestnut
BY VCA		DATE 7/5/20		DESCRIPTION	Cell 10, Point 2 Settlement
CHK. BY		DATE			

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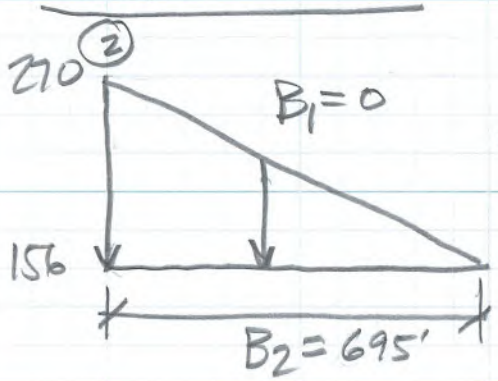
Waste Load U_1



$H_{CDD} = 270 - 137 - 3$
$= 130'$

$p = \Sigma(\gamma H)$
$= (3)(115) + (130)(48.7)$
$= 6676$ psf

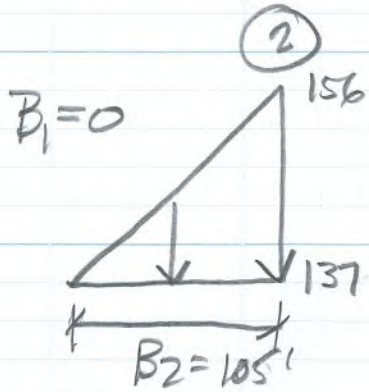
Waste Load U_2



$H_{CDD} = 270 - 156 - 3 = 111'$

$p = \Sigma(\gamma H) = (3)(115) + (111)(48.7) = 5751$

Waste Load U_3



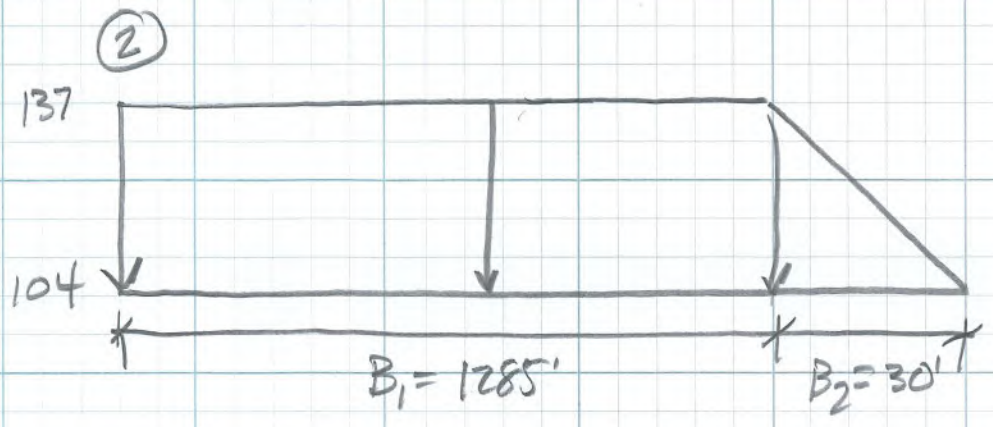
$H_{CDD} = 156 - 137 - 3 = 16'$

$p = \Sigma(\gamma H) = (3)(115) + (16)(48.7)$
$= 1124$ psf

SHEET 1	OF 2	PROJECT NO. 2018-3089		PROJECT NAME	
BY JCA		DATE 7/6/20		DESCRIPTION	Cell 10, Part 2 Settlement
CHK. BY		DATE			

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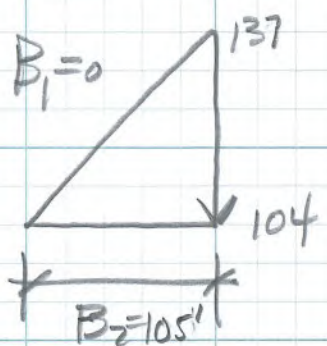
Waste Load L_1



$H_{COD} = 137 - 104 - 6 = 27'$

$p = \Sigma'(\delta H) = (27)(48.7) + (6)(115) = 2005$ psf

Waste Load L_2



$H_{COD} = 132 - 104 - 6 = 27'$

$p = \Sigma'(\delta H)$

$= (27)(48.7) + (6)(115)$

$= 2005$ psf

Net load = $U_1 - U_2 + U_3 + L_1 - L_2$

2018-

SHEET 2	OF 2	PROJECT NO. 3084	PROJECT NAME		
BY	JCA	DATE 7/6/20	DESCRIPTION	Cell 10, Point 2 Settlement	
CHK. BY		DATE			

Cell 10 **Point** 2

Boring Profile: B-105

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Initial Effective Vertical Stress at Bottom of Soil Layer (psf)	Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)
1	Sand w/some fines, gravel	153	138	15	8	101.5	0	101.5	761	0.761	1,523	761
2	Silty Clay to Clay w/trace sand	138	108	30	42	145.0	0	145.0	3,698	3.698	5,873	3,698
3	Clay w/some silt, w/trace sand	108	97	11	42	145.0	0	145.0	6,670	6.670	7,468	6,670
4	Clay w/some silt, w/trace sand	97	-859	956	66	145.0	62.4	82.6	46,950	46.950	86,433	46,950
			Total Depth =	*1012*								

Intermediate Profile >>>> With excavation, soil is now over-consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Intermediate Effective Vertical Stress at Bottom of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	101	97	4	42	145.0	0	145.0	290	0.290	580
4	Clay w/some silt, w/trace sand	97	-859	956	66	145.0	62.4	82.6	40,063	40.063	79,546

Waste Load U1 *B1 =* 795 *B2 =* 520 *Po =* 6,676 *psf*

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	101	97	4	2	4	0.001	1.568	0.500	3,340
4	Clay w/some silt, w/trace sand	97	-859	956	482	960	0.194	1.026	0.483	3,222

Waste Load U2 *B1 =* 0.01 *B2 =* 695 *Po =* 5,751 *psf*

Cell 10, Point 2, pg 1/4

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	101	97	4	2.0	4.0	1.563	0.005	0.499	2,872
4	Clay w/some silt, w/trace sand	97	-859	956	482.0	960.0	0.964	0.000	0.307	1,766

Waste Load U3 *B1 =* 0.01 *B2 =* 105 *Po =* 1,124 *psf*

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y 0	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	101	97	4	2.0	4.0	1.547	0.005	0.494	556
4	Clay w/some silt, w/trace sand	97	-859	956	482.0	960.0	0.214	0.000	0.068	77

Waste Load L1 *B1 =* 1285 *B2 =* 30 *Po =* 2,005 *psf*

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	101	97	4	2	4	0.000	1.569	0.500	1003
4	Clay w/some silt, w/trace sand	97	-859	956	482	960	0.008	1.212	0.491	984

Waste Load L2 *B1 =* 0.01 *B2 =* 105 *Po =* 2,005 *psf*

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	108	97	11	5.5	11	1.517	0.002	0.484	970
4	Clay w/some silt, w/trace sand	97	-859	956	489	967	0.212	0.000	0.067	135

Cell 10, Point 2, pg 3/4

Load Totals

Soil Layer	Soil Description	Load U1 (psf)	Load U2 (psf)	Load U3 (psf)	Load L1 (psf)	Load L2 (psf)	Increase in Effective Pressure (p') at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	3,340	(2,872)	556	1003	(970)	1,057
4	Clay w/some silt, w/trace sand	3,222	(1,766)	77	984	(135)	2,382

Final Profile

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)
3	Clay w/some silt, w/trace sand	108	97	11	145.0	0	145.0	290	1,057	1.057	1,347
4	Clay w/some silt, w/trace sand	97	-859	956	145.0	62.4	82.6	40,063	2,382	2.382	42,445

Elastic Settlement

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_a)	Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
3	Clay w/some silt, w/trace sand	11	42	22.9518	10,041	1.057	0.001	0.01
4	Clay w/some silt, w/trace sand	956	66	52.6254	23,024	2.382	0.099	1.19

Recompression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void Ratio e_o	Compression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
3	Clay w/some silt, w/trace sand	11	2.80	145.0	0.360	0.004	0.003	6,670	290	1347	0.02	0.26
4	Clay w/some silt, w/trace sand	956	2.80	145.0	0.360	0.004	0.003	46,950	40,063	42445	0.07	0.85

Cell 10, Point 2, pg 3/4

Compression Settlement - Cohesive Soils

Soil Layer	*Soil Description*	*Thickness (ft)*	*Specific Gravity*	*Estimated Unit Weight (pcf)*	*Initial Void Ratio* e_o	*Compression Index* C_c	*Corrected Compression Index* C_{cc}	*Effective Pre-consolidation Stress* (σ_p') *(psf)*	*Initial Effective Vertical Stress* (σ_{vo}') *at Center of Soil Layer (psf)*	*Final Effective Vertical Stress* (σ_{vf}') *at Center of Soil Layer (psf)*	*Calculated Compression Settlement (ft)*	*Calculated Compression Settlement (in)*
3	Clay w/some silt, w/trace sand	11	2.80	145.0	0.360	0.009	0.006	6,670	290	1,347	0.00	0.00
4	Clay w/some silt, w/trace sand	956	2.80	145.0	0.360	0.009	0.006	46,950	40,063	42,445	0.00	0.00

Summary

Soil Layer	*Soil Description*	*Top Elev (ft)*	*Bottom Elev (ft)*	*Thickness (ft)*	*Calculated Elastic Settlement (in)*	*Calculated Recompression Settlement (in)*	*Calculated Compression Settlement (in)*	*Total Calculated Settlement (in)*
3	Clay w/some silt, w/trace sand	108	97	11	0.01	0.26	0.00	0.27
4	Clay w/some silt, w/trace sand	97	-859	956	1.19	0.85	0.00	2.04
							Total	**2.32**

GENERAL SOIL PROFILE: CELL 10 **, POINT** 3 (NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
Boring Profile: B-104 MW-18	240 (Top of Landfill)
	3' Cap & Cover 105' CDD Waste 6' Liner & Leachate Collection System
TOG 136	
Sand w/ trace fines Navg = 11	126 (Floor of Landfill)
▽ 112	
110	
Sand w/ trace fines Navg = 34	
100	
clay to Silty clay Navg = 49	
35	
Silty Clayey Sand to Silty Sand Navg = 74	
5	
clay Navg = 70	

RECORD OF BOREHOLE B-104

SHEET 1 of 2

PROJECT: Chesapeake Terrace SFI
PROJECT NUMBER: 063-1431-003
DRILLED DEPTH: 100.0 ft
AZIMUTH: N/A
LOCATION: Odenton, MD

DRILL METHOD: Mud Rotary- 3 in.
DRILL RIG: Simco 2800
DATE STARTED: 4/22/13
DATE COMPLETED: 4/22/13
WEATHER: Partly Sunny

DATUM:
COORDS: N: 501,106.0 E: 1,386,593.8
GS ELEVATION: 109.9 ft
TOC ELEVATION: NA
TEMPERATURE: 55 F

INCLINATION: -90
DEPTH W.L.: NA

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT	COMMENTS
0		0.0 - 2.0 SAND; fine to medium, poorly graded, subrounded; lens of brown silty clay; yellowish brown; noncohesive; moist; compact.	SP		107.9	S1	DO	3 -5 -7 -9	12	0.9/2.0	Sa
		3.0 - 5.0 SAND; medium to coarse, poorly graded, subrounded; some nonplastic fines; reddish brown; noncohesive; moist to wet; very dense.	SP		104.9	S2	DO	26 -27 -27 -30	54	1.3/2.0	Navg = 34
5	105										
		8.0 - 10.0 CLAYEY SAND; medium to coarse, poorly graded; some medium to coarse subrounded gravel; yellowish brown to dark grey; cohesive to noncohesive; moist; dense.	SC		99.9	S3	DO	18 -25 -12 -12	37	0.8/2.0	cl to sicl
10	100										
		13.0 - 15.0 CLAY; high plasticity; light grey mottled maroon, shiny; thinly laminated; cohesive; w>PL; stiff.	CH		94.9	S4	DO	18 -12 -25 -28	37	1.2/2.0	Navg = 49
15	95										
		18.0 - 20.0 CLAY; high plasticity; light grey mottled maroon, shiny; thinly laminated; cohesive; w<PL; stiff.	CH		89.9	S5	DO	10 -12 -25 -28	37	1.3/2.0	Clay possibly swelling in borehole.
20	90										
		23.0 - 25.0 SILTY CLAY; medium plasticity; lens of fine to medium yellow-brown sand, pockets of fine grey sand; light grey mottled dark red, slightly shiny; thinly laminated; cohesive; w<PL; stiff.	CL		84.9	S6	DO	13 -26 -26 -33	52	1.5/2.0	Clay swelled enough to close borehole and refuse rods- used 15' of 4'1/4" HSAs to support hole and resumed drilling and sampling through augers from 0-15 ft bgs.
25	85										
		28.0 - 30.0 SILTY CLAY; medium plasticity; trace of coarse angular gravel, pockets of fine yellowish brown sand; light grey mottled dark red, slightly shiny; thinly laminated; cohesive; w<PL; stiff.	CL		79.9	S7	DO	10 -12 -24 -24	36	1.2/2.0	
30	80										
		33.0 - 35.0 CLAY; medium to high plasticity; some nonplastic fines; dark red mottled light grey, shiny; cohesive; w~PL; stiff.	CH		74.9	S8	DO	9 -12 -22 -31	34	2.0/2.0	
35	75										
		38.0 - 40.0 SILTY CLAY; low to medium plasticity; trace fine sand, pockets of fine sand; brownish red mottled light grey, slightly shiny; slightly fissured; cohesive; w<PL; very stiff.	CL		69.9	S9	DO	12 -22 -37 -40	59	1.4/2.0	
40	70										
		43.0 - 45.0 SILTY CLAY; low to medium plasticity; trace fine sand; brownish red, slightly shiny; cohesive; w>PL; stiff.	CL		64.9	S10	DO	12 -26 -35 -45	61	2.0/2.0	
45	65										
		48.0 - 50.0 SILTY CLAY; low to medium plasticity; trace fine sand; brownish red, slightly shiny; cohesive; w>PL; stiff.	CL		59.9	S11	DO	20 -30 -35 -40	65	0.1/2.0	
50	60										

Log continued on next page

LOG SCALE: 1 in = 6.5 ft
DRILLING COMPANY: Earth Matters Inc.
DRILLER: D. Taylor

GA INSPECTOR: KMC
CHECKED BY: VEF
DATE: 8/8/13

Golder Associates

AA GEOTECH LOG NO PID CHESAPEAKE SFI.GPJ GOLDER NJ-PA 05-24-06.GDT 9/27/13

RECORD OF BOREHOLE B-104

SHEET 2 of 2

PROJECT: Chesapeake Terrace SFI
PROJECT NUMBER: 063-1431-003
DRILLED DEPTH: 100.0 ft
AZIMUTH: N/A
LOCATION: Odenton, MD

DRILL METHOD: Mud Rotary- 3 in.
DRILL RIG: Simco 2800
DATE STARTED: 4/22/13
DATE COMPLETED: 4/22/13
WEATHER: Partly Sunny

DATUM:
COORDS: N: 501,106.0 E: 1,386,593.8
GS ELEVATION: 109.9 ft
TOC ELEVATION: NA
TEMPERATURE: 55 F

INCLINATION: -90
DEPTH W.L.: NA

DEPTH (ft)	ELEVATION (ft)	SOIL PROFILE DESCRIPTION	USCS	GRAPHIC LOG	ELEV. / DEPTH (ft)	SAMPLES NUMBER	TYPE	BLOWS per 6 in	N	REC / ATT	COMMENTS
55	55	53.0 - 55.0 CLAY; high plasticity; purplish grey, mottled light grey, shiny; cohesive, w<PL, very stiff.	CH		54.9	S12	DO	20 -20 -35 -40	55	1.1 2.0	
60	50	58.0 - 60.0 SILTY CLAY; medium plasticity; pockets of fine yellow-brown sand; mottled light grey and dark red; some yellow-brown staining; cohesive; w~PL; stiff. 58.8-59 ft: soft clay.	CL		49.9	S13	DO	14 -30 -35 -42	65	1.0 2.0	
65	45	63.0 - 65.0 CLAY; medium to high plasticity; some nonplastic fines, trace fine sand, lens of fine to medium yellowish brown sand; dark red mottled grey, shiny; thinly laminated; cohesive; w~PL; very stiff.	CH		44.9	S14	DO	12 -20 -30 -30	50	2.0 2.0	
70	40	68.0 - 70.0 SILTY CLAY; low to medium plasticity; some fine sand, pockets of fine grey sand; light grey mottled dark red, slightly shiny; cohesive; w<PL; very stiff.	CL		39.9	S15	DO	13 -23 -31 -39	54	0.4 2.0	
75	35	73.0 - 75.0 SILTY CLAY and SAND; low to medium plasticity; fine, grey, poorly graded, subrounded sand; grey and reddish brown; cohesive; w~PL; stiff.	CL		34.9	S16	DO	11 -17 -17 -50	34	1.7 2.0	Si Cl & Sa to Si Sa Navg = 74
80	30	78.0 - 80.0 SILTY CLAY and SAND; low plasticity; fine, grey, poorly graded, subrounded sand, lenses of grey clay, lenses of fine to medium grey sand; light grey; cohesive; w~PL; firm.	CL		29.9	S17	DO	16 -22 -25 -50/5"	47	1.9 2.0	
85	25	83.0 - 85.0 CLAYEY SILTY SAND; fine, poorly graded, subrounded; lenses of grey clay, lenses of fine to medium grey sand; noncohesive; moist to wet; dense.	SM		24.9	S18	DO	31 -17 -33 -50/3"	50	1.8 2.0	Drilled w/o sampling. (84.6'-86')
90	20	88.0 - 90.0 SILTY SAND; fine to medium, poorly graded, subrounded; some plastic fines, lens of grey clay; light grey; noncohesive; moist; very dense.	SM		19.9	S19	DO	27 -43 -50/3"	100+ N/A	1.0 2.0	Drilled w/o sampling. (89.3'-90')
95	15	93.0 - 95.0 SILTY SAND; fine to medium, well graded, subrounded; lens of soft dark red clay; light grey; trace thin, black, soft, shiny material: possibly coal; noncohesive; moist to wet; very dense.	SM		14.9	S20	DO	50/5"	100+ N/A	0.5 2.0	Drilled w/o sampling. (93.4'-95')
100	10	98.0 - 100.0 CLAY; medium to high plasticity; some nonplastic fines, seams of fine dark grey sand; dark grey, shiny; cohesive; w<PL; very stiff. Boring completed at 100.0 ft	CH		9.9	S21	DO	16 -35 -35 -40	70	2.0 2.0	Cl Navg = 70

LOG SCALE: 1 in = 6.5 ft
DRILLING COMPANY: Earth Matters Inc.
DRILLER: D. Taylor

GA INSPECTOR: KMC
CHECKED BY: VEF
DATE: 8/8/13

Golder Associates

AA GEOTECH LOG NO PID CHESAPEAKE SFI.GPJ GOLDER NJ-PA 05-24-06.GDT 9/27/13

MW-18

Chesapeake Terrace

Client	National Waste Managers	Drill Rig	Hollow Stem
Geologist	Mark Schultz	Ground Elevation	126 Feet
Date Drilled	4-8-03	Total Depth of Borehole	23 Feet
Borehole Diameter	8 Inches	Depth to Water	11.24 Feet

Graphic Log	Description	Depth	Sample	Recovery (in)	Blow Counts	Completion
	Sand, med-crs, tr fines, yellow-brn-tan, moist to wet	5, 10, 15, 20		14, 15, 17, 18	(9) 3-5-4-5; (13) 4-5-8-10; (9) 3-4-5-7; (12) 3-5-7-9	
	Clay, tr silt, maroon and gray mottled, plastic, moist to wet	25		16	(18) 6-8-10-30	
		30, 35, 40, 45				

Nav = 11

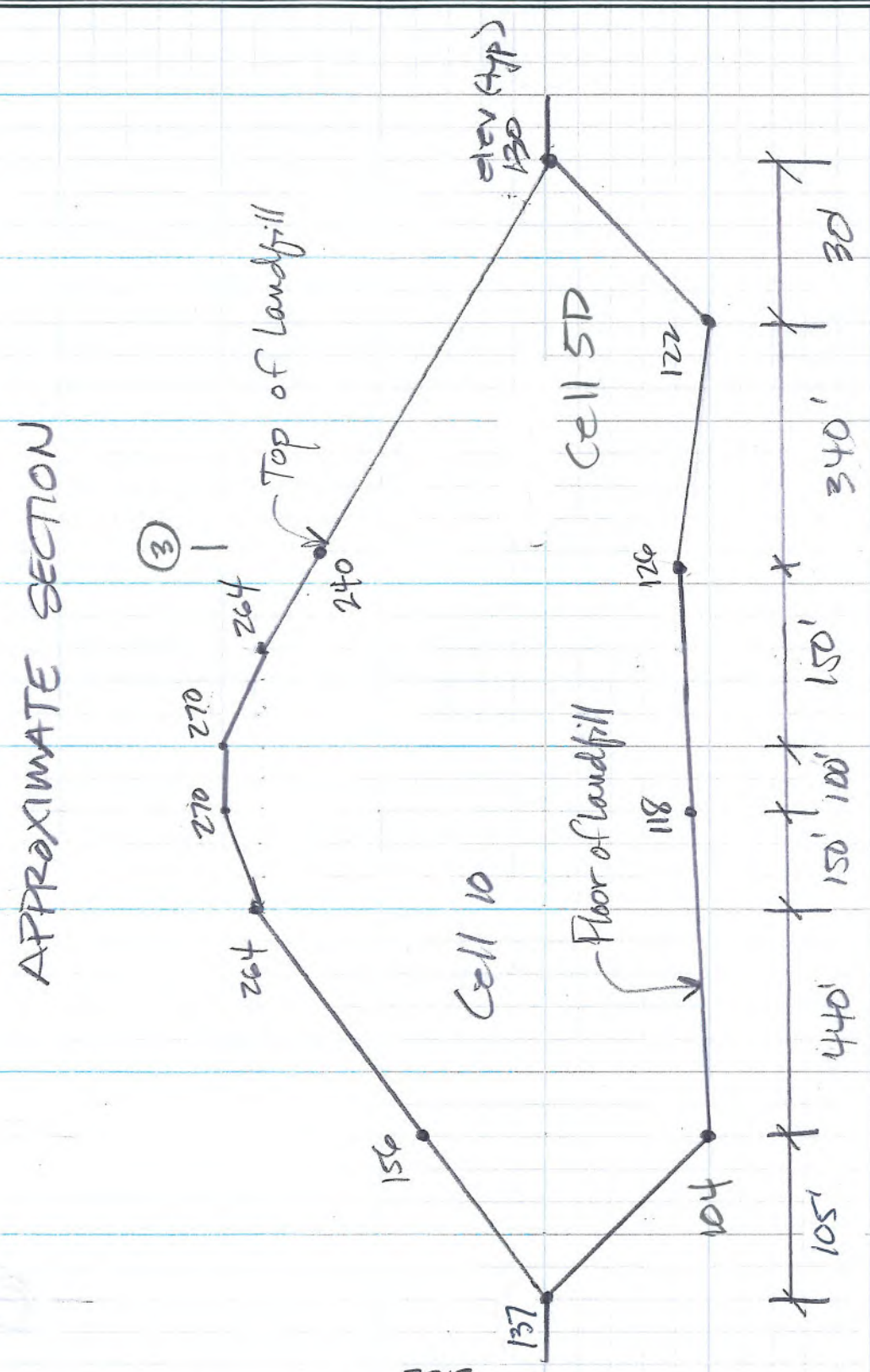
Nav = 18

Notes:

C:\Program Files\Pompoise Media\Well Logger 2.7\Chesapeake Terrace\April 2003 Drilling Program.wl2

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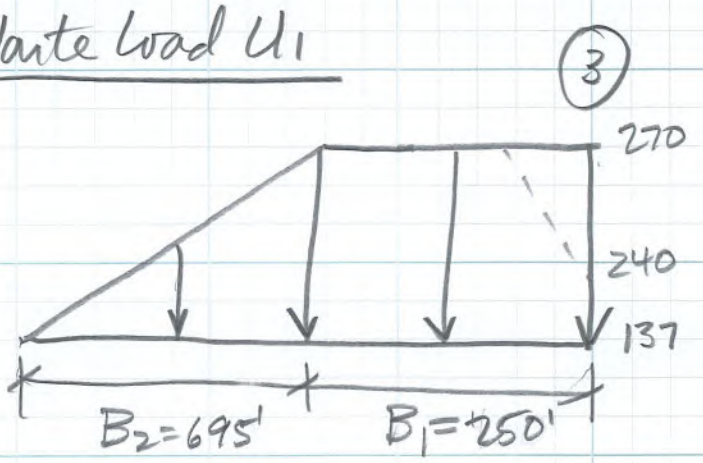


2018-

SHEET 1	OF 1	PROJECT NO. 3084		PROJECT NAME	Chestnut
BY VCA		DATE 7/5/20		DESCRIPTION	Cell 10, Point 3 Settlement
CHK. BY		DATE			

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Waste Load U1



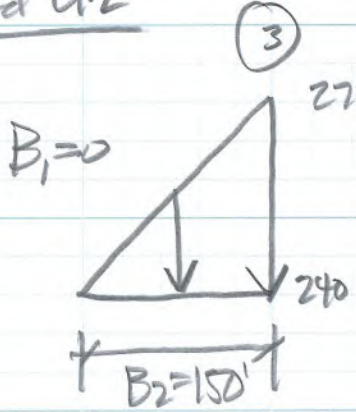
$H_{COD} = 270 - 137 - 3 = 130'$

$p = \xi'(\gamma H)$

$= (3)(115) + (130)(48.7)$

$= 6676$ psf

Waste Load U2

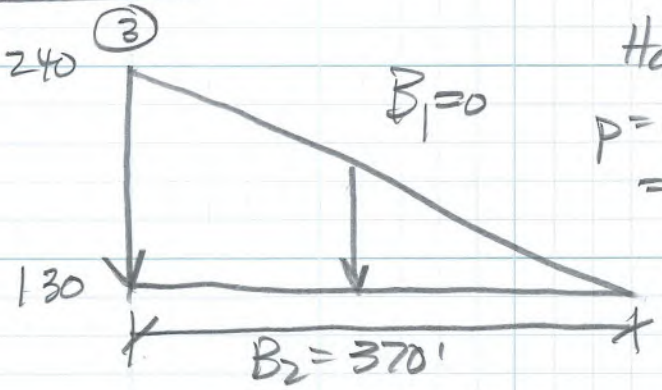


$H_{COD} = 270 - 240 - 3 = 27'$

$p = \xi'(\gamma H) = (3)(115) + (27)(48.7)$

$= 1660$ psf

Waste Load U3



$H_{COD} = 240 - 130 - 3 = 107'$

$p = \xi'(\gamma H) = (3)(115) + (107)(48.7)$

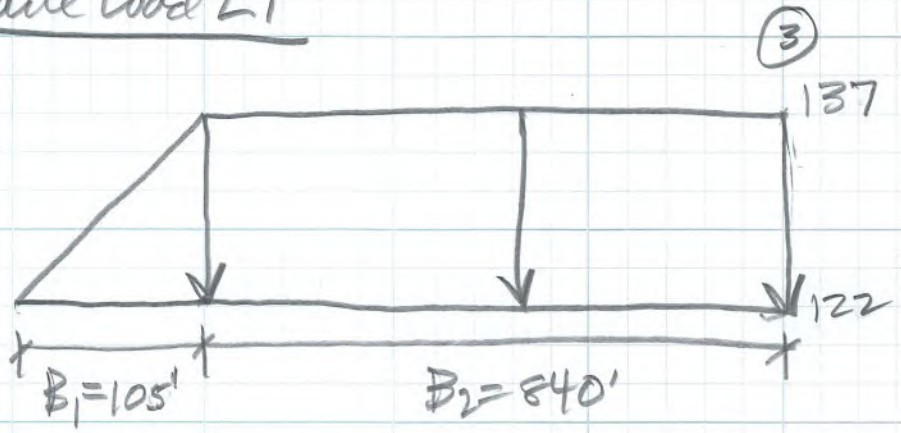
$= 5556$ psf

2018-

SHEET 1	OF 2	PROJECT NO. 3084		PROJECT NAME	
BY JCA		DATE 7/6/20		DESCRIPTION	Cell 10, Part 3 Settlement
CHK. BY		DATE			

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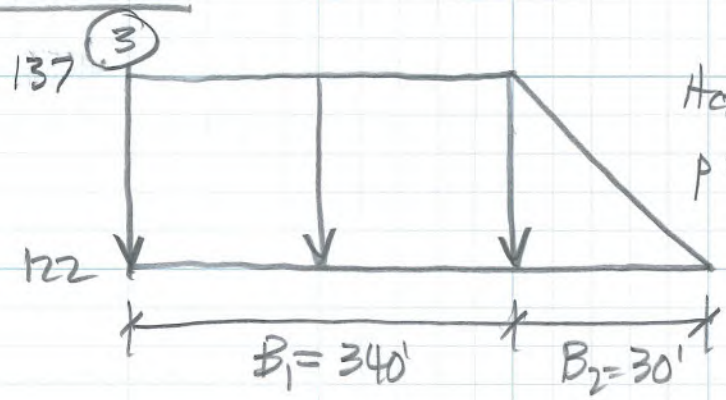
Waste Load L_1



$H_{CDD} = 137 - 122 - 6 = 9'$

$p = \Sigma(\gamma H) = (6)(115) + (9)(48.7) = 1128$ psf

Waste Load L_2



$H_{CDD} = 137 - 122 - 6 = 9'$

$p = \Sigma(\gamma H) = (9)(48.7) + (6)(115)$
$= 1128$ psf

Net load = $U_1 - U_2 + U_3 + L_1 + L_2$

2018

SHEET 2	OF 2	PROJECT NO. 3088		PROJECT NAME	
BY JKA		DATE 7/6/20		DESCRIPTION Cell 10, Part 3 Settlement	
CHK. BY		DATE			

Cell 10 **Point** 3

Boring Profile: B-104, MW-18

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Initial Effective Vertical Stress at Bottom of Soil Layer (psf)	Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)
1	Sand w/trace fines	136	112	24	11	117.7	0	117.7	1,413	1.413	2,826	1,413
2	Sand w/trace fines	112	110	2	11	117.7	62.4	55.3	2,881	2.881	2,936	2,881
3	Sand w/trace fines	110	100	10	34	131.5	62.4	69.1	3,282	3.282	3,627	3,282
4	Clay to Clayey Silt	100	35	65	49	145.0	62.4	82.6	6,312	6.312	8,996	6,312
5	Silty Clayey Sand to Silty Sand	35	5	30	74	145.0	62.4	82.6	10,235	10.235	11,474	10,235
6	Clay	5	-834	839	70	145.0	62.4	82.6	46,125	46.125	80,775	46,125
			Total Depth =	*970*								

Interimediate Profile >>>> With excavation, soil is now over-consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Intermediate Effective Vertical Stress at Bottom of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	11	117.7	0	117.7	824	0.824	1,648
2	Sand w/trace fines	112	110	2	11	117.7	62.4	55.3	1,704	1.704	1,759
3	Sand w/trace fines	110	100	10	34	131.5	62.4	69.1	2,104	2.104	2,450
4	Clay to Clayey Silt	100	35	65	49	145.0	62.4	82.6	5,134	5.134	7,819
5	Silty Clayey Sand to Silty Sand	35	5	30	74	145.0	62.4	82.6	9,058	9.058	10,297
6	Clay	5	-834	839	70	145.0	62.4	82.6	44,947	44.947	79,598

Waste Load U1 ***400*** 695 ***540*** 250 ***Po =*** 6,676 ***psf***

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.003	1.562	0.500	3,340
2	Sand w/trace fines	112	110	2	15	16	0.007	1.552	0.500	3,340
3	Sand w/trace fines	110	100	10	21	26	0.010	1.544	0.500	3,340
4	Clay to Clayey Silt	100	35	65	58.5	91	0.029	1.497	0.500	3,339
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.052	1.438	0.500	3,338
6	Clay	5	-834	839	540.5	960	0.207	0.974	0.477	3,184

Cell 10, Point 3, pg 1/4

Waste Load U2 B1 = 0.01 B2 = 150 Po = 1,660 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.003	1.562	0.500	830
2	Sand w/trace fines	112	110	2	15	16	0.007	1.552	0.500	830
3	Sand w/trace fines	110	100	10	21	26	0.010	1.544	0.500	830
4	Clay to Clayey Silt	100	35	65	58.5	91	0.029	1.497	0.500	830
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.052	1.438	0.500	830
6	Clay	5	-834	839	540.5	960	0.207	0.974	0.477	792

Waste Load U3 B1 = 0.01 B2 = 370 Po = 5,556 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.003	1.562	0.500	2,779
2	Sand w/trace fines	112	110	2	15	16	0.007	1.552	0.500	2,779
3	Sand w/trace fines	110	100	10	21	26	0.010	1.544	0.500	2,779
4	Clay to Clayey Silt	100	35	65	58.5	91	0.029	1.497	0.500	2,779
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.052	1.438	0.500	2,778
6	Clay	5	-834	839	540.5	960	0.207	0.974	0.477	2,650

Waste Load L1 B1 = 105 B2 = 840 Po = 1,128 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.000	1.565	0.500	564
2	Sand w/trace fines	112	110	2	15	16	0.000	1.559	0.500	564
3	Sand w/trace fines	110	100	10	21	26	0.000	1.554	0.500	564
4	Clay to Clayey Silt	100	35	65	58.5	91	0.001	1.525	0.500	564
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.002	1.488	0.500	564
6	Clay	5	-834	839	540.5	960	0.008	1.173	0.488	550

Cell 10, Point 3, Pg 3/4

Waste Load L2

B1 = 340 B2 = 30 Po = 1,128 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.000	1.565	0.500	564
2	Sand w/trace fines	112	110	2	15	16	0.000	1.559	0.500	564
3	Sand w/trace fines	110	100	10	21	26	0.000	1.554	0.500	564
4	Clay to Clayey Silt	100	35	65	58.5	91	0.001	1.525	0.500	564
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.002	1.488	0.500	564
6	Clay	5	-834	839	540.5	960	0.008	1.173	0.488	550

Load Totals

Soil Layer	Soil Description	Waste Load U1 (psf)	Waste Load U2 (psf)	Waste Load U3 (psf)	Waste Load L1 (psf)	Waste Load L2 (psf)	Total Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)
1	Sand w/trace fines	3,340	(830)	2,779	564	564	6,417
2	Sand w/trace fines	3,340	(830)	2,779	564	564	6,417
3	Sand w/trace fines	3,340	(830)	2,779	564	564	6,417
4	Clay to Clayey Silt	3,339	(830)	2,779	564	564	6,417
5	Silty Clayey Sand to Silty Sand	3,338	(830)	2,778	564	564	6,414
6	Clay	3,184	(792)	2,650	550	550	6,142

Final Profile

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Intermediate Effective Vertical Stress (σ_{vo} ') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (ksf)	Final Effective Vertical Stress (σ_{vo} ') at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	11	117.7	0.0	117.7	824	6,417	6.417	7,241
2	Sand w/trace fines	112	110	2	11	117.7	62.4	55.3	1,704	6,417	6.417	8,121
3	Sand w/trace fines	110	100	10	34	131.5	62.4	69.1	2,104	6,417	6.417	8,522
4	Clay to Clayey Silt	100	35	65	49	145.0	62.4	82.6	5,134	6,417	6.417	11,551
5	Silty Clayey Sand to Silty Sand	35	5	30	74	145.0	62.4	82.6	9,058	6,414	6.414	15,472
6	Clay	5	-834	839	70	145.0	62.4	82.6	44,947	6,142	6.142	51,089

Cell 10, Point 3, pg 3/4

Elastic Settlement

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_a)	Estimated Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
1	Sand w/trace fines	14	11		176.00	6.417	0.51	6.13
2	Sand w/trace fines	2	11		176.00	6.417	0.07	0.88
3	Sand w/trace fines	10	34		544.00	6.417	0.12	1.42
4	Clay to Clayey Silt	65	49	30.3452	13,276.03	6.417	0.03	0.38
5	Silty Clayey Sand to Silty Sand	30	74		1,184.00	6.414	0.16	1.95
6	Clay	839	70	58.7582	25,706.71	6.142	0.20	2.41

Recompression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Recompression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Interim Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
1	Sand w/trace fines	14	2.65	117.7								
2	Sand w/trace fines	2	2.65	117.7								
3	Sand w/trace fines	10	2.65	131.5								
4	Clay to Clayey Silt	65	2.80	145.0	0.360	0.009					0.00	0.00
5	Silty Clayey Sand to Silty Sand	30	2.65	145.0								
6	Clay	839	2.80	145.0	0.360	0.009					0.00	0.00

Compression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Compression Index C_c	Corrected Compression Index C_{cc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Compression Settlement (ft)	Calculated Compression Settlement (in)
1	Sand w/trace fines	14	2.65	117.7								
2	Sand w/trace fines	2	2.65	117.7								
3	Sand w/trace fines	10	2.65	131.5								
4	Clay to Clayey Silt	65	2.80	145.0	0.360	0.009					0.00	0.00
5	Silty Clayey Sand to Silty Sand	30	2.65	145.0								
6	Clay	839	2.80	145.0	0.360	0.009					0.00	0.00

Summary

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Calculated Elastic Settlement (in)	Calculated Recompression Settlement (in)	Calculated Compression Settlement (in)	Total Calculated Settlement (in)
1	Sand w/trace fines	14	2.65	117.7	6.13	0.00	0.00	6.13
2	Sand w/trace fines	2	2.65	117.7	0.88	0.00	0.00	0.88
3	Sand w/trace fines	10	2.65	131.5	1.42	0.00	0.00	1.42
4	Clay to Clayey Silt	65	2.80	145.0	0.38	0.00	0.00	0.38
5	Silty Clayey Sand to Silty Sand	30	2.65	145.0	1.95	0.00	0.00	1.95
6	Clay	839	2.80	145.0	2.41	0.00	0.00	2.41
			Totals		**13.15**	**0.00**	**0.00**	**13.15**

Cell 10, Point 3, pg 4/4

GENERAL SOIL PROFILE: CELL 10 **, POINT** 4 (NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
	270 (Top of Landfill)
Boring Profile: B-30	3' cap & cover
	144' COD Waste
	6' Liner & Leachate collection system
	118 (Floor of Landfill)
TOG 116	2' fill Navg = 40
Sand w/ trace fines Navg = 37	▽ 110
101	
Clay w/ trace silt to clay Navg = 58	
56	

65 EL. 116 ±

BORING NUMBER: B-30

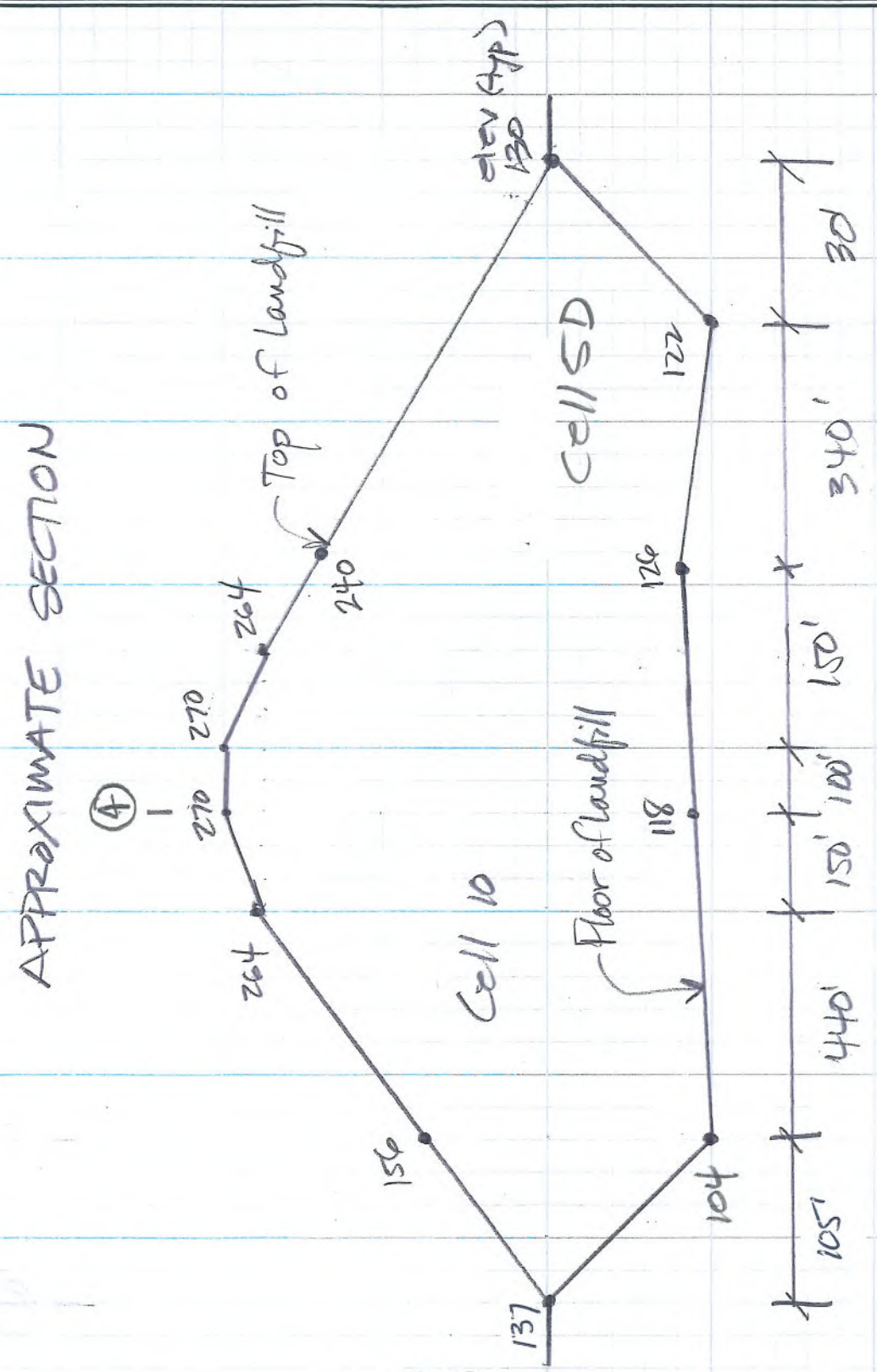
DATE INSTALLED: 4-25-91
PROJECT: CHESAPEAKE RUBBLE FILL
SAMPLE METHOD: SPLIT SPOON DRILLING METHOD: HOLLOW STEM AUGER AND MUD
LOGGED BY: MARK SCHULTZ DRILLER: HARDIN-HUBER, INC

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
1	0 - 2	2-3-4-5 (10)		SAND, med, little fn, tr clay, yellow-brown, moist
2	5 - 7	15-23-25-30 (15)		SAND, as above
3	10-12	9-24-32-30 (24)		SAND, med, little fn and little clay, yellow-brown, wet[a]
4	15-17	11-17-23-28 (22)		CLAY, tr silt, red, moist
5	20-22	10-18-22-26 (24)		CLAY, tr silt, gray-purple, moist
6	25-27	9-15-22-30 (24)		CLAY, tr silt, red-gray, moist
7	30-32	15-17-19-25 (24)		CLAY, tr silt, gray w/red, moist
8	35-37	10-14-18-20 (20)		CLAY, tr silt, red w/gray mottles, slightly moist
9	40-42	30-45-70 (18)		CLAY (no silt), gray w/red mottles, slightly moist
10	45-47	50-60-65 (18)		CLAY, brown-red, slightly moist
11	50-52	14-35-45-51/5 (18)		CLAY, brown, slightly moist
12	55-57	8-20-35-45 (20)		CLAY, brown w/red, slight to tr moist

a. Rods wet at 10 feet.

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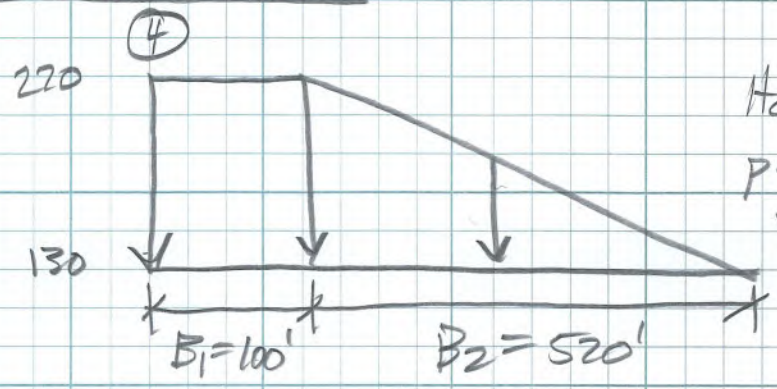


2018-

SHEET 1	OF 1	PROJECT NO. 3984	PROJECT NAME	Chester	
BY VCA		DATE 7/5/20	DESCRIPTION	Cell 10, Point 4 Settlement	
CHK. BY		DATE			

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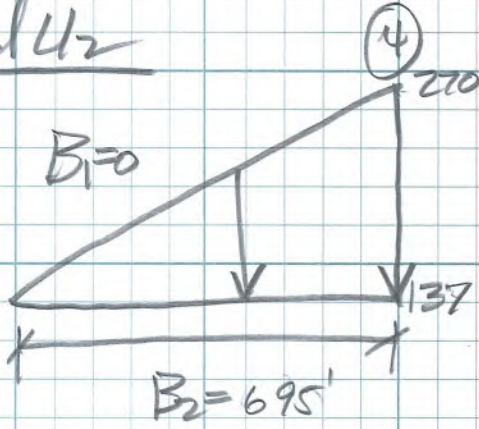
Waste Load U_1



$H_{CDD} = 270 - 130 - 3 = 137'$

$P = \Sigma(\gamma H)$
$= 3(115) + (137)(48.7)$
$= 7017 \text{ psf}$

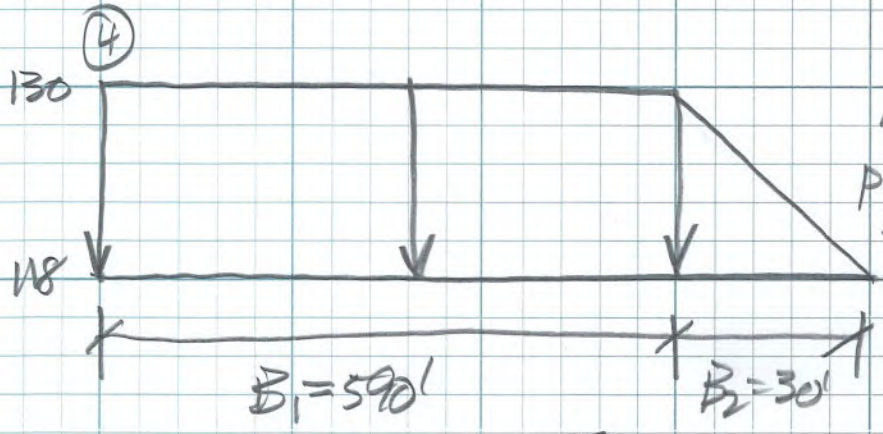
Waste Load U_2



$H_{CDD} = 270 - 137 - 3 = 130$

$P = \Sigma(\gamma H)$
$= (3)(115) + (130)(48.7)$
$= 6676 \text{ psf}$

Waste Load L_1



$H_{CDD} = 130 - 118 - 6 = 6$

$P = \Sigma(\gamma H)$
$= (6)(48.7) + (6)(115)$
$= 982 \text{ psf}$

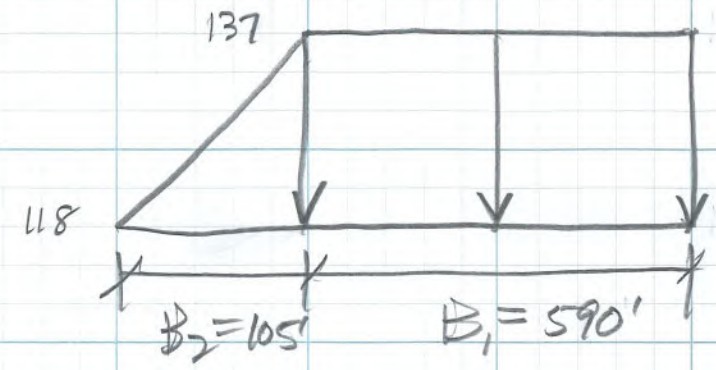
2018-

SHEET 1	OF 2	PROJECT NO. 3084		PROJECT NAME	
BY	VCA	DATE 7/7/20		DESCRIPTION	CC114, Part 4 Settlement
CHK. BY		DATE			

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Waste Load L_2

(4)



$H_{CDD} = 137 - 118 - 6 = 13'$

$p = \gamma'(\gamma H)$

$= (13)(48.7) + (6)(115)$

$= 1323$ psf

Net load $= U_1 + U_2 + L_1 + L_2$

2018-

SHEET 2	OF 2	PROJECT NO. 3084		PROJECT NAME	
BY JCA		DATE 7/7/20		DESCRIPTION Cell 10, Point 4 Settlement	
CHK. BY		DATE			

Cell 10 **Point** 4

Boring Profile: B-30

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Initial Effective Vertical Stress at Bottom of Soil Layer (psf)	Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)
1	Sand w/trace fines	116	110	6	37	121.7	0	121.7	365	0.365	730	365
2	Sand w/trace fines	110	101	9	37	121.7	62.4	59.3	997	0.997	1,264	997
3	Clay w/trace silt to Clay	101	-844	945	58	145.0	62.4	82.6	40,293	40.293	79,321	40,293
			Total Depth =	*960*								

Intermediate Profile >>>> With a thin layer of fill, soil is still normally consolidated. Assume fill will be a sandy material, and will be compacted to a density (i.e., blow count) similar as that of the soil below. Fill adds (2 ft)(121.7 pcf) = 243 psf to vertical stress in underlying soil layers

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)
1	Sand w/trace fines	116	110	6	37	121.7	0	121.7	365	243	0.243	608
2	Sand w/trace fines	110	101	9	37	121.7	62.4	59.3	997	243	0.243	1,240
3	Clay w/trace silt to Clay	101	-844	945	58	145.0	62.4	82.6	40,293	243	0.243	40,536

Elastic Settlement
Due to Fill

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_a)	Estimated Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
1	Sand w/trace fines	6	37		592	0.243	0.0025	0.030
2	Sand w/trace fines	9	37		592	0.243	0.0037	0.044
3	Clay w/trace silt to Clay	945	58	41.4	7,758	0.243	0.0296	0.355

Recompression Settlement - Cohesive Soils
Due to Fill

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Recompression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
3	Clay w/trace silt to Clay	945	2.80	145.0	0.360							

Cell 10, Point 4, pg 1/4

Compression Settlement - Cohesive Soils
Due to Fill

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Compression Index C_c	Corrected Compression Index C_{cc}	Effective Pre-consolidation Stress (σ_p ') (psf)	Initial Effective Vertical Stress (σ_{vo} ') at Center of Soil Layer (psf)	Intermediate Effective Vertical Stress (σ_{vf} ') at Center of Soil Layer (psf)	Calculated Compression Settlement (ft)	Calculated Compression Settlement (in)
3	Clay w/trace silt to Clay	945	2.80	145.0	0.360	0.009	0.006	40,293	40,293	40,536	0.016	0.19

Waste Load U1 B1 = 100 B2 = 520 Po = 7,017 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)
F	Sand w/trace fines	118	116	2	1	2	0.000	1.570	0.500	3,510
1	Sand w/trace fines	116	110	6	5	8	0.002	1.565	0.500	3,510
2	Sand w/trace fines	110	101	9	12.5	15	0.006	1.555	0.500	3,510
3	Clay w/trace silt to Clay	101	-844	945	487.5	954	0.195	1.021	0.482	3,383

Waste Load U2 B1 = 0.01 B2 = 695 Po = 6,676 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)
F	Sand w/trace fines	118	116	2	1	2	0.000	1.570	0.500	3,340
1	Sand w/trace fines	116	110	6	5	8	0.002	1.565	0.500	3,340
2	Sand w/trace fines	110	101	9	12.5	15	0.006	1.555	0.500	3,340
3	Clay w/trace silt to Clay	101	-844	945	487.5	954	0.195	1.021	0.482	3,219

Cell 10, Point 4, pg 4/4

Waste Load L1 B1 = 590 B2 = 30 Po = 982 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v$') at Center of Soil Layer (psf)
F	Sand w/trace fines	118	116	2	1	2	0.000	1.570	0.500	491
1	Sand w/trace fines	116	110	6	5	8	0.000	1.567	0.500	491
2	Sand w/trace fines	110	101	9	12.5	15	0.000	1.561	0.500	491
3	Clay w/trace silt to Clay	101	-844	945	487.5	954	0.008	1.208	0.491	482

Waste Load L2 B1 = 590 B2 = 105 Po = 1,323 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v$') at Center of Soil Layer (psf)
F	Sand w/trace fines	118	116	2	1	2	0.000	1.570	0.500	662
1	Sand w/trace fines	116	110	6	5	8	0.000	1.567	0.500	662
2	Sand w/trace fines	110	101	9	12.5	15	0.000	1.561	0.500	662
3	Clay w/trace silt to Clay	101	-844	945	487.5	954	0.008	1.208	0.491	649

Load Totals

Soil Layer	Soil Description	Waste Load U1 (psf)	Waste Load U2 (psf)	Waste Load L1 (psf)	Waste Load L2 (psf)	Total Increase in Effective Vertical Stress ($\Delta\sigma_v$') at Center of Soil Layer (psf)
F	Sand w/trace fines	3,510	3,340	491	662	8,003
1	Sand w/trace fines	3,510	3,340	491	662	8,003
2	Sand w/trace fines	3,510	3,340	491	662	8,003
3	Clay w/trace silt to Clay	3,383	3,219	482	649	7,733

Final Profile >>>> Includes the fill layer; reflects vertical stress due to fill layer on soil layers below.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v$') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v$') at Center of Soil Layer (ksf)	Final Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)
F	Sand w/trace fines (Fill)	118	116	2	37	121.7	0	121.7	122	8,003	8.003	8,125
1	Sand w/trace fines	116	110	6	37	121.7	0	121.7	365	8,003	8.003	8,368
2	Sand w/trace fines	110	101	9	37	121.7	62.4	59.3	997	8,003	8.003	9,001
3	Clay w/trace silt to Clay	101	-844	945	58	145.0	62.4	82.6	40,293	7,733	7.733	48,026

Cell 10, Point 4, pg 3/4

Elastic Settlement
Due to Waste

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_o)	Estimated Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
F	Sand w/trace fines (Fill)	2	37		592	8.003	0.03	0.32
1	Sand w/trace fines	6	37		592	8.003	0.08	0.97
2	Sand w/trace fines	9	37		592	8.003	0.12	1.46
3	Clay w/trace silt to Clay	945	58	41.4	7,758	7.733	0.94	11.30

Recompression Settlement - Cohesive Soils
Due to Waste

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Recompression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
3	Clay w/trace silt to Clay	945	2.80	145.0				40,293	40,293		0.00	0.00

Compression Settlement - Cohesive Soils
Due to Waste

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Compression Index C_c	Corrected Compression Index C_{cc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Compression Settlement (ft)	Calculated Compression Settlement (in)
3	Clay w/trace silt to Clay	945	2.80	145.0	0.360	0.009	0.006	40,293	40,293	48,026	0.45	5.46

Summary

					Due to Fill			Due to Waste			
Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Calculated Elastic Settlement (in)	Calculated Recompression Settlement (in)	Calculated Compression Settlement (in)	Calculated Elastic Settlement (in)	Calculated Recompression Settlement (in)	Calculated Compression Settlement (in)	Total Calculated Settlement (in)
F	Sand w/trace fines (Fill)	118	116	2				0.32			0.32
1	Sand w/trace fines	116	110	6	0.03			0.97			1.00
2	Sand w/trace fines	110	101	9	0.04			1.46			1.50
3	Clay w/trace silt to Clay	101	-844	945	0.36		0.19	11.30		5.46	17.30
			Totals		0.43	0.00	0.19	14.06	0.00	5.46	20.13

Cell 10, Point 4, pg 4/4

GENERAL SOIL PROFILE: CELL 13 **, POINT** 1 (NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
Boring Profile: B-13	
90	
Sand w/ silt & clay Navg = 5	87 (Edge of Landfill)
85	
Silt w/ sand, some gravel Navg = 29	
81	
Clay w/ silt lenses Navg = 21	
79	
Sand w/ clay lenses Navg = 53	
75	
Clay w/ sand & silt Navg = 28	~71.
70	
Sand w/ thin clay layers Navg = 81	
35	
Clay w/ little silt & trace sand Navg = 97	
20	

BORING NUMBER: B-13

TOP OF GROUND ≃ 83.0

MONITOR WELLS: MW-3

DATE INSTALLED: 7-18-89
PROJECT: CHESAPEAKE RUBBLE FILL
SAMPLE METHOD: SPLIT SPOON DRILLING METHOD: HOLLOW STEM AUGER
LOGGED BY: GREG ADAMSON DRILLER: HARDIN-HUBER, INC

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches) (N)	Description
1	0 - 2	2-2-2-2 (18) (4)	SAND, med, some v fn, tr silt and clay, yellow
2	2.5-4.5	2-2-3-4 (24) (5)	SILT and fn SAND, tr clay, brown
3	5 - 7 (5')	2-12-17-22 (15) (29)	2" SILT and fn SAND, as above 9" GRAVEL, little coarse sand, yellow
4	7.5-9.5 (9')	15-11-11-15 (19) (22)	CLAY, little silt, with lenses of SILT, gray
5	10-12 (11')	8-8-12-14 (12) (20)	6" CLAY, as above 6" SAND, med, some fn, yellow
6	12.5-14.5	17-34-51-51/5" (16) (85)	SAND, as above with thin CLAY lenses, gray, saturated
7	15-17 (15')	12-12-14-22 (24) (26)	CLAY, little fn sand and silt, gray
8	17.5-19.5	7-12-17-17 (19) (29)	CLAY, little vf sand and silt, gray
9	20-22 (20')	30-51/7" (9) (100+)	SAND, med, little fn, tr silt and clay, gray-yellow, saturated
10	22.5-24.5	32-34-51/5" (18) (85)	SAND, as above
11	25-27	22-34-51/5" (18) (85)	SAND, as above, clay stringers in lower 11"
12	27.5-29.5	17-35-51/5" (18) (86)	SAND, as above, with 3" CLAY layer
13	30-32	9-13-51/5" (18) (84)	SAND, as above, some thin lenses of clay, gray
14	32.5-37.5	40-51/3" (0) (100)	No recovery
15	35-37	13-25-51/5" (18) (76)	SAND, vf to med, tr silt and clay, yellow-gray, saturated and CLAY layers 2 and 4" thick
16	37.5-39.5	17-28-40-51/5" (64)	SAND, med, some fine, tr silt, lt tan, (24) saturated, with a 2" CLAY layer



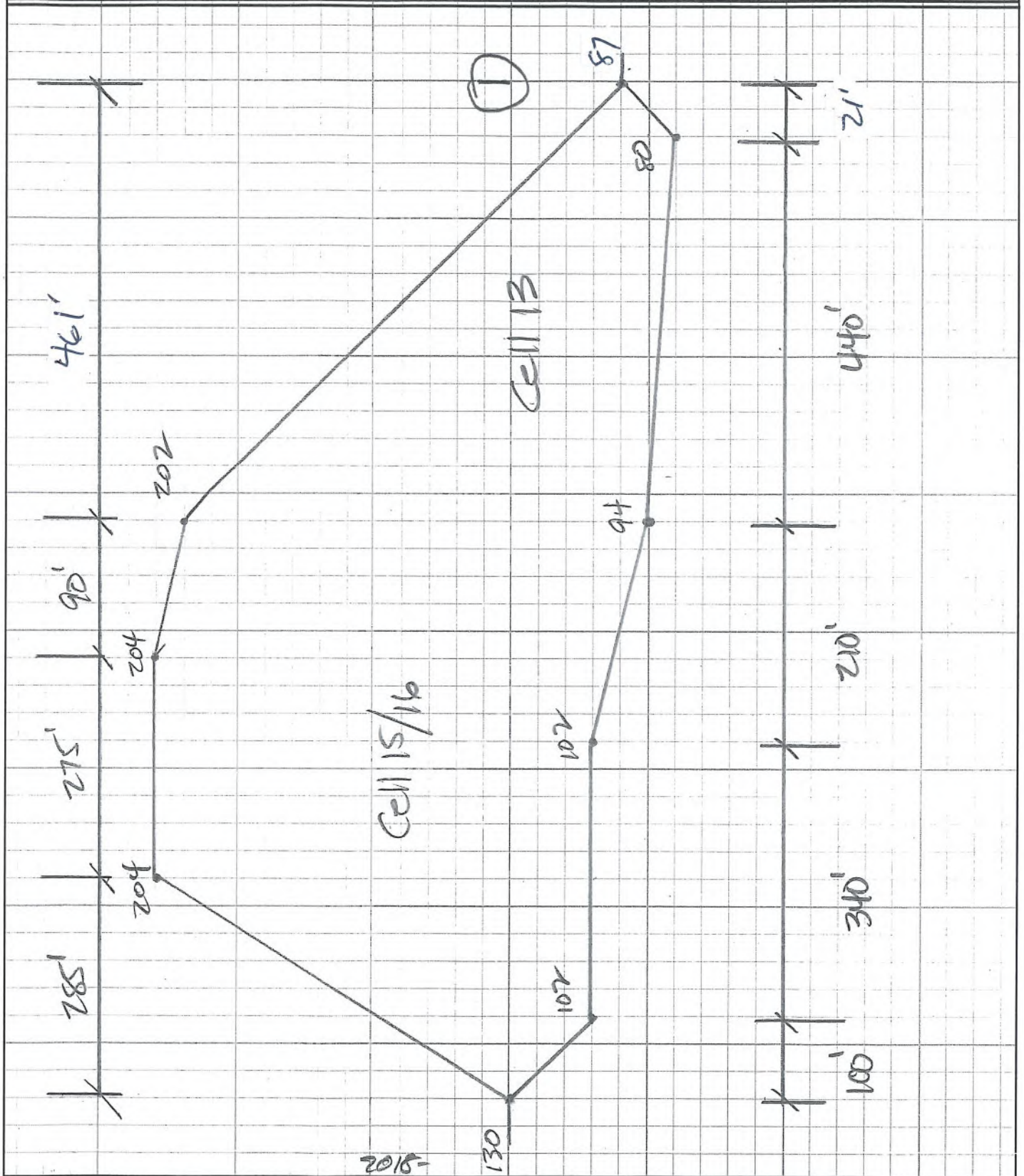
BORING NUMBER: B-13 continued

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
17	40-42	17-24-51/5" (18)	40	SAND, med and fn, little vf, tr silt and clay, few thin clay lenses, lt tan-gray
18	42.5-44.5	10-30-51/5" (18)		SAND, med and fn, little vf, tr silt, few thin clay lenses, tan, saturated
19	45-47	12-30-51/6" (18)	45	SAND, as above
20	47.5-49.5	45-51/2" (12)		SAND, as above, no clay lenses
21	50-52	45-51/6" (12)	50	SAND, as above
22	52.5-54.5	51/4" (4)		SAND, as above
23	55-57	25-51/5" (10)	55	CLAY, little silt, tr sand, mottled red-gray
24	57.5-59.5	51/5" (6)		SILT and CLAY, some sand, gray
25	60-62	28-46-51/2" (14)	60	SILT and vf SAND, little clay, gray
26	62.5-64.5	18-31-51/5" (17)		CLAY, some silt, tr sand, gray
27	65-67	31-51/5" (11)	65	7" CLAY, as above 2" SAND, vf, little silt, gray 2" CLAY and SILT, tr sand, brown-gray
28	67.5-69.5	45-51/5" (12)	70	CLAY and SILT, some sand, gray

Groundwater encountered at 14 feet.

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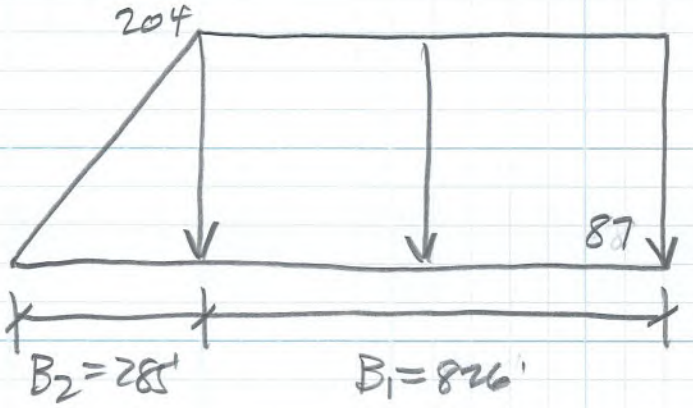
2018-

SHEET 1	OF 1	PROJECT NO. 3064		PROJECT NAME	
BY	JCA	DATE 7/11/20		DESCRIPTION	Cell 13, Point 1 Settlement
CHK. BY		DATE			

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Waste Load L_1

①



$H_{COD} = 204 - 87 - 3 = 114$

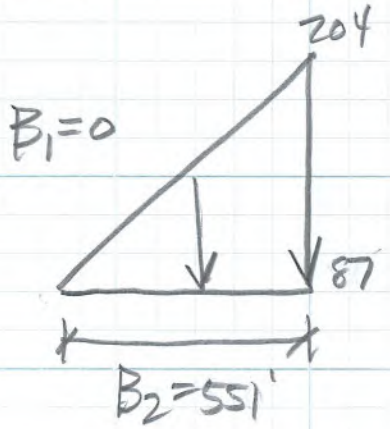
$P = \Sigma'(\gamma H)$

$= (3)(115) + (114)(48.7)$

$= 5897$ psf

Waste Load L_2

①



$H_{COD} = 204 - 87 - 3 = 114'$

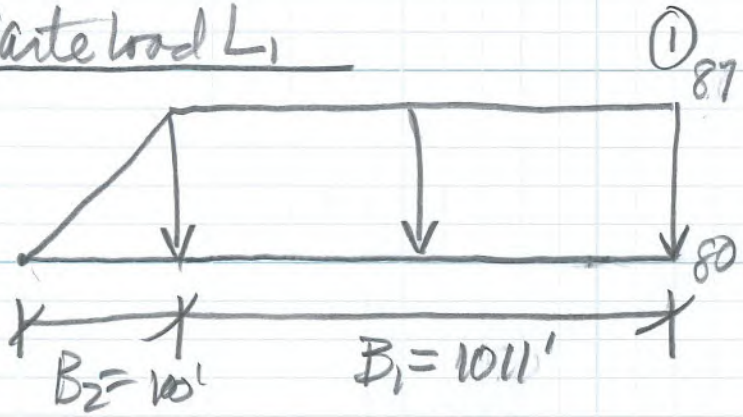
$P = \Sigma'(\gamma H)$

$= (3)(115) + (114)(48.7)$

$= 5897$ psf

Waste Load L_1

①



$H_{COD} = 87 - 80 - 6 = 1$

$P = \Sigma'(\gamma H)$

$= (1)(48.7) + (6)(115)$

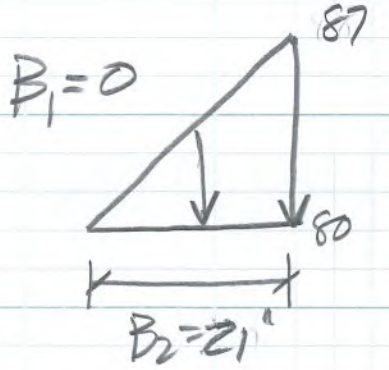
$= 739$ psf

SHEET 1	OF 2	PROJECT NO. 2018-3084		PROJECT NAME	
BY KA		DATE 7/11/20		DESCRIPTION Cell 13, Point 1 Settlement	
CHK. BY		DATE			

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Waste load L_2

①



$H_{CDD} = 87 - 80 - 6 = 1$

$P = \Sigma(\delta H)$

$= (1)(48.7) + (6)(115)$

$= 739$ psf

Net load $= U_1 - U_2 + L_1 - L_2$

2018-

SHEET 2	OF 2	PROJECT NO. 3084		PROJECT NAME	
BY VCA		DATE 7/11/20		DESCRIPTION Cell 13, Point 1 Settlement	
CHK. BY		DATE			

Settlement Analysis

Cell 13 **Point** 1

Boring Profile: B-13

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Initial Effective Vertical Stress at Bottom of Soil Layer (psf)	Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)
1	Sand w/silt & clay	90	85	5	5	99.8	0	99.8	249	0.249	499	249
2	Silt w/sand, some gravel	85	81	4	29	138.1	0	138.1	775	0.775	1,052	775
3	Clay w/silt lenses	81	79	2	21	128.2	0	128.2	1,180	1.180	1,308	1,180
4	Sand w/clay lenses	79	75	4	53	145.0	0	145.0	1,598	1.598	1,888	1,598
5	Clay w/sand & silt	75	71	4	28	136.5	0	136.5	2,161	2.161	2,434	2,161
6	Clay w/sand & silt	71	70	1	28	136.5	62.4	74.1	2,471	2.471	2,508	2,471
7	Sand w/thin clay layers	70	35	35	81	145.0	62.4	82.6	3,954	3.954	5,399	3,954
8	Clay w/little silt & trace sand	35	-912	947	97	145.0	62.4	82.6	44,510	44.510	83,621	44,510
			Total:	*1002*								

Intermediate Profile >>>> With Excavation, soil is now over-consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Intermediate Effective Vertical Stress at Bottom of Soil Layer (psf)
1	Sand w/silt & clay	88	85	3	29	145.0	0	145.0	218	0.218	435
2	Silt w/sand, some gravel	85	81	4	29	138.1	0	138.1	711	0.711	988
3	Clay w/silt lenses	81	79	2	21	128.2	0	128.2	1,116	1.116	1,244
4	Sand w/clay lenses	79	75	4	53	145.0	0	145.0	1,534	1.534	1,824
5	Clay w/sand & silt	75	71	4	28	136.5	0	136.5	2,097	2.097	2,370
6	Clay w/sand & silt	71	70	1	28	136.5	62.4	74.1	2,407	2.407	2,444
7	Sand w/thin clay layers	70	35	35	81	145.0	62.4	82.6	3,890	3.890	5,335
8	Clay w/little silt & trace sand	35	-912	947	97	145.0	62.4	82.6	44,446	44.446	83,557

Waste Load U1 ***B1 =*** 826 ***B2 =*** 285 ***Po =*** 5,897 ***psf***

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/silt & clay	88	85	3	1.5	3	1.561	0.007	0.499	2,945
2	Silt w/sand, some gravel	85	81	4	5	7	1.560	0.002	0.497	2,933
3	Clay w/silt lenses	81	79	2	8	9	1.555	0.001	0.496	2,923
4	Sand w/clay lenses	79	75	4	11	13	1.550	0.001	0.494	2,913
5	Clay w/sand & silt	75	71	4	15	17	1.543	0.001	0.492	2,899
6	Clay w/sand & silt	71	70	1	17.5	18	1.538	0.001	0.490	2,890
7	Sand w/thin clay layers	70	35	35	35.5	53	1.506	0.000	0.480	2,829
8	Clay w/little silt & trace sand	35	-912	947	526.5	1000	0.808	0.000	0.257	1,518

Cell 13, Point 1, pg 1/4

Waste Load U2 B1 = 0.01 B2 = 551 Po = 5,897 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/silt & clay	88	85	3	1.5	3	1.561	0.007	0.499	2,945
2	Silt w/sand, some gravel	85	81	4	5	7	1.560	0.002	0.497	2,933
3	Clay w/silt lenses	81	79	2	8	9	1.555	0.001	0.496	2,923
4	Sand w/clay lenses	79	75	4	11	13	1.550	0.001	0.494	2,913
5	Clay w/sand & silt	75	71	4	15	17	1.543	0.001	0.492	2,899
6	Clay w/sand & silt	71	70	1	17.5	18	1.538	0.001	0.490	2,890
7	Sand w/thin clay layers	70	35	35	35.5	53	1.506	0.000	0.480	2,829
8	Clay w/little silt & trace sand	35	-912	947	526.5	1000	0.808	0.000	0.257	1,518

Waste Load L1 B1 = 1011 B2 = 100 Po = 739 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/silt & clay	88	85	3	1.5	3	0.000	1.569	0.500	370
2	Silt w/sand, some gravel	85	81	4	5	7	0.000	1.566	0.500	370
3	Clay w/silt lenses	81	79	2	8	9	0.001	1.563	0.500	370
4	Sand w/clay lenses	79	75	4	11	13	0.001	1.560	0.500	370
5	Clay w/sand & silt	75	71	4	15	17	0.001	1.556	0.500	370
6	Clay w/sand & silt	71	70	1	17.5	18	0.002	1.553	0.500	370
7	Sand w/thin clay layers	70	35	35	35.5	53	0.003	1.536	0.500	370
8	Clay w/little silt & trace sand	35	-912	947	526.5	1000	0.038	1.091	0.480	355

Waste Load L2 B1 = 0.01 B2 = 21 Po = 739 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/silt & clay	88	85	3	1.5	3	1.493	0.007	0.478	353
2	Silt w/sand, some gravel	85	81	4	5	7	1.335	0.002	0.426	315
3	Clay w/silt lenses	81	79	2	8	9	1.206	0.001	0.385	284
4	Sand w/clay lenses	79	75	4	11	13	1.088	0.001	0.347	256
5	Clay w/sand & silt	75	71	4	15	17	0.950	0.001	0.303	224
6	Clay w/sand & silt	71	70	1	17.5	18	0.876	0.001	0.279	206
7	Sand w/thin clay layers	70	35	35	35.5	53	0.534	0.000	0.170	126
8	Clay w/little silt & trace sand	35	-912	947	526.5	1000	0.040	0.000	0.013	9

Cell 13, Point 1, pg 3/4

Load Totals

Soil Layer	*Soil Description*	*Waste Load U1 (psf)*	*Waste Load U2 (psf)*	*Waste Load L1 (psf)*	*Waste Load L2 (psf)*	*Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)*
1	Sand w/silt & clay	2,945	(2,945)	370	(353)	17
2	Silt w/sand, some gravel	2,933	(2,933)	370	(315)	55
3	Clay w/silt lenses	2,923	(2,923)	370	(284)	85
4	Sand w/clay lenses	2,913	(2,913)	370	(256)	113
5	Clay w/sand & silt	2,899	(2,899)	370	(224)	146
6	Clay w/sand & silt	2,890	(2,890)	370	(206)	163
7	Sand w/thin clay layers	2,829	(2,829)	370	(126)	244
8	Clay w/little silt & trace sand	1,518	(1,518)	355	(9)	346

Final Profile

Soil Layer	*Soil Description*	*Top Elev (ft)*	*Bottom Elev (ft)*	*Thickness (ft)*	*Average SPR (N_a)*	*Estimated Unit Weight (pcf)*	*Unit Weight Water (pcf)*	*Effective Unit Weight (pcf)*	*Initial Effective Vertical Stress (σ_{vo} ') at Center of Soil Layer (psf)*	*Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (psf)*	*Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (ksf)*	*Final Effective Vertical Stress (σ_{vo} ') at Center of Soil Layer (psf)*
1	Sand w/silt & clay	88	85	3	29	145.0	0	145.0	218	17	0.017	234
2	Silt w/sand, some gravel	85	81	4	29	138.1	0	138.1	711	55	0.055	766
3	Clay w/silt lenses	81	79	2	21	128.2	0	128.2	1,116	85	0.085	1,201
4	Sand w/clay lenses	79	75	4	53	145.0	0	145.0	1,534	113	0.113	1,647
5	Clay w/sand & silt	75	71	4	28	136.5	0	136.5	2,097	146	0.146	2,243
6	Clay w/sand & silt	71	70	1	28	136.5	62.4	74.1	2,407	163	0.163	2,570
7	Sand w/thin clay layers	70	35	35	81	145.0	62.4	82.6	3,890	244	0.244	4,134
8	Clay w/little silt & trace sand	35	-912	947	97	145.0	62.4	82.6	44,446	346	0.346	44,792

Elastic Settlement

Soil Layer	*Soil Description*	*Thickness (ft)*	*Average SPR (N_a)*	*Estimated Unconfined Compression Strength qu (ksf)*	*Modulus of Elasticity Es (ksf)*	*Increase in Effective Vertical Stress ($\Delta\sigma_v$ ') at Center of Soil Layer (ksf)*	*Calculated Elastic Settlement (ft)*	*Calculated Elastic Settlement (in)*
1	Sand w/silt & clay	3	29		464	0.017	0.000	0.00
2	Silt w/sand, some gravel	4	29	12.0	2,246	0.055	0.000	0.00
3	Clay w/silt lenses	2	21	7.0	1,313	0.085	0.000	0.00
4	Sand w/clay lenses	4	53		848	0.113	0.001	0.01
5	Clay w/sand & silt	4	28	11.3	2,115	0.146	0.000	0.00
6	Clay w/sand & silt	1	28	11.3	2,115	0.163	0.000	0.00
7	Sand w/thin clay layers	35	81		1,296	0.244	0.007	0.08
8	Clay w/little silt & trace sand	947	97	109.0	20,443	0.346	0.016	0.19

Cell 13, Point 1, pg 3/4

Recompression Settlement - Cohesive Soils

Soil Layer	*Soil Description*	*Thickness (ft)*	*Specific Gravity*	*Unit Weight (pcf)*	*Initial Void ratio* e_o	*Recompression Index* C_r	*Corrected Recompression Index* C_{rc}	*Effective Pre-consolidation Stress* (σ_p') *(psf)*	*Initial Effective Vertical Stress* (σ_{vo}') *at Center of Soil Layer (psf)*	*Final Effective Vertical Stress* (σ_{vf}') *at Center of Soil Layer (psf)*	*Calculated Recompression Settlement (ft)*	*Calculated Recompression Settlement (in)*
1	Sand w/silt & clay	3	2.65	145.0	0.246	-0.043						
2	Silt w/sand, some gravel	4	2.80	138.1	0.483	0.055	0.037	775	711	766	0.006	0.07
3	Clay w/silt lenses	2	2.80	128.2	0.706	0.147	0.086	1,180	1,116	1,201	0.004	0.05
4	Sand w/clay lenses	4	2.65	145.0	0.246	-0.043						
5	Clay w/sand & silt	4	2.80	136.5	0.516	0.068	0.045	2,161	2,097	2,243	0.002	0.03
6	Clay w/sand & silt	1	2.80	136.5	0.516	0.068	0.045	2,471	2,407	2,570	0.001	0.01
7	Sand w/thin clay layers	35	2.65	145.0	0.246	-0.043						
8	Clay w/little silt & trace sand	947	2.80	145.0	0.360	0.004	0.003	44,510	44,446	44,792	0.002	0.02

Compression Settlement - Cohesive Soils

Soil Layer	*Soil Description*	*Thickness (ft)*	*Specific Gravity*	*Unit Weight (pcf)*	*Initial Void ratio* e_o	*Compression Index* C_c	*Corrected Compression Index* C_{cc}	*Effective Pre-consolidation Stress* (σ_p') *(psf)*	*Initial Effective Vertical Stress* (σ_{vo}') *at Center of Soil Layer (psf)*	*Final Effective Vertical Stress* (σ_{vf}') *at Center of Soil Layer (psf)*	*Calculated Compression Settlement (ft)*	*Calculated Compression Settlement (in)*
1	Sand w/silt & clay	3	2.65	145.0	0.246	-0.091						
2	Silt w/sand, some gravel	4	2.80	138.1	0.483	0.116	0.078	775	711	766		
3	Clay w/silt lenses	2	2.80	128.2	0.706	0.312	0.183	1,180	1,116	1,201	0.003	0.03
4	Sand w/clay lenses	4	2.65	145.0	0.246	-0.091						
5	Clay w/sand & silt	4	2.80	136.5	0.516	0.145	0.096	2,161	2,097	2,243	0.006	0.07
6	Clay w/sand & silt	1	2.80	136.5	0.516	0.145	0.096	2,471	2,407	2,570	0.002	0.02
7	Sand w/thin clay layers	35	2.65	145.0	0.246	-0.091						
8	Clay w/little silt & trace sand	947	2.80	145.0	0.360	0.009	0.006	44,510	44,446	44,792	0.016	0.20

Summary

Soil Layer	*Soil Description*	*Top Elev (ft)*	*Bottom Elev (ft)*	*Thickness (ft)*	*Calculated Elastic Settlement (in)*	*Calculated Recompression Settlement (in)*	*Calculated Compression Settlement (in)*	*Total Calculated Settlement (in)*
1	Sand w/silt & clay	88	85	3	0.00	0.00	0.00	**0.00**
2	Silt w/sand, some gravel	85	81	4	0.00	0.07	0.00	**0.07**
3	Clay w/silt lenses	81	79	2	0.00	0.05	0.03	**0.09**
4	Sand w/clay lenses	79	75	4	0.01	0.00	0.00	**0.01**
5	Clay w/sand & silt	75	71	4	0.00	0.03	0.07	**0.11**
6	Clay w/sand & silt	71	70	1	0.00	0.01	0.02	**0.03**
7	Sand w/thin clay layers	70	35	35	0.08	0.00	0.00	**0.08**
8	Clay w/little silt & trace sand	35	-912	947	0.19	0.02	0.20	**0.41**
				Totals	***0.29***	***0.17***	***0.32***	
							Total	***0.78***

Cell 13, Point 1, Pg 4/4

GENERAL SOIL PROFILE: CELL 13, POINT 2 (NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
Boring Profile: B-13	
	98 Top of Landfill
91	3' Cap & Cover
Sand w/ silt & clay Navg = 5 86	9' CDD Waste
Silt w/ sand, some gravel Navg = 29 82	6' Liner & Leachate Collection System
Clay w/ silt lenses Navg = 21 80	80 Floor of Landfill
Sand w/ clay lenses Navg = 53 76	
Clay w/ sand & silt Navg = 28 71	▽ 71
Sand w/ thin clay layers Navg = 81 36	
Clay w/ little silt & trace sand Navg = 97 21	

BORING NUMBER: B-13

TOP OF GROUND ≃ 83.0

MONITOR WELLS: MW-3

DATE INSTALLED: 7-18-89
PROJECT: CHESAPEAKE RUBBLE FILL
SAMPLE METHOD: SPLIT SPOON DRILLING METHOD: HOLLOW STEM AUGER
LOGGED BY: GREG ADAMSON DRILLER: HARDIN-HUBER, INC

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
1	0 - 2	2-2-2-2 (4) (18)		SAND, med, some v fn, tr silt and clay, yellow
2	2.5-4.5	2-2-3-4 (5) (24)	5	SILT and fn SAND, tr clay, brown
3	5 - 7 (5')	2-12-17-22 (29) (15)		2" SILT and fn SAND, as above 9" GRAVEL, little coarse sand, yellow
4	7.5-9.5 (9')	15-11-11-15 (22) (19)		CLAY, little silt, with lenses of SILT, gray
5	10-12 (11')	8-8-12-14 (20) (12)	10	6" CLAY, as above 6" SAND, med, some fn, yellow
6	12.5-14.5	17-34-51-51/5" (80) (16)		SAND, as above with thin CLAY lenses, gray, saturated
7	15-17 (15')	12-12-14-22 (26) (24)	15	CLAY, little fn sand and silt, gray
8	17.5-19.5	7-12-17-17 (29) (19)		CLAY, little vf sand and silt, gray
9	20-22 (20')	30-51/7" (100+) (9)	20	SAND, med, little fn, tr silt and clay, gray-yellow, saturated
10	22.5-24.5	32-34-51/5" (85) (18)		SAND, as above
11	25-27	22-34-51/5" (85) (18)	25	SAND, as above, clay stringers in lower 11"
12	27.5-29.5	17-35-51/5" (86) (18)		SAND, as above, with 3" CLAY layer
13	30-32	9-13-51/5" (84) (18)	30	SAND, as above, some thin lenses of clay, gray
14	32.5-37.5	40-51/3" (100) (0)		No recovery
15	35-37	13-25-51/5" (76) (18)	35	SAND, vf to med, tr silt and clay, yellow-gray, saturated and CLAY layers 2 and 4" thick
16	37.5-39.5	17-28-40-51/5" (64)	40	SAND, med, some fine, tr silt, lt tan, (24) saturated, with a 2" CLAY layer

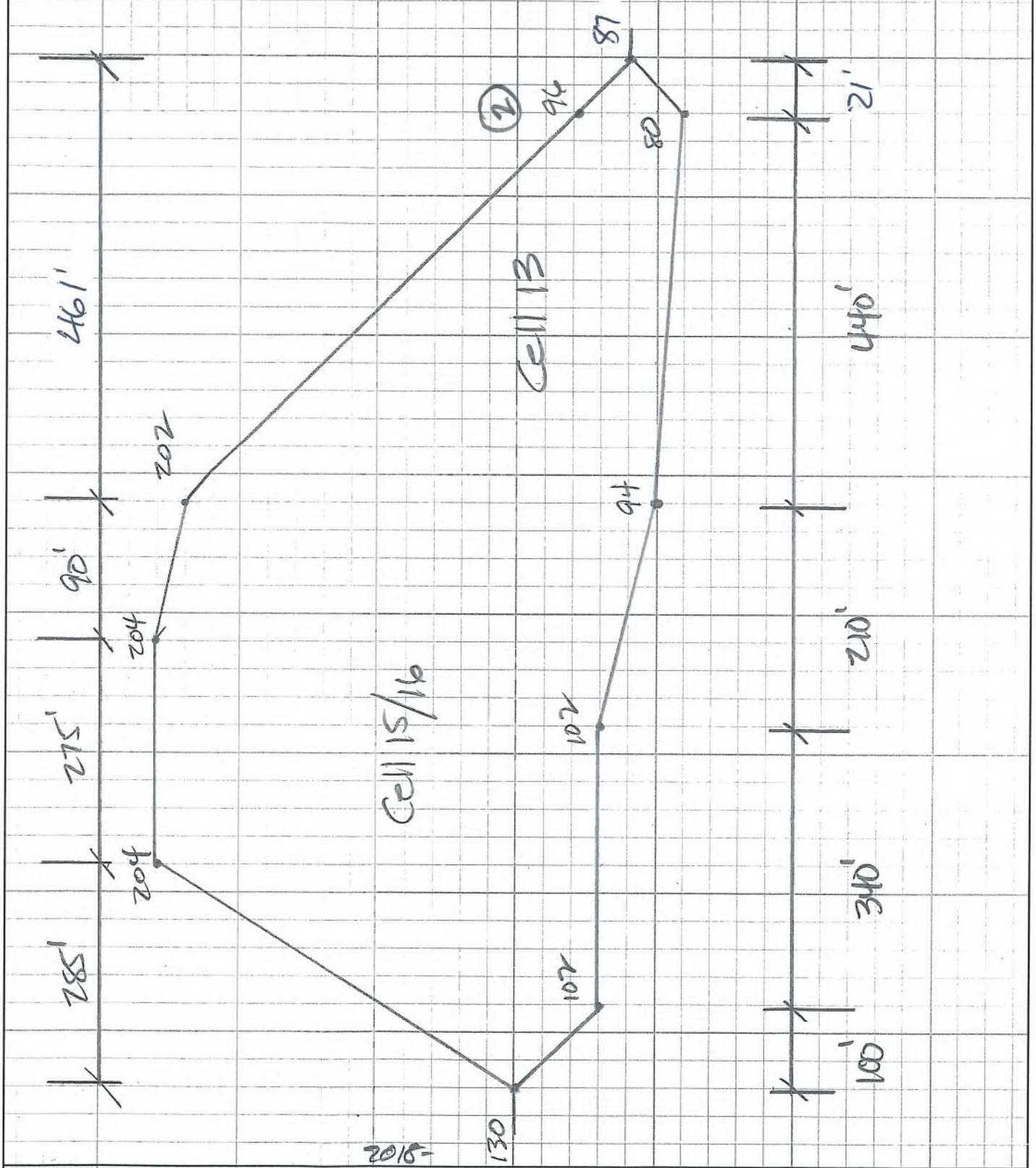
BORING NUMBER: B-13 continued

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
			40	
17	40-42	17-24-51/5" (18)		SAND, med and fn, little vf, tr silt and clay, few thin clay lenses, lt tan-gray
18	42.5-44.5	10-30-51/5" (18)		SAND, med and fn, little vf, tr silt, few thin clay lenses, tan, saturated
			45	
19	45-47	12-30-51/6" (18)		SAND, as above
20	47.5-49.5	45-51/2" (12)		SAND, as above, no clay lenses
			50	
21	50-52	45-51/6" (12)		SAND, as above
22	52.5-54.5	51/4" (4)		SAND, as above
			55	
23	55-57	25-51/5" (10)		CLAY, little silt, tr sand, mottled red-gray
24	57.5-59.5	51/5" (6)		SILT and CLAY, some sand, gray
			60	
25	60-62	28-46-51/2" (14)		SILT and vf SAND, little clay, gray
26	62.5-64.5	18-31-51/5" (17)		CLAY, some silt, tr sand, gray
			65	
27	65-67	31-51/5" (11)		7" CLAY, as above 2" SAND, vf, little silt, gray 2" CLAY and SILT, tr sand, brown-gray
28	67.5-69.5	45-51/5" (12)		CLAY and SILT, some sand, gray
			70	

Groundwater encountered at 14 feet.

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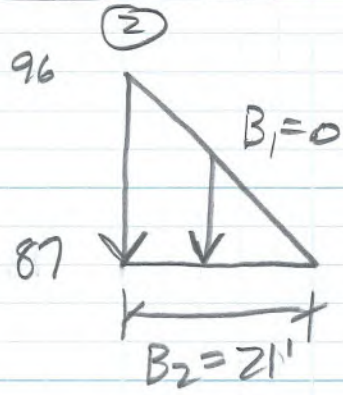


SHEET 1	OF 1	PROJECT NO. 3084		PROJECT NAME	
BY	JCA	DATE 7/11/20		DESCRIPTION	Cell 13, Point 2 Settlement
CHK. BY		DATE			

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Waste Load U1



$H_{CDD} = 96 - 87 - 3 = 6'$

$p = \Sigma(\gamma H)$

$= (3)(115) + (6)(48.7)$

$= 637$ psf

Waste Load U2



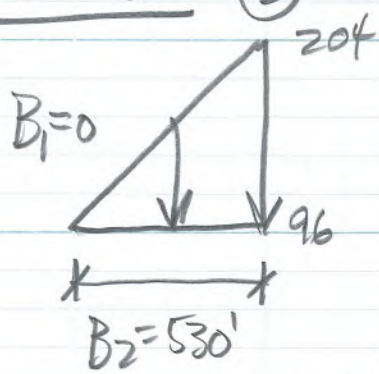
$H_{CDD} = 204 - 87 - 3 = 114'$

$p = \Sigma(\gamma H)$

$= (3)(115) + (114)(48.7)$

$= 5897$ psf

Waste Load U3



$H_{CDD} = 204 - 96 - 3 = 105'$

$p = \Sigma(\gamma H)$

$= (3)(115) + (105)(48.7)$

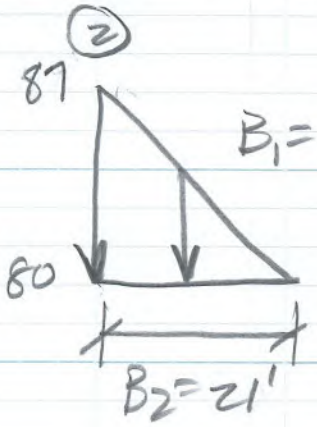
$= 5458$ psf

2018-

SHEET 1	OF 2	PROJECT NO. 3054		PROJECT NAME	
BY	JCA	DATE 7/11/20		DESCRIPTION	Cell 13, Pont 2 Settlement
CHK. BY		DATE			

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Waste Load L_1



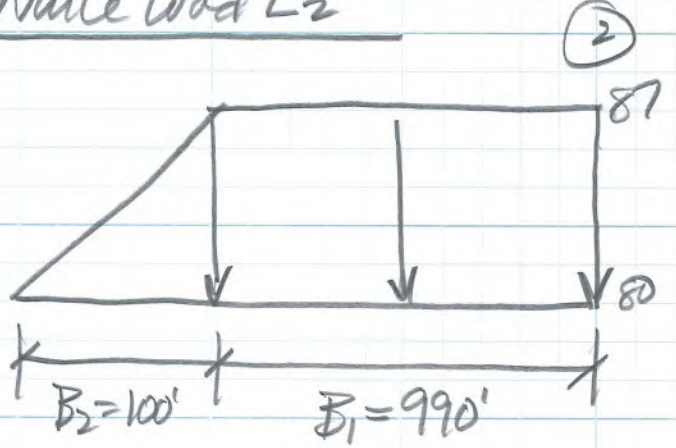
$H_{COD} = 87 - 80 - 6 = 1'$

$p = \Sigma_i (\gamma H)$

$= (1)(48.7) + (6)(115)$

$= 739$ psf

Waste Load L_2



$H_{COD} = 87 - 80 - 6 = 1'$

$p = \Sigma_i (\gamma H)$

$= (1)(48.7) + (6)(115)$

$= 739$ psf

$$\text{Net load} = U_1 + U_2 - U_3 + L_1 + L_2$$

2018-

SHEET 2	OF 2	PROJECT NO. 3084		PROJECT NAME	
BY JCA		DATE 7/11/20		DESCRIPTION Cell 13, Point 2 Settlement	
CHK. BY		DATE			

Cell 13 **Point** 2

Boring Profile: B-13

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_o)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Initial Effective Vertical Stress at Bottom of Soil Layer (psf)	Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)
1	Sand w/silt & clay	91	86	5	5	99.8	0	99.8	249	0.249	499	249
2	Silt w/sand, some gravel	86	82	4	29	138.1	0	138.1	775	0.775	1,052	775
3	Clay w/silt lenses	82	80	2	21	128.2	0	128.2	1,180	1.180	1,308	1,180
4	Sand w/clay lenses	80	76	4	53	145.0	0	145.0	1,598	1.598	1,888	1,598
5	Clay w/sand & silt	76	71	5	28	136.5	0	136.5	2,229	2.229	2,571	2,229
7	Sand w/thin clay layers	71	36	35	81	145.0	62.4	82.6	4,016	4.016	5,462	4,016
8	Clay w/little silt & trace sand	36	-920	956	97	145.0	62.4	82.6	44,944	44.944	84,427	44,944
			Total Depth =	*1011*								

Interimediate Profile >>>> With excavation, soil is now over-consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_o)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Intermediate Effective Vertical Stress at Bottom of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	53	145.0	0	145.0	290	0.290	580
5	Clay w/sand & silt	76	71	5	28	136.5	0	136.5	921	0.921	1,263
7	Sand w/thin clay layers	71	36	35	81	145.0	62.4	82.6	2,708	2.708	4,154
8	Clay w/little silt & trace sand	36	-920	956	97	145.0	62.4	82.6	43,636	43.636	83,119

Waste Load U1 *B1 =* 0.01 *B2 =* 21 *Po =* 637

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	2	4	1.471	0.005	0.470	300
5	Clay w/sand & silt	76	71	5	6.5	9	1.269	0.002	0.405	258
7	Sand w/thin clay layers	71	36	35	26.5	44	0.670	0.000	0.214	136
8	Clay w/little silt & trace sand	36	-920	956	522	1000	0.040	0.000	0.013	8

Cell 13, Point 2, pg 1/4

Waste Load U2 B1 = 805 B2 = 285 Po = 5,897 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	2	4	0.001	1.568	0.500	2950
5	Clay w/sand & silt	76	71	5	6.5	9	0.002	1.563	0.500	2950
7	Sand w/thin clay layers	71	36	35	26.5	44	0.009	1.538	0.500	2950
8	Clay w/little silt & trace sand	36	-920	956	522	1000	0.129	0.996	0.474	2794

Waste Load U3 B1 = 0.01 B2 = 530 Po = 5,458 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y 0	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	2	4	1.562	0.005	0.499	2724
5	Clay w/sand & silt	76	71	5	6.5	9	1.557	0.002	0.496	2709
7	Sand w/thin clay layers	71	36	35	26.5	44	1.520	0.000	0.484	2644
8	Clay w/little silt & trace sand	36	-920	956	522	1000	0.793	0.000	0.253	1378

Waste Load L1 B1 = 0.01 B2 = 21 Po = 739 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	2	4	1.471	0.005	0.470	348
5	Clay w/sand & silt	76	71	5	6.5	9	1.269	0.002	0.405	299
7	Sand w/thin clay layers	71	36	35	26.5	44	0.670	0.000	0.214	158
8	Clay w/little silt & trace sand	36	-920	956	522	1000	0.040	0.000	0.013	9

Cell 13, Point 2, pg 3/4

Waste Load L2

B1 = 990 B2 = 100 Po = 739 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	2	4	0.000	1.569	0.500	370
5	Clay w/sand & silt	76	71	5	6.5	9	0.001	1.564	0.500	370
7	Sand w/thin clay layers	71	36	35	26.5	44	0.002	1.544	0.500	370
8	Clay w/little silt & trace sand	36	-920	956	522	1000	0.039	1.086	0.480	355

Load Totals

Soil Layer	Soil Description	Load U1 (psf)	Load U2 (psf)	Load U3 (psf)	Load L1 (psf)	Load L2 (psf)	Increase in Effective Pressure (p') at Center of Soil Layer (psf)
4	Sand w/clay lenses	300	2,950	(2,724)	348	370	1,243
5	Clay w/sand & silt	258	2,950	(2,709)	299	370	1,168
7	Sand w/thin clay layers	136	2,950	(2,644)	158	370	970
8	Clay w/little silt & trace sand	8	2,794	(1,378)	9	355	1,787

Final Profile

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)
4	Sand w/clay lenses	80	76	4	145.0	0	145.0	290	1,243	1.243	1,533
5	Clay w/sand & silt	76	71	5	136.5	0	136.5	921	1,168	1.168	2,089
7	Sand w/thin clay layers	71	36	35	145.0	62.4	82.6	2,708	970	0.970	3,678
8	Clay w/little silt & trace sand	36	-39	75	145.0	62.4	82.6	43,636	1,787	1.787	45,424

Cell 13, Point 2, Pg 3/4

Elastic Settlement

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_a)	Estimated Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
4	Sand w/clay lenses	4	53		848	1.243	0.006	0.07
5	Clay w/sand & silt	5	28	11.3	4,936	1.168	0.001	0.01
7	Sand w/thin clay layers	35	81		1,296	0.970	0.026	0.31
8	Clay w/little silt & trace sand	75	97	109.0	47,699	1.787	0.003	0.03

Recompression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void Ratio e_o	Compression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
4	Sand w/clay lenses	4	2.65	145.0								
5	Clay w/sand & silt	5	2.80	136.5	0.516	0.068	0.045	2,229	921	2,089	0.069	0.83
7	Sand w/thin clay layers	35	2.65	145.0								
8	Clay w/little silt & trace sand	75	2.80	145.0	0.360	0.004	0.003	44,944	43,636	45,424	0.001	0.02

Compression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void Ratio e_o	Compression Index C_c	Corrected Compression Index C_{cc}	Effective Pre-consolidation Stress (σ_p') (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Compression Settlement (ft)	Calculated Compression Settlement (in)
4	Sand w/clay lenses	4	2.65	145.0								
5	Clay w/sand & silt	5	2.80	136.5	0.516	0.145	0.096	2,229	921	2,089	-0.01	-0.16
7	Sand w/thin clay layers	35	2.65	145.0								
8	Clay w/little silt & trace sand	75	2.80	145.0	0.360	0.009	0.006	44,944	43,636	45,424	0.00	0.03

Summary

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Calculated Elastic Settlement (in)	Calculated Recompression Settlement (in)	Calculated Compression Settlement (in)	Total Calculated Settlement (in)
4	Sand w/clay lenses	80	76	4	0.1			0.07
5	Clay w/sand & silt	76	71	5	0.0	0.83	-0.16	0.68
7	Sand w/thin clay layers	71	36	35	0.3			0.31
8	Clay w/little silt & trace sand	36	-39	75	0.0	0.02	0.03	0.08
							Total	**1.14**

Cell 13, Point 2, pg 4/4

GENERAL SOIL PROFILE: CELL 13 **, POINT** 3 (NOT TO SCALE)

General Existing Profile (elev)	General Final Profile (elev)
Boring Profile: B-12	202 Top of Landfill 3' Cap & Cover 99' CDD Waste 6' Liner & Leachate Collection System
95	94 Floor of Landfill
Clay, Silt & clay w/ sand Navg = 11	
90	
Sand w/ some silt & clay Navg = 39	
85	
Sand w/ silt & clay Navg = 18	
73	
Sand w/ silt & few thin clay layers Navg =	72
52	
Clay w/ some sand Navg =	
23	
Clay & silt w/ sand Navg =	
15	

TOP OF GROUND ≃ 97.0

BORING NUMBER: B-12

MONITOR WELLS: MW-4

DATE INSTALLED: 7-22-89
PROJECT: CHESAPEAKE RUBBLE FILL
SAMPLE METHOD: SPLIT SPOON DRILLING METHOD: HOLLOW STEM AUGER and MUD
LOGGED BY: GREG ADAMSON DRILLER: HARDIN-HUBER, INC

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	N	Description
1	0 - 2	3-3-4-6 (16)	7	CLAY, little silt and sand, red-br-yellow
2	2.5-4.5	3-7-9-11 (21)	16	16" SAND, fn & vf, tr silt & clay, rd-br-yellow 5" SILT and CLAY, little sand, yellow-red
	5'		38	
3	5 - 7	9-19-19-30 (17)		SAND, med, some fn, tr silt and clay, red-brown-lt tan
4	7.5-9.5	6-18-21-26 (20)	40	8" SAND, as above 12" SAND, fn to vf, some silt, tr clay, lt tan-red-brown
	10'			
5	10-12	7-13-13-16 (19)	26	SAND, med, some fn, tr silt, lt tan-red-brown
6	12.5-14.5	6-10-11-13 (21)	21	SAND, fn and vf, little med, tr silt and clay, lt tan-red-brown
7	15-17	3-3-5-3 (20)	8	SAND, as above, gray and red-brown, with 2" clay layer
8	17.5-19.5	3-5-11-24 (18)	16	5" SAND, as above 13" CLAY, some silt, tr sand, gray
	22'			
9	20-22	3-5-16-24 (17)	21	SAND, med, some fn, some silt and clay stringers, gray-red-brown-yellow
10	22.5-24.5	30-33-27-18 (17)	60	8" GRAVEL, some sand, tr silt, red-brown 9" SAND, fn to vf, tr silt & clay, red-br-gray
11	25-27	5-20-41-51/5" (24)	92	6" SAND, as above 6" CLAY, ltl silt, thin sand lenses, gray 8" SAND, med-fn, gray-rd-br, saturated
12	27.5-29.5	20-24-30-38 (20)	54	10" CLAY, ltl sand and silt, gray-rd-br 10" SAND, med, ltl fn, tr silt & clay, gray
13	30-32	22-28-36-40 (20)	64	SAND, as above, saturated
14	32.5-34.5	27-38-43-51 (24)	81	SAND, as above
15	35-37	33-51/6" (12)	100	SAND, as above
16	37.5-39.5	15-51/6" (12)	100	SAND, as above



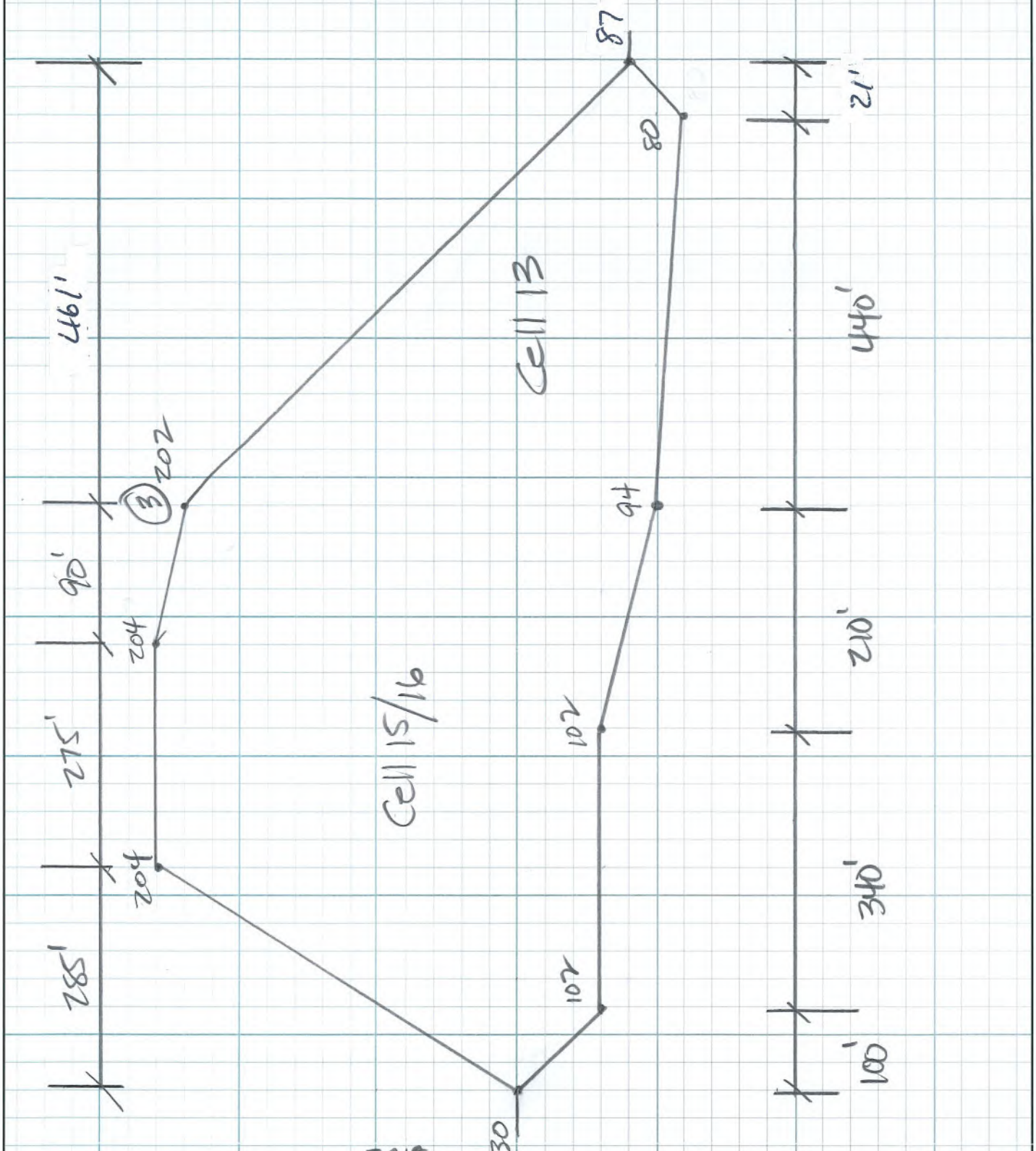
BORING NUMBER: B-12 continued

Sample No.	Depth (ft)	Blows per 6 inches (recovery in inches)	Graphic Log	Description
			40	
17	40-42	4-14-51/5" (65) (8)		SAND, as above
18	42.5-44.5	45-51/3" (100) (8)		CLAY, little silt and sand, with thin sand lenses, mottled red-gray
			45	
19	45-47	14-45-48 (93) (18)		11" SAND, med and coarse, tr silt & clay, gray 7" CLAY, tr silt and sand, dense, gray
20	47.5-49.5	35-47-51/4" (98) (16)		CLAY, as above
			50	
21	50-52	33-51/4" (100) (0)		No recovery - drilled like clay
22	52.5-54.5	29-51/6" (100) (12)		CLAY, as above, mottled gray-red-br-purple
			55	
23	55-57	43-51/5" (100) (11)		CLAY, as above
24	57.5-59.5	34-51/5" (100) (0)		No recovery, drilled like clay
			60	
25	60-62	36-51/5" (100) (11)		CLAY, as above
26	62.5-64.5	41-33-42-47 (75) (21)		6" CLAY, as above 15" CLAY and SILT, little sand, gray
			65	
27	65-67	45-51/5" (100) (0)		No recovery
28	67.5-69.5	37-45-47-51/5" (96) (15)		CLAY, some silt, tr sand, red-br-gray
29	70-72	19-29-33-42 (62) (21)	70	10" CLAY, as above 5" CLAY & SILT, tr sand, mottled red-br-gray 6" SAND, vf, some silt, tr clay, gray
30	72.5-74.5	10-27-36-49 (63) (0)		No recovery
			75	
31	75-77	19-29-38-51/5" (67) (21)		7" SILT & vf SAND, tr clay, mott rd-br-gray 14" SILT & CLAY, little vf sand, red-br-gray
32	77.5-79.5	21-28-51/5" (79) (17)	80	SILT and CLAY, as above

Groundwater on the drill rods at 34 feet.

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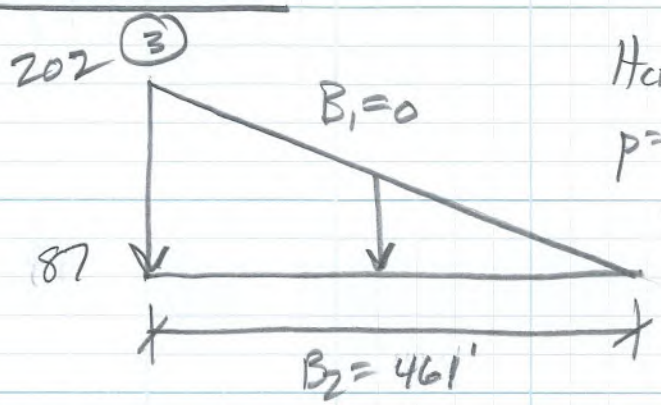


2018-

SHEET 1	OF 1	PROJECT NO. 3054		PROJECT NAME	
BY	JCA	DATE 7/11/20		DESCRIPTION	Cell 13, Point 3 Settlement
CHK. BY		DATE			

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Waste Load U_1



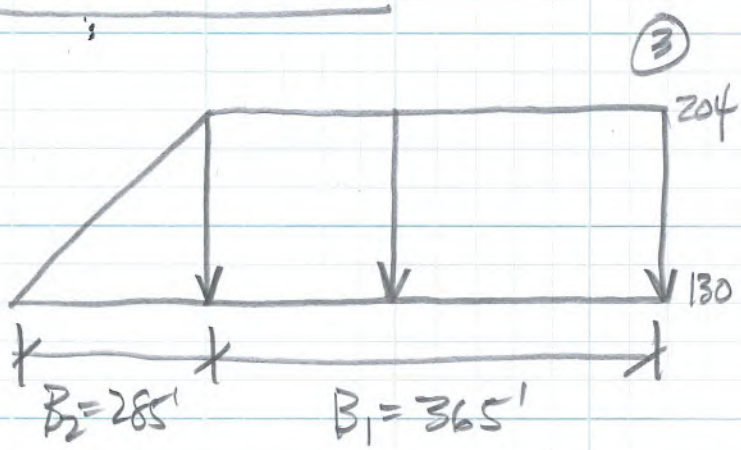
$H_{COD} = 202 - 87 - 3 = 112$

$p = \Sigma(\gamma H)$

$= (3)(115) + (112)(48.7)$

$= 5799$ psf

Waste Load U_2



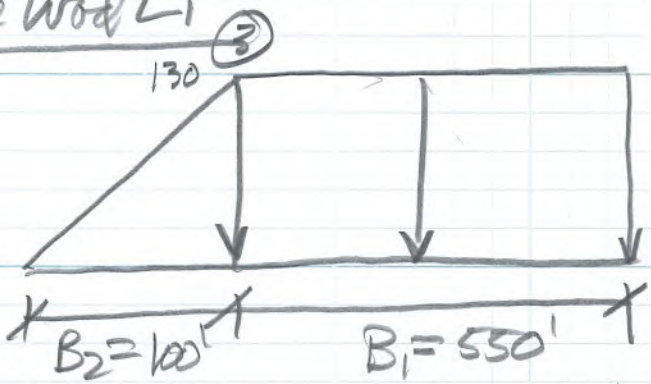
$H_{COD} = 204 - 130 - 3 = 71'$

$p = \Sigma(\gamma H)$

$= (3)(115) + (71)(48.7)$

$= 3803$ psf

Waste Load L_1



$H_{COD} = 130 - 94 - 6 = 30'$

$p = \Sigma(\gamma H)$

$= (30)(48.7) + (6)(115)$

$= 2151$ psf

Net load $= U_1 + U_2 + L_1$

SHEET 1	OF 6	PROJECT NO 2018-3084	PROJECT NAME		
BY JKA		DATE 7/11/20	DESCRIPTION	Cell 13, Point 3 Settlement	
CHK. BY		DATE			

Cell 13 **Point** 3

Boring Profile: B-12

Existing Profile >>>> Assume soil is normally consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Soil Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Soil Unit Weight (kcf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Initial Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Initial Effective Vertical Stress at Bottom of Soil Layer (psf)	Estimated Effective Pre-consolidation Stress (σ_p') at Center of Soil Layer (psf)
1	Sand w/trace fines	136	112	24	11	117.7	0	117.7	1,413	1.413	2,826	1,413
2	Sand w/trace fines	112	110	2	11	117.7	62.4	55.3	2,881	2.881	2,936	2,881
3	Sand w/trace fines	110	100	10	34	131.5	62.4	69.1	3,282	3.282	3,627	3,282
4	Clay to Clayey Silt	100	35	65	49	145.0	62.4	82.6	6,312	6.312	8,996	6,312
5	Silty Clayey Sand to Silty Sand	35	5	30	74	145.0	62.4	82.6	10,235	10.235	11,474	10,235
6	Clay	5	-874	879	70	145.0	62.4	82.6	47,777	47.777	84,079	47,777
			Total Depth =	*1010*								

Interimediate Profile >>>> With excavation, soil is now over-consolidated.

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (ksf)	Intermediate Effective Vertical Stress at Bottom of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	11	117.7	0	117.7	824	0.824	1,648
2	Sand w/trace fines	112	110	2	11	117.7	62.4	55.3	1,704	1.704	1,759
3	Sand w/trace fines	110	100	10	34	131.5	62.4	69.1	2,104	2.104	2,450
4	Clay to Clayey Silt	100	35	65	49	145.0	62.4	82.6	5,134	5.134	7,819
5	Silty Clayey Sand to Silty Sand	35	5	30	74	145.0	62.4	82.6	9,058	9.058	10,297
6	Clay	5	-874	879	70	145.0	62.4	82.6	46,599	46.599	82,902

Waste Load U1 *B1 =* 0.01 *B2 =* 461 *Po =* 5,799 *psf*

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	1.554	0.001	0.495	2873
2	Sand w/trace fines	112	110	2	15	16	1.538	0.001	0.490	2841
3	Sand w/trace fines	110	100	10	21	26	1.525	0.000	0.486	2817
4	Clay to Clayey Silt	100	35	65	58.5	91	1.444	0.000	0.460	2668
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	1.345	0.000	0.428	2484
6	Clay	5	-874	879	560.5	1000	0.688	0.000	0.219	1271

Cell 13, Point 3, B 1/4

Waste Load U2 B1 = 365 B2 = 285 Po = 3,803 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.008	1.552	0.500	1902
2	Sand w/trace fines	112	110	2	15	16	0.018	1.530	0.500	1902
3	Sand w/trace fines	110	100	10	21	26	0.025	1.513	0.500	1902
4	Clay to Clayey Silt	100	35	65	58.5	91	0.069	1.412	0.500	1901
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.121	1.288	0.498	1894
6	Clay	5	-874	879	560.5	1000	0.282	0.577	0.389	1478

Waste Load L1 B1 = 550 B2 = 100 Po = 2,151 psf

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	z ft	y ft	α_1 (radians)	α_2 (radians)	Influence Factor I'	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	7	14	0.002	1.558	0.500	1076
2	Sand w/trace fines	112	110	2	15	16	0.004	1.544	0.500	1076
3	Sand w/trace fines	110	100	10	21	26	0.006	1.533	0.500	1076
4	Clay to Clayey Silt	100	35	65	58.5	91	0.016	1.465	0.500	1076
5	Silty Clayey Sand to Silty Sand	35	5	30	106	121	0.029	1.380	0.499	1074
6	Clay	5	-874	879	560.5	1000	0.083	0.776	0.419	902

Load Totals

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness ft	Waste Load U1 (psf)	Waste Load U2 (psf)	Waste Load L1 (psf)	Total Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	2,873	1,902	1,076	5,851
2	Sand w/trace fines	112	110	2	2,841	1,902	1,076	5,819
3	Sand w/trace fines	110	100	10	2,817	1,902	1,076	5,795
4	Clay to Clayey Silt	100	35	65	2,668	1,901	1,076	5,645
5	Silty Clayey Sand to Silty Sand	35	5	30	2,484	1,894	1,074	5,452
6	Clay	5	-874	879	1,271	1,478	902	3,651

Cell 13, Point 3, pg 3/4

Final Profile

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Average SPR (N_a)	Estimated Unit Weight (pcf)	Unit Weight Water (pcf)	Effective Unit Weight (pcf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (psf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Final Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)
1	Sand w/trace fines	126	112	14	11	117.7	0.0	117.7	824	5,851	5.851	6,676
2	Sand w/trace fines	112	110	2	11	117.7	62.4	55.3	1,704	5,819	5.819	7,523
3	Sand w/trace fines	110	100	10	34	131.5	62.4	69.1	2,104	5,795	5.795	7,900
4	Clay to Clayey Silt	100	35	65	49	145.0	62.4	82.6	5,134	5,645	5.645	10,779
5	Silty Clayey Sand to Silty Sand	35	5	30	74	145.0	62.4	82.6	9,058	5,452	5.452	14,509
6	Clay	5	-874	879	70	145.0	62.4	82.6	46,599	3,651	3.651	50,251

Elastic Settlement

Soil Layer	Soil Description	Thickness (ft)	Average SPR (N_a)	Estimated Unconfined Compression Strength qu (ksf)	Modulus of Elasticity Es (ksf)	Increase in Effective Vertical Stress ($\Delta\sigma_v'$) at Center of Soil Layer (ksf)	Calculated Elastic Settlement (ft)	Calculated Elastic Settlement (in)
1	Sand w/trace fines	14	11		176	5.851	0.47	5.59
2	Sand w/trace fines	2	11		176	5.819	0.07	0.79
3	Sand w/trace fines	10	34		544	5.795	0.11	1.28
4	Clay to Clayey Silt	65	49	30.3	13,276	5.645	0.03	0.33
5	Silty Clayey Sand to Silty Sand	30	74		1,184	5.452	0.14	1.66
6	Clay	879	70	58.8	25,707	3.651	0.12	1.50

Recompression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Recompression Index C_r	Corrected Recompression Index C_{rc}	Effective Pre-consolidation Stress (σ_p') (psf)	Intermediate Effective Vertical Stress (σ_{vo}') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf}') at Center of Soil Layer (psf)	Calculated Recompression Settlement (ft)	Calculated Recompression Settlement (in)
4	Clay to Clayey Silt	65	2.80	145.0	0.360	0.004	0.003	6,312	5,134	10,779	0.017	0.21
6	Clay	879	2.80	145.0	0.360	0.004	0.003	47,777	46,599	50,251	0.028	0.34

Cell 13, point 3, pg 3/4

Compression Settlement - Cohesive Soils

Soil Layer	Soil Description	Thickness (ft)	Specific Gravity	Estimated Unit Weight (pcf)	Initial Void ratio e_o	Compression Index C_c	Corrected Compression Index C_{cc}	Effective Pre-consolidation Stress (σ_p ') (psf)	Intermediate Effective Vertical Stress (σ_{vo} ') at Center of Soil Layer (psf)	Final Effective Vertical Stress (σ_{vf} ') at Center of Soil Layer (psf)	Calculated Compression Settlement (ft)	Calculated Compression Settlement (in)
4	Clay to Clayey Silt	65	2.80	145.0	0.360	0.009	0.006	6,312	5,134	10,779	0.095	1.14
6	Clay	879	2.80	145.0	0.360	0.009	0.006	47,777	46,599	50,251	0.122	1.46

Summary

Soil Layer	Soil Description	Top Elev (ft)	Bottom Elev (ft)	Thickness (ft)	Calculated Elastic Settlement (in)	Calculated Recompression Settlement (in)	Calculated Compression Settlement (in)	Total Calculated Settlement (in)
1	Sand w/trace fines	126	112	14	5.59			5.59
2	Sand w/trace fines	112	110	2	0.79			0.79
3	Sand w/trace fines	110	100	10	1.28			1.28
4	Clay to Clayey Silt	100	35	65	0.33	0.21	1.14	1.68
5	Silty Clayey Sand to Silty Sand	35	5	30	1.66			1.66
6	Clay	5	-874	879	1.50	0.34	1.46	3.30
	Totals				11.14	0.55	2.60	14.29

REFERENCE 9

PRODUCT DATA SHEET

GSE HD Textured Geomembrane

GSE HD Textured is a co-extruded textured high density polyethylene (HDPE) geomembrane available on one or both sides. It is manufactured from the highest quality resin specifically formulated for flexible geomembranes. This product is used in applications that require increased frictional resistance, excellent chemical resistance and endurance properties.

[*]

AT THE CORE:
An HDPE geomembrane used in applications that require increased frictional resistance, excellent chemical resistance and endurance properties.

Product Specifications

These product specifications meet GRI GM13

Tested Property	Test Method	Frequency	Minimum Average Value				
			30 mil	40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	30 27	40 36	60 54	80 72	100 90
Density, g/cm³	ASTM D 1505	200,000 lb	0.940	0.940	0.940	0.940	0.940
Tensile Properties (each direction) Strength at Break, lb/in-width Strength at Yield, lb/in-width Elongation at Break, % Elongation at Yield, %	ASTM D 6693, Type IV Dumbell, 2 ipm G.L. 2.0 in G.L. 1.3 in	20,000 lb	 45 63 100 12	 60 84 100 12	 90 126 100 12	 120 168 100 12	 150 210 100 12
Tear Resistance, lb	ASTM D 1004	45,000 lb	21	28	42	56	70
Puncture Resistance, lb	ASTM D 4833	45,000 lb	45	60	90	120	150
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note(1)	Note(1)	Note(1)	Note(1)	Note(1)
Asperity Height, mil	ASTM D 7466	second roll	16	18	18	18	18
Notched Constant Tensile Load(2), hr	ASTM D 5397, Appendix	200,000 lb	500	500	500	500	500
Oxidative Induction Time, mins	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lb	>100	>100	>100	>100	>100
TYPICAL ROLL DIMENSIONS							
Roll Length(3), ft	Double-Sided Textured Single-Sided Textured		830 1,010	700 780	520 540	400 410	330 330
Roll Width(3), ft			22.5	22.5	22.5	22.5	22.5
Roll Area, ft²	Double-Sided Textured Single-Sided Textured		18,675 22,725	15,750 17,550	11,700 12,150	9,000 9,225	7,425 7,425

NOTES:
- (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2)NCTL for GSE HD Textured is conducted on representative smooth membrane samples.
- (3)Roll lengths and widths have a tolerance of ±1%.
- GSE HD Textured is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- *Modified.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

GSE ENVIRONMENTAL™

[DURABILITY RUNS DEEP] For more information on this product and others, please visit us at GSEworld.com, call 800.435.2008 or contact your local sales office.

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ATTACHMENT 9G

Closure Cap Veneer Stability

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Cap System – Finite (Veneer) Stability Analysis		
	Job No. 2018-3854	Made by: JCA	Date 06/21/20
	Ref.	Checked by: VEF	Sheet 1 of 3

Reviewed by PGS 09/01/2021

These calcualtions were performed for a cap constructed at slope of 3 horizontal to 1 vertical (3:1). The revised design has liner component slopes of 4:1 or flatter. This means that the conclusions and recommendations derived from these calculations are still protective, and can still be followed.

Objective:

The objective of this analysis is to evaluate the veneer stability of the cap system under both drained and undrained conditions, as well as with static and dynamic loading.

Design Approach and Assumptions:

1. The steepest cap slope is 3H: 1V (33%). The longest slope length between berms is 95 ft. (30.0 ft high).

2. The proposed cap system consists of the following components from top to bottom:

   0.5 ft Vegetative Soil;
   1.5 ft Cover Soil;
   Geocomposite Drainage Net;
   Textured Geomembrane; and,
   1.0 ft Intermediate Cover Soil atop Waste.

3. It was assumed that the 2-ft cover soils (vegetative and protective soil) have uniform properties: unit weight of 120 pcf, cohesion of 20 psf, and friction angle of 30 degrees. Higher friction angle values have been documented on another recent project in the Mid-Atlantic Region. However, the value chosen here was considered conservative.

4. The target factors of safety (FS) against veneer instability at the cover are 1.5 for static and construction loading, and 1.0 for seismic loading. The target FS of 1.5 was adopted based on the assumption the site is for non-hazard waste and high in importance ranking.

5. From USGS seismic map, the seismic coefficient (peak ground acceleration) at the site is approximately 0.065g.

6. Low ground pressure equipment is typically used for landfill cap construction. This analysis assumes CAT D6N LGP dozer was assumed to be used in the construction.

7. Interface friction angles were taken from GRI Report #30 (direct shear database).

8. The analyses were performed following Koerner and Soong 2005. As is common, soil cohesion and interface adhesion were neglected to be conservative.

Reviewed by PGS 09/01/2021

Calculations:

This analysis considered the following scenarios (the calculation spread sheets and equations used for the calculation are attached):

Case 1. Static, Drained;
Case 2. Dynamic, Drained, CAT D6N LGP Pushing Upslope;
Case 3. Dynamic, Drained, CAT D6N LGP Pushing Downslope;
Case 5a. Static, Undrained, Slope Parallel Seepage Build-up to 50% Cap Thickness;
Case 5b. Static, Undrained, Slope Parallel Seepage Build-up to 100% Cap Thickness; and,
Case 6. Dynamic, Drained, Seismic Loading.

The method used here includes a "Case 4" which addresses the physical situation of horizontal seepage build-up on the cap. For this project, a horizontal seepage build-up is not possible. The summary of the calculated FS values is shown the following table:

Scenario	Target Factor of Safety, FS_{min}	Calculated Factor of Safety, FS_{min}	Acceptable? (Yes or No)
Case 1. Static, Drained	1.5	1.54	**Yes**
Case 2. Dynamic, Drained, CAT D6N LGP Pushing Upslope	1.5	1.52	**Yes**
Case 3. Dynamic, Drained, CAT D6N LGP Pushing Downslope	1.5	1.37	**No**
Case 5a. Static, Undrained, Slope Parallel Seepage Build-up to 50% Cap Thickness	1.5	1.13	**No**
Case 5b. Static, Undrained, Slope Parallel Seepage Build-up to 100% Cap Thickness	1.5	0.81	**No**
Case 6. Dynamic, Drained, Seismic Loading	1.0	1.24	**Yes**

CONCLUSIONS:

Based on the foregoing, the following conclusions are presented:

1. Case 3 has an unacceptable FS values where construction equipment is presumed to be pushing downslope. Therefore, the operation should not allow construction equipment to push downslope.

2. Cases 5a and 5b have unacceptable FS values where seepage is permitted to build up in the cap layer.. Therefore, the design should accommodate the seepage through the cap to be completely contained within the geocomposite drainage net.

3. To successfully accomplish the construction and operation of the landfill with respect to cap stability, the materials used should meet or exceed the parameters used in this analysis.

References:

Koerner, R.M., and Soong, T.Y.; *"Analysis and Design of Veneer Cover Soils"*; Geosynthetics International, 2005, Vol. 12, No.1, p28-49.

Soong, T.Y, and Koerner, R.M.; *"Cover Soil Slope Stability Involving Geosynthetic Interfaces"*, GRI Report #18, 1996.

Koerner, R.M., and Daniel, D.; *"Final Covers for Solid Waste Landfills and Abandoned Dumps"*, 1997.

Soong, T.Y, and Koerner, R.M.; *"The Design of Drainage Systems over Geosynthetically Lined Slopes"*; , GRI Report #19, 1997.

Koerner, G.R., Narejo, D.; *"Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces"*; GRI Report #30, 2005.

U.S.E.P.A.; *"RCRA Substitute D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities"*; EPA/600/R-95/051, April, 1995.

Map on Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years, USGS Map, Oct. 2002.

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Project:			
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By:	JCA	**Date:**	06/21/20
Checked:		**Date:**	08/14/20
Subject:	Cap System - Finite (Veneer) Slope Analysis		

Description

Perform a finite slope (veneer) analysis of the cap system.

Slope Information

Slope, β =	3	H to 1V =	18.4	deg	2β =	36.87	deg
Maximum Slope Length, L =	95	ft					
Height of Slope, H =	30	ft					

Materials

Cover Soil =	USCS Silty Sand to Clayey Sand, SM - SC	
Cover soil thickness, h =	2	ft
Moist unit weight, γ_{moist} =	115	pcf
Saturated unit weight, γ_{sat} =	130	pcf
Internal friction angle, ϕ =	28	deg
Soil cohesion, c =	0	psf
Water unit weight, γ_w =	62.4	pcf
Geocomposite drainage net, GDN =	GSE TenFlow 350 with NW-NP-GT both sides	
Textured Geomembrane =	40-mil LLDPE-T	

Interface Friction Angles

Cover soil to GDN, δ_1 =	27	deg	Use δ =		
GDN to LLDPE-T, δ_2 =	26	deg		26	deg
LLDPE to cover soil, δ_3 =	26	deg			
All interface adhesion, c_a =	0	kPa	=	0.0	psf

Case 1: Static, Drained

sin β =	0.32	W_A =	20,442	lb/ft
tan β =	0.33	W_P =	767	lb/ft
cos β =	0.95	N_A =	19,393	lb/ft
$\sin^2\beta$ =	0.10	C_a =	0	lb/ft
sin 2β =	0.60	C =	0	lb/ft
tan ϕ =	0.53	a =	1,939	lb/ft
tan δ =	0.49	b =	-3,310	lb/ft
		c =	503	lb/ft

Minimum Factor of Safety, FSmin =	1.5
Factor of Safety, FS =	1.54

Case 2: Dynamic, Drained, Equipment Pushing Upslope

$\sin \beta$ =	0.32	W_A =	20,442	lb/ft	q =	685	lb/ft
$\tan \beta$ =	0.33	W_P =	767	lb/ft	We =	6,565	lb/ft
$\cos \beta$ =	0.95	N_A =	19,393	lb/ft	Ne =	6,228	lb/ft
$\sin^2 \beta$ =	0.10	C_a =	0	lb/ft			
$\sin 2\beta$ =	0.60	C =	0	lb/ft			
$\tan \phi$ =	0.53	a =	8,102	lb/ft			
$\tan \delta$ =	0.49	b =	-13,699	lb/ft			
		c =	2,101	lb/ft			

Weight of Equipment, W_b =	39,112
Length of Equipment Track, w =	10.2
Width of Equipment Track, b =	2.8
Width-to-Thickness Ratio, b/h =	1.4
Influence Factor, I =	0.94

Minimum Factor of Safety, FSmin = 1.5
Factor of Safety, FS = 1.52

Case 3: Dynamic, Drained, Equipment Pushing Downslope

$\sin \beta$ =	0.32	W_A =	20,442	lb/ft	q =	685	lb/ft
$\tan \beta$ =	0.33	W_P =	767	lb/ft	We =	6,565	lb/ft
$\cos \beta$ =	0.95	N_A =	19,393	lb/ft	Ne =	6,228	lb/ft
$\sin^2 \beta$ =	0.10	C_a =	0	lb/ft	Fe =	985	lb/ft
$\sin 2\beta$ =	0.60	C =	0	lb/ft			lb/ft
$\tan \phi$ =	0.53	a =	9,036	lb/ft			
$\tan \delta$ =	0.49	b =	-13,864	lb/ft			
		c =	2,101	lb/ft			

Dozer-to-Gravity Acceleration Ratio, a/g =	0.15	
Acceleration of Dozer, a_d =	4.827	ft/s^2
Anticipated speed =	15	mi/hr
=	24.1	km/h
Time to speed =	4	s

Minimum Factor of Safety, FSmin = 1.5
Factor of Safety, FS = 1.36

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Case 5a: Static, Undrained, Slope Parallel Seepage Build-up to 50% of Cap Thickness

$\sin \beta$ =	0.32	W_A =	22,451	lb/ft	Uv =	374	lb/ft
$\tan \beta$ =	0.33	W_P =	792	lb/ft	Uh =	31	lb/ft
$\cos \beta$ =	0.95	N_A =	15,791	lb/ft	Un =	5,517	lb/ft
$\sin^2 \beta$ =	0.10	C_a =	0	lb/ft			
$\sin 2\beta$ =	0.60	C =	0	lb/ft			
$\tan \phi$ =	0.53	a =	6,738	lb/ft			
$\tan \delta$ =	0.49	b =	-8,717	lb/ft			
		c =	1,295	lb/ft			

Thickness of Saturated Layer, hw = 1.0 ft

Saturated Soil Unit Weight, γ_{sat} = 130 pcf

Parallel Submergence Ratio, $PSR = hw/h$ = 0.50

Minimum Factor of Safety, FSmin = 1.5

Factor of Safety, FS = 1.12

Case 5b: Static, Undrained, Slope Parallel Seepage Build-up to 100% of Cap Thickness

$\sin \beta$ =	0.32	W_A =	23,799	lb/ft	Uv =	374	lb/ft
$\tan \beta$ =	0.33	W_P =	867	lb/ft	Uh =	125	lb/ft
$\cos \beta$ =	0.95	N_A =	11,780	lb/ft	Un =	10,837	lb/ft
$\sin^2 \beta$ =	0.10	C_a =	0	lb/ft			
$\sin 2\beta$ =	0.60	C =	0	lb/ft			
$\tan \phi$ =	0.53	a =	7,152	lb/ft			
$\tan \delta$ =	0.49	b =	-6,958	lb/ft			
		c =	966	lb/ft			

Thickness of Saturated Layer, hw = 2.0 ft

Saturated Soil Unit Weight, γ_{sat} = 130 pcf

Parallel Submergence Ratio, $PSR = hw/h$ = 1.00

Minimum Factor of Safety, FSmin = 1.5

Factor of Safety, FS = 0.81

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Case 6: Dynamic, Drained, Seismic Loading

$\sin \beta$ =	0.32	W_A =	20,363	lb/ft
$\tan \beta$ =	0.33	W_P =	767	lb/ft
$\cos \beta$ =	0.95	N_A =	19,318	lb/ft
$\sin^2 \beta$ =	0.10	C_a =	0	lb/ft
$\sin 2\beta$ =	0.60	C =	0	lb/ft
$\tan \phi$ =	0.53	a =	6,447	lb/ft
$\tan \delta$ =	0.49	b =	-9,232	lb/ft
Seismic coefficient, Cs =	0.065	c =	1,503	lb/ft
(0.5)Cs =	0.0325			

Minimum Factor of Safety, FSmin = 1.0

Factor of Safety, FS = 1.24

References:

1 Koerner, R.M., and Soong, T.Y.; "Analysis and Design of Veneer Cover Soils"; Geosynthetics International, 2005, Vol. 12, No.1, p28-49.

2 Soong, T.Y, and Koerner, R.M.; "Cover Soil Slope Stability Involving Geosynthetic Interfaces", GRI Report #18, 1996.

3 Koerner, R.M., and Daniel, D.; "Final Covers for Solid Waste Landfills and Abandoned Dumps", 1997.

4 Soong, T.Y, and Koerner, R.M.; "The Design of Drainage Systems over Geosynthetically Lined Slopes"; , GRI Report #19, 1997.

5 Koerner, G.R., Narejo, D.; "Direct Shear Database of Geosynthetic-to-Geosynthetic and Geosynthetic-to-Soil Interfaces"; GRI Report #30, 2005.

6 U.S.E.P.A.; "RCRA Substitute D (258) Seismic Design Guidance for Municipal Solid Waste Landfill Facilities"; EPA/600/R-95/051, April, 1995.

7 Map on Peak Acceleration (%g) with 2% Probability of Exceedance in 50 Years, USGS Map, Oct. 2002.

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By: JCA **Date:** 10-Oct-19
Checked: VGS **Date:** 07/04/20
Subject: Cap System - Finite (Veneer) Slope Analysis

Caterpillar Performance Handbook (Edition 32, October 2001)

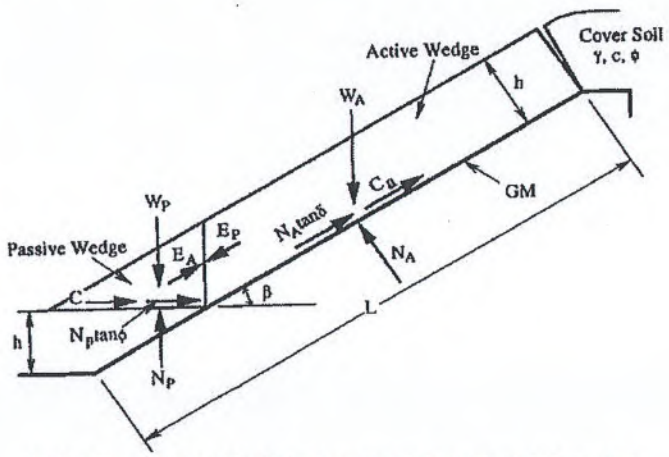
Model	Unit	D4G LGP Hystat	D6R	D6R LGP	D7R LGP Series II	D8R	D9R	D10R	***D6N LGP****
Weight of Equipment, W_b	lb	17,877	40,400	45,600	60,300	82,850	107,670	144,200	***39,112***
Length of Equipment Track, w	in	80.9	103	128	125	126	137	153	***122.7***
	ft	6.7	8.6	10.7	10.4	10.5	11.4	12.8	***10.2***
Width of Equipment Track, b	in	25	22	36	36	22	24	24	***33.07***
	ft	2.1	1.8	3.0	3.0	1.8	2.0	2.0	***2.8***
Ground contact area, calculated	in^2	4,045	4,532	9,216	9,000	5,544	6,576	7,344	***8,115***
	ft^2	28.1	31.5	64.0	62.5	38.5	45.7	51.0	***56.4***
Ground contact area, from book	in^2	4,045	4,518	9,194	9,029	5,565	6,569	7,321	***8,122***
	ft^2	28.1	31.4	63.8	62.7	38.6	45.6	50.8	***56.4***
Ground pressures, from book	psi	4.11	8.82	4.94	6.55	14.67	16.08	19.63	***4.8***
	psf	592	1270	711	943	2112	2316	2827	***691***
Ground pressures, calculated	psi	4.42	8.91	4.95	6.70	14.94	16.37	19.64	***4.82***
	psf	636	1,284	713	965	2,152	2,358	2,827	***694***

Reference

1 *D6N track-type tractor product literature; www.cat.com.*

REFERENCE 1 pg 1/5

Case 1: Drained



Limit equilibrium forces in a finite length slope analysis for a uniformly thick cover soil.

$$W_A = \gamma_{moist} \cdot h^2 \cdot \left[\frac{L}{h} - \frac{1}{\sin\beta} + \frac{\tan\beta}{2}\right]$$

$$W_P = \frac{h^2 \cdot \gamma_{moist}}{\sin 2\beta}$$

$$N_A = W_A \cdot \cos\beta$$

$$C_a = c_a \cdot \left(L - \frac{h}{\sin\beta}\right)$$

$$C = \frac{c \cdot h}{\sin\beta}$$

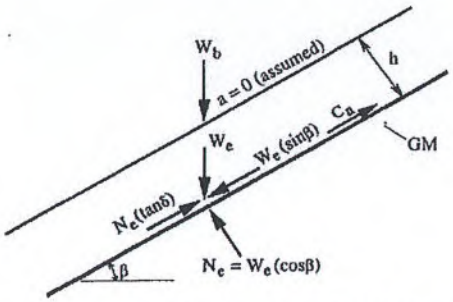
$$a = (W_A - N_A \cdot \cos\beta) \cdot \cos\beta$$

$$c = (N_A \cdot \tan\delta + C_a) \cdot \sin^2\beta \cdot \tan\phi$$

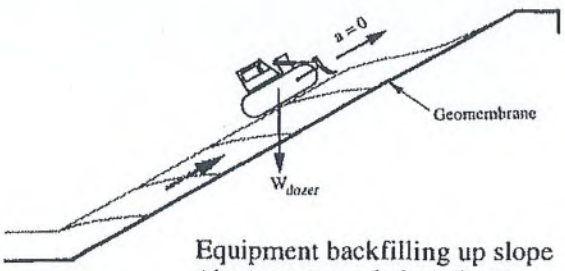
$$b = -[(W_A - N_A \cdot \cos\beta) \cdot \sin\beta \cdot \tan\phi + (N_A \cdot \tan\delta + C_a) \cdot \sin\beta \cdot \cos\beta + \sin\beta \cdot (C + W_P \cdot \tan\phi)]$$

$$FS = \frac{-b + \sqrt{b^2 - 4a \cdot c}}{2a}$$

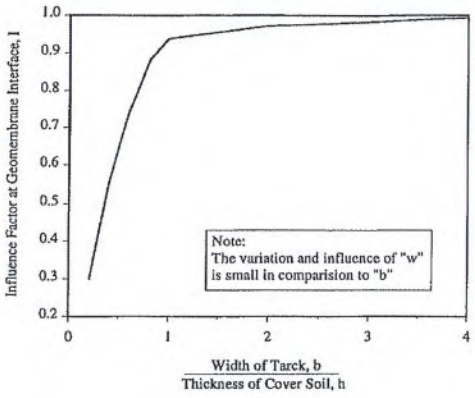
Case 2: Drained, Equipment Pushing Upslope



Equipment moving up slope
(load with no assumed acceleration)



Equipment backfilling up slope
(the recommended method)



- W_A, W_P, N_A, Ca, C, and FS same as Case 1

$$q = \frac{W_b}{(2 \cdot w \cdot b)}$$

$$W_e = q \cdot w \cdot I$$

$$N_e = W_e \cdot \cos\beta$$

$$a = [(W_A + W_e) \cdot \sin\beta] \cdot \cos\beta$$

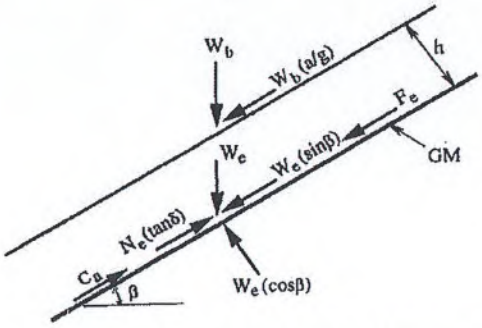
$$c = [(N_e + N_A) \cdot \tan\delta + C_a] \cdot \sin\beta \cdot \tan\phi$$

$$b = -\{[(N_e + N_A) \cdot \tan\delta + C_a] \cdot \cos\beta + [(W_A + W_e) \cdot \sin\beta] \cdot \sin\beta \cdot \tan\phi + (C + W_P \cdot \tan\phi)\}$$

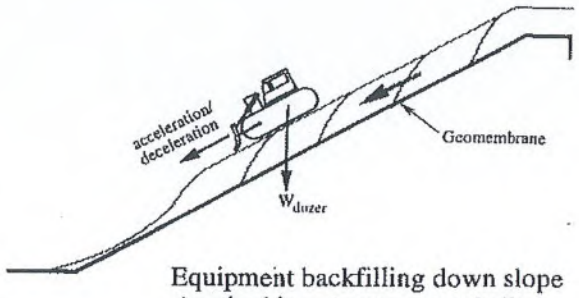
REFERENCE 1

pg 3/5

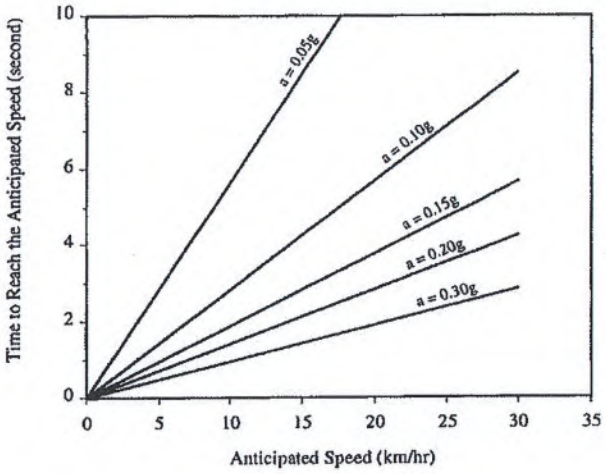
Case 3: Drained, Equipment Pushing Downslope



Equipment moving down slope
(load plus acceleration or deceleration)



Equipment backfilling down slope
(method is not recommended)



- W_A, W_P, N_A, Ca, C, and FS same as Case 1

- We, q, and Ne same as Case 2

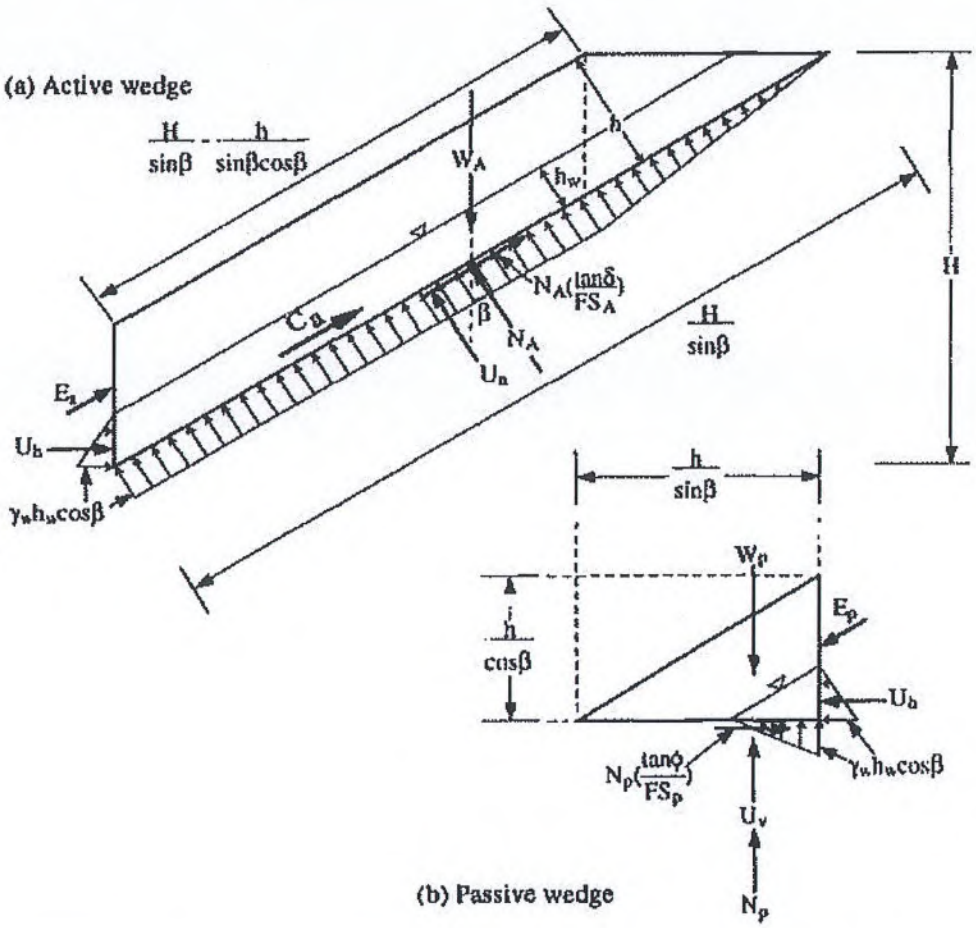
$$F_e = W_e \cdot \left(\frac{a}{g}\right)$$

$$a = [(W_A + W_e) \cdot \sin\beta + F_e] \cdot \cos\beta$$

$$c = [(N_e + N_A) \cdot \tan\delta + C_a] \cdot \sin\beta \cdot \tan\phi$$

$$b = -\{[(N_e + N_A) \cdot \tan\delta + C_a] \cdot \cos\beta + [(W_A + W_e) \cdot \sin\beta + F_e] \cdot \sin\beta \cdot \tan\phi + (C + W_P \cdot \tan\phi)\}$$

Case 5: Parallel Seepage Build-up



$$W_A = \frac{\gamma_{moist} \cdot (h - h_w) \cdot \left[2H \cdot \cos\beta - (h + h_w)\right]}{\sin 2\beta} + \frac{\gamma_{sat} \cdot h_w \cdot (2H \cdot \cos\beta - h_w)}{\sin 2\beta}$$

$$W_P = \frac{\gamma_{moist} \cdot (h^2 - h_w{}^2) + h_w{}^2 \cdot \gamma_{sat}}{\sin 2\beta}$$

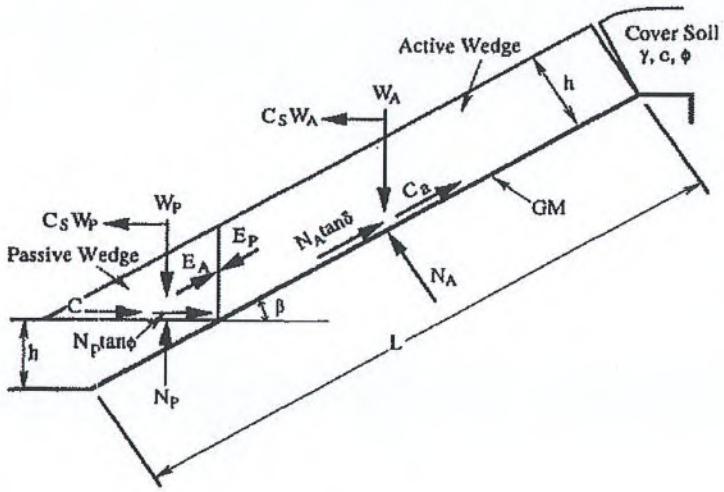
- Ca, C, and FS same as Case 1
- a, b, c, Uv, and NA same as Case 4

$$U_N = \frac{\gamma_w \cdot h_w \cdot \cos\beta \cdot (2H \cdot \cos\beta - h_w)}{\sin 2\beta}$$

$$U_h = \frac{\gamma_w \cdot h_w{}^2}{2}$$

REFERENCE 1 pg 5/5

Case 6: Drained, Seismic Affect



- Wa, Wp, Na, Ca, C, and FS same as Case 1

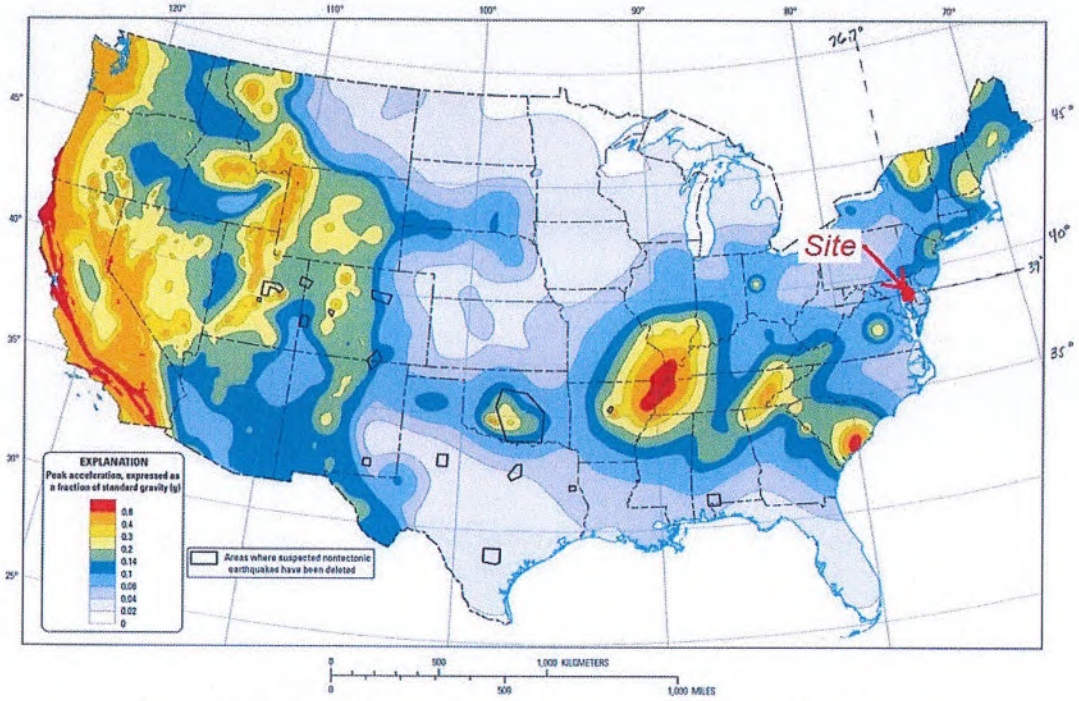
$$a = (C_s \cdot W_A + N_A \cdot \sin\beta) \cdot \cos\beta + C_s \cdot W_P \cdot \cos\beta$$

$$c = (N_A \cdot \tan\delta + C_a) \cdot \cos\beta \cdot \sin\beta \cdot \tan\phi$$

$$b = -[(C_s \cdot W_A + N_A \cdot \sin\beta) \cdot \sin\beta \cdot \tan\phi + (N_A \cdot \tan\delta + C_a) \cdot \cos^2\beta + (C + W_P \cdot \tan\phi) \cdot \cos\beta]$$

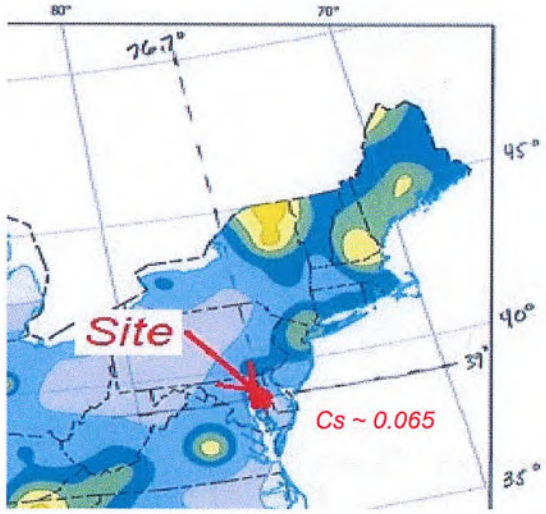
REFERENCE 7 pg 1/1

Case 6: Drained, Seismic Affect (cont.)



Two-percent probability of exceedance in 50 years map of peak ground acceleration

https://earthquake.usgs.gov/hazards/hazmaps/



Approximate Site Location

Two-percent probability of exceedance in 50 years map of peak ground acceleration

https://earthquake.usgs.gov/hazards/hazmaps/

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 9H

Closure Cap Isolated Settlement Evaluation

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Cap System, Isolated Settlement		
	Job No. 2018-3854	Made by: JCA	Date 06/19/20
	Ref.	Checked by: VEF	Sheet 1 of 1

Reviewed by PGS 09/01/2021

Objective: These calculations are still acceptable for the revised design.

Determine the maximum allowable isolated settlement of the cap system.

Design Approach:

1. Assume an isolated settlement will present as a spherical shaped "bowl" in the surface of the capped landfill. Consequently, such a shape can be addressed as if it as a horizontal curve, and using traditional horizontal curve design equations. (Reference 1) Use these equations to calculate the strain (%) experienced by the textured, linear low density polyethylene (LLDPE-T) geomembrane in the cap system.
2. Any amount of strain can be experienced by an infinite number of combinations of observed settlement and length over which the settlement occurs (span).
3. Set the maximum allowable strain at 8%. (Reference 2)
4. Develop a table that can be used by landfill operations personnel to determine if observed isolated settlement has resulted in an exceedance of the maximum allowable strain.

Calculation:

See attached calculation sheet for example calculations.

Conclusion:

See attached table developed for use by landfill operations personnel.

References:

1. Linburg, Michael R.; *"Civil Engineering Reference Manual"*; 6th Ed., 1992, Section 17-10.
2. Peggs, et al; *"Assessment of Maximum Allowable Strains In Polyethylene and Propylene Geomembranes"*; Geo-Frontiers Congress 2005.
3. Qian, X., Koerner, R.M., Gray, D.H., (2002). *"Geotechnical Aspects of Landfill Design and Construction"*; Prentice Hall; Upper Saddle River, NJ; 1st Ed., Sect. 4.7.2.

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Project:			
P.N.:	2018-3854	**Page:**	1 of 1
By:	JCA	**Date:**	19-Jun-20
Checked:	[illegible]	**Date:**	07/14/20
Subject:	Cap System, Isolated Settlement		

Cap System - Isolated Settlement

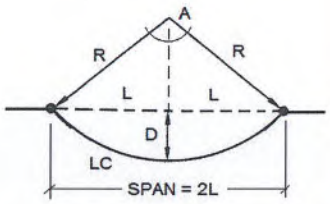
Reviewed by PGS 09/01/2021

Description

Determine the maximum allowable isolated settlement of the cap system.

Variables

Measured depth of subsidence =	D	ft
Shortest measured distance where D occurs, = original length of geomembrane =	SPAN	ft
(SPAN)/2 =	L	ft
Radius of the resultant curvature of depression =	R	ft
Angle of the resultant curvature of depression =	A	deg
Length of elongated geomembrane =	LC	ft
Percent Strain of the geomembrane at yield or break =	E	%
Calculated percent strain of elongated geomembrane =	E'	%



Equations (References 1 and 3)

(1) $LC = (RA)/57.32$

(2a) $R^2 = L^2 + (R-D)^2$

(2b) $R = (D^2 + L^2)/(2D)$

(3a) $SPAN = 2L = 2R(\sin(A/2))$

(3b) $A = 2(\sin^{-1}(2LD/(D^2 + L^2)))$

(4) $E = (\text{change in length})/(\text{original length})$

Since there are an infinite number of combinations of D and SPAN that could be observed, the maximum allowable isolated settlement of the cap system is related to the resulting strain of the geomembrane, rather than an observed settlement amount, D. Therefore, use these equations to develop a series of graphs to be used by operations personnel to evaluate observed isolated settlement(s) of the cap system.

Cap System Geomembrane

Material =	40-mil LLDPE-T		
Maximum Strain, E_{max} =	8.0	%	(Reference 2)

Example Calculations

Example 1

Measured depth of subsidence, D =	1.0	ft
Shortest measured distance where D occurs, = original length of geomembrane, SPAN =	5.0	ft
(SPAN)/2, L =	2.5	ft
Radius of the resultant curvature of depression, R =	3.6	ft
Angle of the resultant curvature of depression, A =	87.21	deg
Length of elongated geomembrane, LC =	5.5	ft
Calculated percent strain of elongated geomembrane, E' =	10.3	%

Example 2

Measured depth of subsidence, D =	2.25	ft
Shortest measured distance where D occurs, = original length of geomembrane, SPAN =	23.00	ft
(SPAN)/2, L =	11.5	ft
Radius of the resultant curvature of depression, R =	30.5	ft
Angle of the resultant curvature of depression, A =	44.28	deg
Length of elongated geomembrane, LC =	23.6	ft
Calculated percent strain of elongated geomembrane, E' =	2.5	%

Note: This analysis cannot be used for D > (SPAN/2).

References:

1 "Civil Engineering Reference Manual"; Michael R. Linburg; 6th Ed., 1992, Section 17-10.

2 "Assessment of Maximum Allowable Strains In Polyethylene and Propylene Geomembranes"; Peggs, Schmucker, Carey; Geo-Frontiers Congress 2005.

3 Qian, X., Koerner, R.M., Gray, D.H., (2002). "Geotechnical Aspects of Landfill Design and Construction"; Prentice Hall; Upper Saddle River, NJ; 1st Ed., Sect. 4.7.2.

Strain, E (%), as Related to Subsidence Span, SPAN (ft), and Subsidence Depth, D (in.), for 40-mil Textured LLDPE

		SPAN, ft						
		1	5	10	15	20	25	30
D, in	1.25	2.6						
	1.75	5.9						
	2.11	**8.0**						
	2.50	**10.3**						
	3.00		0.6					
	6.00		2.6	0.6	0.3	0.1	0.1	0.0
	9.00		5.9	1.5	0.6	0.3	0.2	0.1
	10.50		**8.0**					
	12.00		**10.3**	2.6	1.1	0.6	0.4	0.3
	18.00			5.9	2.6	1.5	0.9	0.6
	21.00			**8.0**				
	24.00			**10.3**	4.6	2.6	1.7	1.1
	30.00				7.2	4.1	2.6	1.8
	31.60				**8.0**			
	36.00				**8.7**	5.9	3.8	2.6
	42.00					**8.0**	5.1	3.5
	48.00					**10.3**	6.6	4.6
	52.70						**8.0**	
	54.00						**8.4**	5.9
	60.00							7.2
	63.10							**8.0**
	66.00							**8.7**
	72.00							

NOTES:

1 Combinations of SPAN and D that fall in the green zone indicate strains < 8% - acceptable.

2 Combinations of SPAN and D that fall in the red zone indicate strains > 8% - not acceptable.

Reviewed by PGS 09/01/2021

PRODUCT DATA SHEET

GSE UltraFlex Textured Geomembrane

GSE UltraFlex Textured is a co-extruded textured linear low density polythylene (LLDPE) geomembrane available on one or both sides. It is manufactured from the highest quality resin specifically formulated for flexible geomembranes. This product is used in applications that require increased frictional resistance, flexibility and elongation properties where differential or localized subgrade settlements may occur such as in a landfill closure application.

[*]

AT THE CORE:

An LLDPE geomembrane that is used in applications requiring increased frictional resistance, flexibility and elongation properties, such as landfill closures and mining applications.

Product Specifications

These product specifications meet GRI GM17

Tested Property	Test Method	Frequency	Minimum Average Value			
			40 mil	60 mil	80 mil	100 mil
Thickness, mil Lowest individual reading	ASTM D 5994	every roll	40 36	60 54	80 72	100 90
Density, g/cm³ (max.)	ASTM D 1505	200,000 lb	0.939	0.939	0.939	0.939
Tensile Properties (each direction) Strength at Break, lb/in-width Elongation at Break, %	ASTM D 6693, Type IV Dumbbell, 2 ipm G.L. 2.0 in	20,000 lb	 60 250	 90 250	 120 250	 150 250
Tear Resistance, lb	ASTM D 1004	45,000 lb	22	33	44	55
Puncture Resistance, lb	ASTM D 4833	45,000 lb	44	66	88	110
Carbon Black Content, % (Range)	ASTM D 1603*/4218	20,000 lb	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0	2.0 - 3.0
Carbon Black Dispersion	ASTM D 5596	45,000 lb	Note(1)	Note(1)	Note(1)	Note(1)
Asperity Height, mil	ASTM D 7466	second roll	18	18	18	18
Oxidative Induction Time, mins	ASTM D 3895, 200°C; O_2, 1 atm	200,000 lb	> 100	> 100	> 100	> 100
TYPICAL ROLL DIMENSIONS						
Roll Length(2), ft	Double-Sided Textured Single-Sided Textured		700 800	520 540	400 410	330 330
Roll Width(2), ft			22.5	22.5	22.5	22.5
Roll Area, ft²	Double-Sided Textured Single-Sided Textured		15,750 18,000	11,700 12,150	9,000 9,225	7,425 7,425

NOTES:

- (1)Dispersion only applies to near spherical agglomerates. 9 of 10 views shall be Category 1 or 2. No more than 1 view from Category 3.
- (2)Roll lengths and widths have a tolerance of ±1%.
- GSE UltraFlex Textured is available in rolls weighing approximately 4,000 lb.
- All GSE geomembranes have dimensional stability of ±2% when tested according to ASTM D 1204 and LTB of <-77°C when tested according to ASTM D 746.
- *Modified.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

GSE ENVIRONMENTAL™

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ATTACHMENT 9I

Closure Cap Drainage Layer

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Cap System, Geocomposite Drainage Net Requirements		
	Job No. 2018-3854	Made by: JCA	Date 06/19/20
	Ref.	Checked by: VEF	Sheet 1 of 3

Reviewed by PGS 09/01/2021

Objective:

Determine various design parameters for the cap system.

Design Approach:

1. Two different slope conditions are included in the general landfill design: 25H:1V (4%) top, 3H:1V side slope, and 31H:1V (6.0%) bench sub-drainage.
2. Using various design parameters and estimated material characteristics, estimate the vertical load imposed on the geocomposite drainage net (GDN).
3. Consider manufacturer's data for a moderate compressive strength, high flow (GDN) product for use in the cap drainage system. (Reference 4)
4. Select mid-range reduction factors for use in calculating the allowable transmissivity and final thickness of the GDN to account for creep deformation of the GDN core, intrusion of the geotextile into the GDN core, chemical clogging of the GDN core and/or geotextile, and biological clogging of the GDN core and/or geotextile. Assume the GDN layer is saturated (full-flow) and under laminar flow conditions. (Reference 1)
5. The minimum product of all reduction factors is set at a value of 8, and the minimum factor of safety is set at a value of 8. (Reference 2)
6. Select a maximum distance between cap drains (this can vary in conjunction with other parameters).
7. Estimate the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the GDN, and the maximum permeability of the cover soil layer overlying the GDN.

Discussion:

Darcy's Law is typically used to analyze flow through geosynthetics, as follows:

$$Q = k\,i\,A = k\,i\,w\,t$$

Setting transmissivity, $\theta = k\,t$,

$$Q = \theta\,i\,w \qquad or \qquad Q = \theta\,i \;\; (using\ a\ unit\ width)$$

and,

$$\theta = Q / iw \qquad or \qquad k\,t = Q / i \;\; (using\ a\ unit\ width)$$

where: Q = flow rate, cm^3/sec;
k = coefficient of permeability, cm/sec;

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i = hydraulic gradient;
A = cross-sectional area of flow, cm^2;
θ = transmissivity, cm^2/sec;
w = width, cm; and,
t = thickness, cm.

For a given flow rate needed, Q, and an established flow area, A (also defined by $A = w\,t$), the permeability, k, of the GDN is inversely related to the hydraulic gradient, i. That is, as hydraulic gradient increases, permeability decreases.

Calculation:

Landfill Top (25H:1V = 4% slope):

For this arrangement, the longest slope length is approximately 130 ft. Based on the attached calculation sheet, to maintain a factor of safety of at least 8, a maximum permeability of the cover soils overlying the GDN was calculated to be $1.0x10^{-5}$ cm/sec. Additionally, the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the GDN were calculated to be $8.13x10^{-4}$ m^2/sec, 0.64 cm, and 12.80 cm/sec, respectively. The calculated factor of safety is 8.2 The flow calculated from the landfill top is added to the flow from the sideslope (next section) to allow to allow the combined flows to be managed in the sideslope cap drainage layer.

Landfill Side Slopes (3H:1V = 33% slope):

For this arrangement, the longest slope length is approximately 115 ft. The maximum permeability of the cover soil overlying the GDN was presumed to be the same as the top of the landfill, $1x10^{-5}$ cm/sec. Additionally, the flow from the landfill top was added to the combined flows to be managed in the sideslope cap drainage layer. Based on the attached calculation sheet, the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the GDN were calculated to be $9.26x10^{-4}$ m^2/sec, 0.64 cm, and 14.58 cm/sec, respectively. With these parameters, a factor of safety of at least 8 is provided.

Conclusion:

For the given GDN product characteristics, and the estimated soil characteristics, limiting the permeability of the cover soils overlying the GDN to a maximum of $1x10^{-5}$ cm/sec, a minimum factor of safety of 8 can be maintained. Since the flow from the landfill top was included in the sideslope flow, and the factor of safety of landfill top itself was 8.2, cap pipe drains are not proposed. The calculated GDN parameters of final thickness and permeability (hydraulic conductivity) can be used in other calculations as appropriate.

Reviewed by PGS 09/01/2021

References:

1. Zhao, A., and Richardson, G.M.,(2003). *"Geocomposite Drains for Side Slope Stability in Landfill Covers"*, 2000.
2. Richardson, G.N, and Pavlik, K.L.; *"Lessons Learned From Failure: Landfill Covers"*; GFR Oct/Nov 2004; pp 31-33.
3. *"Geotechnical Aspects of Landfill Design and Construction";* Qian, Koerner, and Gray; 1st Ed., 2002; Sect 8.4.3.
4. Manufacturer's data, various.
5. Site specific data, estimated.

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Project:			
P.N.:	2018-3854	**Page:**	1 of 2
By:	JCA	**Date:**	18-Jun-20
Checked:	VEF	**Date:**	7.15.20
Subject:	Cap Drainage System Geocomposite Drainage Net Requiierments Landfill Top		

Cap Drainage System - Landfill Top

Description

Determine various design parameters for the cap system for the landfill top to maintain a minimum factor of safety with respect to cap drainage.

Slope Information

Maximum slope length between drains, L =	130	ft	=	39.6	m
Slope, H =	25	to 1V	=	0.040	ft/ft
Slope angle, β =	2.29	deg			

Vertical Loads

Cap System Thickness, D1 =	2	ft			
Overall Cap System Unit Weight, $\gamma 1$ =	115	pcf			
Approximate Overall Cap System Pressure, $\sigma 1$ =	230	psf			
Approximate Total Vertical Pressure, $\sigma T = \sum \sigma$ =	230	psf	=	11.0	kPa

Geocomposite Drainage Net Product *(Reference 4)*

Product Type = GSE TenFlow 350

Estimated Ultimate Transmissivity from Manufacturer's Data, θU = 6.50E-03 m^2/sec @ gradient, i_{in} = 0.1

Reduction Factors *(References 1 and 3)*

Creep deformation of the drainage core itself and/or intrusion of the adjacent geotextile into the drainage core space, RF_{CR} =	1.4	>>>>	Range: 1.1 to 1.4
Elastic deformation of the adjacent geotextile intruding into the drainage core space, RF_{IN} =	1.5	>>>>	Range: 1.3 to 1.5
Chemical clogging of the adjacent geotextile or the drainage core space, RF_{CC} =	1.2	>>>>	Range: 1.0 to 1.2
Biological clogging of the adjacent geotextile or the drainage core space, RF_{BC} =	1.5	>>>>	Range: 1.2 to 1.5

Mathematical product of all RFs, XRF = 3.8 XRF_{min} = 8 (Reference 2)

XRF = 8

Allowable Transmissivity *(Reference 1)*

Allowable transmissivity, $\theta all = \theta U / XRF$ = 8.13E-04 m^2/sec

Water Infiltration Quantity *(Reference 1)*

Permeability of cover soil, k_c = 1.00E-05 cm/sec = 1.00E-07 m/sec

Water infiltration through cover soil, $Q_{in} = (k_c)(L)$ 4.0E-06 m^2/sec

Geocomposite Capacity *(References 1 and 2)*

Geocomposite allowable transmissivity, θ_{all} = 8.13E-04 m^2/sec = 8.13E+00 cm^2/sec

Surface Flow Gradient, i = 0.04

Flow capacity of the geocomposite, $Q_{out} = \theta_{all}(i)$ = 3.25E-05 m^2/sec

Minimum Factor of Safety FS_{min} = 8 (Reference 2)

Factor of Safety $FS = Q_{out}/Q_{in}$ = 8.20

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Subject:	Cap Drainage System Geocomposite Drainage Net Requiierments Landfill Top		

Geocomposite Drainage Net Thickness *(Reference 1)*

Starting thickness, Ti =	350.0	mil	=	0.35	in
Final thickness, Tf = Ti/RF $_{CR}$ =	0.25	in	=	0.64	cm

Geocomposite Drainage Net Hydraulic Conductivity *(Reference 1)*

Allowable hydraulic conductivity, K all = θ all/Tf =	12.80	cm/sec

References:

1 *Zhao, A., and Richardson, G.M.,(2000). "Geocomposite Drains for Side Slope Stability in Landfill Covers", 2003.*
2 *"Lessons Learned From Failure: Landfill Covers"; Richardson, G.N, and Pavlik, K.L.; GFR Oct/Nov 2004; pp 31-33.*
3 *"Geotechnical Aspects of Landfill Design and Construction";* Qian, Koerner, and Gray; 1st Ed., 2002; Sect 8.4.3.
4 *Manufacturer's data.*
5 *Site specific data, estimated.*

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Project:			
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By:	JCA	**Date:**	18-Jun-20
Checked:	VEF VEJ	**Date:**	7.15.20
Subject:	Cap Drainage System Geocomposite Drainage Net Requirements Longest Landfill Sideslope + Top		

Cap Drainage System - Longest Side Slope + Top

Description

Determine various design parameters for the cap system at the longest sideslsope to maintain a minimum factor of safety with respect to cap drainage. Flow from the landfill top is included.

Slope Information

Maximum slope length between drains, L =	115	ft	=	35.1	m
Slope, H =	3	to 1V	=	0.333	ft/ft
Slope angle, β =	18.43	deg			

Vertical Loads

Cap System Thickness, D 1 =	2	ft			
Overall Cap System Unit Weight, $\gamma 1$ =	115	pcf			
Approximate Overall Cap System Pressure, $\sigma 1$ =	230	psf			
Approximate Total Vertical Pressure, $\sigma T = \sum \sigma$ =	230	psf	=	11.0	kPa

Geocomposite Drainage Net Product *(Reference 4)*

Product Type = GSE TenFlow 350

Estimated Ultimate Transmissivity from Manufacturer's Data, θU = 3.50E-03 m^2/sec @ hydraulic garadient, i_{in} = 1.0

Reduction Factors *(References 1 and 3)*

Creep deformation of the drainage core itself and/or intrusion of the adjacent geotextile into the drainage core space, RF_{CR} =	1.4	>>>>	*Range: 1.1 to 1.4*
Elastic deformation of the adjacent geotextile intruding into the drainage core space, RF_{IN} =	1.5	>>>>	*Range: 1.3 to 1.5*
Chemical clogging of the adjacent geotextile or the drainage core space, RF_{CC} =	1.2	>>>>	*Range: 1.0 to 1.2*
Biological clogging of the adjacent geotextile or the drainage core space, RF_{BC} =	1.5	>>>>	*Range: 1.2 to 1.5*

Mathematical product of all RFs, XRF = 3.8 XRF_{min} = 8 (Reference 2)

XRF = 8

Allowable Transmissivity *(Reference 1)*

Allowable transmissivity, $\theta all = \theta U / XRF$ = 9.26E-04 m^2/sec

Water Infiltration Quantity *(Reference 1)*

Permeability of cover soil, k_c =	1.00E-05	cm/sec	=	1.00E-07	m/sec
Water infiltration through cover soil, $Q_{in} = (k_c)(L)$	3.5E-06	m^2/sec			
Water infiltration through cover soil of landfiil top, Q_{in} =	4.00E-06	m^2/sec			
Total Water Infiltration, Qin =	7.5E-06	m^2/sec			

Geocomposite Capacity *(References 1 and 2)*

Geocomposite allowable transmissivity, θ_{all} =	9.26E-04	m^2/sec	=	9.26E+00	cm^2/sec
Surface Flow Gradient, i =	0.33				
Flow capacity of the geocomposite, $Q_{out} = \theta_{all}(i)$ =	3.09E-04	m^2/sec			

Minimum Factor of Safety FS_{min} = 8

Factor of Safety $FS = Q_{out}/Qin$ = 41.12

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Subject:	Cap Drainage System Geocomposite Drainage Net Requirements Longest Landfill Sideslope + Top		

Geocomposite Drainage Net Thickness *(Reference 1)*

Starting thickness, Ti =	350.0	mil	=	0.35	in
Final thickness, Tf = Ti/RF $_{CR}$ =	0.25	in	=	0.64	cm

Geocomposite Drainage Net Hydraulic Conductivity *(Reference 1)*

Allowable hydraulic conductivity, $K_{all} = \theta_{all}/Tf$ =	14.58	cm/sec

References:

1 *Zhao, A., and Richardson, G.M.,(2000). "Geocomposite Drains for Side Slope Stability in Landfill Covers", 2003.*
2 *"Lessons Learned From Failure: Landfill Covers"; Richardson, G.N, and Pavlik, K.L.; GFR Oct/Nov 2004; pp 31-33.*
3 *"Geotechnical Aspects of Landfill Design and Construction";* Qian, Koerner, and Gray; 1st Ed., 2002; Sect 8.4.3.
4 *Manufacturer's data.*
5 *Site specific data, estimated.*

REFERENCE 3
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RF_{IN} = reduction factor for elastic deformation, or intrusion, of the adjacent geosynthetics into the geonet's core space;
RF_{CR} = reduction factor for creep deformation of the geonet and adjacent geosynthetics into geonet's core space;
RF_{CC} = reduction factor for chemical clogging and/or precipitation of chemicals in the geonet's core space; and
RF_{BC} = reduction factor for biological clogging in the geonet's core space.

Some guidelines as to various reduction factors to be used in different situations are given in Table 8.8. Note that these values are based on preliminary and relatively sparse information. Other reduction factors, such as installation damage, viscosity effects and temperature effects, could also have been incorporated. If needed, they can be included on a site-specific basis. An example problem follows, which illustrates the use of geonets and points out that high factors of safety are warranted in critical situations.

EXAMPLE 8.2

What is the allowable geonet flow rate to be used in the design of a secondary leachate collection (i.e., leak detection) system? Assume that laboratory testing at proper design load and proper hydraulic gradient gave a short-term between-rigid-plate index value of 1.2 gal/min-ft (14.9 liter/min-m).

Solution: Average values from Table 8.8 are used (however, note the large resulting reduction):

$$q_{allow} = \frac{q_{ult}}{RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}} \tag{8.17}$$

$$= \frac{1.2}{1.75 \times 1.7 \times 1.75 \times 1.75}$$

$$= \frac{1.2}{9.11} = 0.13 \text{ gal/min-ft (1.6 liter/min-m)}$$

TABLE 8.8 Recommended Preliminary Reduction Factors for Determining Allowable Flow Rate or Transmissivity of Biplanar Geonets (Koerner, 1998)

Application Area	Reduction Factor Values			
	RF_{IN}	RF_{CR}*	RF_{CC}	RF_{BC}
Sport fields	1.0 to 1.2	1.0 to 1.5	1.0 to 1.2	1.1 to 1.3
Capillary break	1.1 to 1.3	1.0 to 1.2	1.1 to 1.5	1.1 to 1.3
Roof and plaza decks	1.2 to 1.4	1.0 to 1.2	1.0 to 1.2	1.1 to 1.3
Retaining walls, seeping rock and soil slopes	1.3 to 1.5	1.2 to 1.4	1.1 to 1.5	1.0 to 1.5
Drainage blankets	1.3 to 1.5	1.2 to 1.4	1.0 to 1.2	1.0 to 1.2
Surface water drains for landfill caps	1.3 to 1.5	1.1 to 1.4	1.0 to 1.2	1.2 to 1.5
Secondary leachate collection (landfill)	1.5 to 2.0	1.4 to 2.0	1.5 to 2.0	1.5 to 2.0
Primary leachate collection (landfill)	1.5 to 2.0	1.4 to 2.0	1.5 to 2.0	1.5 to 2.0

*These values are sensitive to the density of the resin used in the geonet's manufacture. The higher the density, the lower the reduction factor. Creep of the covering geotextile(s) is a product-specific issue.

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PRODUCT DATA SHEET

GSE TenFlow 350 mil Geocomposite

GSE TenFlow geocomposite consists of a 350 mil thick GSE TenFlow geonet heat-laminated on both sides with a GSE nonwoven needle-punched geotextile. TenFlow 350 is a T-shaped tri-axial geonet comprised of HDPE strands forming a three dimensional structure to provide planar water flow. The geotextile is available in mass per unit area range of 6 oz/yd² to 16 oz/yd². TenFlow 350 geocomposite provides high transmissivity in a soil environment.

[*]

AT THE CORE:
A 350 mil thick TenFlow geonet heat-laminated on both sides with a nonwoven needlepunched geotextile.

Product Specifications

Tested Property	Test Method	Frequency	Minimum Average Roll Value[1]	
Geocomposite[6]			6 oz/yd²	8 oz/yd²
Transmissivity[2], gal/min/ft, (m²/sec) at gradient=0.1	ASTM D 4716	1/540,000 ft²	31.4 ($6.5x10^{-3}$)	31.4 ($6.5x10^{-3}$)
Transmissivity[2], gal/min/ft, (m²/sec) at gradient=0.33	ASTM D 4716	1/540,000 ft²	16.9 ($3.5x10^{-3}$)	16.9 ($3.5x10^{-3}$)
Ply Adhesion, lb/in	ASTM D 7005	1/50,000 ft²	0.5	0.5
Geonet Core[1,3] – GSE TenFlow				
Geonet Core Thickness, mil	ASTM D 5199	1/50,000 ft²	350	350
Density, g/cm³	ASTM D 1505	1/50,000 ft²	0.94	0.94
Carbon Black Content, %	ASTM D 4218	1/50,000 ft²	2.0	2.0
Creep Reduction Factor[4]	GRI-GC8	per formulation	1.05	1.05
Geotextile[1,3]				
Mass per Unit Area, oz/yd²	ASTM D 5261	1/90,000 ft²	6	8
Grab Tensile Strength, lb	ASTM D 4632	1/90,000 ft²	160	220
Grab Elongation, %	ASTM D 4632	1/90,000 ft²	50	50
CBR Puncture Strength, lb	ASTM D 6241	1/540,000 ft²	435	575
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000 ft²	65	90
AOS, US sieve[1], (mm)	ASTM D 4751	1/540,000 ft²	70 (0.212)	80 (0.180)
Permittivity, sec^{-1}	ASTM D 4491	1/540,000 ft²	1.5	1.3
Water Flow Rate, gpm/ft²	ASTM D 4491	1/540,000 ft²	110	95
UV Resistance, % retained	ASTM D 4355 (after 500 hours)	per formulation	70	70
NOMINAL ROLL DIMENSIONS[5]				
Roll Width, ft			12.5	12.5
Roll Length, ft			150	150
Roll Area , ft²			1,875	1,875

NOTES:
- [1] All geotextile properties are minimum average roll values except AOS which is maximum average roll value and UV resistance is typical value. Geonet core thickness is minimum average value.
- [2] Normal load of 1,000 psf, boundary condition: plate/sand/geocomposite/geomembrane/plate, water at 70°F for 1 hour.
- [3] Component properties prior to lamination.
- [4] 10,000 hour creep test under 2,000 psf at 70°F temperature.
- [5] Roll widths and lengths have a tolerance of ±1%
- [6] The TenFlow geonet has a circular aperture side and a cuspated side. The side with the circular apertures should be placed against the soil while the cuspated side should be placed against the geomembrane.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

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ATTACHMENT 9J

Global Slope Stability

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ATTACHMENT 9J

Global Slope Stability

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1. Purpose

The purpose of this analysis is to evaluate the global slope stability of the proposed landfill.

2. Analysis Approach

a. This analysis relies on related project information, data, and design calculations, as appropriate.

b. The computer program SLOPE/W of GeoStudio by GEO-SLOPE International, Ltd., was used to evaluate potential circular and non-circular slip surfaces in a pseudo-static analysis using the Spence and Bishop methods.

c. Seismic factors were also included for evaluation. The analysis is called "pseudo-dynamic" with the addition of seismic factors.

d. This analysis included a sliding wedge analysis to evaluate the factor of safety against a mass sliding on the geosynthetics used in the liner and leachate collection system. Based on the anchor trench design, the interface between the ~~geosynthetic clay liner (GCL)~~ HDPE-T and the underlying subsoil has the lowest interface friction value of ~~23°~~ 18° (COHESIVE SATURATED). This value of δ was used in this analysis.

e. It is common in many engineering applications to consider 1.5 an acceptable minimum factor of safety for static conditions, and 1.0 for seismic conditions.

3. Locations of Interest

Cells 10 and 13 were selected for the settlement and bearing analyses for this project. Therefore, this analysis also focused on these cells. The scope of consideration was expanded to include immediately adjacent Cells 5D, and 16, as they share alignment along the long dimension of the cross-section used for these cells. Additionally, Cell 11 was added for the sliding wedge analysis.

4. Material Parameters

The generalized soil profiles developed for the settlement and bearing analyses were used here as well. Soil designations were simplified for the SLOPE/W program, and soil parameters assigned. Parameters were assigned consistent with the settlement and bearing analyses.

Material Parameters for Cells 13 and 16			
Material	**Unit Weight, γ (pcf)**	**Cohesion, c (psf)**	**Internal Friction Angle, ϕ (deg)**
Sand S1	115.7	0	35.3
Sand S2	128.1	0	39.0
Sand S3	145.0	0	50.0
Sand S4	98.0	0	28.5
Clay C1	120.5	2,796	0
Clay C2	136.5	3,737	0
Clay C3	145.0	12,070	0
Clay C4	145.0	11,667	0
LLCS	115.0	0	28.0
CDD Waste	48.7	0	35.0
Protective Cover	115.0	0	28.0
Cap and Cover	115.0	0	28.0

Material Parameters for Cells 10 and 5D			
Material	**Unit Weight, γ (pcf)**	**Cohesion, c (psf)**	**Internal Friction Angle, ϕ (deg)**
Sand S1	103.1	0	29.6
Sand S2	120.7	0	37.3
Sand S3	102.0	0	29.4
Sand S4	145.0	0	55.4
Sand S5	145.0	0	55.4
Clay C1	136.5	3,737	0
Clay C2	145.0	4,365	0
LLCS	115.0	0	28.0
CDD Waste	48.7	0	35.0
Protective Cover	115.0	0	28.0
Cap and Cover	115.0	0	28.0

5. Seismic Impact

From the USGS (Ref. 3), the site was estimated to have maximum horizontal acceleration value of 0.065g. From the work of Hynes and Franklin (1984), as cited in USEPA guidance (Ref. 4), 50% of this value, 0.0325, was used for design. It was assigned as the horizontal coefficient, K_h. The vertical coefficient, K_v, is typically less than K_h, and is often insignificant.

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6. Circular Slip Surfaces

The following table provides a summary of the critical (minimum) factors of safety calculated for circular slip surfaces.

Minimum Factors of Safety Circular Slip Surface, Pseudo-Static Condition		
Cell/Slip Direction	**Bishop Method**	**Spencer Method**
1. Cell 16 into Cell 13	1.6	1.6
2. Cell 13 into Cell 16	1.6	1.6
3. Cell 5D into Cell 10	1.7	1.7
4. Cell 10 into Cell 5D	1.6	1.6

Graphical representations of items 1 and 4 and attached. It is noted these minimum factors of safety were associated with slip surfaces occurring within the cap layers. Circular slip circles extending into the waste had higher factors of safety. Slip surfaces extending deeper through the waste, and into the subsoils also had higher factors of safety. Additional graphics for circular slip circles extending through the cap layers, the waste and just into the subsoils for items 1 and 4 are also attached.

With the addition of the seismic factor, K_h, factors of safety were calculated as follows:

Minimum Factors of Safety Circular Slip Surface, Pseudo-Dynamic Condition		
Cell/Slip Direction	**Bishop Method**	**Spencer Method**
1. Cell 16 into Cell 13	1.4	1.4
2. Cell 13 into Cell 16	1.4	1.4
3. Cell 5D into Cell 10	1.6	1.6
4. Cell 10 into Cell 5D	1.5	1.5

7. Non-Circular Slip Surfaces

The following table provides a summary of the critical (minimum) factors of safety calculated for non-circular slip surfaces.

Minimum Factors of Safety Non-Circular Slip Surface, Pseudo-Static Condition		
Cell/Slip Direction	**Bishop Method**	**Spencer Method**
1. Cell 16 into Cell 13	3.4	2.9
2. Cell 13 into Cell 16	1.7	4.0
3. Cell 5D into Cell 10	5.2	4.8
4. Cell 10 into Cell 5D	2.9	2.6

Graphical representations of items 1 and 4 are attached. With the addition of the seismic factor, K_h, factors of safety were calculated as follows:

Minimum Factors of Safety Non-Circular Slip Surface, Pseudo-Dynamic Condition		
Cell/Slip Direction	**Bishop Method**	**Spencer Method**
1. Cell 16 into Cell 13	3.0	2.9
2. Cell 13 into Cell 16	1.5	3.5
3. Cell 5D into Cell 10	4.3	3.9
4. Cell 10 into Cell 5D	2.5	2.3

8. Sliding Wedge Analysis

A sliding wedge analysis was performed for Cells 10, 5D, 13, and 11. It was not performed for Cell 16 since it was believed the overall geometry of Cell 16 would render acceptable results compared to the other cells analyzed. Cell 11, however, is the only cell to have the potential slip surface ~~(GCL~~ to HDPE-T underlying subsoil) located on all three general areas of the cell – the sideslope at the sump, the floor, and the sideslope on the upgradient end of the cell.

Other cells have the floor and sump sideslope portions. In those cells, an active slip surface on the upgradient end of the floor was assumed to be oriented based on earth pressure theory (Bowles, Ref. 7), as follows:

$$\beta_a = 45 + \phi/2$$

Where ϕ is the angle of internal friction of the waste. The mass located upgradient of the floor is called the "active block". For the active block in cell 10, 5D, and 13, the resultant horizontal force, P_a, was calculated based on earth pressure theory equations provided by Sowers (Ref. 8). The resultant force P_a for the active block in Cell 11 was calculated as for other parts of the cell.

The mass located on the floor of the cell is called the "central block". The mass located on the sump sideslope is called the "passive block". The resultant forces from these blocks, P_c and P_p, were

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calculated based on a free body diagram of forces on a liner from Koerner (Ref. 9). Koerner and Soong (Ref. 10) added the a horizontal seismic factor. This also appears in Qian, *et al*, (Ref. 11).

The horizontal seismic force is added by multiplying the horizontal factor by the weight of each block, and using that as an additional force in the horizontal direction. This force is presumed to act towards the downslope direction.

Based on this analysis, the following tables summarize the factors of safety calculated.

Factors of Safety Sliding Wedge Slip Surface, Static		
Cell	**Static Factor of Safety**	**Dynamic Factor of Safety**
1. Cell 13	13.8 ✓	~~6.3~~ 5.2
2. Cell 11	~~3.9~~ 19.6	~~1.6~~ 7.1
3. Cell 5D	~~4.8~~ 3.7	~~3.3~~ 2.5
4. Cell 10	~~12.3~~ 9.3	~~6.0~~ 4.7

9. Conclusion

Based on the foregoing, the design parameters result in a minimum factor of safety of 1.5 being maintained.

6. References

1. Project Design Information
2. Related Project Calculations.
3. USGS; *"Two–Percent Probability of Exceedance in 50 Years Map of Peak Ground Acceleration"*; http://earthquake.usgs.gov/hazards/hazmaps/.
4. USEPA; *"RCRA Subtitle D (258) Seismic Design Guidance For Municipal Solid Waste Landfill Facilities"*, EPA/600/R-95/051; p 107.
5. GEO-SLOPE International, Ltd.; *"Stability Modeling with GeoStudio – SLOPE/W"* computer program.
6. USACOE; *"Slope Stability Design Manual"*; EM 1110-2-1902, Oct. 31, 2003; p3-2, Table 3-1.
7. Bowles, Joseph E.; *"Foundation Analysis and Design"*, The McGraw-Hill Companies, Inc., 5th Ed., 1996; Fig. 11-2, p 591.

8. Sowers, George F.; *"Introductory Soil Mechanics and Foundations: Geotechnical Engineering"*; Macmillan Publishing Co., Inc., 4th Ed., 1979; p 386, Eqn 9:4.

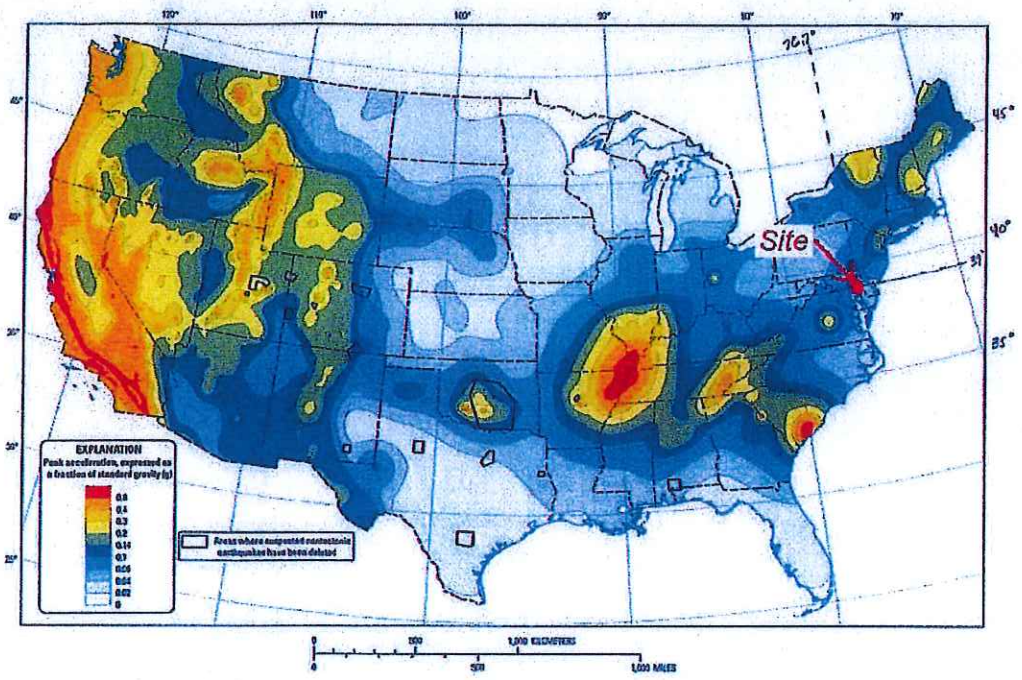
9. Koerner, Robert M.; *"Designing With Geosynthetics"*, 4th Ed., Prentice-Hall, Inc., 1998; p 479, Fig 5.28(a).

10. Koerner, Robert M., and Soong, T.Y.; *"Analysis and Design of Veneer Cover Soils"*; Geosynthetics International, 2005, Vol 12, No. 1; p 39. Fig 15.

11. Qian, Xuede; Koerner, Robert M.; Gray, Donald H.; *"Geotechnical Aspects of Landfill Design and Construction"*, Prentice-Hall, Inc., 2002; p 509, Fig 13.17.

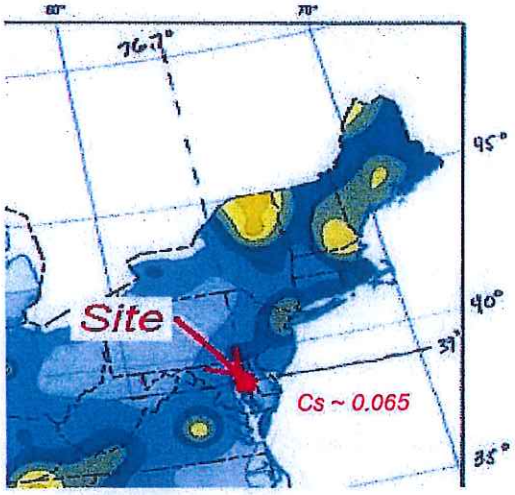
REFERENCE 3 pg 1/1

Case 6: Drained, Seismic Affect (cont.)



Two-percent probability of exceedance in 50 years map of peak ground acceleration

https://earthquake.usgs.gov/hazards/hazmaps/



Approximate Site Location

Two-percent probability of exceedance in 50 years map of peak ground acceleration

https://earthquake.usgs.gov/hazards/hazmaps/

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Figure 6.5 shows the results of Newmark seismic deformation analyses performed by Hynes and Franklin (1984) using 387 strong motion records and 6 artificial accelerograms. Based upon this data and their experience with seismic response analyses of slopes and embankments, Hynes and Franklin (1984) concluded that slopes and embankments with a yield acceleration equal to half the peak ground acceleration would experience permanent seismic deformations of less than one meter (3 ft) in any earthquake, even for embankments where amplification of acceleration by a factor of three occurs. In the absence of amplification, or if amplification is taken into account in determining the peak acceleration, the Hynes and Franklin data suggest that deformations will remain less than 0.3 m (1 ft) for yield accelerations less than or equal to one-half the peak acceleration. Therefore, based upon the work of Hynes and Franklin, it appears that the maximum value of k_s may be determined as $k_s = 0.5 \cdot a_{max}/g$ to limit permanent seismic deformations to less than 0.3 m (1 ft), where a_{max} is peak horizontal acceleration at the ground surface for analyses of the liner system and at the top of the landfill for analyses of the cover system. a_{max} can be estimated either using the simplified methods presented in Section 4 of this guidance document or from the results of a seismic response analysis.

Step 3: Perform the pseudo-static stability analysis. If the minimum factor of safety, FS_{min}, exceeds 1.0 and 0.3 m (1 ft) of deformation is acceptable, the seismic stability analysis is completed.

Step 4: If the pseudo-static factor of safety is less than 1.0 or the acceptable deformation is less than 0.3 m (1 ft), perform a Newmark deformation analysis. This is done with the following three steps:

1) Calculate the yield acceleration, k_y. The yield acceleration is usually calculated in pseudo-static analyses using a trial and error procedure in which the seismic coefficient is varied until $FS_{min} = 1.0$ is obtained. The lowest yield acceleration for all possible failure surfaces passing through the liner, cover, and/or waste mass should be evaluated.

2) Calculate the permanent seismic deformation. The permanent seismic deformation may be calculated using either simplified design charts (e.g., Hynes and Franklin, 1984; Makdisi and Seed, 1978) or a formal time-history analysis in which the excursions of the average acceleration time history above the yield acceleration are double integrated.

REFERENCE 7 pg 1/1

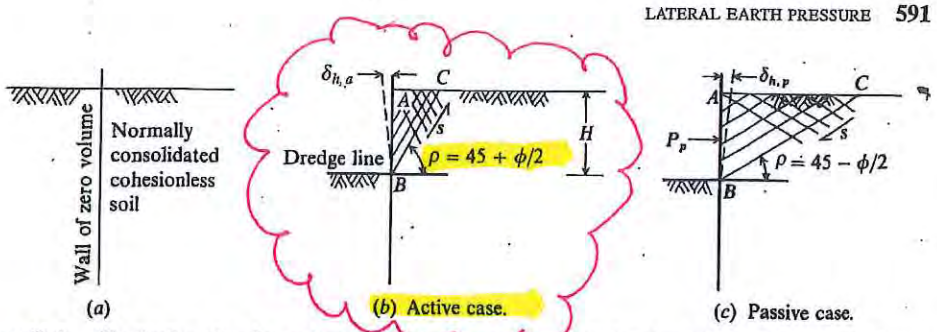


Figure 11-2 Idealization of active and passive earth pressure from a K_o developed by inserting a wall of zero thickness (and volume) into a soil mass as in (*a*).

It is also usual to use K_a for the $\tan^2$ term as shown previously in Fig. 4-2 and regularly used in this chapter. For the $\tan(45° + \phi/2)$ (passive) values of the next section, reverse the signs of the sine ratio terms.

Let us investigate the practical implications of Fig. 11-1 by using Fig. 11-2. In Fig. 11-2 we have inserted a wall of zero thickness into a normally consolidated; isotropic, cohesionless soil mass (we could use any soil but this simplifies the discussion). At this point we have a K_o stress state on the wall; and the lateral (soil-to-wall or wall-to-soil) pressure is, from the definition of K_o,

$$\sigma_3 = K_o \sigma_1$$

and is triangular since at any depth z the vertical pressure $\sigma_1 = \gamma z$. If we assume the soil is normally consolidated, K_o can be defined by one of the qualitative stress ratios of Fig. 11-1*a* as

$$K_o = \frac{OE}{OA}$$

Now let us excavate the soil on the left side of the wall of Fig. 11-2*a* to the depth H in Fig. 11-2*b* and *c*. If the wall does not shear off at point B (termed the *dredge line*) the wall will do one of the following:

1. Deflect laterally under the cantilever beam loading causing slip planes to form in the soil as in Fig. 11-1*c*. The lateral pressure $\sigma_h = \sigma_3$ on the Mohr's circle plot moves from E toward O. The Fig. 11-1*c* case develops since the K_o pressure exerted on the wall decreases as it deflects away from (but is followed by) the soil behind the wall.

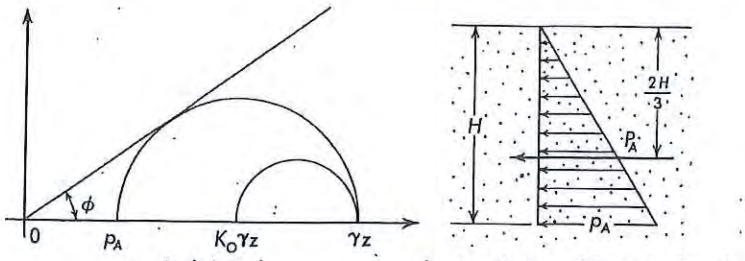
   If the wall displacement is sufficient, the lateral pressure reaches plastic equilibrium at OC and the wall pressure is a minimum (termed *active pressure case*) defined from Eq. (2-55) as

   $$\sigma_h = \sigma_1 K_a \qquad (\text{since } c = 0)$$

   This minimum pressure case can be explained from observing that the slip wedge is a minimum volume at $45° + \phi/2$ from the horizontal. That is, the slope of the line from C to the point of tangency of Fig. 11-1*a* is also the slope of line BC of Fig. 11-2*b*. The shear resistance developed on line BC of Fig. 11-2*b* also reduces the tendency of the wedge ABC to push against the wall.

   If the lateral displacement ($\delta_{h,a}$) is limited (by a brace, prop, or wall stiffness), the wall pressure becomes indeterminate but is intermediate between the K_o and K_a pressures

REFERENCE 8 pg 1/1



a. Mohr's circle

b. Distribution of horizontal earth pressure and location of resultant, P_A

Figure 9.3 *Active earth pressure in cohesionless soils, sands, and gravels.*

The expression $\tan^2[45-(\phi/2)]$ is often called the *coefficient of active earth pressure* and is given the symbol K_A. The state of shear failure accompanying the minimum earth pressure is called the *active state*. The resultant force P_A per unit of length of wall for the dry sand can be found by integrating the expression for active pressure or from the area of the pressure diagram:

$$P_A = \frac{\gamma H^2 K_A}{2} \qquad (9:4)$$

The action line is through the centroid at a depth of $2H/3$ (Fig. 9.3b).

If the soil is below water, neutral stress must again be considered. The effective active pressure is computed from the effective vertical pressure and K_A. The total is the sum of the effective and the neutral stress:

$$p'_A = (\gamma z - u)K_A \qquad (9:5a)$$

$$p_A = (\gamma z - u)K_A + u \qquad (9:5b)$$

When a dry cohesionless soil is inundated by a rising water table, the effective pressure is reduced to about half its original value. The total pressure, however, is approximately tripled. The location and magnitude of the resultant for a cohesionless soil below water is found by combining the effective and neutral stress diagrams.

Example 9:1

Compute the active earth pressure at a depth of 6 m or 19.7 ft in a clean sand whose angle of internal friction is 34° and which weighs 15.4 kN/m^3 or 98 lb/ft^3 drained and 20 kN/m^3 or 127.4 lb/ft^3 saturated.

1. The sand is dry throughout

$$p_A = \gamma z \tan^2[45-(\phi/2)] \qquad (9:3a)$$

$$p_A = 15.4 \times 6 \times (0.532)^2 = 26.15 \text{ kN/m}^2$$

$$p_A = 98 \times 19.7 \times (0.532)^2 = 546 \text{ lb/ft}^2.$$

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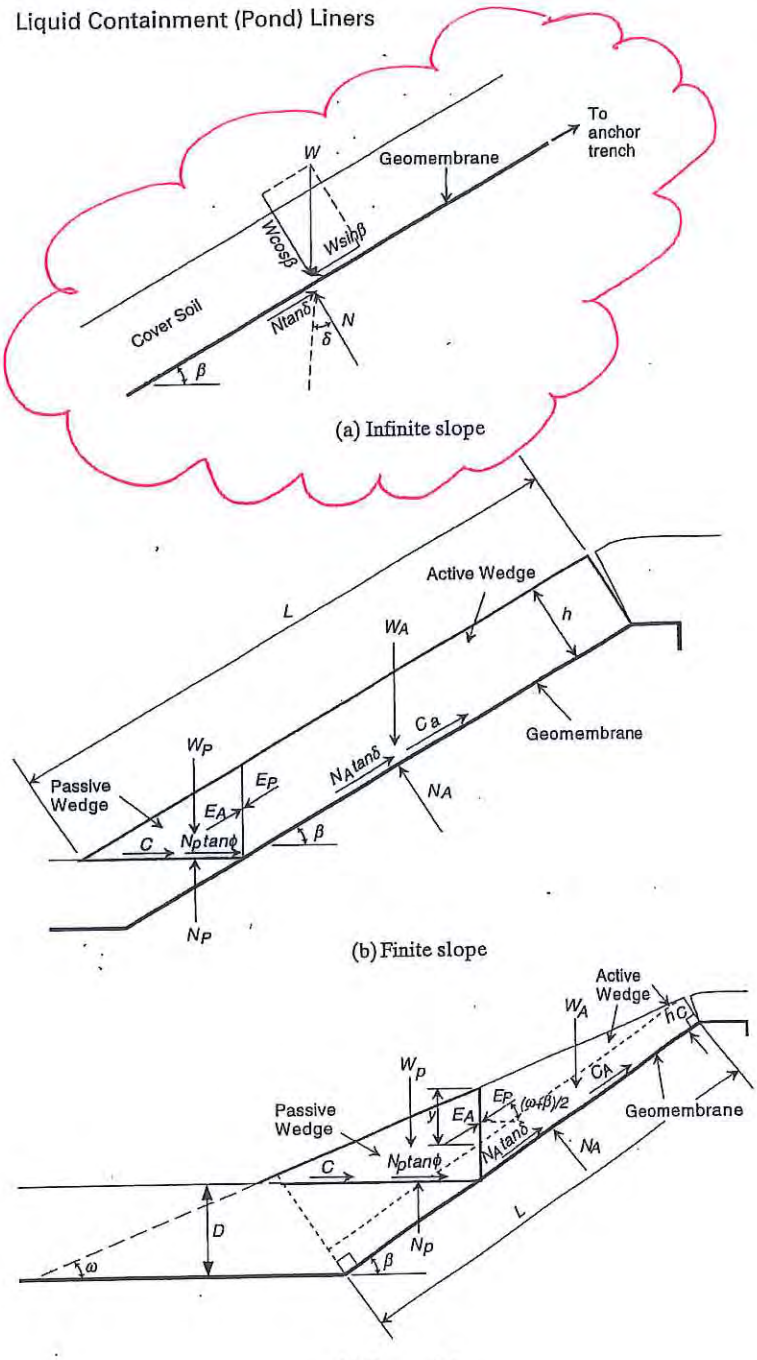


Figure 5.28 Schematic diagrams for forces involved with cover soils on geomembrane-lined slopes: (a) infinite slope; (b) finite slope with uniform cover soil thickness; (c) finite slope with tapered cover soil thickness.

REFERENCE 11 Pg 1/1

regulations require such an analysis for sites that have a probability of $\geq 10\%$ of experiencing a 0.10-g peak horizontal acceleration within 250 years. For the continental United States, this includes not only the western states, but major sections of the Midwest and northeast states, as well. If practiced worldwide, such a criterion would have huge implications.

The seismic analysis of cover soils of the type under consideration in this section is a two-part process:

(i) The calculation of a *FS*-value using a pseudostatic analysis via the addition of a horizontal force acting at the centroid of the cover soil cross section.

(ii) If the *FS*-value in the above calculation is less than 1.0, a permanent deformation analysis is required. The calculated deformation is then assessed in light of the potential damage to the cover soil section and is either accepted, or the slope requires an appropriate redesign. The redesign is then analyzed until the situation becomes acceptable.

The *first part* of the analysis is a pseudostatic approach that follows the previous examples except for the addition of a horizontal force at the centroid of the cover soil in proportion to the anticipated seismic activity. It is first necessary to obtain an average seismic coefficient (C_S) from a representative seismic zone map (e.g., as in Algermissen, 1969). Such maps are available on a worldwide basis. The value of C_S is nondimensional and is a ratio of the bedrock acceleration to gravitational acceleration. This value of C_S is modified using available computer codes such as "SHAKE" (see Schnabel et al., 1972) for propagation to the site and then to the landfill cover as shown in Figure 13.17. The computational process within such programs is quite intricate. For detailed discussion, see Seed and Idriss (1982) and Idriss (1990). The analysis is nonetheless similar to those previously presented.

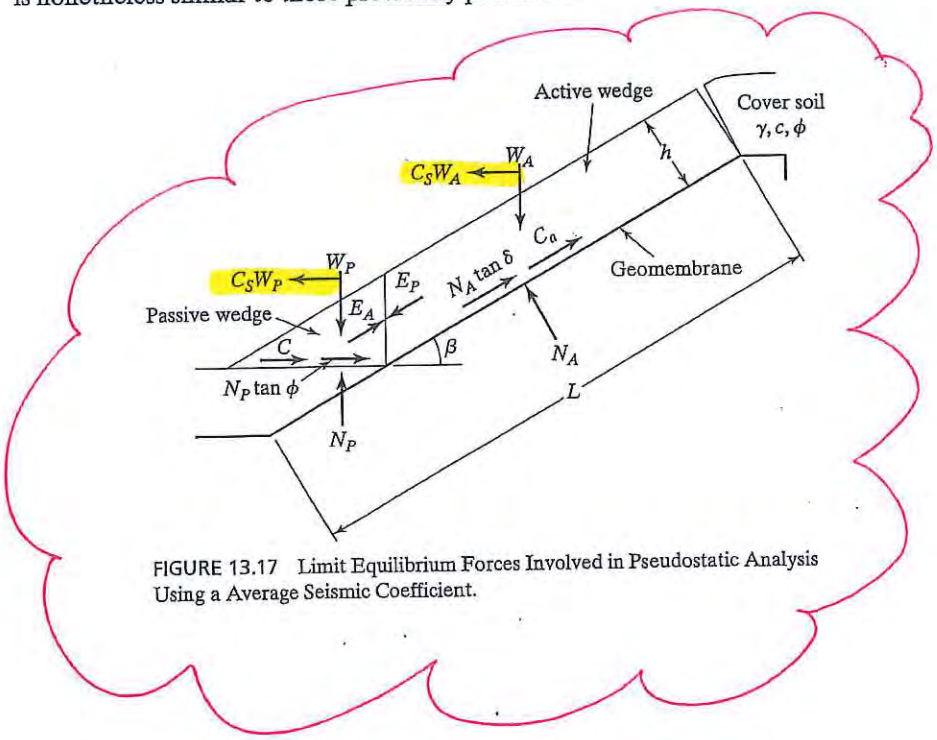
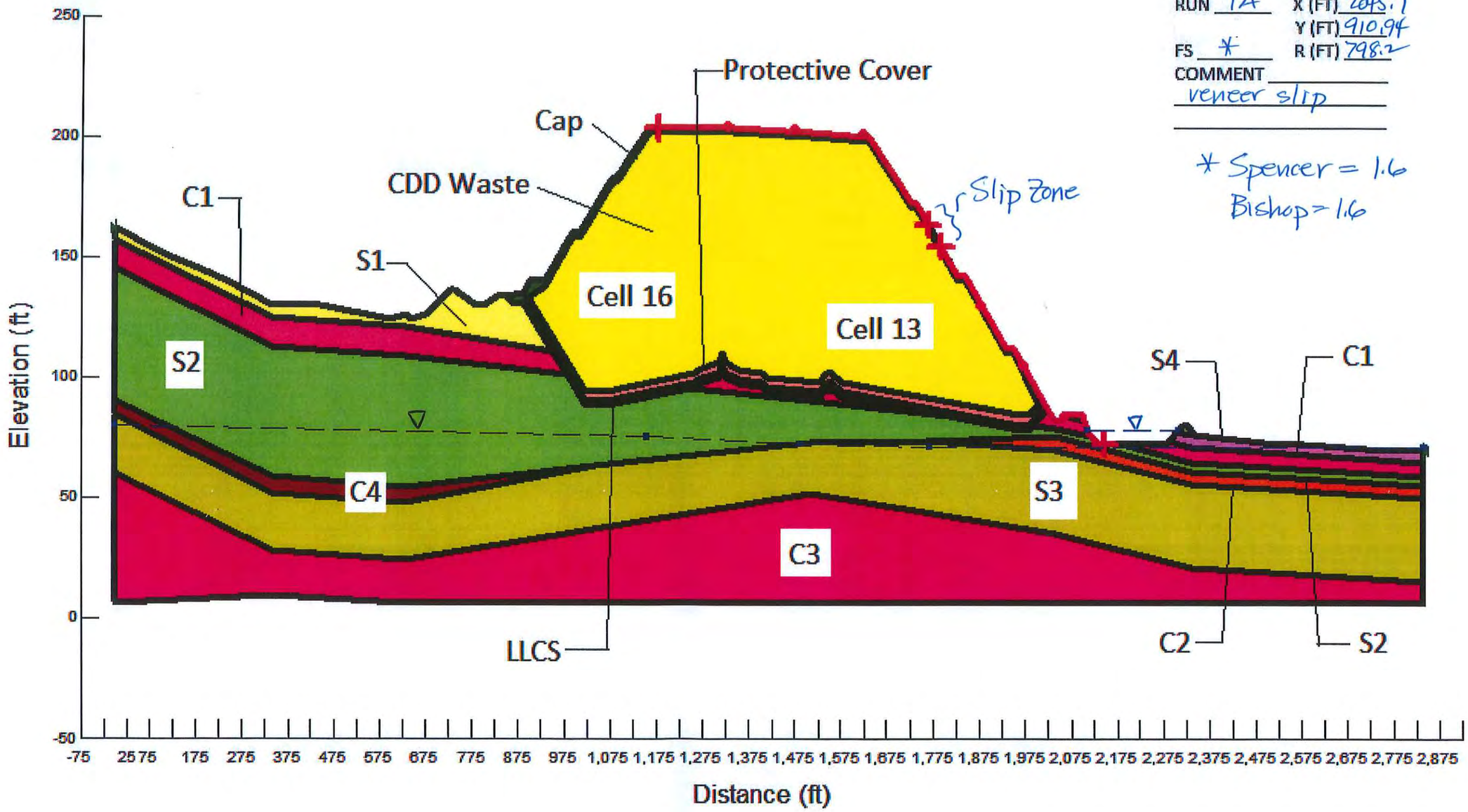


FIGURE 13.17 Limit Equilibrium Forces Involved in Pseudostatic Analysis Using a Average Seismic Coefficient.

Chesapeake Terrace Landfill, Slope Stability Analysis, Circular Slip Surface
Run 1A: Cell 16 through Cell 13, Static



RUN 1A X (FT) 2045.7
Y (FT) 910.94
FS * R (FT) 798.2
COMMENT veneer slip

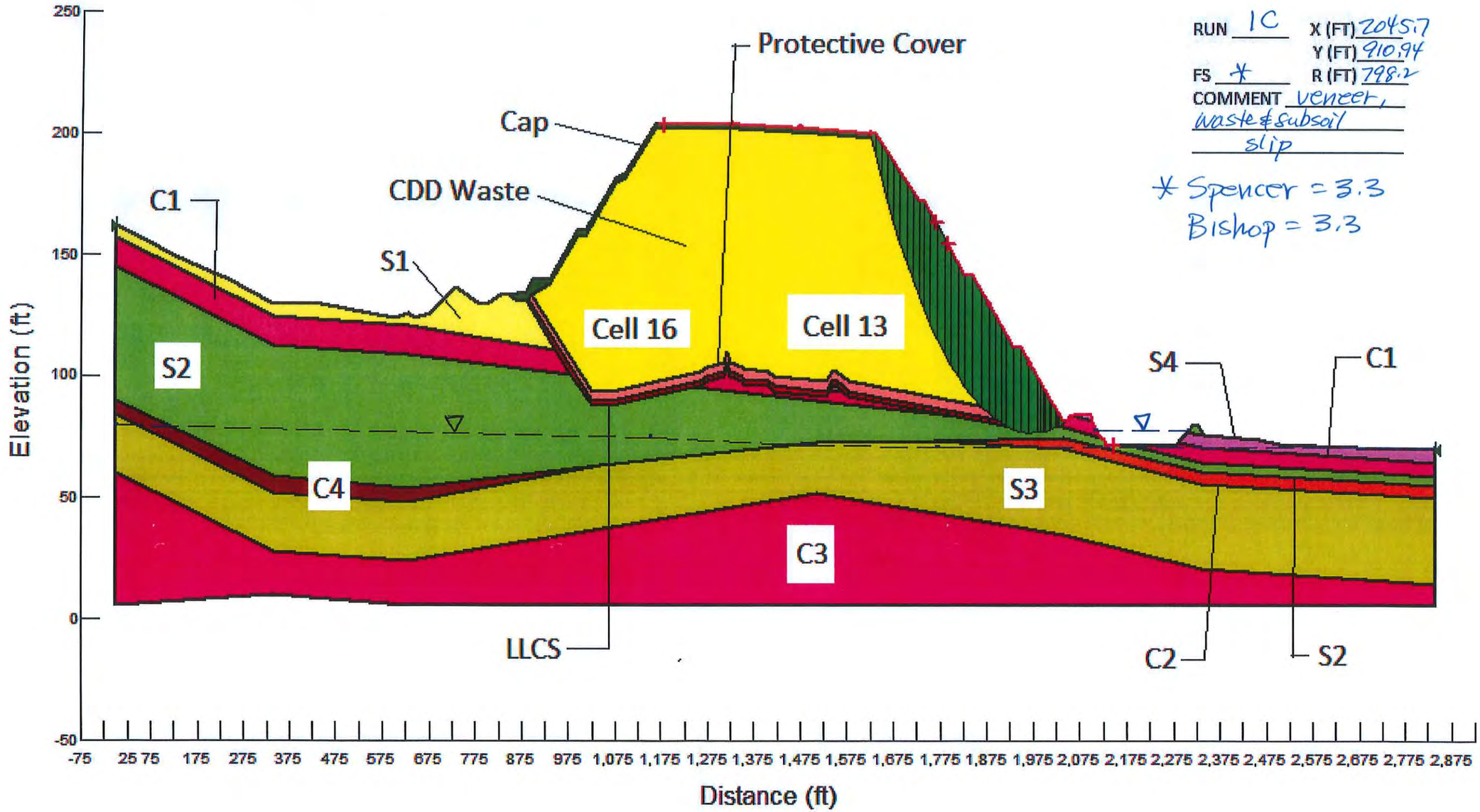
* Spencer = 1.6
Bishop = 1.6

GeoStudio/Slope W by Geo-Slope International, Ltd.

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By [illegible] Date: 7/18/20 Chk: [illegible] Date 7/19/20

Chesapeake Terrace Landfill, Slope Stability Analysis, Circular Slip Surface
Run 1C: Cell 16 through Cell 13



RUN 1C X (FT) 20457
Y (FT) 910.94
FS * R (FT) 798.2
COMMENT veneer, waste & subsoil slip

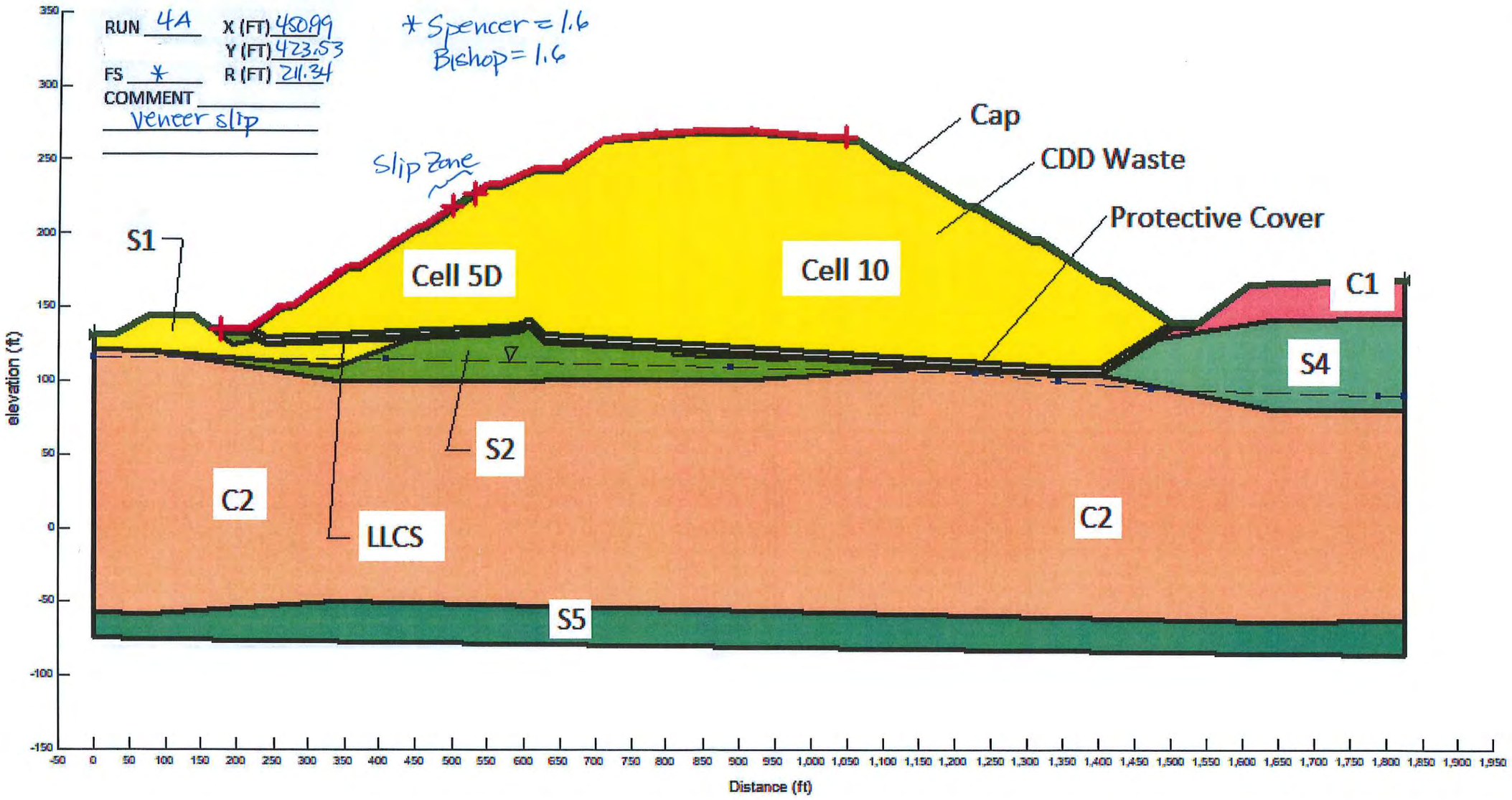
* Spencer = 3.3
Bishop = 3.3

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By [illegible] Date: 7/18/20 Chk: [illegible] Date 7/19/20

Chesapeake Terrace Landfill, Slope Stability Analysis, Circular Slip Surface
Run 4A: Cell 10 through Cell 5D, Static

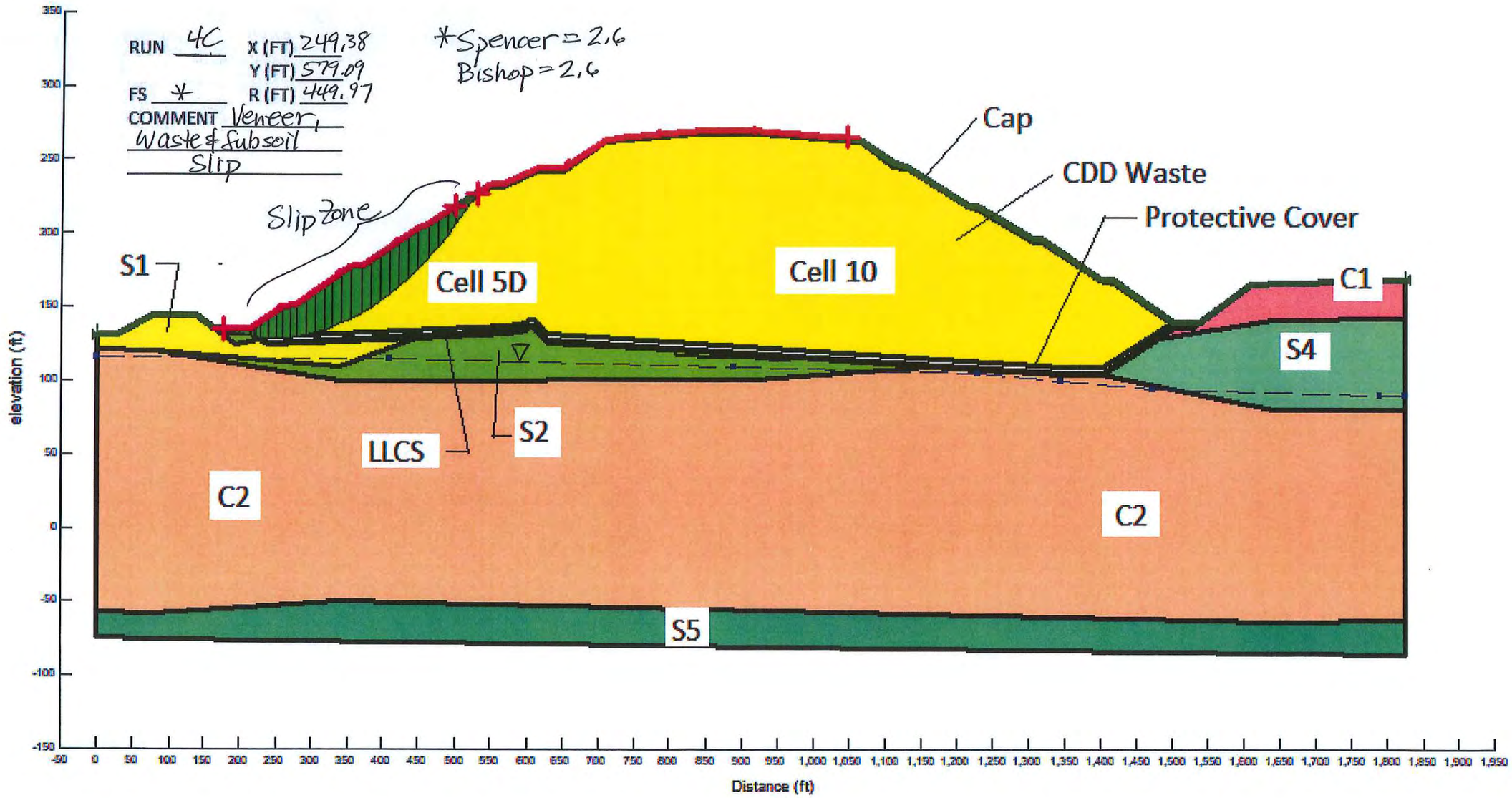


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Chesapeake Terrace Landfill, Slope Stability Analysis, Circular Slip Surface
Run 4C: Cell 10 through Cell 5D, Static

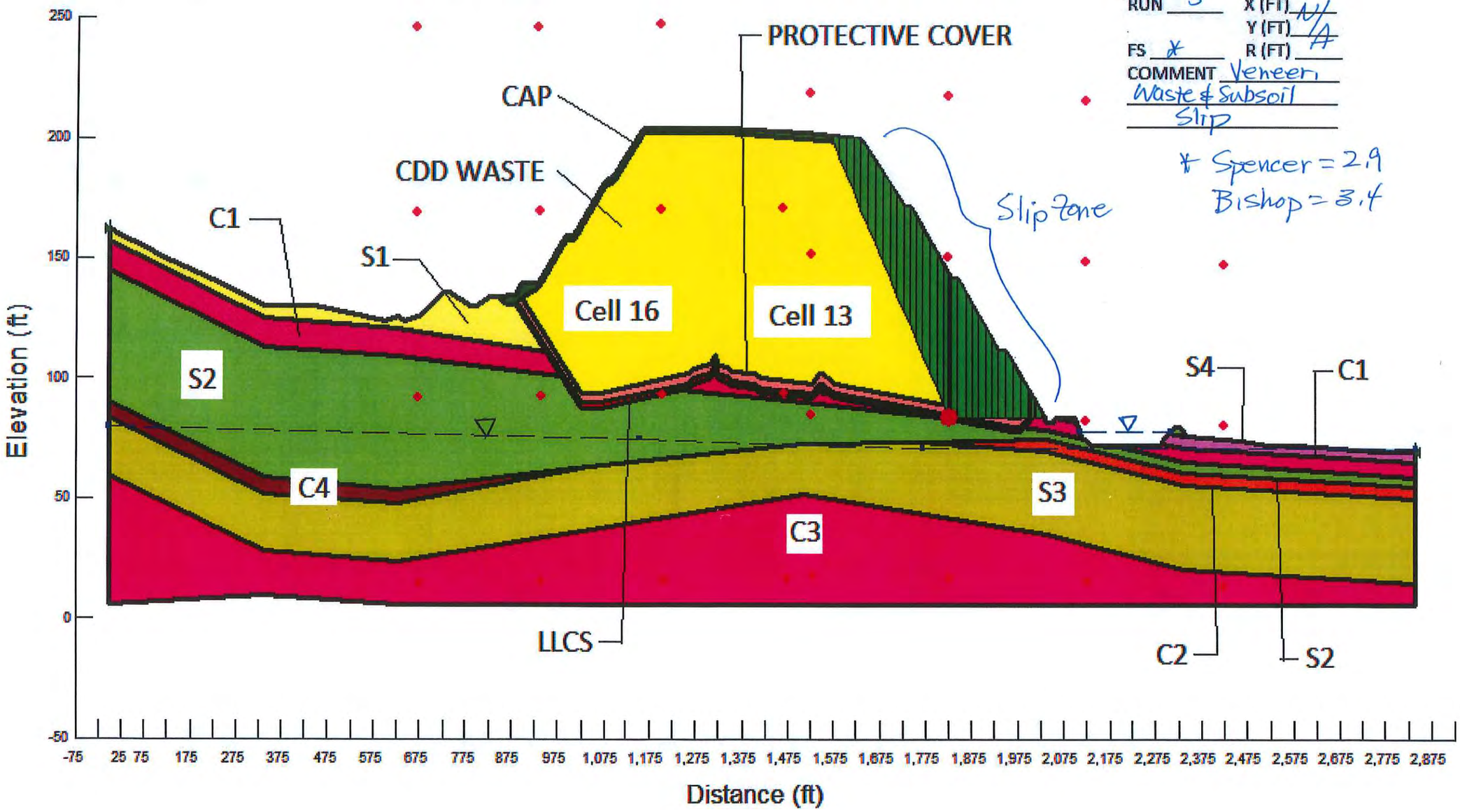


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By [signature] Date: 7/16/20 Chk: [signature] Date 7/19/20

Chesapeake Terrace Landfill, Slope Stability Analysis, Non-Circular Slip Surface
Run 5: Cell 16 through Cell 13, Static



RUN 5 X (FT) N/A
Y (FT) N/A
FS * R (FT) ___
COMMENT Veneer, Waste & Subsoil Slip

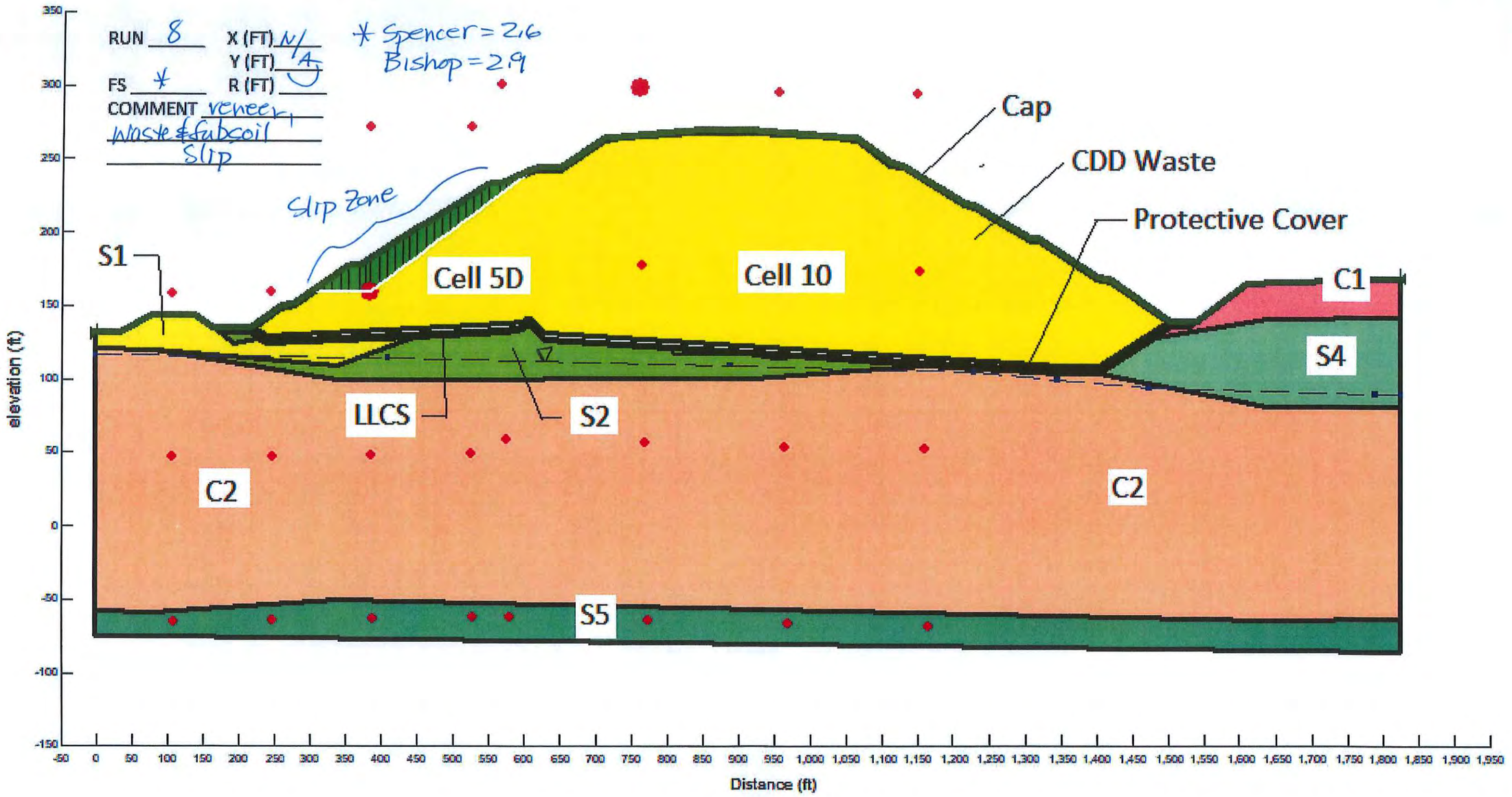
* Spencer = 2.9
Bishop = 3.4

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Chesapeake Terrace Landfill, Slope Stability Analysis, Non-Circular Slip Surface
Run 8: Cell 10 through Cell 5D, Static



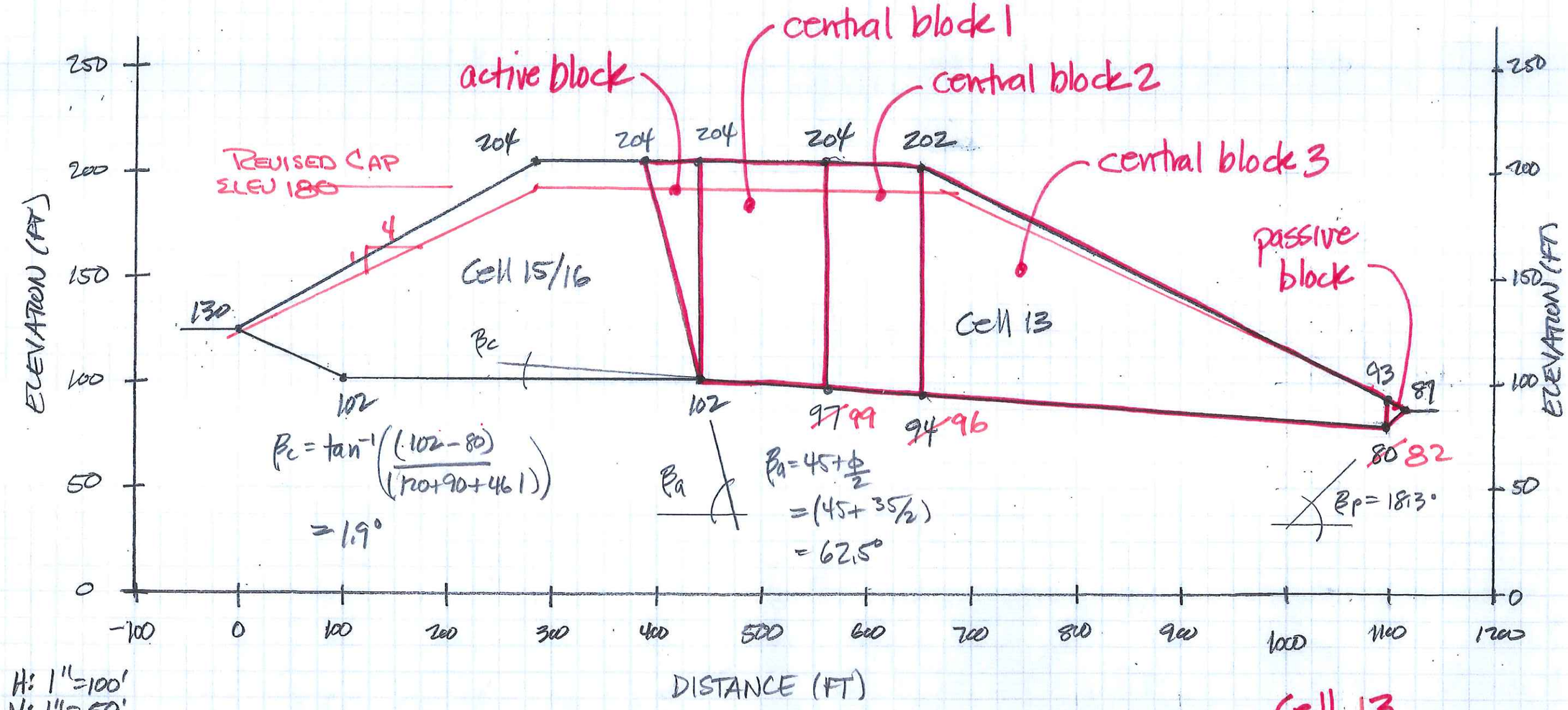
GeoStudio/Slope W by Geo-Slope International, Ltd.

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APPROXIMATE SECTION





H: 1" = 100'
V: 1" = 50'

Cell 13
Sliding Block

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assume unit 1' slice

Active Block

$a = 0$ $b = (\cancel{204} \to 180 - 102) = \cancel{102'} \to 78$ $h = 52'$

Area $A = \frac{(a+b)}{2}(h) = \frac{(0+\cancel{102} \to 78)}{2}(52) = \cancel{2652} \to 2{,}028\ sf$

$W_A = \gamma A = \frac{(48.7)(\cancel{2652} \to 2028)}{1000} = \cancel{129} \to 99\ K$

$\gamma = 48.7\ pcf$ ✓
$\phi = 35°$ ✓

$P_A = \frac{\gamma H^2}{2}\left(\tan^2\left(45 - \frac{\phi}{2}\right)\right) = \frac{(48.7)(\cancel{102} \to 78)^2}{(2)(1000)}\left(\tan^2\left(45 - \frac{35}{2}\right)\right)$

$= \frac{(48.7)(\cancel{102} \to 78)^2}{2(1000)}\left(\tan^2(27.5)\right) = \cancel{69} \to 40\ K$

Central Block 1

$a = (\cancel{204} \to 180 - 102) = \cancel{102'} \to 78$ $b = (\cancel{204} \to 180 - 97) = \cancel{107'} \to 81$ $h = 120'$

Area $A = \frac{(a+b)}{2}(h) = \frac{(\cancel{102} \to 78 + 107 \to 81)}{2}(120) = \cancel{12{,}540} \to 9540\ sf$

$W = \gamma A = \frac{(48.7)(\cancel{12{,}540} \to 9540)}{1000} = \cancel{611} \to 465\ K$

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BY JCA	DATE 7/19/20	DESCRIPTION	Cell 13 Sliding Block
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Central Block 2

$a = (\cancel{204} - \cancel{97}) = \cancel{107}\ 81'$ $\quad b = (\cancel{202} - \cancel{94}) = \cancel{108}\ 84'$ $\quad h = 90'$

Area $A = \frac{(a+b)}{2}(h) = \frac{(\cancel{107}\ 81 + \cancel{108}\ 84)}{2}(90) = \cancel{9675}\ 7425\ sf$

$W = \gamma A = \frac{(48.7)(\cancel{9675}\ 7425)}{1000} = \cancel{471}\ 362\ K$

Central Block 3

$a = (\cancel{202} - \cancel{94}) = \cancel{108}\ 84'$ $\quad b = (93 - \cancel{80}\ 82) = \cancel{13}\ 11'$ $\quad h = 461'$

Area $A = \frac{(a+b)}{2}(h) = \frac{(\cancel{108}\ 84 + \cancel{13}\ 11)}{2}(461) = \cancel{27,890}\ 21,898\ sf$

$W = \gamma A = \frac{(48.7)(\cancel{27,890}\ 21,898)}{1000} = \cancel{1358}\ 1,066\ K$

$W_c = (611 + \cancel{471}\ 465 + 362 + \cancel{1358}\ 1066) = \cancel{2440}\ 1893\ K$

Passive Block

$a = (93 - \cancel{80}\ 82) = \cancel{7}\ 11'$ $\quad b = 0'$ $\quad h = 21'$

Area $A = \frac{(a+b)}{2}(h) = \frac{(\cancel{7}\ 11 + 0)}{2}(21) = \cancel{73}\ 115\ sf$

$W_p = \gamma A = \frac{(48.7)(\cancel{73}\ 115)}{1000} = \cancel{3}\ 5.\ K$

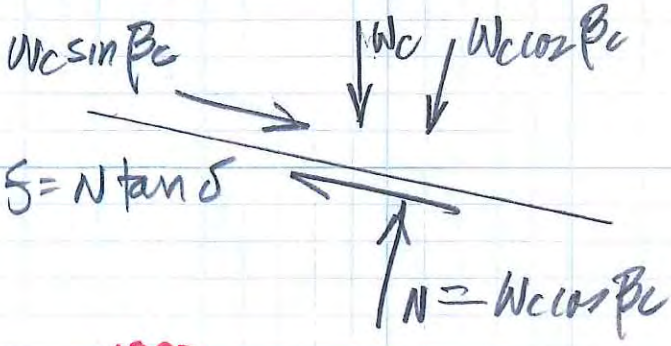
SHEET 2	OF 5	PROJECT NO. 3854		PROJECT NAME	Chevron Cell 13 Sliding Block
BY JCA		DATE 7/19/20		DESCRIPTION	
CHK. BY PGS		DATE 9/2/21			

2018-

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Central Block Forces

$\beta_c = 1.9°$
$\delta = 23°$
$W_c = 2440\ k$



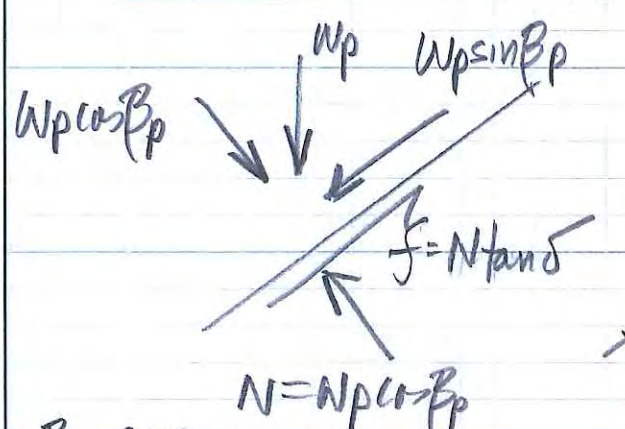
$W_c \sin\beta_c = (\cancel{2440}\ 1893)(\sin 1.9) = \cancel{81}\ 63\ k$

$W_c \cos\beta_c = (\cancel{2440}\ 1893)(\cos 1.9) = \cancel{2439}\ 1892\ k = N$

$S = N \tan\delta = (\cancel{2439}\ 1892)(\tan \cancel{23}) = \cancel{1035}\ 615\ k$

$\Sigma F = W_c \sin\beta_c - S = \cancel{81}\ 63 - \cancel{1035}\ 615 = \cancel{-954}\ -552\ k = P_c$

Passive Block Forces



$W_p \sin\beta_p = (\cancel{5}\ 2)(\sin 18.3) = \cancel{1.6}\ 1\ k$

$W_p \cos\beta_p = (\cancel{5}\ 5)(\cos 18.3) = \cancel{5}\ 3\ k = N$

$S = (\cancel{5}\ 5)(\tan \cancel{23}\ 18) = \cancel{1.3}\ 1.6\ k$

$\Sigma F = S - W_p \sin\beta_p$

$= \cancel{1.3}\ 1.6 - 1 = 0.3\ k = P_p$ (0.6)

$\beta_p = 18.3°$
$\delta = \cancel{23°}\ 18°$
$W_p = \cancel{3}\ 5\ k$

SHEET 3	OF 5	PROJECT NO. 3854	PROJECT NAME	Chevron	
BY JCA		DATE 7/19/20	DESCRIPTION	Cell 13 Sliding Block	
CHK. BY RGS		DATE 9/2/21			

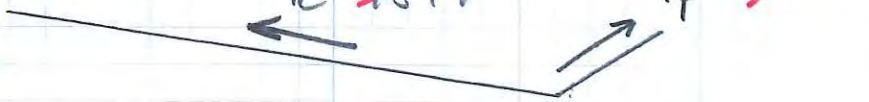
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$P_A = \cancel{69}\ 40\ k$

$P_c = \cancel{954}\ 552\ k$

$P_p = \cancel{0.3}\ 0.6\ k$



Resolve Forces in the Horizontal Direction

$P_{ch} = P_c \cos\beta_c = (\cancel{954}\ 552)(\cos 1.9) = \cancel{953\ k}\ 552\ k$

$P_{ph} = P_p \cos\beta_p = (\cancel{0.3}\ 0.6)(\cos 1.9) = \cancel{0.3\ k}\ 0.6$

Σ Driving Forces $= P_A + P_{ph} = (\cancel{69}\ 40 + 0.6) = \cancel{69}\ 41\ k$

Σ Resisting Forces $= P_{ch} = \cancel{954}\ 552\ k$

$FS = \dfrac{\Sigma \text{ Resisting Forces}}{\Sigma \text{ Driving Forces}} = \dfrac{\cancel{954}\ 552}{\cancel{69}\ 40} = 13.8$ ✓

Add Seismic Influence

$a = 0.065$

$C_s = \frac{a}{2} = 0.0325$

$K_h = 0.0325$

$P_A' = K_h(W_A) = (0.0325)(\cancel{129}\ 99) = \cancel{4\ k}\ 3\ k$

$P_{ch}' = K_h(W_c) = (0.0325)(\cancel{2440}\ 1893) = \cancel{79\ k}\ 62\ k$

$P_{ph}' = K_h(W_p) = (0.0325)(\cancel{3}\ 5) = \cancel{0.1\ k}\ 0.2\ k$

* The added seismic forces act towards downslope. *

2018

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Σ Driving Forces $= (P_A + P_A') + P_{ch}' + P_{ph}$

$= (69 + 4) + 79 + 0.3 = 152$ K 40 + 3 62 0.6 106 K

Σ Resisting Forces $= P_{ch} + P_{ph}' = 953 + 0.1 = 953$K

$FS = \dfrac{\Sigma \text{ Resisting Forces}}{\Sigma \text{ Driving Forces}} = \dfrac{953}{152} = 6.3$ 552 953 106 5.2

2018 -

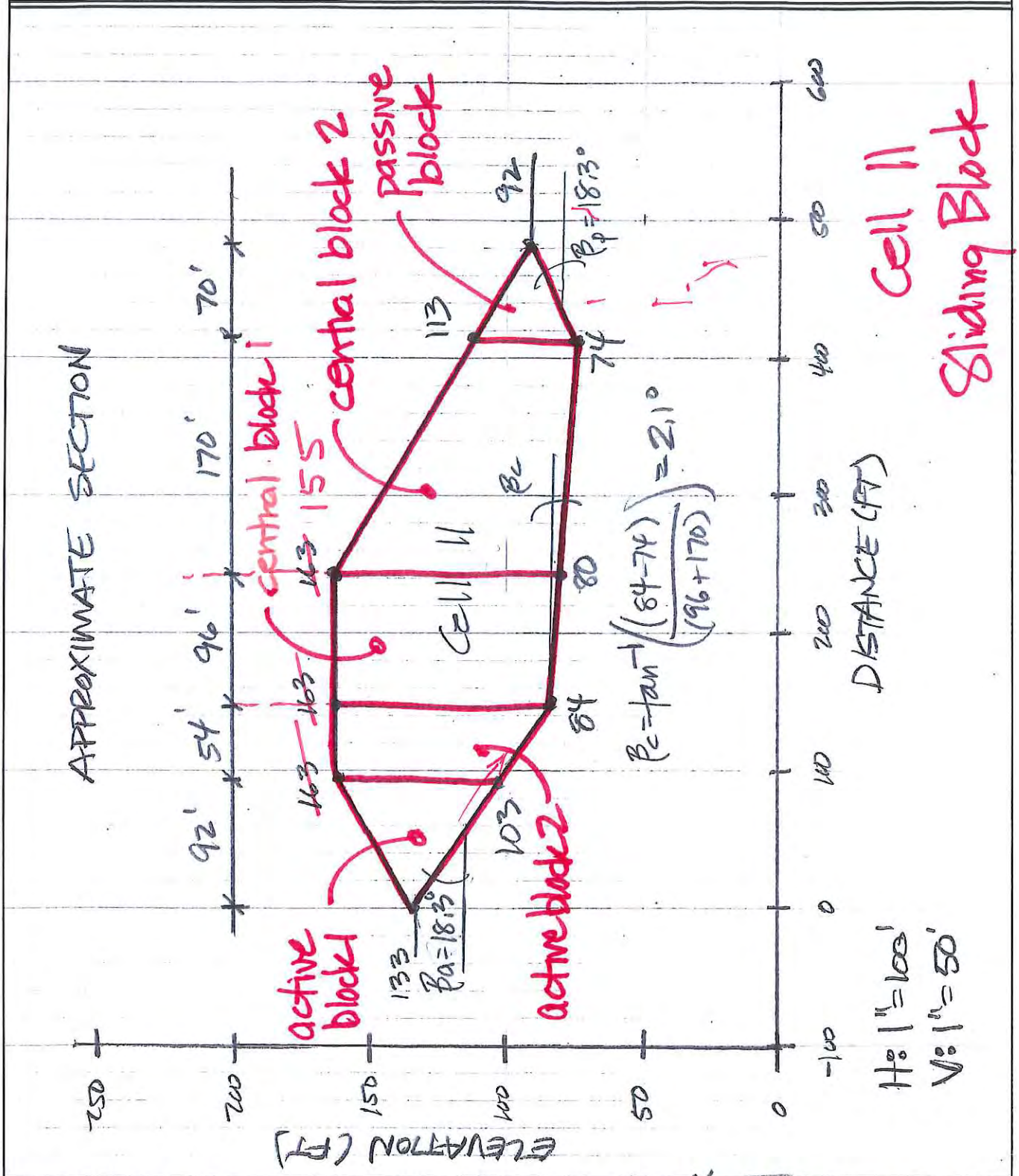
SHEET 5 OF 5 PROJECT NO. 3854 PROJECT NAME Chevron

BY KA DATE 7/9/20 DESCRIPTION Cell 13 Sliding Block

CHK. BY MGS DATE 9/2/21

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SHEET 1 OF 1	PROJECT NO. 2018-3654	PROJECT NAME	Chestnut
BY JCA	DATE 7/19/21	DESCRIPTION	Cell 11 Sliding Block
CHK. BY PGS	DATE 9/2/21		

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#assume unit 1' slice#

Active Block 1

a=0 b=(~~165~~ 155 − 103) = ~~60~~ 52 h = 92'

Area A = $\frac{(a+b)}{2}(h) = \frac{(0+52)}{2}(92) =$ ~~2760~~ 2392 sf

$W = \gamma A = \frac{(48.7)(\text{~~2760~~ } 2392)}{1000} =$ ~~134~~ 116 k

Active Block 2

a = (~~165~~ 155 − 103) = ~~60~~ 52' b = (~~165~~ 155 − 84) = ~~79~~ 71' h = 54'

Area A = $\frac{(a+b)}{2}(h) = \frac{(\text{~~60~~ } 52 + \text{~~79~~ } 71)}{2}(54) =$ ~~3753~~ 3321 sf

$W = \gamma A = \frac{(48.7)(\text{~~3753~~ } 3321)}{1000} =$ ~~183~~ 162 k

$W_A = (\text{~~183~~ } 162 + 134) =$ ~~317~~ 278 k

Central Block 1

a = (~~165~~ 155 − 84) = ~~79~~ 71' b = (~~165~~ 155 − 80) = ~~85~~ 75' h = 96'

Area A = $\frac{(a+b)}{2}(h) = \frac{(\text{~~79~~ } 71 + \text{~~85~~ } 75)}{2}(96) =$ ~~7776~~ 7008 sf

$W = \gamma A = \frac{(48.7)(\text{~~7776~~ } 7008)}{1000} =$ ~~379~~ 341 k

2018-

SHEET 1 OF 5	PROJECT NO. 3854	PROJECT NAME	Chester Cell 11 Sliding Block
BY KA	DATE 7/19/20	DESCRIPTION	
CHK. BY TGS	DATE 9/1/21		

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Central Block 2

$a = (\cancel{163}\ 155 - 80) = \cancel{83}\ 75'$ $\quad b = (113 - \cancel{74}) = 39'$ $\quad h = 170'$

Area $A = \frac{(a+b)}{2}(h) = \left(\frac{\cancel{83}\ 75 + 39}{2}\right)(\cancel{170}\ 170) = \cancel{10,370}\ 9,690$ sf

$W = \gamma A = \frac{(48.7)(\cancel{10,370}\ 9690)}{1000} = \cancel{505}\ 472$ K

$W_c = (\cancel{379}\ 341 + \cancel{505}\ 472) = \cancel{884}\ 813$ K

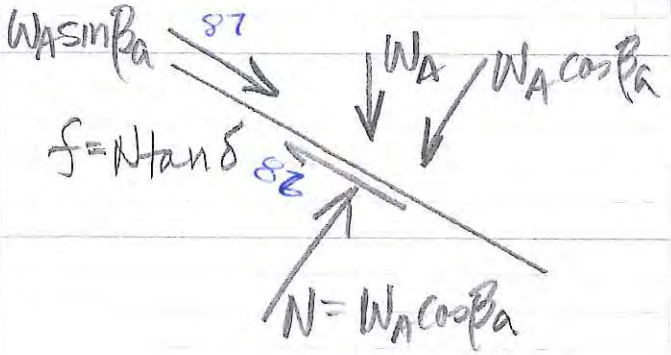
Passive Block

$a = (113 - 74) = 39'$ $\quad b = 0$ $\quad h = 70'$

Area $A = \frac{(a+b)}{2}(h) = \left(\frac{39+0}{2}\right)(70) = 1365$ sf

$W_p = \gamma A = \frac{(48.7)(1365)}{1000} = 66$ K

Active Block Forces



$\beta_a = 18.3°$

$\delta = \cancel{23°}\ 18°$

$W_A = \cancel{317}\ 278$ K

2018-

SHEET 2	OF 5	PROJECT NO. 3854	PROJECT NAME	Chelan Cell 11 Sliding Block	
BY VA		DATE 7/9/20	DESCRIPTION		
CHK. BY PGS		DATE 9/2/21			

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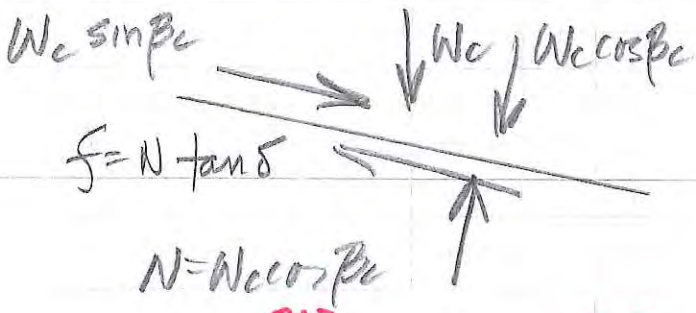
$W_A \sin\beta_a = (\cancel{317}\ 278)(\sin 18.3) = \cancel{99}\ 87\ K$

$W_A \cos\beta_a = (\cancel{317}\ 278)(\cos 18.3) = \cancel{301}\ 264\ K = N$

$f = N \tan\delta = (\cancel{301}\ 264)(\tan \cancel{23}\ 18) = \cancel{13}\ 86\ K$

$\Sigma F = W_A \sin\beta_a - f = \cancel{99 - 13}\ 87 - 86 = \cancel{86}\ 1\ K = P_A$

Central Block Forces



$\beta_c = 2.1°$

$\delta = \cancel{23}\ 18°$

$W_c = \cancel{884}\ 813\ K$

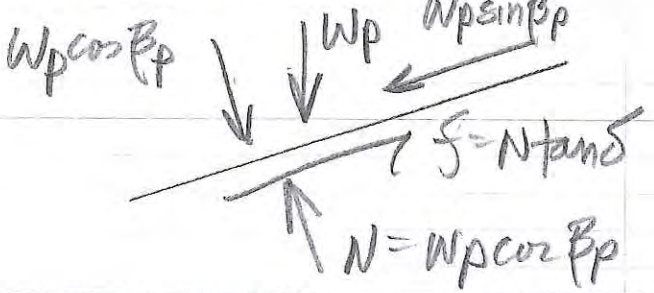
$W_c \sin\beta_c = (\cancel{884}\ 813)(\sin 2.1) = \cancel{32}\ 30\ K$

$W_c \cos\beta_c = (\cancel{884}\ 813)(\cos 2.1) = \cancel{883}\ 812\ K = N$

$f = N \tan\delta = (\cancel{883}\ 812)(\tan \cancel{23}\ 18) = \cancel{373}\ 264\ K$

$\Sigma F = W_c \sin\beta_c - f = (\cancel{32}\ 30 - \cancel{373}\ 264) = \cancel{-343}\ -234\ K = P_c$

Passive Block Forces



$\beta_p = 18.3°$

$\delta = \cancel{23}\ 18°$

$W_p = 66\ K$ ✓

SHEET 3 OF 5	PROJECT NO 2018-385Y	PROJECT NAME	Cherry Tew
BY CKA	DATE 2/19/21	DESCRIPTION	Cell 11 Sliding Block
CHK. BY PGS	DATE 9/2/21		

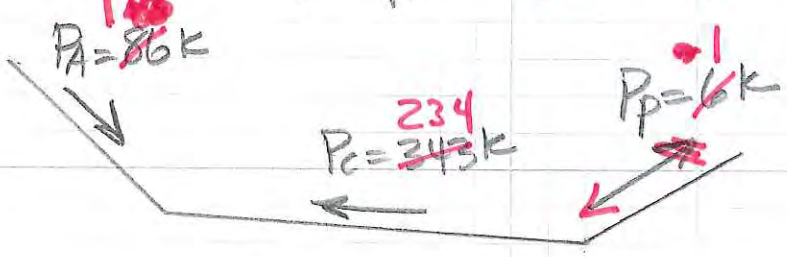
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$W_p \sin\beta_p = (66)(\sin 18.3) = 21\,k$ ✓

$W_p \cos\beta_p = (66)(\cos 18.3) = 63\,k = N$ ✓

$f = N \tan\delta = (63)(\tan 18) = 20\,k = P_p$

$\Sigma F = f - W_p \sin\beta_p = (20 - 21) = -1\,k$



Resolve forces in the Horizontal Direction

$P_{Ah} = P_A \cos\beta_A = (\quad)(\cos 18.3) =$

$P_{ch} = P_c \cos\beta_c = (\quad)(\cos 21) =$

$P_{ph} = P_p \cos\beta_p = (\quad)(\cos 18.3) =$

Σ Driving forces $= P_{Ah} + P_{ph} =$

Σ Resisting forces $= P_{ch} =$

$FS = \dfrac{\Sigma \text{ Resisting forces}}{\Sigma \text{ Driving forces}} =$

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Add Seismic Influence

$a = 0.065$

$C_s = \frac{a}{2} = 0.0325$

$K_h = 0.0325$

$P_{Ah}' = K_h (W_A) = (0.0325)(\cancel{317}\ 278)$

$= \cancel{10}\ 9\ K$

$P_{ch}' = K_h (W_c) = (0.0325)(\cancel{884}\ 813) = \cancel{29}\ 26\ K$

$P_{Ph}' = K_h (W_p) = (0.0325)(66) = 2\ K$ ✓

* The added Seismic forces act towards downslope. *

Σ Driving forces $= (P_{Ah} + P_{Ah}') + P_{ch}' + P_{ph}$

$= (\cancel{8.2}\ 12 + 10\ 9) + \cancel{29}\ 26 + 5.7\ 1 = \cancel{209}\ 48\ K$

Σ Resisting forces $= P_{ch} + P_{Ph}'$

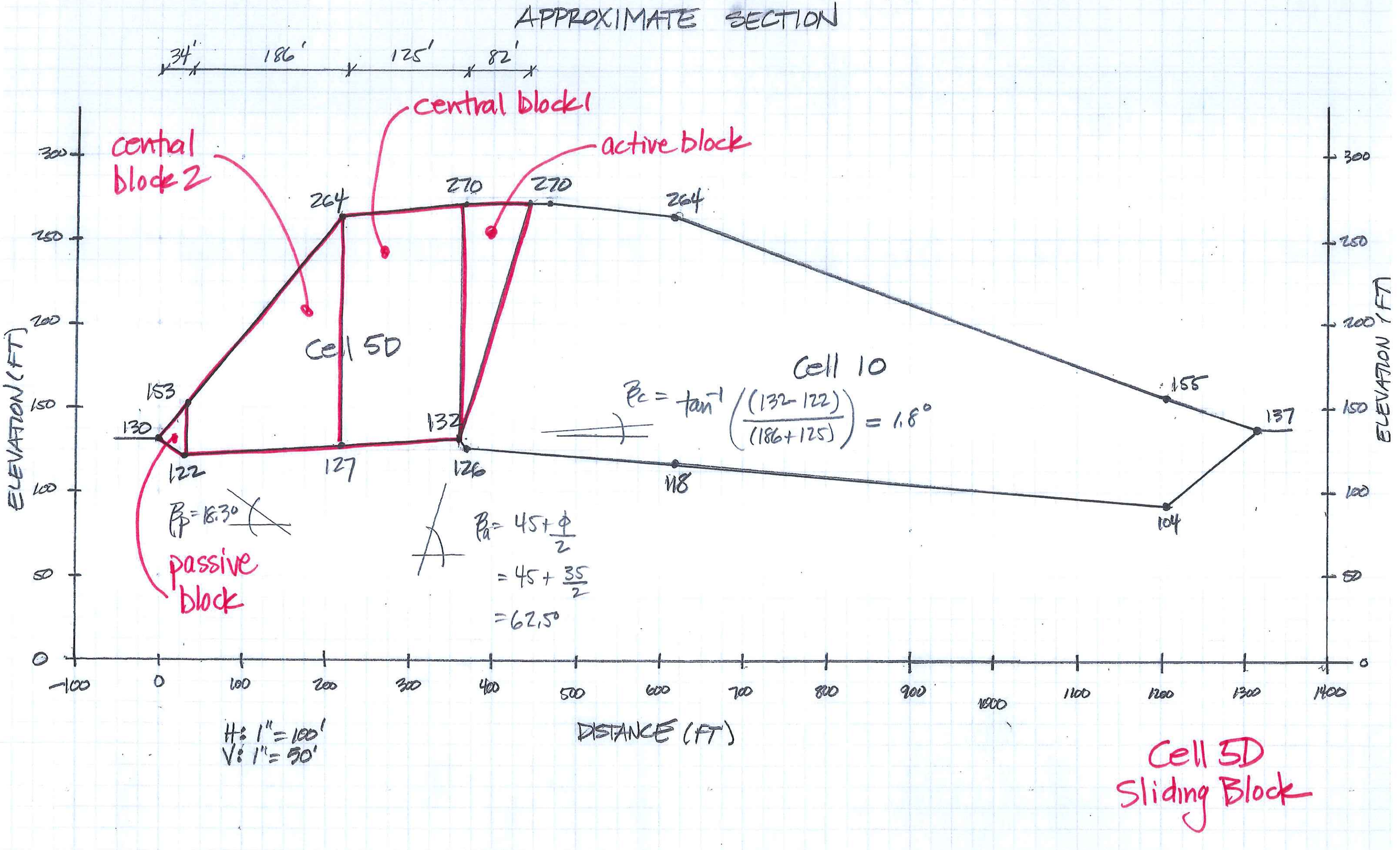
$= 342.8 + 2 = 344.8\ K$

$FS = \dfrac{\Sigma \text{ Resisting forces}}{\Sigma \text{ Driving forces}} = \dfrac{344.8}{\cancel{209}\ 48} = \cancel{1.6}\ 7.1$

2018-

SHEET 5 OF 5	PROJECT NO. 3854	PROJECT NAME	Chapter
BY JCA	DATE 7/19/20	DESCRIPTION	Cell 11 Sliding Block
CHK. BY PGS	DATE 9/2/21		

APPROXIMATE SECTION



H: 1" = 100'
V: 1" = 50'

Cell 5D
Sliding Block

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Active Block

assume unit 1' slice

$\gamma = 48.7$ pcf

$\phi = 35°$

$a = 0$ $\quad b = (270 - 132) = 138'$ $\quad h = 82'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(0+138)}{2}(82) = 5658 \text{ sf}$$

$$W_A = \gamma A = \frac{(48.7)(5658)}{1000} = 275 \text{ K}$$

$$P_A = \frac{\gamma H^2}{2}\left(\tan^2\left(45 - \frac{\phi}{2}\right)\right) = \frac{(48.7)(138)^2}{2(1000)}\left(\tan\left(45 - \frac{35}{2}\right)\right)$$

$$= \frac{(48.7)(138)^2}{2(1000)}\left(\tan^2\left(45 - \frac{35}{2}\right)\right) = 126 \text{ K}$$

Central Block 1

$a = (270 - 132) = 138'$ $\quad b = (264 - 127) = 137'$ $\quad h = 125'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(138+137)}{2}(125) = 17{,}187 \text{ sf}$$

$$W = \gamma A = \frac{(48.7)(17{,}187)}{1000} = 837 \text{ K}$$

RUN WITHOUT RECALCULATING LOWER ELEVATIONS (MORE CONSERVATIVE)

SHEET 1 OF 5	PROJECT NO. 2018-3854	PROJECT NAME Chester	
BY JCA	DATE 7/9/20	DESCRIPTION Cell 5D Sliding Block	
CHK. BY PKS	DATE 9/2/21		

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Central Block 2

$a = (264 - 127) = 137$ $\quad b = (153 - 122) = 31$ $\quad h = 186'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(137+31)}{2}(186) = 15{,}624 \text{ sf}$$

$$W = \gamma A = \frac{(48.7)(15{,}624)}{1000} = 761 \text{ K}$$

$$W_c = (837 + 761) = 1598 \text{ K}$$

Passive Block

$a = (153 - 122) = 31'$ $\quad b = 0$ $\quad h = 34'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(31+0)}{2}(34) = 527 \text{ sf}$$

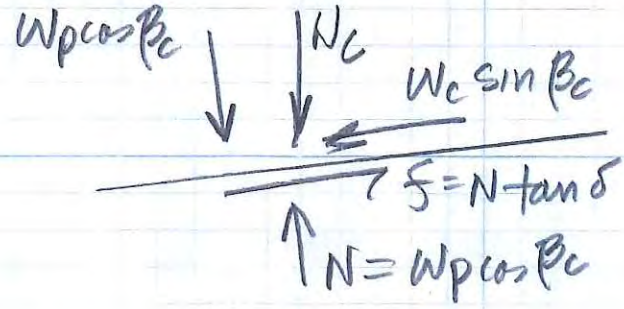
$$W_p = \gamma A = \frac{(48.7)(527)}{1000} = 26 \text{ K}$$

SHEET 2	OF 5	PROJECT NO. 2015-3854	PROJECT NAME Chas Terr		
BY DCA		DATE 7/19/20	DESCRIPTION Cell 5D Shirley Block		
CHK. BY PGS		DATE 9/2/21			

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Central Blocks Forces

$\beta_c = 1.8°$
$\delta = 23° \rightarrow 18°$
$W_c = 1598\ K$



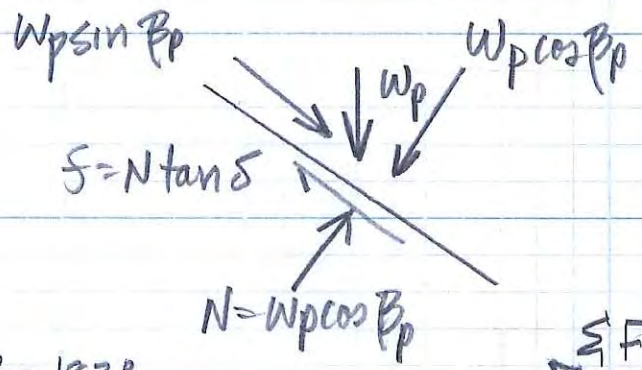
$W_c \sin\beta_c = (1598)(\sin 1.8) = 50\ K$

$W_c \cos\beta_c = (1598)(\cos 1.8) = 1597\ K = N$

$f = N \tan\delta = (1597)(\tan 23) = 678\ K \rightarrow 519\ K$ (18)

$\sum F = W_c \sin\beta_c - f = 50 - 678 = -628\ K \rightarrow -469\ K = P_c$ (519)

Passive Block Forces



$W_p \sin\beta_p = (26)(\sin 18.3) = 8\ K$

$W_p \cos\beta_p = (26)(\cos 18.3) = 25\ K = N$

$f = N \tan\delta = (25)(\tan 23) \rightarrow (\tan 18)$

$= 11\ K \rightarrow 8\ K$

$\sum F = f - W_p \sin\beta_p$

$= 11 - 8 = 3\ K = P_p$

$8 - 8 = 0$

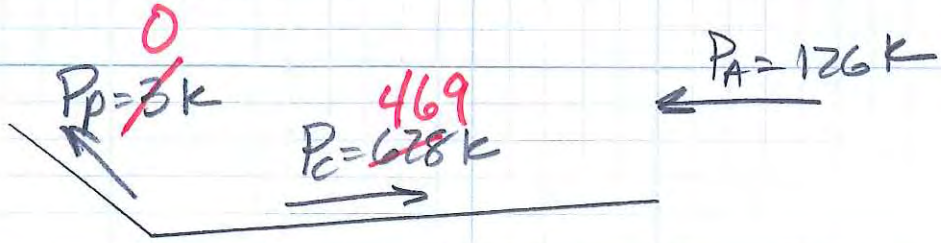
$\beta_p = 18.3°$

$\delta = 23° \rightarrow 18°$

$W_p = 26\ K$

SHEET 3	OF 5	PROJECT NO. 2018-3854	PROJECT NAME	Chestnut Cell 5D Shoring Block
BY JCH		DATE 7/19/20	DESCRIPTION	
CHK. BY PGS		DATE 9/2/21		

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Resolve Forces in the Horizontal Direction

$P_{ch} = P_c \cos\beta_c = (\cancel{628}\ 469)(\cos 1.8) = \cancel{625}\ 468$ k

$P_{ph} = P_p \cos\beta_p = (\cancel{3}\ 0)(\cos 18.3) = \cancel{2.8}\ 0$ k

Σ Driving Forces $= P_A + P_{ph} = 126 + \cancel{2.8}\ 0 = \cancel{129}\ 126$ k

Σ Resisting Forces $= P_{ch} = \cancel{625}\ 469$ k

$$FS = \frac{\Sigma \text{ Resisting Forces}}{\Sigma \text{ Driving Forces}} = \frac{469.625}{126/\cancel{129}} = \cancel{4.8}\ 3.7$$

Add Seismic Influence

$a = 0.065$

$C_S = \frac{a}{2} = 0.0325$

$K_h = 0.0325$

$P_A' = K_h (W_A) = (0.0325)(275) = 9$ k

$P_{ch}' = K_h (W_C) = (0.0325)(1598) = 52$ k

2018-

SHEET 4 OF 5 PROJECT NO. 3854 PROJECT NAME Chin Tew
BY JCA DATE 7/9/20 DESCRIPTION Cell 50 Sliding Block
CHK. BY PGS 9/2/21 DATE

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$P_{Ph}' = K_h(W_p) = (0.0325)(26) = 1\ K$

* The additional seismic forces act towards downslope. *

Σ Driving forces $= (P_A + P_A') + P_{Ch}' + P_{Ph}$

$= (126 + 9) + 52 + \cancel{3}\ 0 = \cancel{190}\ 187\ k$

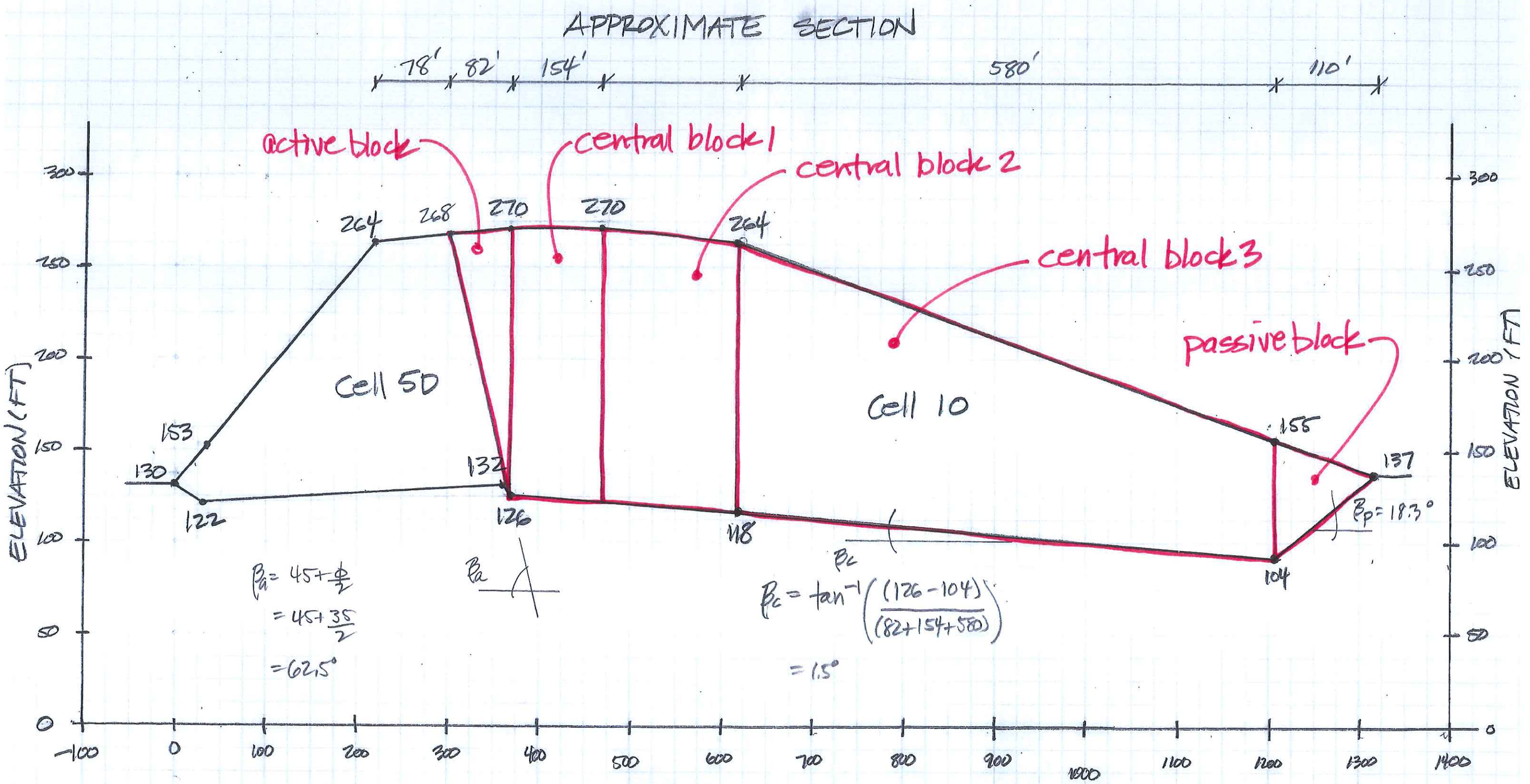
Σ Resisting forces $= P_{Ch} + P_{Ph}' = \cancel{625}\ 469 + 1 = \cancel{626}\ 470\ k$

$FS = \dfrac{\Sigma \text{ Resisting forces}}{\Sigma \text{ Driving forces}} = \dfrac{\cancel{626}\ 470}{\cancel{190}\ 187} = \cancel{3.3}\ 2.5$

2018-

SHEET 5 OF 5	PROJECT NO. 3854	PROJECT NAME	Chestnut
BY JCA	DATE 7/19/20	DESCRIPTION	Cell 5D Sliding Block
CHK. BY PGS	DATE 9/2/21		

APPROXIMATE SECTION



Cell 10
Sliding Block

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Active Block

assume unit 1' slice

$a = 0$ $b = (270-126) = 144$ $h = 78'$ $\gamma = 48.7$ pcf $\phi = 35°$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(0+144)}{2}(78) = 5616 \text{ sf}$$

$$W_A = \gamma A = \frac{(48.7)(5616)}{1000} = 274 \text{ K}$$

$$P_A = \frac{\gamma H^2}{2}\left(\tan^2\left(45 - \frac{\phi}{2}\right)\right) = \frac{(48.7)(144)^2}{(2)1000}\left(\tan^2\left(45 - \frac{35}{2}\right)\right)$$

$$= \frac{(48.7)(144)^2}{(2)1000}(0.52)^2 = 137 \text{ K}$$

Central Block 1

$a = (270-126) = 144'$ $b = (270-122) = 148'$ $h = 82'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(144+148)}{2}(82) = 11,972 \text{ SF}$$

$$W = \gamma A = \frac{(48.7)(11,972)}{1000} = 583 \text{ K}$$

- RERUN FOR LOWER δ BETWEEN HDPE-T AND SUBBASE. ASSUME CAP ELEVATIONS UNCHANGED

SHEET 1 OF 1	PROJECT NO. 2018-3854	PROJECT NAME Chestnut	
BY JCA	DATE 7/19/20	DESCRIPTION Cell 10 Sliding Block	
CHK. BY PGS	DATE 9/2/21		

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Central Block 2

$a = (270 - 122) = 148'$ $\quad b = (264 - 118) = 146'$ $\quad h = 154'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(148+146)}{2}(154) = 22{,}638 \text{ sf}$$

$$W = \gamma A = \frac{(48.7)(22{,}638)}{1000} = 1102 \text{ K}$$

Central Block 3

$a = (264 - 118) = 146'$ $\quad b = (155 - 104) = 51'$ $\quad h = 580'$

$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(146+51)}{2}(580) = 57{,}130 \text{ sf}$$

$$W = \gamma A = \frac{(48.7)(57{,}130)}{1000} = 2782 \text{ K}$$

$$W_C = (583 + 1102 + 2782) = 4467 \text{ K}$$

Passive Block

$a = (155 - 104) = 51'$ $\quad b = 0$ $\quad h = 110'$

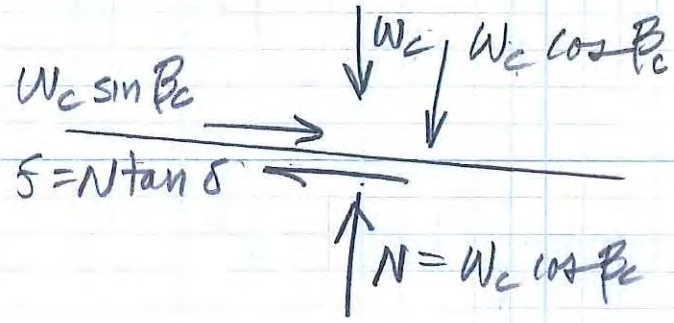
$$\text{Area } A = \frac{(a+b)}{2}(h) = \frac{(51+0)}{2}(110) = 2805 \text{ sf}$$

$$W_P = \gamma A = \frac{(48.7)(2805)}{1000} = 137 \text{ K}$$

SHEET 2 OF 5 PROJECT NO. 2018-3854 PROJECT NAME Chestem
BY JCA DATE 7/19/20 DESCRIPTION Cell 10 Sliding Block
CHK. BY RGS DATE 9/2/21

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Central Blocks Forces

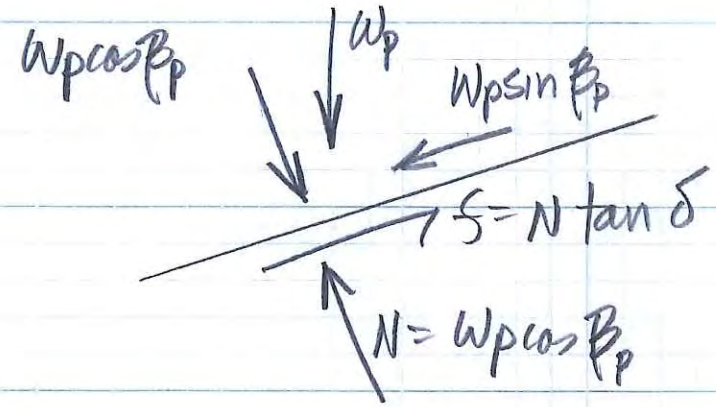


$\beta_c = 1.5°$
$\delta = 23° \rightarrow 18°$
$W_c = 4467\ k$

$W_c \sin \beta_c = (4467)(\sin 1.5) = 117\ k$
$W_c \cos \beta_c = (4467)(\cos 1.5) = 4465\ k = N$
$f = N \tan \delta = (4465)(\tan 23 \rightarrow 18) = 1895 \rightarrow 1450\ k$

$\rightarrow \Sigma F = W_c \sin \beta_c - f = 117 - 1895 \rightarrow 1450 = -1778 \rightarrow -1333\ k = P_c$

Passive Block Forces



$\beta_p = 18.3°$
$\delta = 23° \rightarrow 18°$
$W_p = 137\ k$

2018-

SHEET 3 OF 5 PROJECT NO. 3854 PROJECT NAME Chester
BY JCA DATE 7/19/20 DESCRIPTION Cell 10 Sliding Block
CHK. BY PGS DATE 9/1/21

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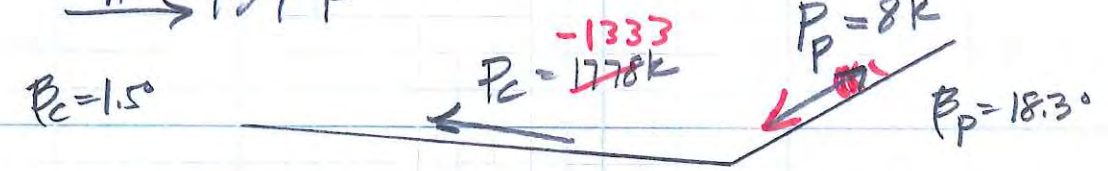
$W_p \sin\beta_p = (137)(\sin 18.3) = 43$ k

$W_p \cos\beta_p = (137)(\cos 18.3) = 130$ k $= N$

$f = N \tan\delta = (130)(\tan 23) = 55$ k → 18 → 42

$\Sigma F = f - W_p \sin\beta_p = 55 - 43 = 8$ k $= P_p$ → 42 → -1

$P_A = 137$ k



Resolve Forces in the Horizontal Direction

$P_{ch} = P_c(\cos\beta_c) = (1778)(\cos 1.5) = 1777$ k → 1333 → 1332

$P_{ph} = P_p(\cos\beta_p) = (8)(\cos 18.3) = 7$ k → 1 → 1

Σ Driving forces $= P_A + P_{ph} = (137 + 7) = 144$ k → -1 → 137

Σ Resisting forces $= P_{ch} = 1777$ k → 1332

$FS = \frac{\Sigma \text{Resisting forces}}{\Sigma \text{Driving forces}} = \frac{1777}{144} = 12.3$ → $\frac{1332}{137} = 9.7$

2018-

SHEET 4 OF 5 PROJECT NO. 3854 PROJECT NAME Chester
BY JCA DATE 7/16/20 DESCRIPTION Cell 10 Sliding Block
CHK. BY PGS DATE 9/1/21

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Add Seismic Influence

$a = 0.065$

$C_s = a/2 = 0.0325$

$K_h = 0.0325$

$P_A' = K_h(W_A) = (0.0325)(274)$

$= 9\ k$

$P_{Ch}' = K_h(W_c) = (0.0325)(4467) = 145\ k$

$P_{Ph}' = K_h(W_p) = (0.0325)(137) = 4\ k$

* The additional seismic forces act towards downslope. *

Σ Driving Forces $= (P_A + P_A') + P_{Ch}' + P_{Ph}'$

$= (137+9) + \cancel{145} + \cancel{1} = \cancel{298}$ 284 k

Σ Resisting Forces $= P_{Ch} + P_{Ph}' = (\cancel{1777}$ 1332 $+4) = \cancel{1781}$ 1336 k

$FS = \dfrac{\Sigma \text{ Resisting Forces}}{\Sigma \text{ Driving Forces}} = \dfrac{\cancel{1781}\ 1336}{\cancel{298}\ 284} = \cancel{6.0}\ 4.7$

2018-

SHEET 5	OF 5	PROJECT NO. 3854		PROJECT NAME	Chester
BY JCA		DATE 7/19/20		DESCRIPTION	Cell 10 Sliding Block
CHK. BY PGS		DATE 9/2/21			

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 9K

Geotextile Soil Retention

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Geotextiles – Soil Retention		
	Job No. 2018-3854	Made by: JCA	Date 07/15/20
	Ref.	Checked by: VEI	Sheet 1 of 2

Reviewed by PGS 09/01/2021

Objective:

The objective of this analysis is evaluate the soil retention of the nonwoven geotextiles chosen for the design against the poorly-graded, sandy soils onsite.

Design Approach and Assumptions:

The greater the size of the void spaces in a geotextile, the greater the flow of liquid that will be allowed through it. However, there is a point where the soil particles on the "upstream" side begin to migrate through the geotextile with the liquid flow. Over time, the loss of soil on the upstream side lead to larger and larger void spaces created on the upstream side until the upstream soil structure begins to collapse. This may result in the formation of localized, isolated settlement features that can continue to enlarge with time.

Excessive soil loss is prevented by the void spaces in the geotextile being small enough to retain the soil particles while still allowing adequate flow. Initially, some fine particles will migrate through the geotextile as the flow regime begins and the soil and geotextile respond accordingly. The relatively large fraction of the soil particles will eventually block the finer particles from migrating through the geotextile. Therefore, it is the larger fraction of soil particles that are targeted in this analysis.

1. Manufacturer's data was used for product data related to this analysis.

2. The soil gradation from PMW-13A (bag sample) was selected for use in this analysis because it qualitatively seems rather typical of the sandy soils at the site. The gradation plot was used to estimate various particle diameters for use in analysis.

3. The coefficients C'_u , and C_c were compared to the soil retention design criteria from Koerner 1998 (after Luettich, *et al*).

Calculations:

1. The proposed nonwoven, needle-punched geotextile has Apparent Opening Size, AOS, values that vary based on the product weight. The AOS is defined as the O_{95}, the 95% opening size. The three select geotextile weights are as follows:

Geotextile Weight (oz/sy)	O_{95} (mm)
6	0.212
8	0.180
10	0.150
16	0.150

Reviewed by PGS 09/01/2021

From the soil gradation plot, the particle diameter at which 85% of the soil is finer, d_{85}, is 0.38 mm. From Koerner 1998, an acceptable O_{95} value for a given soil is :

$$O_{95} = AOS < (2 \text{ or } 3)d_{85}$$

in this case, = 0.76mm to 1.14 mm.

2. From Holtz and Kovacs 1981, and Koerner 1998, the coefficients C'_u , and C_c are defined as follows:

$$C'_u = SQRT\ (d'_{100}/d'_0) \qquad \text{and} \qquad C_c = (d_{30})^2 / (d_{60})(d_{10})$$

These calculations indicate the C_c and C'_u values are 2.65 and 2.02, respectively. Using the soil retention criteria from Koerner 1998, a C_c value that favors a retention function is characterized by:

$$1 < C_c < 3.$$

Additionally, a favorable geotextile for soil retention is characterized by:

$$O_{95} < (1 \text{ to } 2)\ C'_u(d'_{50})$$

in this case = O_{95} < 0.525 mm to 1.051 mm.

Conclusions:

Based on the foregoing, the following conclusions are presented:

1. The nonwoven, needle-punched geotextiles selected for design when compared with poorly-graded, sandy soils selected exhibit acceptable filtration and soil retention properties. However, the use of the on-site soils in any application will be based on a number of factors, not just this analysis.

2. This analysis should be performed for actual soils and actual geotextiles used prior to construction.

References:

1. Koerner, R.M.; *"Designing With Geosynthetics"*; 4th Ed., Prentice-Hall, Inc., 1998; Section 2.2.3.
2. Holtz, R.D., and Kovacs, W.D.; *"An Introduction to Geotechnical Engineering"*; Prentice-Hall, Inc., 1981.
3. Golder Associates Inc.; Site-specific soils testing.; P.N. 063-1431-003; Dec 2013.
4. GSE product data.

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Project:			
P.N.:	2018-3854	**Page:**	1 of 2
By:	JCA	**Date:**	07/15/20
Checked:	VEF	**Date:**	7/15/20
Subject:	Geotextiles - Soil Retention		

Description

Evaluate the proposed geotextiles against the onsite soils and their use.

Soil Retention and Separation

Onsite Soils

d_x = the partical size, d, at which x percent is finer.

d'_{100} =	0.49	mm		
d_{85} =	0.38	mm		
$2d_{85}$ =	0.76	mm		
$3d_{85}$ =	1.14	mm		
d_{60} =	0.26	mm		
d'_{50} =	0.24	mm		
$2d'_{50}$ =	0.48	mm		
d_{30} =	0.18	mm		
$(d_{30})^2$ =	0.0324	mm^2		
d_{10} =	0.047	mm		
d'_0 =	0.12	mm		

Coefficient of Curvature, $C_c = (d_{30})^2 / (d_{60} \times d_{10})$ = 2.65

Coefficient of Uniformity, $C'_u = SQRT((d'_{100} / d'_0)$ = 2.02

$C'_u d'_{50}$ = 0.485

$2C'_u d'_{50}$ = 0.970

Proposed Geotextile(s)

Type = non-woven, needle-punched (NW-NP-GT)

6 oz/sy GT-NW-NP Apparent Opening Size, AOS =	0.212	mm				
Is AOS < $2d_{85}$?	Yes	to $3d_{85}$?	Yes			
Is AOS < $C'_u d_{50}$?	Yes	to $2C'_u d_{50}$?	Yes			
Permitivity, ψ =	1.5	sec^{-1}				
Cross-Plane Water Flow Rate, k_n =	110	gpm/ft^2	=	6.02E-02	cm/sec	
Thickness, $t = k_n / \psi$ =	4.01E-02	cm	=	1.58E-02	in	

8 oz/sy GT-NW-NP Apparent Opening Size, AOS =	0.180	mm				
Is AOS < $2d_{85}$?	Yes	to $3d_{85}$?	Yes			
Is AOS < $C'_u d_{50}$?	Yes	to $2C'_u d_{50}$?	Yes			
Permitivity, ψ =	1.3	sec^{-1}				
Cross-Plane Water Flow Rate, k_n =	95	gpm/ft^2	=	5.20E-02	cm/sec	
Thickness, $t = k_n / \psi$ =	4.00E-02	cm	=	1.57E-02	in	

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Project:			
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By:	JCA	**Date:**	15-Jul-20
Checked:	VEF	**Date:**	7/15/20
Subject:	Geotextiles - Soil Retention		

10 oz/sy GT-NW-NP Apparent Opening Size, AOS =	0.150	*mm*			
Is AOS < $2d_{85}$?	**Yes**	*to $3d_{85}$?*	**Yes**		
Is AOS < $C'_u d_{50}$?	**Yes**	*to $2C'_u d_{50}$?*	**Yes**		
Permitivity, ψ =	1	sec^{-1}			
Cross-Plane Water Flow Rate, k_n =	75	gpm/ft^2	=	4.10E-02	cm/sec
Thickness, $t = k_n / \psi$ =	4.10E-02	cm	=	1.62E-02	in

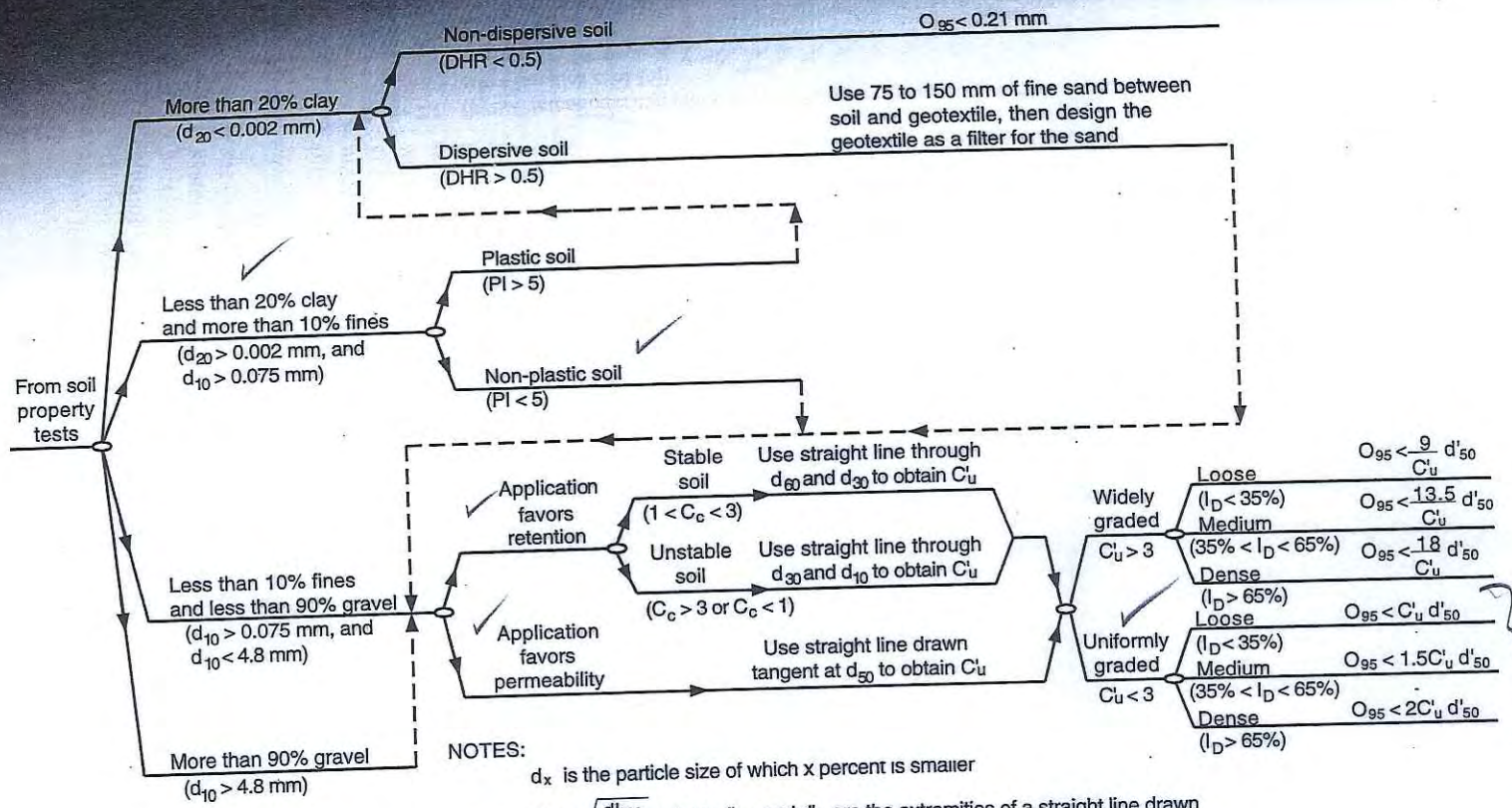
References

1 *Koerner, R.M.; "Designing With Geosynthetics"; 4th Ed., Prentice-Hall, Inc 1998; Section 2.2.3.*

2 *Holtz, R.D., and Kovacs, W.D.; "An Introduction to Geotechnical Engineering"; Prentice-Hall, Inc., 1981.*

3 *Site-specific soils testing; Golder Associates Inc.; P.N. 063-1431-003; Dec 2013.*

4 *GSE product data.*



NOTES:

d_x is the particle size of which x percent is smaller

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}}$ where d'_{100} and d'_0 are the extremities of a straight line drawn through the particle-size distribution, as directed above; and d'_{50} is the midpoint of this line.

$C_c = \frac{(d_{30})^2}{d_{60} \times d_{10}}$

I_D = relative density of the soil
PI = plasticity index of the soil
DHR = double-hydrometer ratio of the soil

Figure 2.4 (a) Soil retention criteria for geotextile filter design using steady-state flow conditions. (After Luettich et al. [6])

Koerner 1998

REFERENCE 1 P.61

REFERENCE 3
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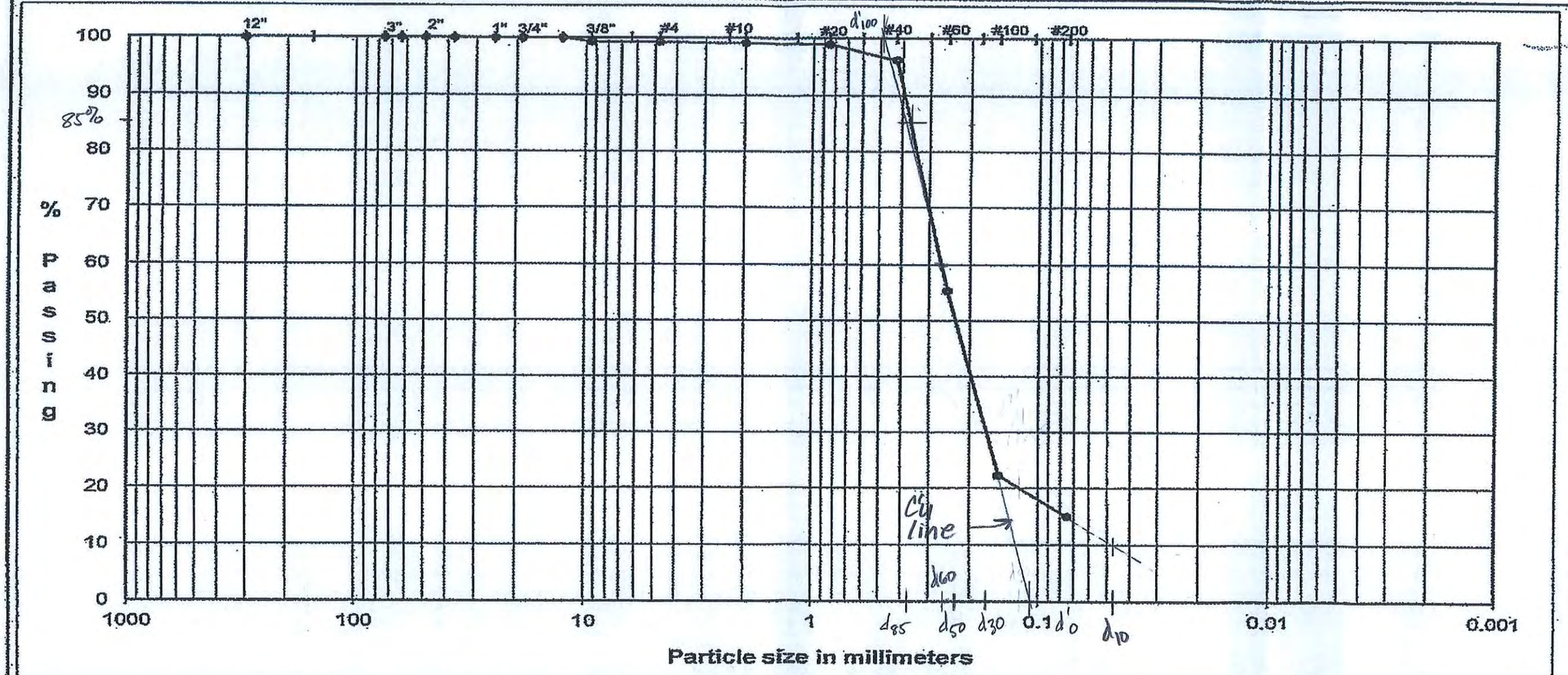
DECEMBER 2013

063-1431-003

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

PROJECT NAME: NWM/CHESAPEAKE TERRACE SFI/MD
SAMPLE ID: PMW-13A Depth: -
TYPE: Bag



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

$C_c = \frac{(d_{30})^2}{(d_{60})(d_{10})} \simeq 2.6$

$d_{60} \simeq 0.26\text{mm}$ $d_{85} \simeq 0.38\text{mm}$
$d_{30} \simeq 0.18\text{mm}$ $d_{10} \simeq 0.047\text{mm}$

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}} = \sqrt{\frac{0.49}{0.12}} = 2.02$

$d'_{100} = 0.49\text{ mm}$
$d'_0 = 0.12\text{mm} \sim$
$d_{50} = 0.24\text{ mm}$

$C'_u d_{50} = (2.02)(0.24) = 0.48$

$D_{95} < 2 C'_u d_{50}$
$< (2)(2.02)(0.24) = 0.97\text{ mm}$

REFERENCE 4 B 1/1

PRODUCT DATA SHEET

GSE Nonwoven Geotextiles

GSE Nonwoven Geotextiles are a family of staple fiber needlepunched geotextiles. The geotextiles are manufactured using an advanced manufacturing and quality system to produce the most uniform and consistent nonwoven needlepunched geotextile currently available in the industry. GSE combines a fiber selection and approval system with an in-line quality control and a state-of-the-art laboratory to ensure that every roll shipped meets customer specifications.

[*]

AT THE CORE:
A family of geotextiles used for separation, filtration, protection and drainage applications.

Product Specifications

These product specifications meet GRI GT12, GRI GT13 and AASHTO M288

Tested Property[1]	Test Method	Frequency	Minimum Average Roll Value					
			NW4	NW6	NW8	NW10	NW12	NW16
AASHTO M288 Class			3	2	1	>1	>>1	>>>1
Mass per Unit Area, oz/yd²	ASTM D 5261	90,000 ft²	4	6	8	10	12	16
Grab Tensile Strength, lb	ASTM D 4632	90,000 ft²	120	170	220	270	320	390
Grab Elongation, %	ASTM D 4632	90,000 ft²	50	50	50	50	50	50
CBR Puncture Strength, lb	ASTM D 6241	540,000 ft²	303	435	575	725	925	1,125
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000 ft²	50	70	95	105	125	155
Apparent Opening Size, Sieve No. (mm)	ASTM D 4751	540,000 ft²	70 (0.212)	70 (0.212)	80 (0.180)	100 (0.150)	100 (0.150)	100 (0.150)
Permittivity, sec⁻¹	ASTM D 4491	540,000 ft²	1.8	1.5	1.3	1.0	0.8	0.7
Water Flow Rate, gpm/ft²	ASTM D 4491	540,000 ft²	135	110	95	75	60	50
UV Resistance % retained after 500 hours	ASTM D 4355	per formulation		70	70	70	70	70
TYPICAL ROLL DIMENSIONS								
Roll Length[2], ft			300	300	300	300	300	300
Roll Width[2], ft			15	15	15	15	15	15
Roll Area, ft² Roll Area (yd²)			4500 500	4500 500	4500 500	4500 500	4500 500	4500 500

NOTES:
- [1]The property values listed are in weaker principal direction. All values listed are Minimum Average Roll Values except apparent opening size in mm and UV resistance. Apparent opening size (mm) is a Maximum Average Roll Value. UV is a typical value.
- [2]Roll lengths and widths have a tolerance of ±1%.

GSE is a leading manufacturer and marketer of geosynthetic lining products and services. We've built a reputation of reliability through our dedication to providing consistency of product, price and protection to our global customers.

Our commitment to innovation, our focus on quality and our industry expertise allow us the flexibility to collaborate with our clients to develop a custom, purpose-fit solution.

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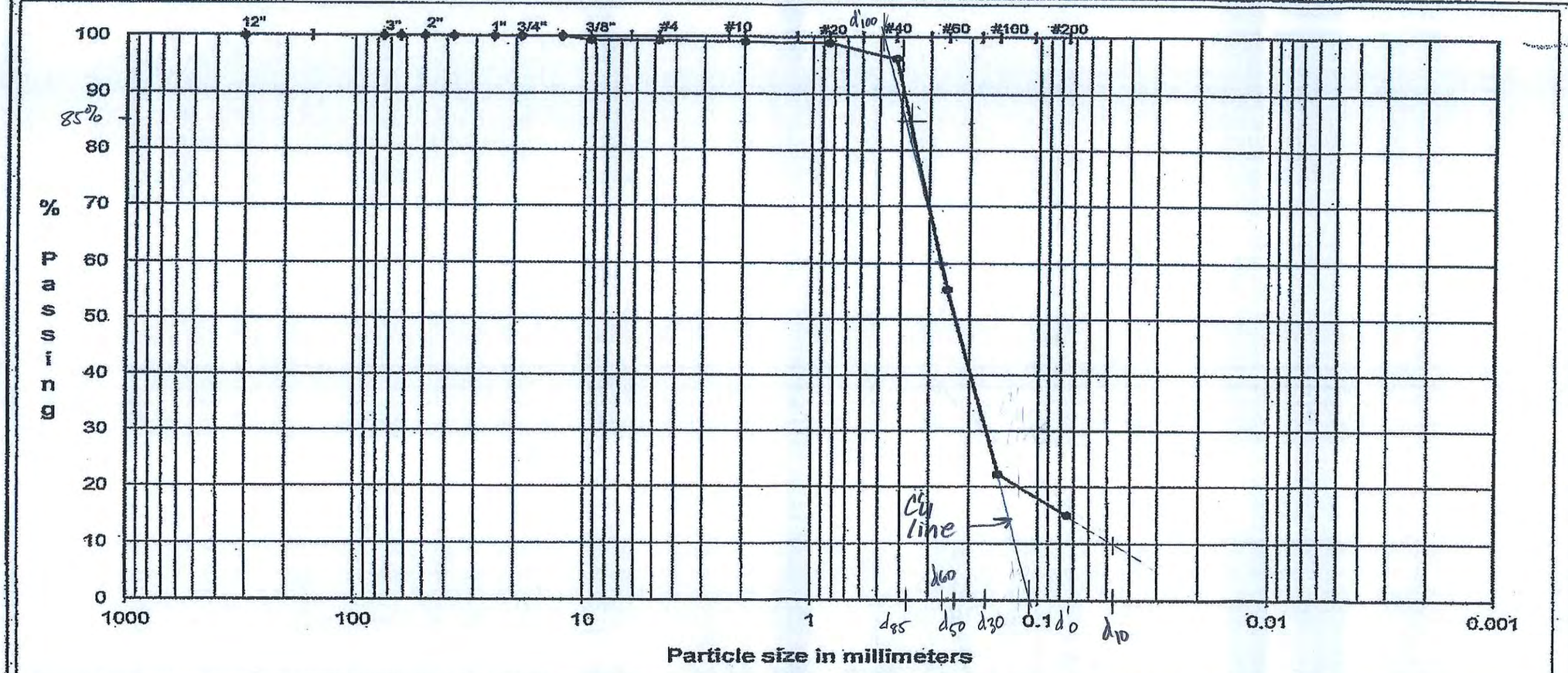
DECEMBER 2013

063-1431-003

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

PROJECT NAME: NWM/CHESAPEAKE TERRACE SFI/MD
SAMPLE ID: PMW-13A Depth: -
TYPE: Bag



COBBLES	GRAVEL: Coarse	GRAVEL: Fine	SAND: Coarse	SAND: Medium	SAND: Fine	FINES: Silt or Clay

$C_c = \frac{(d_{30})^2}{(d_{60})(d_{10})} \simeq 2.6$

$d_{60} \simeq 0.26mm$ $d_{85} \simeq 0.38mm$
$d_{30} \simeq 0.18mm$ $d_{10} \simeq 0.047mm$

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}} = \sqrt{\frac{0.49}{0.12}} = 2.02$

$d'_{100} = 0.49mm$
$d'_0 = 0.12mm$
$d_{50} = 0.24mm$

$C'_u d_{50} = (2.02)(0.24) = 0.48$

$D_{95} < 2 C'_u d_{50}$
$< (2)(2.02)(0.24) = 0.97mm$

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Geotextiles – Soil Retention		
	Job No. 2018-3854	Made by: JCA	Date 07/15/20
	Ref.	Checked by: VEI	Sheet 1 of 2

Reviewed by PGS 09/01/2021

Objective:

The objective of this analysis is evaluate the soil retention of the nonwoven geotextiles chosen for the design against the poorly-graded, sandy soils onsite.

Design Approach and Assumptions:

The greater the size of the void spaces in a geotextile, the greater the flow of liquid that will be allowed through it. However, there is a point where the soil particles on the "upstream" side begin to migrate through the geotextile with the liquid flow. Over time, the loss of soil on the upstream side lead to larger and larger void spaces created on the upstream side until the upstream soil structure begins to collapse. This may result in the formation of localized, isolated settlement features that can continue to enlarge with time.

Excessive soil loss is prevented by the void spaces in the geotextile being small enough to retain the soil particles while still allowing adequate flow. Initially, some fine particles will migrate through the geotextile as the flow regime begins and the soil and geotextile respond accordingly. The relatively large fraction of the soil particles will eventually block the finer particles from migrating through the geotextile. Therefore, it is the larger fraction of soil particles that are targeted in this analysis.

1. Manufacturer's data was used for product data related to this analysis.

2. The soil gradation from PMW-13A (bag sample) was selected for use in this analysis because it qualitatively seems rather typical of the sandy soils at the site. The gradation plot was used to estimate various particle diameters for use in analysis.

3. The coefficients C'_u , and C_c were compared to the soil retention design criteria from Koerner 1998 (after Luettich, *et al*).

Calculations:

1. The proposed nonwoven, needle-punched geotextile has Apparent Opening Size, AOS, values that vary based on the product weight. The AOS is defined as the 0_{95}, the 95% opening size. The three select geotextile weights are as follows:

Geotextile Weight (oz/sy)	0_{95} (mm)
6	0.212
8	0.180
10	0.150
16	0.150

Reviewed by PGS 09/01/2021

From the soil gradation plot, the particle diameter at which 85% of the soil is finer, d_{85}, is 0.38 mm. From Koerner 1998, an acceptable 0_{95} value for a given soil is :

$$0_{95} = AOS < (2 \text{ or } 3)d_{85}$$

in this case, = 0.76mm to 1.14 mm.

2. From Holtz and Kovacs 1981, and Koerner 1998, the coefficients C'_u , and C_c are defined as follows:

$$C'_u = SQRT\ (d'_{100}/d'_0) \qquad \text{and} \qquad C_c = (d_{30})^2 / (d_{60})(d_{10})$$

These calculations indicate the C_c and C'_u values are 2.65 and 2.02, respectively. Using the soil retention criteria from Koerner 1998, a C_c value that favors a retention function is characterized by:

$$1 < C_c < 3.$$

Additionally, a favorable geotextile for soil retention is characterized by:

$$0_{95} < (1 \text{ to } 2)\ C'_u(d'_{50})$$

in this case = 0_{95} < 0.525 mm to 1.051 mm.

Conclusions:

Based on the foregoing, the following conclusions are presented:

1. The nonwoven, needle-punched geotextiles selected for design when compared with poorly-graded, sandy soils selected exhibit acceptable filtration and soil retention properties. However, the use of the on-site soils in any application will be based on a number of factors, not just this analysis.

2. This analysis should be performed for actual soils and actual geotextiles used prior to construction.

References:

1. Koerner, R.M.; *"Designing With Geosynthetics"*; 4th Ed., Prentice-Hall, Inc., 1998; Section 2.2.3.
2. Holtz, R.D., and Kovacs, W.D.; *"An Introduction to Geotechnical Engineering"*; Prentice-Hall, Inc., 1981.
3. Golder Associates Inc.; Site-specific soils testing.; P.N. 063-1431-003; Dec 2013.
4. GSE product data.

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Subject:	Geotextiles - Soil Retention		

Description

Evaluate the proposed geotextiles against the onsite soils and their use.

Soil Retention and Separation

Onsite Soils

d_x = the partical size, d, at which x percent is finer.

d'_{100} =	0.49	mm		
d_{85} =	0.38	mm		
$2d_{85}$ =	0.76	mm		
$3d_{85}$ =	1.14	mm		
d_{60} =	0.26	mm		
d'_{50} =	0.24	mm		
$2d'_{50}$ =	0.48	mm		
d_{30} =	0.18	mm		
$(d_{30})^2$ =	0.0324	mm^2		
d_{10} =	0.047	mm		
d'_0 =	0.12	mm		

Coefficient of Curvature, $C_c = (d_{30})^2 / (d_{60} \times d_{10})$ = 2.65

Coefficient of Uniformity, $C'_u = SQRT((d'_{100} / d'_0)$ = 2.02

$C'_u d'_{50}$ = 0.485

$2C'_u d'_{50}$ = 0.970

Proposed Geotextile(s)

Type = non-woven, needle-punched (NW-NP-GT)

6 oz/sy GT-NW-NP Apparent Opening Size, AOS =	0.212	mm				
Is AOS < $2d_{85}$?	Yes	to $3d_{85}$?	Yes			
Is AOS < $C'_u d_{50}$?	Yes	to $2C'_u d_{50}$?	Yes			
Permitivity, ψ =	1.5	sec^{-1}				
Cross-Plane Water Flow Rate, k_n =	110	gpm/ft^2	=	6.02E-02	cm/sec	
Thickness, $t = k_n / \psi$ =	4.01E-02	cm	=	1.58E-02	in	

8 oz/sy GT-NW-NP Apparent Opening Size, AOS =	0.180	mm				
Is AOS < $2d_{85}$?	Yes	to $3d_{85}$?	Yes			
Is AOS < $C'_u d_{50}$?	Yes	to $2C'_u d_{50}$?	Yes			
Permitivity, ψ =	1.3	sec^{-1}				
Cross-Plane Water Flow Rate, k_n =	95	gpm/ft^2	=	5.20E-02	cm/sec	
Thickness, $t = k_n / \psi$ =	4.00E-02	cm	=	1.57E-02	in	

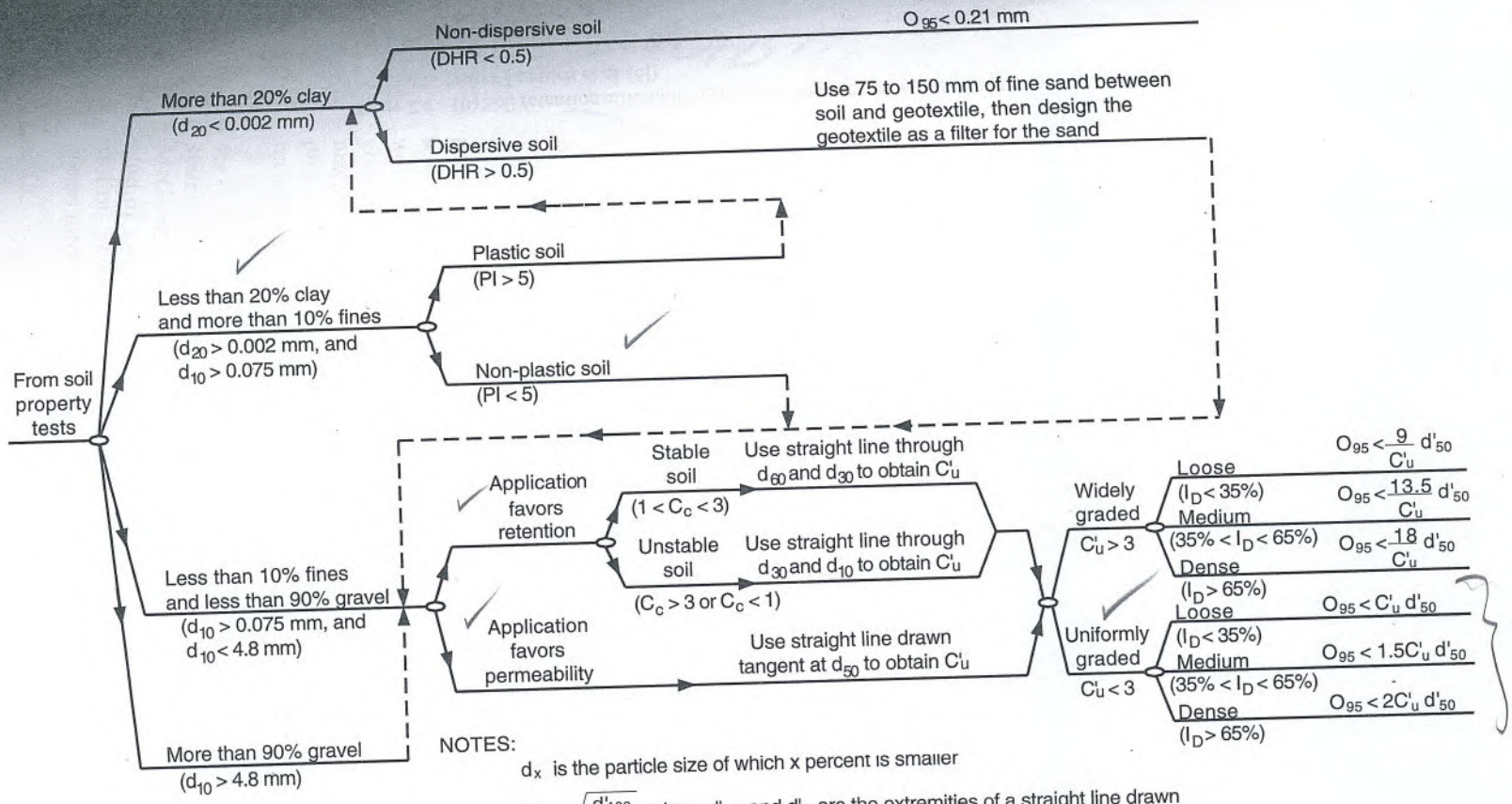
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Project:			
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By:	JCA	**Date:**	15-Jul-20
Checked:	VEF	**Date:**	7/15/20
Subject:	Geotextiles - Soil Retention		

10 oz/sy GT-NW-NP Apparent Opening Size, AOS =	0.150	*mm*				
Is AOS < $2d_{85}$?	**Yes**	*to $3d_{85}$?*	**Yes**			
Is AOS < $C'_u d_{50}$?	**Yes**	*to $2C'_u d_{50}$?*	**Yes**			
Permitivity, ψ =	1	sec^{-1}				
Cross-Plane Water Flow Rate, k_n =	75	gpm/ft^2	=	4.10E-02	cm/sec	
Thickness, $t = k_n / \psi$ =	4.10E-02	cm	=	1.62E-02	in	

References

1 *Koerner, R.M.; "Designing With Geosynthetics"; 4th Ed., Prentice-Hall, Inc 1998; Section 2.2.3.*
2 *Holtz, R.D., and Kovacs, W.D.; "An Introduction to Geotechnical Engineering"; Prentice-Hall, Inc., 1981.*
3 *Site-specific soils testing; Golder Associates Inc.; P.N. 063-1431-003; Dec 2013.*
4 *GSE product data.*



NOTES:

d_x is the particle size of which x percent is smaller

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}}$ where d'_{100} and d'_0 are the extremities of a straight line drawn through the particle-size distribution, as directed above; and d'_{50} is the midpoint of this line.

$C_c = \frac{(d_{30})^2}{d_{60} \times d_{10}}$

I_D = relative density of the soil
PI = plasticity index of the soil
DHR = double-hydrometer ratio of the soil

Figure 2.4 (a) Soil retention criteria for geotextile filter design using steady-state flow conditions. (After Luettich et al. [6])

Koerner 1998

REFERENCE 1 P&I

REFERENCE 3
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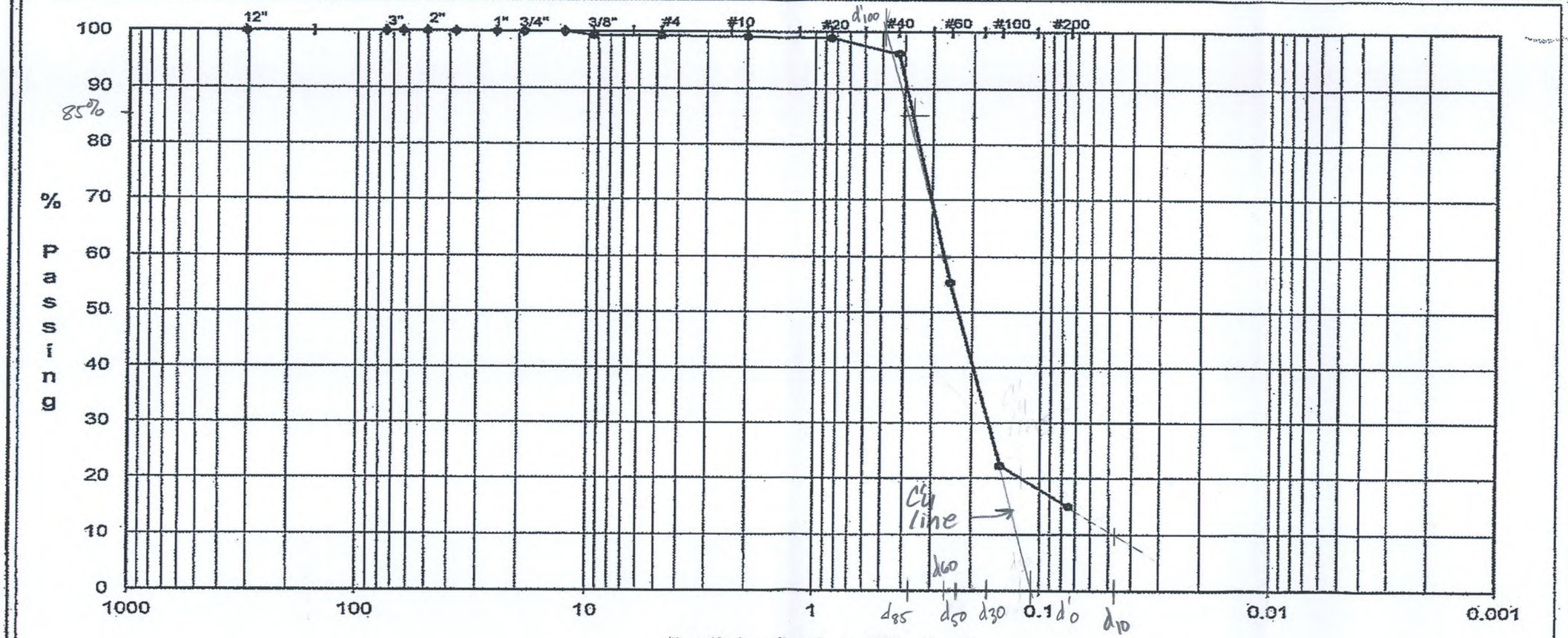
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063-1431-003

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

PROJECT NAME: NWM/CHESAPEAKE TERRACE SFI/MD
SAMPLE ID: PMW-13A Depth: -
TYPE: Bag



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

$C_c = \frac{(d_{30})^2}{(d_{60})(d_{10})} \simeq 2.6$

$d_{60} \simeq 0.26mm$ $d_{85} = 0.38mm$
$d_{30} \simeq 0.18mm$ $d_{10} \simeq 0.047mm$

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}} = \sqrt{\frac{0.49}{0.12}} = 2.02$

$d'_{100} = 0.49mm$
$d'_0 = 0.12mm \sim$
$d_{50} = 0.24mm$

$C'_u d_{50} = (2.02)(0.24) = 0.48$

$D_{95} < 2 C'_u d_{50}$
$< (2)(2.02)(0.24) = 0.97mm$

REFERENCE 4 pg 1/1

PRODUCT DATA SHEET

GSE Nonwoven Geotextiles

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[*]

AT THE CORE:
A family of geotextiles used for separation, filtration, protection and drainage applications.

Product Specifications

These product specifications meet GRI GT12, GRI GT13 and AASHTO M288

Tested Property[1]	Test Method	Frequency	Minimum Average Roll Value					
			NW4	NW6	NW8	NW10	NW12	NW16
AASHTO M288 Class			3	2	1	>1	>>1	>>>1
Mass per Unit Area, oz/yd²	ASTM D 5261	90,000 ft²	4	6	8	10	12	16
Grab Tensile Strength, lb	ASTM D 4632	90,000 ft²	120	170	220	270	320	390
Grab Elongation, %	ASTM D 4632	90,000 ft²	50	50	50	50	50	50
CBR Puncture Strength, lb	ASTM D 6241	540,000 ft²	303	435	575	725	925	1,125
Trapezoidal Tear Strength, lb	ASTM D 4533	90,000 ft²	50	70	95	105	125	155
Apparent Opening Size, Sieve No. (mm)	ASTM D 4751	540,000 ft²	70 (0.212)	70 (0.212)	80 (0.180)	100 (0.150)	100 (0.150)	100 (0.150)
Permittivity, sec⁻¹	ASTM D 4491	540,000 ft²	1.8	1.5	1.3	1.0	0.8	0.7
Water Flow Rate, gpm/ft²	ASTM D 4491	540,000 ft²	135	110	95	75	60	50
UV Resistance % retained after 500 hours	ASTM D 4355	per formulation		70	70	70	70	70
TYPICAL ROLL DIMENSIONS								
Roll Length[2], ft			300	300	300	300	300	300
Roll Width[2], ft			15	15	15	15	15	15
Roll Area, ft² Roll Area (yd²)			4500 500	4500 500	4500 500	4500 500	4500 500	4500 500

NOTES:
- [1]The property values listed are in weaker principal direction. All values listed are Minimum Average Roll Values except apparent opening size in mm and UV resistance. Apparent opening size (mm) is a Maximum Average Roll Value. UV is a typical value.
- [2]Roll lengths and widths have a tolerance of ±1%.

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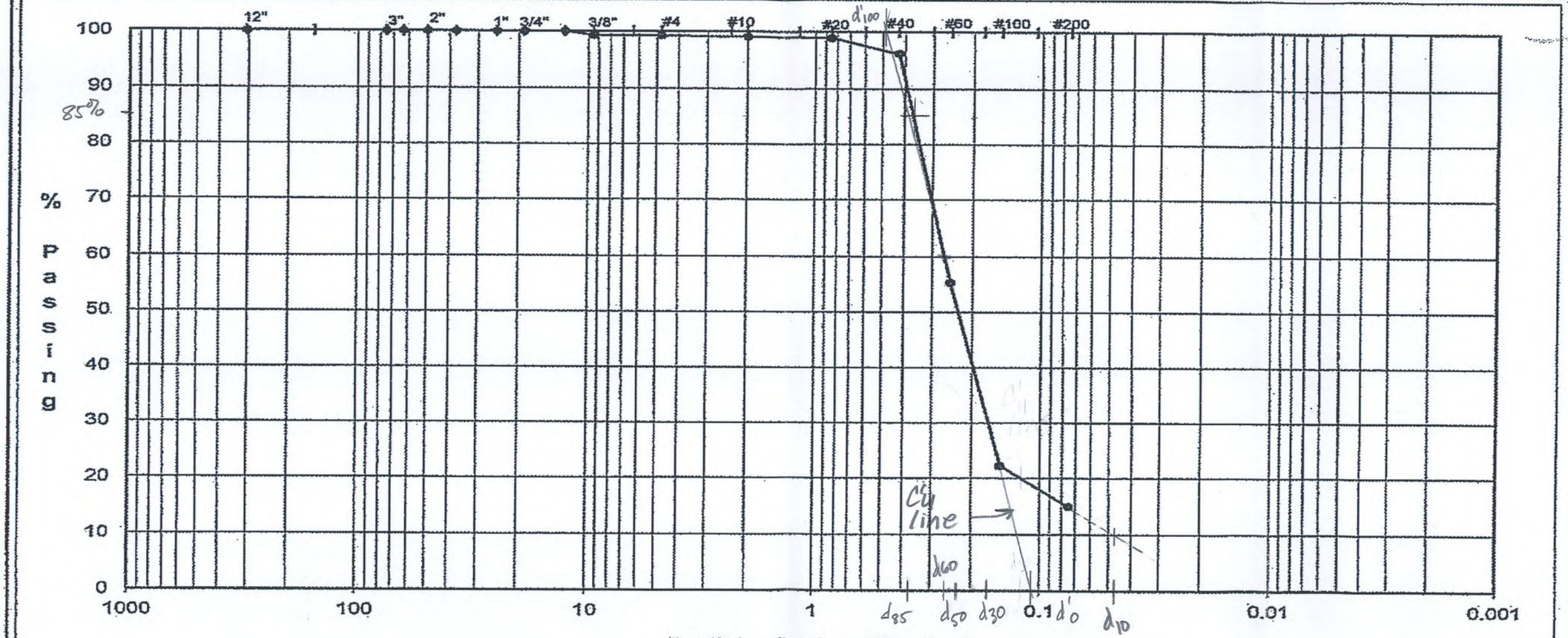
DECEMBER 2013

063-1431-003

PARTICLE SIZE DISTRIBUTION & ATTERBERG LIMITS

ASTM D6913, D4318

PROJECT NAME: NWM/CHESAPEAKE TERRACE SFI/MD
SAMPLE ID: PMW-13A Depth: -
TYPE: Bag



COBBLES	GRAVEL		SAND			FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt or Clay

$C_c = \frac{(d_{30})^2}{(d_{60})(d_{10})} \simeq 2.6$

$d_{60} \simeq 0.26mm$ $d_{85} = 0.38mm$
$d_{30} \simeq 0.18mm$ $d_{10} \simeq 0.047mm$

$C'_u = \sqrt{\frac{d'_{100}}{d'_0}} = \sqrt{\frac{0.49}{0.12}} = 2.02$

$d'_{100} = 0.49mm$
$d'_0 = 0.12mm \sim$
$d_{50} = 0.24mm$

$C'_u d_{50} = (2.02)(0.24) = 0.48$

$D_{95} < 2 C'_u d_{50}$
$< (2)(2.02)(0.24) = 0.97mm$

SECTION 10

LEACHATE MANAGEMENT SYSTEM

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LIST OF ATTACHMENTS

Attachments

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10E - Peak Daily Flows from Each Cell
10F - Leachate Pump Sizing Calculations
10G - Leachate Generation over Landfill Life
10H - Leachate Storage Facility Secondary Containment
10I - Force Main Sizing Calculations
10J - Environmental Recovery Corp. Leachate Disposal Letter

10.0 LEACHATE MANAGEMENT SYSTEM

COMAR Section 26.04.07.16 (C)(2) requires a liner system to be "designed, constructed, and installed to contain and facilitate the collection of leachate generated in the landfill in order to prevent the migration of pollutants out of the landfill to the adjacent subsurface soils, ground water, or surface water."

10.1 Introduction

There are 21 rubble landfill cells/subcells, each with a leachate collection system.

The Proposed Liner System for the Chesapeake Terrace Rubble Landfill includes the following, from top to bottom:

- Four feet of Select Waste
- 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator if breached;
- Two feet of leachate collection layer, comprised of locally mined sandy soils;
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides;
- 60 mil HDPE Geomembrane; and,
- Prepared subbase with a minimum thickness of 2 feet and having a permeability less than or equal to 1.0×10^{-5} cm/sec.

Leachate percolation through rubble waste headers and laterals along the cell floor, graded at minimum three percent (3%) slope and two percent (2%) slopes, respectively, at the time of construction, to a sump with a submersible pump contained in a 24-inch diameter HDPE carrier, or sideslope riser, pipe.

Leachate is pumped from each cell sump through a pump house to one of five force main, discharging to one of two leachate storage facilities. Each leachate storage facility has two 500,000-gallon leachate storage tanks, i.e., 1,000,000-gallon storage capacity per facility.

The following list indicates Drawings associated with Leachate Collection System Grading and installation of Leachate Pumps, Force Mains, and Storage Tanks.

- Drawing 17 – Top of Leachate Collection System Grading Plan and Layout - West Section
- Drawing 18 – Top of Leachate Collection System Grading Plan and Layout - East Section
- Drawings 19-21 – Leachate Collection System Details
- Drawings 22-23 – Leachate Force Main Details
- Drawings 24-25 – Leachate Force Main Profiles
- Drawing 26 – Leachate Pump House Details
- Drawing 27 – Leachate (Pump) Control Panels Layout Main Details
- Drawings 28 – 29 –Leachate Storage Tank Details

10.2 Leachate Production Estimates

The computer program, Hydrologic Evaluation of Landfill Performance (HELP) version 3.07 was used to estimate the amount of leachate percolation through rubble waste onto the cell leachate collection system (see Section 10.3).

To determine the most efficient manner to provide leachate management for the facility over the life of landfill construction and operation, HELP analyses were performed for a range of filling conditions (i.e., first lift, mid-lift, full-height, etc.) to understand the peak daily leachate generation rates. These conditions were evaluated for a range of cell floor slope conditions, for a unit area of 1-acre, so it would be easy to extrapolate leachate generation rates for each cell, based on cell area. Peak Daily Leachate Generations rates were used to size leachate collection system headers and laterals (in the cells), leachate sump pumps, and leachate force mains.

The peak daily leachate generation was used for varying fill conditions to construct a timeline of filling and new cells coming online with other cells were being closed. Using this sophisticated timeline, the peak daily leachate was determined and used for sizing the leachate storage tanks.

HELP Analysis Methodology is described further in Section 10.7. Summary of Analyses for Leachate Generation is in Section 10.9.

10.3 Leachate Collection System COMAR Regulations

The rubble landfill leachate collection system design is based on adherence to the following COMAR requirements:

- 26.04.07.16C (3): Liner system components, comprised of layers of construction materials and thicknesses in conformance with this regulation, are specified on Drawing 14.
- 26.04.07.16C (6)(a): In accordance with this regulation, there is minimum 3-foot vertical buffer distance (after landfill settlement) between the highest anticipated groundwater elevation (as defined in the Phase II Report) and the bottom of each cell sump's prepared subbase components (see Section 4.0 herein).
- 26.04.07.16C (3)(e): Three percent (3%) minimum cell floor slope at the time of construction is provided in all cells, as shown on Drawings 10 and 11, to meet the regulatory-required two percent (2%) slope after differential settlement.
- 26.04.07.16 C (7)(d): Less than 30 centimeters (1 foot) of leachate head on the liner required by this regulation is achieved by utilization of HELP Analysis Methodology in Section 10.7. Results of all HELP Analyses (see Section 10.9 and Attachment 10A) indicate less than 1-foot head on the liner is achieved with the Alternate Liner System specified.

10.4 Leachate Pumps

Submersible pumps and accessories will be manufactured by EPG Companies. Existing electrical power supply for pump operation is located near the site in Patuxent Road and Conway Road rights-of-way.

Pump sizes were selected based upon the peak daily leachate production under “first lift” conditions. As shown on the "Cell Pump List" on Drawing 27 and in Section 10.9.3, one pump in each cell sump is sufficient to remove leachate under the peak daily generation scenario, described further in Section 10.9. A spare pump will be provided during construction of each cell for storage in the associated Leachate Pump House for immediate installation when the installed pump needs annual servicing or malfunctions.

10.4.1 Pump Level Sensors and Alarm Systems

A level sensor for each submersible pump will be provided in all cell sumps. Leachate levels will be monitored in the pump control panel, mounted on the Pump House wall (see Drawing 26). Level sensor pump-off position will be 6 inches above the sump floor. Pump-on position will be 12 inches above sump floor, and pump high-level alarm will be 16-inches above the sump floor, per COMAR Regulations (See detail on Drawing 19). See Drawing 19 for materials to be placed in cell sumps, and depiction of pump control positions.

Equipment in the Pump Control Panel, provided by the Pump Manufacturer, will monitor and record leachate levels in the landfill cells. In the event of high-level alarm occurrence, a light at the Pump Control Panel will be activated. During landfill operating hours, the alarm signal will be electronically transmitted to the Scale House. During landfill non-operation hours, the landfill manager and Superintendent will receive a high-level alarm signal, via electronic telemetry from the Pump Control Panel. If a caretaker is not provided, a designated landfill employee will receive the high-level alarm signal offsite, via telemetry.

A Master Control Panel will be located in the Leachate Storage Facility Controls Building (located as shown on Drawing 10). This Master Control Panel will include a display for each Cell pump as well as each Leachate Storage Tank. The controls for cells sump pumps and the storage tanks will be interconnected so that high liquid levels in the tanks will trigger an alarm and notification to the landfill manager, care taker, or landfill employees and shut-off the cell sump pumps.

See Section 12, "Operations Plan" for actions taken by landfill personnel as response to pump high-level alarm activation.

10.4.2 Pump Access and Maintenance

Access to the pumps within 24-inch HDPE sideslope riser pipes is provided by means of stainless steel pulling cables as shown on Drawing 19. The Landfill Perimeter Berm and Pump House are designed to provide equipment access, as necessary to install and remove pumps. As shown on Drawing 26, an 8 ft wide doorway, preferably an industrial roll-up overhead door, allows access to both pump carrier pipes.

The Landfill Perimeter Berm top width is designed to allow access for Pump Installation and Removal Equipment (i.e., equipment mounted with boom and winch, with steel cable for attachment to the pumps stainless steel pulling cable). Pump Installation and Removal Equipment access across the perimeter channels to the top of the Landfill Perimeter Berm will be provided by installation of a precast concrete or steel ramp. The details for the precast ramps are provided on Drawings 19, 23, and 40.

Upon receipt of an order for a pump, the Pump Manufacturer will provide a Pump Operations and Maintenance (O&M) Manual, prepared based on site specific application. The Pump O&M Manual is included with delivery of each pump to a specified site. A listing of a typical EPG Companies, Inc. Pump O&M Manual along with other Pump Manufacturer's Literature is provided in Section 10.4.3 below.

10.4.3 Pump Manufacturer's Accessories

In addition to pumps and alarm system described above, the Pump Manufacturer will provide accessories and appurtenances that will be used for the landfill's leachate pump and conveyance systems. Pump Manufacturer's Literature typically includes:

- Information regarding the pump itself (including pump curves for site specific pumps); stainless steel check valves on pump discharge lines in the Pump House and leak detection sensor on the Pump House floor; Pump Control Panels; Level Sensor and Monitoring Equipment; Flow Metering and Control Devices; SCADA (Supervisory Control and Data Acquisition) and Telemetry Equipment.
- Pump description, illustrations, capacities, materials of construction; suitability for Class 1, Division 1 & 2 application; and Engineer's Specification Sheet for pump order;
- Pump curve for pump(s) in each cell sump, with system TDH/GPM line intersects indicative of the specified pump's capacity;
- Pump Control Panel description, illustrations, and Series L950PT Engineers Specification;
- Level meter, level sensor, bellows, LMSA level monitoring system, tank gauging system and sensor data sheets;
- Alarm system data acquisition, SCADA and telemetry;
- Flow metering and control devices;
- Miscellaneous accessories (stainless steel check valves and leak detection sensor); and,

- EPG Companies, Inc. provides a Pump O&M Manual for each pump delivered to a site, based on the pump's site-specific requirements.

10.5 Leachate Force Mains and Sideslope Riser Pipes

All pipes associated with landfill cell construction (excluding stainless steel pipes at select locations) will be High Density Polyethylene (HDPE), manufactured by Performance Pipe, or approved equal.

The Sideslope Riser Pipe has among the lowest loading for the piping at the site, due the Sideslope Riser being located along the outer edges of the landfill. The Sideslope Riser with the highest load is in Cell 7, with a sump elevation of 102 ft MSL and a top of closure cap grade immediately above the sump of approximately 208 ft MSL, for a net load of 106 feet (8 feet of soils and 98 feet of rubble waste). Previous calculations conducted by the local Performance Pipe Distributor, Lee Supply Company, Inc., for loading of the 24-inch perforated Sideslope Riser pipe show adequate strength and performance for a maximum burial depth of 138 feet (15 feet of soil and 123 feet of rubble waste). This calculations are repeated in Attachment 10I.

The force main has been specifically designed to have a minimum depth of 3.5 feet in the side of the perimeter (access) road. This depth was selected to provide adequate protection for the HS20 loading of the waste trucks as well as frost depth.

10.6 Leachate Storage Tanks

As shown on Drawings 28 and 29, leachate from the entire landfill is conveyed to two leachate storage facilities, each with two 500,000-gallon storage tanks inside a secondary containment area. Each secondary containment area is comprised of concrete floor and walls, designed for 500,000 gallons containment capacity, with 1-foot freeboard to top of berm, as shown on Drawing 28. To prevent storage tank overflow, Pump Manufacturer will provide tank-gauging systems, under which an alarm would be activated and all leachate pumps, pumping to a tank filled to near capacity, would automatically shut down, per description under Section 10.4.1.

Storage tanks will be 45-foot diameter, glass coated, bolted steel Aquastore Tanks, manufactured by Engineered Storage Products, Inc. Specifications of these tanks are provide in Section 14, Technical Specification Section 02653.

10.7 Leachate Production - HELP Analysis Methodology

The HELP computer program models climatologic, soil, and design data and utilizes a solution technique that accounts for infiltration, percolation, evapotranspiration, soil moisture storage, and lateral drainage over a specified time period. A 1-year time period was used for a variety of filling active conditions, per unit area of cell. This allowed apply the leachate generation rates per acre of cell to all cells by simply multiplying the leachate generation rates by the area of each cell.

The program uses climatologic, soil, and landfill design data to produce daily estimates of water moving across, into, through, and out of landfills. To accomplish this, daily precipitation is partitioned to maintain a water budget. The following describes the data fields in detail:

- Climatologic Data - Climatologic data includes daily precipitation, mean monthly temperatures, mean monthly insolation, leaf area indices, vegetative cover, and winter cover factors. These values may be entered manually or default climatologic data for 102 cities is available in the HELP program. Based on nearest proximity to the landfill, default rainfall for Baltimore, Maryland was used, with average rainfall and average precipitation modified to reflect average values for Anne Arundel County, Maryland, from the National Oceanic and Atmospheric Administration (NOAA).
- Soil Data - Soil data includes material types used in the landfill and the characteristics of the material, i.e. vertical percolation, lateral drainage, barrier soils, or geomembrane liners. Material properties such as thickness, porosity, field moisture capacity, wilting point, initial material water content, and effective saturated hydraulic conductivity are used in the evaluation. Geosynthetic properties and installation construction such as pinhole density, installation defects, and placement quality are considered. HELP 3 provides default values for the properties of 42 material types. The user may edit these values.
- Design Data - Design data includes information that models the layout of the landfill such as total surface area, material layer thickness, and drainage slope and length. Other data such as surface runoff curve number, membrane leakage fraction, and potential runoff fraction may be requested by the program for certain materials.

Once the input is entered, the HELP program is used to evaluate the landfill design for the specified one-year time period for active landfilling conditions. The model runs simulations for 30-years for the closed conditions. However, after seven years of closed condition, the model shows a leachate generation of zero.

HELP performs water budget calculations by modeling each of the hydrologic processes that occur and outputs information used to design components associated with the landfill's leachate collection, conveyance and storage.

10.8 Analyses for Post-Closure and Peak Daily Leachate Production

The landfill will be constructed and filled with rubble waste in accordance with conditions specified on Drawing 63, "Sequence and General Notes for Construction" and Intermediate Construction Stage Plans on Drawings 64 through 81. As shown on Intermediate Construction Stage Plans, surface runoff in areas adjacent to a cell under construction will be diverted around the cell, during cell construction and as the cell is filled with rubble waste. Therefore, leachate production for the entire landfill will primarily be limited to precipitation that falls directly within the cell as waste is being placed, during the life of landfill construction and operation.

To determine the most efficient manner to provide leachate management over the life of landfill construction and operation, the following HELP analyses were performed:

- Analysis #1 – Active Landfilling, covering a range of waste thickness from "first lift" through "17 Lifts" to determine the peak daily rate of leachate production under each scenario and floor slope condition. The maximum per acre "first lift" leachate production rate was used for sizing the cell pumps and the leachate collection layer header pipes in the cells.
- Analysis #2 – Closed condition for various list conditions (impacts duration and length of leachate being released from cell due to moisture storage in the waste). This scenario in tandem with the peak daily rates developed under Analysis #1, were used with the cell sequencing and landfill timeline to determine the peak leachate generation when multiple cells were undergoing various stages of filling and closure.

10.9 Develop Leachate Generation Rates

The Liner System Configuration and input data in summarized in the Table 1, below.

Table 1 - Summary of Liner System Soil and Material Data		
Layer	**Description**	**HELP Default Soil**
1	12 inches intermediate cover cover	6
2	96 inches of waste	19
3	48 inches of Select Waste	19
4	24 inches of gravel/course sand	6
5	Tri-planar GDL	34 (modified k = 4.4 cm/sec)
6	60 mil HDPE geomembrane	35
8	36 inches natural soils	5

The Closure Cap (Final Cover) System configuration and input data is summarized in Table 2 below:

Table 2 - Summary of Closure Cap System Soil and Material Data		
Layer	Description	HELP Default Soil
1	6 inches of vegetative support layer	9
2	18 inches of protective cover	6 (modified k = 1x10-5 cm/sec)
3	GDL	34 (modified k = 12.8 cm/sec)
4	40 mil LLDPE geomembrane	36
5	24 inches Final cover	6

The waste properties were assumed to be consistent with municipal solid waste with channeling. Channeling is expected to occur in the rubble waste. No runoff was allowed under active landfilling conditions, forcing all rainfall to be treated as leachate.

The per acre peak daily generation rates developed under Analysis #1 (which indicate less than 1-foot head on the landfill's textured 60-mil HDPE liner, for each HELP3 Run) are included in the table below.

Table 3 - Summary of Peak Daily Leachate Generation (cf/acre/day)						
Total Waste Thickness	**Leachate Collection System Drainage Slope (%)**					
(ft)	***2***	***3***	***4***	***5***	***6***	***33***
First Lift						
8	1100	1224	1300	1300	1214	1655
Mid-Fill						
20	788	793	802	785	836	1001
32	839	832	1011	837	854	1001
52	883	924	838	864	841	1001
68	885	921	832	843	842	1001
Full-Fill						
40	1031	1070	1028	1028	1096	977
64	963	978	975	980	944	1031
104	1058	1062	1113	1110	933	1024
136	1012	1022	1030	1027	985	993

Based on the summary table above, the peak leachate generation rates for the flatter sloped cells floors was 1300 cf/acre/day (9,724 gal/ac/day) and 1655 cf/acre/day (12,380 gal/ac/day) for the steeper cell sideslopes. The area in each cell with the shallow slope and the steep slope were multiplied by their corresponding peak leachate generation rate, then added to get the peak daily leachate for the cell. The detailed analyses, with supporting HELP model printouts, are provided in Attachment 10A.

The calculated peak daily flow for each cell, under first lift conditions is as follows:

Table 4 - Summary of Peak Daily Leachate Generation for each Cell				
Cell	**Area of Floor (acre)**	**Area of Slope (acre)**	**Peak Daily Leachate (gal/day)**	**Peak Daily Leachate (gal/min)**
1	11.7	1.5	132,340	91.9
2	5.4	2.1	78,506	54.5
3	4.2	0.7	49,506	34.4
4	4.9	0.6	55,075	38.2
5A	4.7	0.9	56,844	39.5
5B	2.9	0.5	34,389	23.9
5C	3.6	.8	45,405	31.5
5D	1.9	1.0	30,855	21.4
5E	2.3	0.9	33,507	23.3
5F	1.0	0.7	28,340	12.8
6	2.0	3.2	58,788	40.8
7	2.2	4.5	76,826	53.4
8	4.6	1.4	62,327	43.3
9	2.7	1.3	42,348	29.4
10	7.5	2.1	98,193	68.2
11	3.9	3.1	76,963	53.4
12	5.7	1.0	67,806	47.1
13	2.6	0.8	35,186	24.4
14	4.0	0.3	42,609	29.6
15	2.8	1.9	50,748	35.2
16	2.1	2.4	50,131	34.8

Detailed summary and the HELP model output is included in Attachment 10A. Calculations showing the peak flow from each cell are presented in Attachment 10E.

10.9.1 Leachate Lateral Spacing

The initial analysis was to determine the spacing the leachate collection laterals in the leachate collection layers. While the high-flow geocomposite drainage layer (GDL) will quickly convey the leachate which gets to it, a key to landfill design is redundancy. Thus, NWM proposes including a series of perforated leachate collection piping in the 2-foot thick layer of sandy soils immediately atop of the GDL. The header pipe will convey flow from the laterals to the sump. Headers and laterals will be perforated and installed in a stone bedding, then wrapped by a 16 oz/s.y. nonwoven geotextile to maintain layer separation with the surrounding soils and provide additional protection of the underlying geosynthetics from puncture due to possible angularity of the stone bedding.

Based upon a series of HELP model runs, the spacing which maintained a head of less than 12-inches is 250 feet.

10.9.2 Leachate Collection Header and Lateral Sizing

As indicated previously, leachate collection headers and laterals are being include in the leachate collection system design. The pipes will convey any flow they intercept by gravity

to the leachate sump in each cell. Based on the peak flow in Cell 1 (the largest cell), the pipe sizes and pipe perforation sizing was confirmed to have adequate capacity of the anticipated flow. The configuration of each system is as follows:

- Leachate collection system header is 8" diameter HDPE pipe
- Leachate collection system lateral is 6" diameter HDPE pipe
- Perforations are 3/8" dia holes, two per row, a row every 6-inches, each row is rotated 90-degrees

Attachment 10C includes these calculations.

10.9.3 Leachate Pumps

Pump sizing is dependent upon two features: required flow rate and head loss to overcome. The required flows for each cell were assumed to be the same as the peak daily flows computed and included in Table 4, above. While the pumps are sized to accommodate this peak daily flow rate, the pump will not be in continuous operation. As indicated elsewhere, the pump will be equipped with transducers, or floats, to monitor leachate levels as it accumulates, so the pump can engage at a pre-determined level and pump down the leachate until the liquid level drops to a pre-set level (usually 6 to 9 inches above the pump intake to avoid burning-out the pump). Then, leachate will be allowed to build again. During drier periods (less rainfall) or after more waste is within the cell, the leachate flow rates will be less and the pump will operate less often.

For landfill application, the elevation difference between the intake and the discharge location is often the biggest driver of the head loss to be overcome. To determine the headloss, the elevation of the sump and the elevation of the discharge at the leachate storage tanks was the static head. The dynamic head is the friction loss associated with the force main pipe. Since smooth-walled HDPE is proposed for the force main, the friction loss is negligible, but actually tabulated using Hazen-Williams equation.

In the end, four pump models were specified for the 21 cells at the site, as summarized in Table 5 and presented in Attachment 10F.

Table 5 - Summary of Sump Pump Sizing for each Cell

Cell or Sub-cell	Peak Leachate Generation (gpm)	Total Head (feet)	Selected Pump
1	91.9	105.9	Model 18-4 HP 5.0
2	54.5	47.2	Model 18-2 HP 3.0
3	34.4	35.2	Model 18-1 HP 1.5
4	38.2	32.8	Model 18-1 HP 1.5
5A	39.5	92.4	Model 18-2 HP 3.0
5B	23.9	88.7	Model 18-2 HP 3.0
5C	31.5	87.4	Model 18-2 HP 3.0

Table 5 - Summary of Sump Pump Sizing for each Cell (continued)			
Cell or Sub-cell	**Peak Leachate Generation (gpm)**	**Total Head (feet)**	**Selected Pump**
5D	21.4	85.7	Model 18-2 HP 3.0
5E	23.3	85.8	Model 18-2 HP 3.0
5F	12.8	87.2	Model 18-3 HP 5.0
6	40.8	98.3	Model 18-3 HP 5.0
7	53.4	105.1	Model 18-3 HP 5.0
8	43.3	99.1	Model 18-3 HP 5.0
9	29.4	95.9	Model 18-2 HP 3.0
10	68.2	104.8	Model 18-3 HP 5.0
11	53.4	62.2	Model 18-2 HP 3.0
12	47.1	61.8	Model 18-2 HP 3.0
13	24.4	58.2	Model 18-1 HP 1.5
14	29.6	56.3	Model 18-1 HP 1.5
15	35.2	53.5	Model 18-2 HP 3.0
16	34.8	55.2	Model 18-1 HP 1.5

*Pumps are made by EPG Companies.

It is possible the manufacturer may adjust the capabilities of these pump models over the life of the landfill construction and operation. As such, cells constructed later in the landfill operation timeline may have to order different pumps, due to manufacturer changes.

10.9.4 Leachate Force Main Sizing

Based on the same data use for leachate sump pump for each cell, the force main sizing can be checked. A previous effort to confirm the force main sizing was done by providing the force main data to the Pipe Manufacturer who performed calculations that indicate all force mains will be 6-inch SDR- 11 HDPE, contained in 10-inch SDR-17 HDPE, on Drawing 22. Pipe Manufacturer's previous force main calculations are in Attachment 10I. While the peak flows and heads have changed since the pipe manufacturer's calculations, the analysis assumed that all cells discharging through the same force main were pumping the peak flows at the same time, which will not be happening. This is considered a very conservative design and demonstrates the force is more than ample. At the same time, the head loss associated with these flows in a smaller diameter pipe, like a 2-inch force main, are no longer negligible because it would be putting too much flow through the pipe.

10.10 Summary of Leachate Storage Tank Sizing

The landfill will have two Leachate Storage Facilities as shown on Drawings 10 and 11, with details shown on Drawings 28 and 29. Facility No. 1 (for Cells 2 through 4 and 11 through 16) has a drainage area of 48.5 acres. Facility No. 2 (for Cells 1 and 5A through 10) has a drainage area of 65.9 acres.

Sections 10.10.1 and 10.10.2 describe the analysis of the peak flows for the leachate tanks.

10.10.1 HELP Analysis

Using the same simulations from which the peak daily rates were obtained described in 10.9 above, estimates were developed for the entire 12 year operational timeline. In general, multiple cells will be in operation each year – one nearing maximum filling grades, one actively filling, and one just beginning to fill. Due to the variety of cell size, some cells may be developed and operated at the same time as a larger cell. The benefit of the smaller cell size is reduction in leachate management.

Based on the construction sequencing for the landfill cells, there may be cells in operation for less than one year and others in operation for two years.

The following is a description of how the leachate timeline was developed.

1. Since the life of each cell is relatively short – most a few months, some for two (2) years – planning for cell construction will require that multiple cells be "grouped together".
2. From the HELP modeling, each cell has peak daily flows for the first lift, mid-fill, and full-fill. The mid-fill and full-fill were estimated to be average heights for each cell for timeline design and modeling purposes.
3. From the cell life estimates, each cell has an estimated life, and collectively they provide twelve (12) years of landfilling. For each cell, mid-fill is associated with mid-life, and full-fill is associated with maximum waste grades. Since each cell has a different life, each cell group has a different total life.
4. The first cell is brought into service, and experiences the "first lift" daily peak flow.
5. At mid-life in the first cell, the first cell experiences the "mid-life" peak daily flow. At the same time, the second cell in the group is brought into service, and experiences its "first lift" peak daily flow.
6. At the mid-life of the second cell, it experiences its mid-life peak daily flow. At the same time, the third cell is brought into service with its "first lift" peak daily flow.
7. At mid-life, the third cell experiences its "mid-fill" peak daily flow.
8. All of the cells in the group are presumed to experience their respective full-fill peak daily flows at the end of the total life for the group.
9. Between any of the calculated peak daily flows, between first lift and mid-fill flows, and between mid-fill and full-fill flows, flow values were linearly interpolated.
10. A closure construction period of 10 months was assumed. Between the calculated flows for full-fill and post-closure year 1, peak daily flows for each month were interpolated.
11. Flows during post-closure months between calculated values were interpolated.
12. This arrangement continued for each cell, each group, and through a minimum of 10 years after the last cell is closed. The HELP model output shows that leachate continues

For example, refer to the tables in Attachment 10G, and consider the following:

Step 1: The first cell group includes Cells 11, 16, and 12, in that order.

Step 4: Cell 11 is brought into service, and it has an estimated life of 8 months. In Month 1, the flow is the first lift peak daily flow.

Step 5: At Month 4, the flow from Cell 11 is the mid-fill peak daily flow. Cell 16 is brought into service with its first lift peak daily flow. Cell 16 has an estimated life of 5 months.

Step 6: At month 6, the flow from Cell 11 continues. The flow from Cell 16 is at its mid-fill peak daily flow. Cell 12 is brought into service with its first lift peak daily flow. Cell 12 has an estimated life of 5 months.

Step 7: At month 8, the flows from Cells 11 and 16 continue. The flow from Cell 12 is its mid-fill peak daily flow.

Step 8: In month 18, all three cells experience their respective full-fill peak daily flows. Cell 13 is brought into service with its first lift peak daily flow. Cell 13 is the first cell planned in the next group of cells to be constructed.

Step 10: During the subsequent 10 months after Cells 11, 16, and 12 have been completely filled, closure construction takes place. Leachate flow from these three cells continue. Filling occurs in the next group of cells with their leachate flows.

Step 11: Once closure of Cells 11, 16, and 12 is complete, the leachate flow begins to taper off. By post-closure year 7, modeling indicates flow will have ceased. Concurrently, filling and leachate flow continues from the next group of cells.

During the timeline, peak daily flows each month are summed to estimate the total peak daily leachate flow from the facility. At some point, the facility will experience a maximum total flow – a combination of peak daily flows from cells under different fill conditions, including cells that are being closed, and cells that are actively being filled.

Leachate Storage Facility No. 1 will serve Cells 11, 16, 12, 13, 14, 15, 2, 3, and 4. The peak daily flow is estimated to be 254,933 gallons. This is associated with the following fill conditions:

Leachate Storage Facility No.1
Peak Daily Leachate Flow and Fill Conditions

Location	Fill Condition
Cells 11, 16, and 12	Post-Closure
Cells 13, 14, and 15	Closure construction in progress
Cells 2 and 3	At or beyond Mid-Fill
Cell 4	First Lift

Leachate Storage Facility No. 2 will serve Cells 1, 5E, 5F, 10, 9, 5D, 5C, 5B, 8, 5A, 7, and 6. 1, 16, 12, 13, 14, 15, 2, 3, and 4. The peak daily flow is estimated to be 245,579 gallons. This is associated with the following fill conditions:

Leachate Storage Facility No.2 Peak Daily Leachate Flow and Fill Conditions	
Location	**Fill Condition**
Cells 1, 5E, and 5F	Just at Full-Fill
Cell 10	First Lift

It should be noted that this evaluation is conservative as it assumes the peak daily rates for multiple filling conditions coincide. A shift in the peaks so that they do not align is expected. For example, the peak leachate generation from each stage of filling will vary based on the thickness of waste through which the leachate, produced as a result of a rainfall event, will migrate to the sump. A significant rainfall may result in the peak in a first lift condition on the same day as the rainfall, but a peak rate for a cell that is nearly full may not occur for 4 or 5 days after the rain event.

For the post-closure period, flows were based on the peak month of each post-closure year for that waste thickness within that particular cell. The HELP analysis shows that after a few years of closure, the peak month discharges is the same regardless of waste thickness.

During the life of cell construction and waste placement, surface run-on from adjacent areas will be diverted around waste placement areas, as shown on Drawings 38 through 44.

10.10.2 Leachate Storage Tank Selection

Per criteria under Sections 10.10.1, comparing the peak daily with average annual leachate production rates, the peak daily rates are typically three times the average monthly rates. Further, as indicated above, peak operational daily rates assume the peak production in each cell under differing fill conditions occurs on the same date.

If the average daily rates are one-third the peak daily values, then the average daily values is 255,000 gpd/3 = 85,000 gallons/day. By providing 1M gallons of leachate storage capacity in each Leachate Storage Facility, there will be 11 days of on-site storage for average daily flow from the filling condition which produces the highest peak daily operational leachate generation. The leachate generation volume calculations were prepared assuming that installation of the Closure Cap will be completed in groups of 3 cells at a time. This results in between 8.4 and 18.2 acres sitting in “full-fill” conditions when filling operations have been moved to other cells. Sequencing completion of filling in a manner allow installation of the Closure Cap in smaller areas more frequently will help reduce leachate generation rates.

10.11 Leachate Disposal

From the leachate storage tanks, the leachate will be hauled off-site for disposal.

We have received a favorable response from Environmental Recovery Corporation (ERC) of Maryland, located in Baltimore that they do receive rubble landfill leachate and they have provided a preliminary quote for disposal of the leachate. The facility can currently handle up to 50,000 gpd at the Baltimore location and they expect to be completing an expansion of the facility before the proposed landfill comes on-line. They also have a facility that can accommodate the anticipated leachate in Lancaster, Pennsylvania. A copy of the ERC quote and acceptance criteria for disposal is provided in Attachment 10J.

Details and layout of the leachate management system are provided on Drawings 17 through 29. Detailed description pertinent to leachate collection system design and installation is presented in Section 10.0 "Leachate Management System" and in Section 14.0, "Construction Specifications", respectively.

Depending on the nature of the waste disposed, the levels of contaminants in the leachate, and the volume of leachate produced (which is directly linked to the amount of rainfall), the owner may choose, in the future to develop an on-site wastewater treatment plant to treat leachate and obtain a NPDES discharge permit.

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ATTACHMENT 10A

Leachate Generation Rates (per acre)

1. Purpose

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The purpose of this analysis is to estimate the leachate flow from the landfill.

2. Analysis Approach

a. The life of each cell was estimated based on cell area, the floor grading, the final grading, design thicknesses for the liner and leachate collection system and the cap system, the estimated gate tons of waste received each day, the planned work week, and the estimated waste density. The cell life information is used to plan the modeling of the leachate generation.

b. The landfill is modeled using the computer program, "Hydrologic Evaluation of Landfill Performance" (HELP) Version 3. The HELP computer program models climatologic, soil, and design data and utilizes a solution technique that accounts for infiltration, percolation, evapotranspiration, soil moisture storage, and lateral drainage over a specified time period.

c. A unit one acre was chosen for modeling. This allows the unit acre flow results to be multiplied by the acreage of each cell to estimate the flow from each cell.

d. Since the cells have brief life spans, most in terms of months, the unit acre was modeled with three general waste thicknesses designated as "First Lift", "Mid-Fill", and "Full-Fill". The waste thickness for the First Lift was 8 feet. This is experienced by each cell.

e. The number of lifts associated with the Full-Fill condition utilized for the modeling ranged from 5 to 17 (see Attached Table 1). In order to have a range of data that shows how the number of lifts affect leachate generation, the Full-Fill condition was modeled with 5, 8, 13, and 17 lifts. Correspondingly, the Mid-Fill condition was modeled with 2.5, 4, 6.5, and 8.5 lifts. (The September 3, 2021 design revisions reduced the number of lifts to 5 to 15, but did not significantly change the cell life because the operating life of the facility is set at 12 years, and the cell areas remained essentially unchanged).

f. Related, the post settlement slope of the landfill floor varies between 2% and 6% with sideslopes of 33%. Therefore, fill condition was modeled with drainage slope values (%) of 2, 3, 4, 5, 6, and 33. This gives a range of data that shows how the peak head buildup peak flow vary with drainage slope for each fill condition.

g. The primary focus of the modeling is to estimate the maximum head buildup on the liner, and the peak leachate flow. Therefore, the liner system is modeled as flawless material with a perfect installation. Also, perform several First Lift models using the lowest slope value to determine the drainage length between leachate pipes that limits the maximum head buildup to 12 inches.

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h. Related to the brief life spans of the cells, each of the lift conditions described were modeled for one year. This is also a consequence of a limitation of the HELP program in that model time frames are units of whole years.

i. The HELP program is allowed to establish the beginning moisture content values for the various soil and material layers for the First Lift condition. These values were noted for use in subsequent models.

   For the Mid-Fill condition, the moisture contents of the First Lift layers were set to the ending values from the First Lift model. The added layers to establish the Mid-Fill condition were set to moisture content values the same as the beginning of the First Lift models.

   For example, a First Lift layer may have started with a moisture content of 0.25, and ended with a moisture content of 0.18. For the Mid-Fill condition, the starting moisture content of that layer was set to 0.18. If that same type of layer was added to establish the Mid-Fill condition, the moisture content of the added layer was set to 0.25. This approach was also used for the transitions from the end of Mid-Fill to the start of Full-Fill, and from the end of Full-Fill to the start of Closed Fill.

j. Although the HELP program includes default climatological data for nearby Baltimore, the modeling was enhanced by using the current average monthly temperature and average monthly precipitation for Baltimore. Thirty (30) years of predicted temperature and precipitation data was generated for use.

   Since the storm water management system is required to be designed for the 25-year, 24-hour storm event, use this value in the predicted precipitation data to enhance the model.

k. Storm water runoff parameters are selected from default HELP data, and from "TR-55, Urban Hydrology for Small Watersheds".

l. To evaluate the impact of the closure cap on leachate generation, the Closed Fill condition is modeled for a time period of 30 years.

m. From the modeling output, determine the maximum head buildup for each fill condition with each slope value. Also determine the unit leachate production per acre for each fill condition and

3. HELP Program Description

The HELP computer program models climatologic, soil, and design data and utilizes a solution technique that accounts for infiltration, percolation, evapotranspiration, soil moisture storage, and

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lateral drainage over a specified time period. The program uses climatologic data with soil, and landfill design data to produce daily estimates of water moving across, into, through, and out of landfills.

4. Soil, Climatological, and Design Data

a. Climatological Data: The following climatological data was used to enhance the model.

Current Baltimore, MD		
Average Precipitation (in)	**Month**	**Average Temperature (ºF)**
3.47	Jan	32.4
3.02	Feb	35.5
3.93	Mar	43.7
3.00	Apr	53.2
3.89	May	62.8
3.43	Jun	71.7
3.85	Jul	76.5
3.74	Aug	74.5
3.98	Sep	67.4
3.16	Oct	55.3
3.12	Nov	45.5
3.35	Dec	36.6
Total = 41.94		

Additionally, the 25-year 24-hour storm event was confirmed to be 6.16" of precipitation. In the first year of the predicted precipitation data, the precipitation value on the day of highest precipitation was replaced with the value 6.16 to further enhance the modeling.

b. Soil: The following soil and material data was used for the liner system and waste layers.

Summary of Liner System Soil and Material Data		
Layer	**Description**	**HELP Default Soil**
1	12 inches intermediate cover	6
2	96 inches of waste	19
3	48 inches of Select Waste	6
4	24 inches of gravel/course sand	6
5	Tri-planar GDL	34 (modified k = 4.4 cm/sec)
6	60 mil HDPE textured geomembrane Pinhole Density = 0 holes/ac Installation defects = 0 defects/ac	35

	Placement quality = 1, perfect	

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The following soil and material data was used for the closure cap system.

Summary of Closure Cap System Soil and Material Data		
Layer	**Description**	**HELP Default Soil**
1	6 inches of vegetative support layer	9
2	18 inches of protective cover	6 (modified k = $1x10^{-5}$ cm/sec)
3	GDL	34 (modified k = 12.8 cm/sec)
4	40 mil LLDPE geomembrane Pinhole Density = 0 holes/ac Installation defects = 0 defects/ac Placement quality = 1, perfect	36
5	12* inches Final cover	6

Note: The Help modeling was performed with a final cover thickness of 12 inches. Actual final cover thickness is designed at 24 inches. As a result the HELP post closure predictions are slightly higher than what would be expected with the 24 inch thick final cover.

c. Design: The following design features were incorporated into the model.

Summary of Other Design Data	
Description	**Value**
Hydrologic Soil Group	B
Runoff Curve Number	86 – Active 69 - Closed
Fraction of Area Allowing Runoff	First Lift – 0% Mid-Fill – 50% Full-Fill – 75% Closed Fill – 100%
Evaporative Zone Depth	9 in
Maximum Leaf Area Index	0
Start of Growing Season	Day 102
End of Growing Season	Day 300
Average Wind Speed	9.3 mph
Average Humidity	62% - 71%

5. Summary of Modeling

The attached Table B summarizes the peak unit leachate flows for the active landfill periods of First Lift, mid-Fill, and Full-Fill. Table B(a) Summarizes the peak average unit leachate flow in units of

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(in/ac)/month. These values are taken directly from the HELP modeling output. The month with the greatest leachate flow was chosen for this table.

Table B(b) converts this data to units of (in/ac)/day by dividing the Table B(a) values by 30. Table B(c) converts the Table B(b) data to units of (cf/ac)/day. Note 1"/ac = 3,630 cf/ac. Table B(d) provides a comparison with the peak daily unit leachate flows in units of (cf/ac)/day. This data is also taken directly from the HELP modeling output. Specific Table B(d) values are used for design since they are greater than the Table B(c) values.

From this data, the following specific Table B(d) values were selected for design.

Active Landfill Unit Leachate Flows (cf/ac)/day		
Lift Condition	**Floor**	**Sideslope**
First Lift	1,300	1,655
Mid-Fill	1,011	1,001
Full-Fill	1,113	1,031

Attached Tables C through L provide similar data for the post-closure years 1 through 10. From this data, the following specific values were selected for design.

Closed Landfill Unit Leachate Flows Full-Fill (cf/ac)/day		
Year	**Floor**	**Sideslope**
1	521	486
2	16	16
3	3	3
4	2	2
5	1	1
6	1	1
7	0	0
8	0	0
9	0	0
10	0	0

6. Calculations

The active and closed unit flows were multiplied by cell acres for the various fill conditions and floor or sideslope areas, and converted to gal. Cell 1 has the greatest peak daily flow of 132,216 gal. Cell 5F has the least peak daily flow of 16,877 gal. The following table summarizes these calculations.

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Summary of Peak Daily Leachate Generation for each Cell				
Cell	**Area of Floor (acre)**	**Area of Slope (acre)**	**Peak Daily Leachate (gal/day)**	**Peak Daily Leachate (gal/min)**
1	11.7	1.5	132,340	19.9
2	5.4	2.1	78,506	54.5
3	4.2	0.7	49,506	34.4
4	4.9	0.6	55,075	38.2
5A	4.7	0.9	56,844	39.5
5B	2.9	0.5	34,389	23.9
5C	3.6	.8	45,405	31.5
5D	1.9	1.0	30,855	21.4
5E	2.3	0.9	33,507	23.3
5F	1.0	0.7	28,340	12.8
6	2.0	3.2	58,788	40.8
7	2.2	4.5	76,826	53.4
8	4.6	1.4	62,327	43.3
9	2.7	1.3	42,348	29.4
10	7.5	2.1	98,193	68.2
11	3.9	3.1	76,963	53.4
12	5.7	1.0	67,806	47.1
13	2.6	0.8	35,186	24.4
14	4.0	0.3	42,609	29.6
15	2.8	1.9	50,748	35.2
16	2.1	2.4	50,131	34.8

7. Conclusion(s)

Based on the foregoing, the estimated leachate flows for each cell by fill condition can be used to develop a timeline of potential peak daily leachate flows for the facility based on the cell life values. Additionally, this data can be used to size pumps and force main.

8. References

1. Schroeder, Paul R., et al; *"The Hydrologic Evaluation of landfill Performance (HELP) Model"*; U.S. Environmental protection Agency; Version 3.

2. Project Design Information.

3. Related Project Design Calculations.

4. *"Climate for Baltimore, Maryland"*; http:/www.rssweather,com; Average Temperatures and Rainfall; 01/20/2020.

5. *"Point Precipitation Frequency Estimates"*; NOAA Atlas 14, Volume 2, Version 3, 2018.

6. *"Urban Hydrology for Small Watersheds"*; Technical Release 55 (TR-55); US Dept. of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division; June 1986.

Table A - Cell Life Estimates

Cell	Total Cell Area (ac)	Avg. Top of Waste Elevation (ft)	Avg. Top of LCL Elevation (ft)	Avg. Waste Thickness (ft)	Avg. Number of 8-ft Lifts (ea)	HELP [2] Number of 8-ft Lifts (ea)	Estimated Cell Life [3] (months)	Cell Life [4] (months)
1	13.2	236	120	116	14.5	15	24.2	24
2	7.5	184	104	80	10.0	10	8.4	8
3	4.9	206	113	93	11.6	12	5.4	5
4	5.5	170	117	53	6.6	7	4.3	4
5A	5.6	220	126	94	11.8	12	7.7	8
5B	3.4	208	128	80	10.0	10	3.6	4
5C	4.4	194	130	64	8.0	8	4.2	4
5D	2.9	186	130	56	7.0	7	2.1	2
5E	3.2	172	129	43	5.4	5	2.3	2
5F	1.7	172	128	44	5.5	6	1.6	2
6	5.2	220	118	102	12.8	13	9.7	10
7	6.7	230	112	118	14.8	15	11.8	12
8	6	220	120	100	12.5	13	9.2	9
9	4	220	120	100	12.5	13	5.7	6
10	9.6	236	122	114	14.3	14	14.8	15
11	7	144	84	60	7.5	8	7.9	8
12	6.7	140	87	53	6.6	7	5.0	5
13	3.4	138	87	51	6.4	6	2.9	3
14	4.3	156	89	67	8.4	8	3.5	4
15	4.7	166	91	75	9.4	9	4.7	5
16	4.5	178	90	88	11.0	11	5.5	6
Total	114.4					*Total Months*	144.5	144.0
						Total Years	12.0	12.0

Table B - Unit Leachate Flows for Active Landfill

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	3.9646	3.9762	3.9061	3.8971	3.9324	5.0931
Mid-Fill						
20	3.9096	3.8765	3.9012	3.8921	3.8917	4.1508
32	3.9895	3.9579	5.0739	3.9747	3.9817	4.2507
52	4.2913	4.2622	4.2675	4.2878	4.2894	4.5609
68	4.5604	4.5358	4.5527	4.5454	4.5562	4.5609
Full-Fill						
40	4.9051	4.9167	4.8789	4.8825	4.8052	4.6126
64	4.8495	4.8600	4.8580	4.8608	4.7205	3.0332
104	4.2406	4.2719	4.2472	4.2562	3.9390	3.8179
136	3.7138	3.7049	3.6791	3.6822	3.9749	4.4312

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	0.1322	0.1325	0.1302	0.1299	0.1311	0.1698
Mid-Fill						
20	0.1303	0.1292	0.1300	0.1297	0.1297	0.1384
32	0.1330	0.1319	0.1691	0.1325	0.1327	0.1417
52	0.1430	0.1421	0.1423	0.1429	0.1430	0.1520
68	0.1520	0.1512	0.1518	0.1515	0.1519	0.1520
Full-Fill						
40	0.1635	0.1639	0.1626	0.1628	0.1602	0.1538
64	0.1617	0.1620	0.1619	0.1620	0.1574	0.1011
104	0.1414	0.1424	0.1416	0.1419	0.1313	0.1273
136	0.1238	0.1235	0.1226	0.1227	0.1325	0.1477

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	480	481	473	472	476	616
Mid-Fill						
20	473	469	472	471	471	502
32	483	479	614	481	482	514
52	519	516	516	519	519	552
68	552	549	551	550	551	552
Full-Fill						
40	594	595	590	591	581	558
64	587	588	588	588	571	367
104	513	517	514	515	477	462
136	449	448	445	446	481	536

Total Waste Thickness (ft)	Peak Unit Leachate Flow - (cf/ac)/day (d)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	1100	1224	1300	1300	1214	1655
Mid-Fill						
20	788	793	802	785	836	1001
32	839	832	1011	837	854	1001
52	883	924	838	864	841	1001
68	885	921	832	843	842	1001
Full-Fill						
40	1031	1070	1028	1028	1096	977
64	963	978	975	980	944	1031
104	1058	1062	1113	1110	933	1024
136	1012	1022	1030	1027	985	993

Table C - Closed Landfill Year 1

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	2.0601	2.0771	1.8408	1.8450	1.9747	3.8101
64	3.2090	3.2387	3.3047	3.3121	3.0468	2.8131
104	3.1961	3.8942	3.8415	3.8314	4.0152	4.0198
136	4.2577	4.2622	4.2852	4.3087	4.1621	3.9763

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0687	0.0692	0.0614	0.0615	0.0658	0.1270
64	0.1070	0.1080	0.1102	0.1104	0.1016	0.0938
104	0.1065	0.1298	0.1281	0.1277	0.1338	0.1340
136	0.1419	0.1421	0.1428	0.1436	0.1387	0.1325

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	249	251	223	223	239	461
64	388	392	400	401	369	340
104	387	471	465	464	486	486 ✓
136	515	516	519	521 ✓	504	481

Table D - Closed Landfill Year 2

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.1239	0.1237	0.1283	0.1283	0.1292	0.1316
64	0.1245	0.1243	0.1288	0.1288	0.1298	0.1324
104	0.1255	0.1253	0.1295	0.1295	0.1306	0.1328
136	0.1260	0.1258	0.1256	0.1299	0.1311	0.1336

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0041	0.0041	0.0043	0.0043	0.0043	0.0044
64	0.0042	0.0041	0.0043	0.0043	0.0043	0.0044
104	0.0042	0.0042	0.0043	0.0043	0.0044	0.0044
136	0.0042	0.0042	0.0042	0.0043	0.0044	0.0045

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	15	15	16	16	16	16
64	15	15	16	16	16	16
104	15	15	16	16	16	16
136	15	15	15	16	16	16

Table E - Closed Landfill Year 3

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0234	0.0234	0.0236	0.0236	0.0237	0.0238
64	0.0235	0.0235	0.0237	0.0237	0.0237	0.0238
104	0.0235	0.0235	0.0237	0.0237	0.0237	0.0238
136	0.0235	0.0235	0.0235	0.0237	0.0238	0.0239

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
64	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
104	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008
136	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	3	3	3	3	3	3
64	3	3	3	3	3	3
104	3	3	3	3	3	3
136	3	3	3	3	3	3

Table F - Closed Landfill Year 4

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0129	0.0138	0.0134	0.0134	0.0133	0.0131
64	0.0137	0.0137	0.0133	0.0133	0.0132	0.0131
104	0.0136	0.0136	0.0133	0.0133	0.0132	0.0132
136	0.0136	0.0136	0.0136	0.0132	0.0131	0.0132

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0004	0.0005	0.0004	0.0004	0.0004	0.0004
64	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004
104	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004
136	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	2	2	2	2	2	2
64	2	2	2	2	2	2
104	2	2	2	2	2	2
136	2	2	2	2	2	2

Table G - Closed Landfill Year 5

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0090	0.0090	0.0091	0.0091	0.0091	0.0091
64	0.0090	0.0090	0.0091	0.0091	0.0091	0.0091
104	0.0090	0.0090	0.0091	0.0091	0.0091	0.0091
136	0.0091	0.0090	0.0090	0.0091	0.0091	0.0092

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
64	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
104	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
136	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	1	1	1	1	1	1
64	1	1	1	1	1	1
104	1	1	1	1	1	1
136	1	1	1	1	1	1

Table H - Closed Landfill Year 6

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0051	0.0051	0.0052	0.0052	0.0052	0.0052
64	0.0051	0.0051	0.0052	0.0052	0.0052	0.0052
104	0.0051	0.0051	0.0052	0.0052	0.0052	0.0052
136	0.0051	0.0051	0.0051	0.0052	0.0052	0.0052

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
64	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
104	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
136	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	1	1	1	1	1	1
64	1	1	1	1	1	1
104	1	1	1	1	1	1
136	1	1	1	1	1	1

Table I - Closed Landfill Year 7

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0	0	0	0	0	0
64	0	0	0 ✓	0	0	0 ✓
104	0	0	0	0	0	0
136	0	0	0	0	0	0

Table J - Closed Landfill Year 8

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0	0	0	0	0	0
64	0	0	0	0	0	0
104	0	0	0	0	0	0
136	0	0	0	0	0	0

Table K - Closed Landfill Year 9

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0	0	0	0	0	0
64	0	0	0	0	0	0
104	0	0	0	0	0	0
136	0	0	0	0	0	0

Table L - Closed Landfill Year 10

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/month (a)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (in/ac)/day (b)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
64	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Total Waste Thickness (ft)	Peak Avg. Unit Leachate Flow - (cf/ac)/day (c)					
	Leachate Collection System Drainage Slope (%)					
	2	3	4	5	6	33
First Lift						
8	--	--	--	--	--	--
Mid-Fill						
20	--	--	--	--	--	--
32	--	--	--	--	--	--
52	--	--	--	--	--	--
68	--	--	--	--	--	--
Full-Fill						
40	0	0	0	0	0	0
64	0	0	0	0	0	0
104	0	0	0	0	0	0
136	0	0	0	0	0	0

REFERENCE 1 Pg 1/2

TABLE 4. DEFAULT SOIL, WASTE, AND GEOSYNTHETIC CHARACTERISTICS

Classification			Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity
HELP	USDA	USCS	vol/vol	vol/vol	vol/vol	cm/sec
1	CoS	SP	0.417	0.045	0.018	1.0×10^{-2}
2	S	SW	0.437	0.062	0.024	5.8×10^{-3}
3	FS	SW	0.457	0.083	0.033	3.1×10^{-3}
4	LS	SM	0.437	0.105	0.047	1.7×10^{-3}
5	LFS	SM	0.457	0.131	0.058	1.0×10^{-3}
6	SL	SM	0.453	0.190	0.085	7.2×10^{-4}
7	FSL	SM	0.473	0.222	0.104	5.2×10^{-4}
8	L	ML	0.463	0.232	0.116	3.7×10^{-4}
9	SiL	ML	0.501	0.284	0.135	1.9×10^{-4}
10	SCL	SC	0.398	0.244	0.136	1.2×10^{-4}
11	CL	CL	0.464	0.310	0.187	6.4×10^{-5}
12	SiCL	CL	0.471	0.342	0.210	4.2×10^{-5}
13	SC	SC	0.430	0.321	0.221	3.3×10^{-5}
14	SiC	CH	0.479	0.371	0.251	2.5×10^{-5}
15	C	CH	0.475	0.378	0.265	1.7×10^{-5}
16	Barrier Soil		0.427	0.418	0.367	1.0×10^{-7}
17	Bentonite Mat (0.6 cm)		0.750	0.747	0.400	3.0×10^{-9}
18	Municipal Waste (900 lb/yd^3 or 312 kg/m^3)		0.671	0.292	0.077	1.0×10^{-3}
19	Municipal Waste (channeling and dead zones)		0.168	0.073	0.019	1.0×10^{-3}
20	Drainage Net (0.5 cm)		0.850	0.010	0.005	$1.0 \times 10^{+1}$
21	Gravel		0.397	0.032	0.013	3.0×10^{-1}
22	L*	ML	0.419	0.307	0.180	1.9×10^{-5}
23	SiL*	ML	0.461	0.360	0.203	9.0×10^{-6}
24	SCL*	SC	0.365	0.305	0.202	2.7×10^{-6}
25	CL*	CL	0.437	0.373	0.266	3.6×10^{-6}
26	SiCL*	CL	0.445	0.393	0.277	1.9×10^{-6}
27	SC*	SC	0.400	0.366	0.288	7.8×10^{-7}
28	SiC*	CH	0.452	0.411	0.311	1.2×10^{-6}
29	C*	CH	0.451	0.419	0.332	6.8×10^{-7}
30	Coal-Burning Electric Plant Fly Ash*		0.541	0.187	0.047	5.0×10^{-5}
31	Coal-Burning Electric Plant Bottom Ash*		0.578	0.076	0.025	4.1×10^{-3}
32	Municipal Incinerator Fly Ash*		0.450	0.116	0.049	1.0×10^{-2}
33	Fine Copper Slag*		0.375	0.055	0.020	4.1×10^{-2}
34	Drainage Net (0.6 cm)		0.850	0.010	0.005	$3.3 \times 10^{+1}$

* Moderately Compacted (Continued)

REFERENCE 1 Pg 2/2

TABLE 4 (continued). DEFAULT SOIL, WASTE, AND GEOSYNTHETIC CHARACTERISTICS

Classification		Total Porosity	Field Capacity	Wilting Point	Saturated Hydraulic Conductivity
HELP	Geomembrane Material	vol/vol	vol/vol	vol/vol	cm/sec
35	High Density Polyethylene (HDPE)				2.0×10^{-13}
36	Low Density Polyethylene (LDPE)				4.0×10^{-13}
37	Polyvinyl Chloride (PVC)				2.0×10^{-11}
38	Butyl Rubber				1.0×10^{-12}
39	Chlorinated Polyethylene (CPE)				4.0×10^{-12}
40	Hypalon or Chlorosulfonated Polyethylene (CSPE)				3.0×10^{-12}
41	Ethylene-Propylene Diene Monomer (EPDM)				2.0×10^{-12}
42	Neoprene				3.0×10^{-12}

(concluded)

user-defined soil option accepts non-default soil characteristics for layers assigned soil type numbers greater than 42. This is especially convenient for specifying characteristics of waste layers. User-specified soil characteristics can be assigned any soil type number greater than 42.

When a default soil type is used to describe the top soil layer, the program adjusts the saturated hydraulic conductivities of the soils in the top half of the evaporative zone for the effects of root channels. The saturated hydraulic conductivity value is multiplied by an empirical factor that is computed as a function of the user-specified maximum leaf area index. Example values of this factor are 1.0 for a maximum LAI of 0 (bare ground), 1.8 for a maximum LAI of 1 (poor stand of grass), 3.0 for a maximum LAI of 2 (fair stand of grass), 4.2 for a maximum LAI of 3.3 (good stand of grass) and 5.0 for a maximum LAI of 5 (excellent stand of grass).

The manual option requires values for porosity, field capacity, wilting point, and saturated hydraulic conductivity. These and related soil properties are defined below.

Soil Water Storage (Volumetric Content): the ratio of the volume of water in a soil to the total volume occupied by the soil, water and voids.

Total Porosity: the soil water storage/volumetric content at saturation (fraction of total volume).

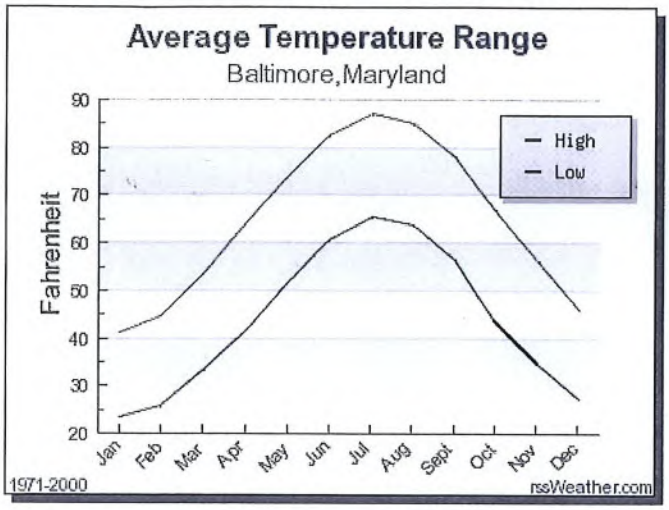
REFERENCE 4
B4/1

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Climate for Baltimore, Maryland

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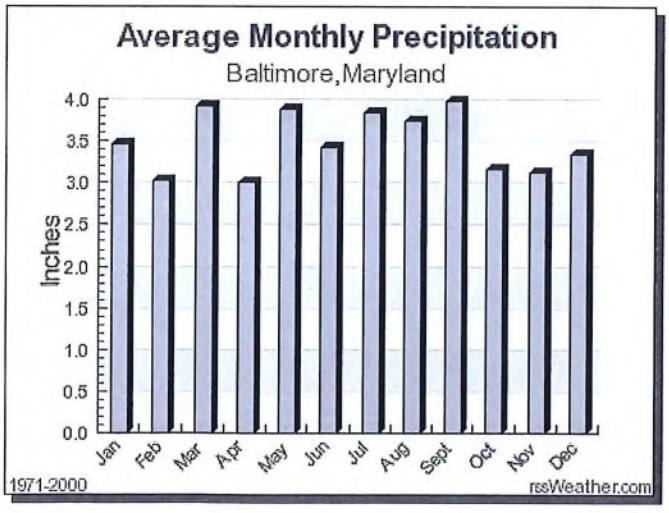
Average Temperatures for Baltimore



Month	Low	High	AVG (°F)
Jan	23.5°F	41.2°F	32.4
Feb	26.1°F	44.8°F	35.5
Mar	33.6°F	53.9°F	43.7
Apr	42.0°F	64.5°F	53.2
May	51.8°F	73.9°F	62.8
Jun	60.8°F	82.7°F	71.7
Jul	65.8°F	87.2°F	76.5
Aug	63.9°F	85.1°F	74.5
Sept	56.6°F	78.2°F	67.4
Oct	43.7°F	67.0°F	55.3
Nov	34.7°F	56.3°F	45.5
Dec	27.3°F	46.0°F	36.6

Baltimore's coldest month is January when the average temperature overnight is 23.5°F. In July, the warmest month, the average day temperature rises to 87.2°F.

Average Rainfall for Baltimore



Month	Precipitation
Jan	3.47in.
Feb	3.02in.
Mar	3.93in.
Apr	3.00in.
May	3.89in.
Jun	3.43in.
Jul	3.85in.
Aug	3.74in.
Sept	3.98in.
Oct	3.16in.
Nov	3.12in.
Dec	3.35in.

Total = 41.94"

The driest month in Baltimore is April with 3.00 inches of precipitation, and with 3.98 inches September is the wettest month.

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REFERENCE 5 B 1/1

NOAA Atlas 14, Volume 2, Version 3
Location name: Odenton, Maryland, USA*
Latitude: 39.0489°, Longitude: -76.7288°
Elevation: 65.46 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

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NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.347 (0.315-0.382)	0.415 (0.376-0.457)	0.494 (0.447-0.544)	0.551 (0.498-0.607)	0.623 (0.559-0.687)	0.677 (0.605-0.747)	0.729 (0.649-0.807)	0.779 (0.689-0.867)	0.842 (0.736-0.943)	0.891 (0.773-1.00)
10-min	0.554 (0.503-0.610)	0.664 (0.602-0.730)	0.791 (0.716-0.871)	0.882 (0.797-0.971)	0.993 (0.892-1.10)	1.08 (0.963-1.19)	1.16 (1.03-1.28)	1.24 (1.09-1.37)	1.33 (1.17-1.49)	1.40 (1.22-1.58)
15-min	0.693 (0.629-0.763)	0.834 (0.756-0.918)	1.00 (0.906-1.10)	1.12 (1.01-1.23)	1.26 (1.13-1.39)	1.37 (1.22-1.51)	1.47 (1.30-1.62)	1.56 (1.38-1.73)	1.68 (1.47-1.88)	1.76 (1.53-1.98)
30-min	0.950 (0.862-1.05)	1.15 (1.05-1.27)	1.42 (1.29-1.57)	1.62 (1.46-1.78)	1.87 (1.67-2.06)	2.06 (1.84-2.27)	2.24 (2.00-2.48)	2.43 (2.15-2.70)	2.67 (2.33-2.99)	2.85 (2.47-3.21)
60-min	1.18 (1.08-1.30)	1.45 (1.31-1.59)	1.82 (1.65-2.01)	2.10 (1.90-2.32)	2.48 (2.23-2.74)	2.79 (2.49-3.08)	3.09 (2.75-3.42)	3.40 (3.01-3.78)	3.83 (3.35-4.29)	4.16 (3.61-4.69)
2-hr	1.40 (1.27-1.55)	1.71 (1.55-1.88)	2.16 (1.96-2.38)	2.51 (2.27-2.76)	3.01 (2.70-3.31)	3.41 (3.05-3.75)	3.83 (3.40-4.22)	4.26 (3.76-4.72)	4.88 (4.25-5.45)	5.38 (4.64-6.04)
3-hr	1.52 (1.38-1.67)	1.84 (1.67-2.03)	2.34 (2.12-2.58)	2.73 (2.46-3.00)	3.28 (2.94-3.62)	3.74 (3.33-4.13)	4.22 (3.73-4.67)	4.74 (4.14-5.26)	5.47 (4.72-6.11)	6.07 (5.17-6.82)
6-hr	1.87 (1.71-2.07)	2.27 (2.06-2.50)	2.86 (2.60-3.16)	3.35 (3.03-3.70)	4.08 (3.65-4.50)	4.70 (4.16-5.19)	5.36 (4.71-5.95)	6.09 (5.29-6.77)	7.16 (6.10-8.03)	8.06 (6.77-9.10)
12-hr	2.27 (2.05-2.55)	2.75 (2.48-3.09)	3.50 (3.14-3.93)	4.14 (3.69-4.64)	5.12 (4.52-5.73)	5.98 (5.22-6.70)	6.93 (5.98-7.79)	8.00 (6.81-9.03)	9.64 (8.01-10.9)	11.1 (9.02-12.6)
24-hr	2.64 (2.41-2.93)	3.20 (2.91-3.55)	4.11 (3.74-4.56)	4.92 (4.45-5.44)	6.16 (5.53-6.76)	7.26 (6.46-7.94)	8.50 (7.49-9.27)	9.91 (8.64-10.8)	12.1 (10.4-13.1)	14.0 (11.8-15.1)
2-day	3.06 (2.78-3.38)	3.71 (3.37-4.10)	4.76 (4.32-5.26)	5.66 (5.12-6.24)	7.02 (6.31-7.72)	8.21 (7.33-9.00)	9.53 (8.44-10.4)	11.0 (9.65-12.1)	13.2 (11.4-14.5)	15.2 (12.9-16.6)
3-day	3.23 (2.94-3.56)	3.90 (3.56-4.31)	5.00 (4.56-5.52)	5.95 (5.40-6.54)	7.36 (6.64-8.08)	8.60 (7.70-9.41)	9.97 (8.86-10.9)	11.5 (10.1-12.6)	13.8 (12.0-15.1)	15.8 (13.5-17.3)
4-day	3.39 (3.10-3.74)	4.10 (3.75-4.52)	5.25 (4.79-5.78)	6.23 (5.67-6.84)	7.70 (6.96-8.44)	8.99 (8.07-9.82)	10.4 (9.28-11.4)	12.0 (10.6-13.1)	14.4 (12.5-15.7)	16.4 (14.1-18.0)
7-day	3.94 (3.61-4.32)	4.74 (4.35-5.20)	5.99 (5.48-6.57)	7.06 (6.45-7.73)	8.66 (7.86-9.45)	10.0 (9.06-10.9)	11.6 (10.4-12.6)	13.2 (11.8-14.4)	15.8 (13.8-17.2)	17.9 (15.5-19.5)
10-day	4.48 (4.13-4.89)	5.39 (4.96-5.87)	6.73 (6.19-7.32)	7.84 (7.20-8.53)	9.47 (8.65-10.3)	10.8 (9.85-11.7)	12.3 (11.1-13.3)	13.9 (12.5-15.1)	16.2 (14.4-17.6)	18.2 (16.0-19.8)
20-day	6.05 (5.62-6.52)	7.19 (6.68-7.75)	8.69 (8.07-9.37)	9.91 (9.18-10.7)	11.6 (10.7-12.5)	13.0 (11.9-14.0)	14.4 (13.2-15.5)	15.9 (14.5-17.1)	17.9 (16.2-19.3)	19.6 (17.6-21.1)
30-day	7.47 (6.97-8.01)	8.84 (8.25-9.48)	10.5 (9.81-11.3)	11.9 (11.0-12.7)	13.7 (12.7-14.7)	15.2 (14.1-16.3)	16.7 (15.4-17.9)	18.2 (16.7-19.5)	20.4 (18.5-21.8)	22.0 (19.9-23.7)
45-day	9.40 (8.82-10.0)	11.1 (10.4-11.8)	13.0 (12.2-13.8)	14.4 (13.5-15.3)	16.3 (15.2-17.3)	17.7 (16.6-18.9)	19.2 (17.9-20.4)	20.6 (19.1-21.9)	22.4 (20.7-23.9)	23.7 (21.8-25.3)
60-day	11.2 (10.5-11.9)	13.2 (12.4-14.0)	15.2 (14.3-16.1)	16.8 (15.8-17.7)	18.8 (17.6-19.9)	20.2 (19.0-21.4)	21.7 (20.3-23.0)	23.0 (21.5-24.4)	24.7 (23.0-26.3)	26.0 (24.1-27.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information. — 2018

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Appendix A Hydrologic Soil Groups

Soils are classified into hydrologic soil groups (HSG's) to indicate the minimum rate of infiltration obtained for bare soil after prolonged wetting. The HSG's, which are A, B, C, and D, are one element used in determining runoff curve numbers (see chapter 2). For the convenience of TR-55 users, exhibit A-1 lists the HSG classification of United States soils.

The infiltration rate is the rate at which water enters the soil at the soil surface. It is controlled by surface conditions. HSG also indicates the transmission rate—the rate at which the water moves within the soil. This rate is controlled by the soil profile. Approximate numerical ranges for transmission rates shown in the HSG definitions were first published by Musgrave (USDA 1955). The four groups are defined by SCS soil scientists as follows:

Group Asoils have low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sand or gravel and have a high rate of water transmission (greater than 0.30 in/hr).

Group Bsoils have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission (0.15-0.30 in/hr).

Group Csoils have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine texture. These soils have a low rate of water transmission (0.05-0.15 in/hr).

Group Dsoils have high runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very low rate of water transmission (0-0.05 in/hr).

In exhibit A-1, some of the listed soils have an added modifier; for example, "Abrazo, gravelly." This refers to a gravelly phase of the Abrazo series that is found in SCS soil map legends.

Disturbed soil profiles

As a result of urbanization, the soil profile may be considerably altered and the listed group classification may no longer apply. In these circumstances, use the following to determine HSG according to the texture of the new surface soil, provided that significant compaction has not occurred (Brakensiek and Rawls 1983).

HSG	*Soil textures*
A	Sand, loamy sand, or sandy loam
B	Silt loam or loam
C	Sandy clay loam
D	Clay loam, silty clay loam, sandy clay, silty clay, or clay

Drainage and group D soils

Some soils in the list are in group D because of a high water table that creates a drainage problem. Once these soils are effectively drained, they are placed in a different group. For example, Ackerman soil is classified as A/D. This indicates that the drained Ackerman soil is in group A and the undrained soil is in group D.

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Table 2-2a Runoff curve numbers for urban areas [1]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

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Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S

[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.

[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

ATTACHMENT 10A

Leachate Generation Rates (per acre)

HELP MODEL PRINTOUTS

FIRST LIFT

Floor slope 2%

Reviewed by PGS 08/29/2021

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\L1 S2.OUT


TIME:  10:22     DATE:   6/24/2020


**********************************************************************

     TITLE:  LIFT 1, S = 2%

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
               COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2146 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```



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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =     96.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0752 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     48.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2857 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   5
          THICKNESS                    =     24.00   INCHES
          POROSITY                     =      0.4570 VOL/VOL
          FIELD CAPACITY               =      0.1310 VOL/VOL
          WILTING POINT                =      0.0580 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2681 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                      TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      0.15   INCHES
          POROSITY                     =      0.8500 VOL/VOL
          FIELD CAPACITY               =      0.0100 VOL/VOL
          WILTING POINT                =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.7418 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =   4.42000008000     CM/SEC
          SLOPE                        =      2.00   PERCENT
```

DRAINAGE LENGTH = 250.0 FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	= 0.06	INCHES
POROSITY	= 0.0000	VOL/VOL
FIELD CAPACITY	= 0.0000	VOL/VOL
WILTING POINT	= 0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	= 0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	= 0.00	HOLES/ACRE
FML PLACEMENT QUALITY	= 1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	= 86.00	
FRACTION OF AREA ALLOWING RUNOFF	= 0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	= 1.000	ACRES
EVAPORATIVE ZONE DEPTH	= 9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	= 1.829	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	= 4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	= 0.765	INCHES
INITIAL SNOW WATER	= 0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	= 30.054	INCHES
TOTAL INITIAL WATER	= 30.054	INCHES
TOTAL SUBSURFACE INFLOW	= 0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	= 39.18	DEGREES
MAXIMUM LEAF AREA INDEX	= 0.00	
START OF GROWING SEASON (JULIAN DATE)	= 102	
END OF GROWING SEASON (JULIAN DATE)	= 300	
EVAPORATIVE ZONE DEPTH	= 9.0	INCHES
AVERAGE ANNUAL WIND SPEED	= 9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	= 62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	= 65.00	%

AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.675	1.864	2.700	2.247	1.954	4.920
	1.901	3.316	1.120	3.010	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.9506	1.1506	0.5951	0.5382	0.3354	0.2925
FROM LAYER 5	0.3398	0.2785	0.2241	3.9646	1.6774	2.3662

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.064	0.021	0.010	0.009	0.005	0.005
TOP OF LAYER 6	0.005	0.004	0.004	0.511	0.028	0.626
STD. DEVIATION OF DAILY	0.035	0.004	0.002	0.002	0.002	0.001
HEAD ON TOP OF LAYER 6	0.001	0.001	0.001	1.435	0.008	1.657

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.293	102702.633	64.29
DRAINAGE COLLECTED FROM LAYER 5	15.7129	57037.941	35.70
PERC./LEAKAGE THROUGH LAYER 6	0.000006	0.023	0.00
AVG. HEAD ON TOP OF LAYER 6	0.1076		
CHANGE IN WATER STORAGE	0.004	15.703	0.01
SOIL WATER AT START OF YEAR	30.055	109099.852	
SOIL WATER AT END OF YEAR	30.059	109115.555	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.006	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.675	1.864	2.700	2.247	1.954	4.920
	1.901	3.316	1.120	3.010	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	3.9506	1.1506	0.5951	0.5382	0.3354	0.2925
	0.3398	0.2785	0.2241	3.9646	1.6774	2.3662
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6						
AVERAGES	0.0636	0.0205	0.0096	0.0090	0.0054	0.0049
	0.0055	0.0045	0.0037	0.5113	0.0279	0.6257
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	28.293	(0.0000)	102702.63	64.287
LATERAL DRAINAGE COLLECTED FROM LAYER 5	15.71293	(0.00000)	57037.941	35.70309
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00001	(0.00000)	0.023	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.108	(0.000)		
CHANGE IN WATER STORAGE	0.004	(0.0000)	15.70	0.010

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 5	0.30316	1100.45642
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000001	0.00241
AVERAGE HEAD ON TOP OF LAYER 6	5.845	
MAXIMUM HEAD ON TOP OF LAYER 6	8.948	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	58.6 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5774	0.2148
2	7.2211	0.0752
3	13.7150	0.2857
4	6.4331	0.2680
5	0.1113	0.7418
6	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FIRST LIFT

Floor slope 3%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\L1 S3.OUT


TIME:  10:30     DATE:   6/24/2020


**************************************************************************

     TITLE:  LIFT 1, S = 3%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2146 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2680	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4882	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.829	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	30.013	INCHES
TOTAL INITIAL WATER	=	30.013	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%

AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.675	1.864	2.700	2.247	1.954	4.920
	1.901	3.316	1.120	3.010	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.9178	1.1465	0.5932	0.5385	0.3341	0.2929
FROM LAYER 5	0.3400	0.2774	0.2251	3.9762	1.6694	2.4020
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.042	0.014	0.006	0.006	0.004	0.003
TOP OF LAYER 6	0.004	0.003	0.002	0.043	0.019	0.026
STD. DEVIATION OF DAILY	0.024	0.002	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 6	0.000	0.001	0.001	0.029	0.005	0.034

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.293	102702.633	64.29
DRAINAGE COLLECTED FROM LAYER 5	15.7130	57038.230	35.70
PERC./LEAKAGE THROUGH LAYER 6	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0143		
CHANGE IN WATER STORAGE	0.004	15.440	0.01
SOIL WATER AT START OF YEAR	30.014	108950.914	
SOIL WATER AT END OF YEAR	30.018	108966.359	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.675	1.864	2.700	2.247	1.954	4.920
	1.901	3.316	1.120	3.010	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	3.9178	1.1465	0.5932	0.5385	0.3341	0.2929
	0.3400	0.2774	0.2251	3.9762	1.6694	2.4020
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
DAILY AVERAGE HEAD ON TOP OF LAYER 6						
AVERAGES	0.0421	0.0136	0.0064	0.0060	0.0036	0.0033
	0.0037	0.0030	0.0025	0.0427	0.0185	0.0258
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	28.293	(0.0000)	102702.63	64.287
LATERAL DRAINAGE COLLECTED FROM LAYER 5	15.71301	(0.00000)	57038.230	35.70327
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.014	(0.000)		
CHANGE IN WATER STORAGE	0.004	(0.0000)	15.44	0.010

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 5	0.33714	1223.81494
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 6	0.112	
MAXIMUM HEAD ON TOP OF LAYER 6	0.222	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	2.8 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5774	0.2148
2	7.2211	0.0752
3	13.7150	0.2857
4	6.4301	0.2679
5	0.0732	0.4879
6	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FIRST LIFT

Floor slope 4%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\L1 S4.OUT


TIME:  10:34     DATE:   6/24/2020


**************************************************************************

     TITLE:  LIFT 1, S = 4%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2162 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2698	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3845	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.847	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	30.035	INCHES
TOTAL INITIAL WATER	=	30.035	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%

AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.684	1.880	2.770	2.254	1.951	4.906
	1.943	3.303	1.126	3.010	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.9061	1.1604	0.5986	0.5331	0.3441	0.2903
FROM LAYER 5	0.3283	0.2594	0.2130	3.8189	1.7367	2.3797
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.031	0.010	0.005	0.004	0.003	0.002
TOP OF LAYER 6	0.003	0.002	0.002	0.031	0.014	0.019
STD. DEVIATION OF DAILY	0.018	0.002	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 6	0.000	0.001	0.001	0.021	0.004	0.025

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.413	103139.414	64.56
DRAINAGE COLLECTED FROM LAYER 5	15.5684	56513.383	35.37
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0106		
CHANGE IN WATER STORAGE	0.029	103.488	0.06
SOIL WATER AT START OF YEAR	30.037	109033.961	
SOIL WATER AT END OF YEAR	30.065	109137.445	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.684	1.880	2.770	2.254	1.951	4.906
	1.943	3.303	1.126	3.010	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	3.9061	1.1604	0.5986	0.5331	0.3441	0.2903
	0.3283	0.2594	0.2130	3.8189	1.7367	2.3797
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6						
AVERAGES	0.0315	0.0104	0.0048	0.0044	0.0028	0.0024
	0.0026	0.0021	0.0018	0.0308	0.0145	0.0192
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	28.413	(0.0000)	103139.41	64.560
LATERAL DRAINAGE COLLECTED FROM LAYER 5	15.56843	(0.00000)	56513.383	35.37474
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.011	(0.000)		
CHANGE IN WATER STORAGE	0.029	(0.0000)	103.49	0.065

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 5	0.35806	1299.75378
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 6	0.089	
MAXIMUM HEAD ON TOP OF LAYER 6	0.177	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	2.3 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5967	0.2164
2	7.2708	0.0757
3	13.6426	0.2842
4	6.4960	0.2707
5	0.0577	0.3847
6	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FIRST LIFT

Floor slope 5%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\L1 S5.OUT


TIME:  10:36     DATE:   6/24/2020


**************************************************************************

     TITLE:  LIFT 1, S = 5%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
            COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2162 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2698	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3086	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.847	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	30.024	INCHES
TOTAL INITIAL WATER	=	30.024	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%

AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.684	1.880	2.770	2.254	1.951	4.906
	1.943	3.303	1.126	3.010	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.8971	1.1591	0.5980	0.5332	0.3438	0.2903
FROM LAYER 5	0.3283	0.2591	0.2133	3.8225	1.7341	2.3894
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.025	0.008	0.004	0.004	0.002	0.002
TOP OF LAYER 6	0.002	0.002	0.001	0.025	0.012	0.015
STD. DEVIATION OF DAILY	0.014	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.017	0.004	0.020

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.413	103139.414	64.56
DRAINAGE COLLECTED FROM LAYER 5	15.5684	56513.332	35.37
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0085		
CHANGE IN WATER STORAGE	0.029	103.544	0.06
SOIL WATER AT START OF YEAR	30.026	108992.641	
SOIL WATER AT END OF YEAR	30.054	109096.180	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.684	1.880	2.770	2.254	1.951	4.906
	1.943	3.303	1.126	3.010	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	3.8971	1.1591	0.5980	0.5332	0.3438	0.2903
	0.3283	0.2591	0.2133	3.8225	1.7341	2.3894
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6						
AVERAGES	0.0251	0.0083	0.0039	0.0036	0.0022	0.0019
	0.0021	0.0017	0.0014	0.0247	0.0116	0.0154
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	28.413	(0.0000)	103139.41	64.560
LATERAL DRAINAGE COLLECTED FROM LAYER 5	15.56841	(0.00000)	56513.332	35.37471
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.008	(0.000)		
CHANGE IN WATER STORAGE	0.029	(0.0000)	103.54	0.065

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 5	0.35803	1299.65283
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.072	
MAXIMUM HEAD ON TOP OF LAYER 6	0.143	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5967	0.2164
2	7.2708	0.0757
3	13.6426	0.2842
4	6.4960	0.2707
5	0.0463	0.3089
6	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FIRST LIFT

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\L1 S6.OUT


TIME:  10:38     DATE:   6/24/2020


**************************************************************************

     TITLE:  LIFT 1, S = 6%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER WERE
              COMPUTED AS NEARLY STEADY-STATE VALUES BY THE PROGRAM.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2184 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2834	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2706	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2643	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.866	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	30.092	INCHES
TOTAL INITIAL WATER	=	30.092	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%

AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.685	1.892	2.770	2.245	1.962	4.882
	1.941	3.322	1.128	3.025	2.301	1.281
LATERAL DRAINAGE COLLECTED	3.9324	1.1691	0.6030	0.5437	0.3435	0.2874
FROM LAYER 5	0.3235	0.2682	0.2070	3.7555	1.7751	2.3821
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.021	0.007	0.003	0.003	0.002	0.002
TOP OF LAYER 6	0.002	0.001	0.001	0.020	0.010	0.013
STD. DEVIATION OF DAILY	0.012	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.014	0.003	0.017

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	28.434	103214.734	64.61
DRAINAGE COLLECTED FROM LAYER 5	15.5903	56592.941	35.42
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0071		
CHANGE IN WATER STORAGE	-0.014	-51.436	-0.03
SOIL WATER AT START OF YEAR	30.094	109240.766	
SOIL WATER AT END OF YEAR	30.080	109189.336	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.685	1.892	2.770	2.245	1.962	4.882
	1.941	3.322	1.128	3.025	2.301	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	3.9324	1.1691	0.6030	0.5437	0.3435	0.2874
	0.3235	0.2682	0.2070	3.7555	1.7751	2.3821
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6						
AVERAGES	0.0212	0.0070	0.0032	0.0030	0.0018	0.0016
	0.0017	0.0014	0.0012	0.0202	0.0099	0.0128
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	28.434	(0.0000)	103214.73	64.608
LATERAL DRAINAGE COLLECTED FROM LAYER 5	15.59034	(0.00000)	56592.941	35.42455
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.007	(0.000)		
CHANGE IN WATER STORAGE	-0.014	(0.0000)	-51.44	-0.032

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 5	0.33446	1214.10095
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 6	0.056	
MAXIMUM HEAD ON TOP OF LAYER 6	0.110	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	3.9 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6235	0.2186
2	7.3349	0.0764
3	13.5910	0.2831
4	6.4897	0.2704
5	0.0392	0.2611
6	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FIRST LIFT

Floor slope 33%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\L1S33.OUT


TIME:   9:12     DATE:   6/26/2020


**************************************************************************

     TITLE:  FIRST LIFT 8 FT; S=33%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2834	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2706	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2643	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 6

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	0.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	29.977	INCHES
TOTAL INITIAL WATER	=	29.977	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%

AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.824	1.867	2.419	2.046	1.775	4.580
	1.625	3.255	0.866	3.028	2.137	1.277
LATERAL DRAINAGE COLLECTED	3.7862	1.0902	0.5624	0.4940	0.3539	0.4715
FROM LAYER 5	0.4345	0.2208	0.2850	5.0931	1.8656	2.2461
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 6	0.000	0.000	0.000	0.002	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 6	0.000	0.000	0.000	0.001	0.000	0.001

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	0.000	0.000	0.00
EVAPOTRANSPIRATION	26.699	96915.625	60.66
DRAINAGE COLLECTED FROM LAYER 5	16.9035	61359.539	38.41
PERC./LEAKAGE THROUGH LAYER 6	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 6	0.0005		
CHANGE IN WATER STORAGE	0.408	1481.120	0.93
SOIL WATER AT START OF YEAR	30.017	108961.148	
SOIL WATER AT END OF YEAR	30.425	110442.266	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.824	1.867	2.419	2.046	1.775	4.580
	1.625	3.255	0.866	3.028	2.137	1.277
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 5						
TOTALS	3.7862	1.0902	0.5624	0.4940	0.3539	0.4715
	0.4345	0.2208	0.2850	5.0931	1.8656	2.2461
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 6						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 6						
AVERAGES	0.0012	0.0004	0.0002	0.0002	0.0001	0.0002
	0.0001	0.0001	0.0001	0.0017	0.0006	0.0007
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	0.000	(0.0000)	0.00	0.000
EVAPOTRANSPIRATION	26.699	(0.0000)	96915.62	60.665
LATERAL DRAINAGE COLLECTED FROM LAYER 5	16.90345	(0.00000)	61359.539	38.40821
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 6	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.408	(0.0000)	1481.12	0.927

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	0.000	0.0000
DRAINAGE COLLECTED FROM LAYER 5	0.45608	1655.55908
PERCOLATION/LEAKAGE THROUGH LAYER 6	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 6	0.005	
MAXIMUM HEAD ON TOP OF LAYER 6	0.037	
LOCATION OF MAXIMUM HEAD IN LAYER 5 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3855

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6653	0.2221
2	7.5117	0.0782
3	13.5059	0.2814
4	6.6983	0.2791
5	0.0040	0.0269
6	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 2.5 LIFTS

Floor slope 2%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF2-5S2.OUT


TIME:  12: 8     DATE:   6/24/2020


**************************************************************************

     TITLE:  MID FILL @ 2.5 LIFTS, S = 2%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2680	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7418	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.518	INCHES
TOTAL INITIAL WATER	=	43.518	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.9096	1.1403	0.7120	0.4506	0.5215	0.2855
FROM LAYER 7	0.2769	0.3636	0.2172	1.2992	2.1901	1.0233
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.063	0.020	0.011	0.007	0.008	0.005
TOP OF LAYER 8	0.004	0.006	0.004	0.021	0.036	0.016
STD. DEVIATION OF DAILY	0.027	0.004	0.003	0.002	0.002	0.001
HEAD ON TOP OF LAYER 8	0.001	0.000	0.001	0.028	0.013	0.007

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	12.3899	44975.187	28.15
PERC./LEAKAGE THROUGH LAYER 8	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0169		
CHANGE IN WATER STORAGE	1.183	4295.227	2.69
SOIL WATER AT START OF YEAR	43.629	158372.875	
SOIL WATER AT END OF YEAR	44.812	162668.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.039	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.9096	1.1403	0.7120	0.4506	0.5215	0.2855
	0.2769	0.3636	0.2172	1.2992	2.1901	1.0233
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0629	0.0203	0.0115	0.0075	0.0084	0.0047
	0.0045	0.0059	0.0036	0.0209	0.0364	0.0165
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.38986	(0.00000)	44975.187	28.15237
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.017	(0.000)		
CHANGE IN WATER STORAGE	1.183	(0.0000)	4295.23	2.689

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.21716	788.30511
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 8	0.108	
MAXIMUM HEAD ON TOP OF LAYER 8	0.213	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	4.1 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	11.0014	0.0764
3	3.5432	0.2953
4	7.3889	0.0770
5	14.0817	0.2934
6	6.1266	0.2553
7	0.0017	0.0110
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 2.5 LIFTS

Floor slope 3%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF2-5S3.OUT


TIME:  12:15     DATE:   6/24/2020


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     TITLE:  MID FILL @ 2.5 LIFTS, S = 3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2679	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4879	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.477	INCHES
TOTAL INITIAL WATER	=	43.477	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.8765	1.1378	0.7091	0.4515	0.5203	0.2852
FROM LAYER 7	0.2770	0.3643	0.2162	1.3177	2.1762	1.0179
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.042	0.014	0.008	0.005	0.006	0.003
TOP OF LAYER 8	0.003	0.004	0.002	0.014	0.024	0.011
STD. DEVIATION OF DAILY	0.018	0.003	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.001	0.019	0.009	0.005

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	12.3495	44828.777	28.06
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0113		
CHANGE IN WATER STORAGE	1.224	4441.648	2.78
SOIL WATER AT START OF YEAR	43.550	158087.641	
SOIL WATER AT END OF YEAR	44.774	162529.297	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.050	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.8765	1.1378	0.7091	0.4515	0.5203	0.2852
	0.2770	0.3643	0.2162	1.3177	2.1762	1.0179
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0416	0.0135	0.0076	0.0050	0.0056	0.0032
	0.0030	0.0039	0.0024	0.0141	0.0241	0.0109
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.34953	(0.00000)	44828.777	28.06073
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.011	(0.000)		
CHANGE IN WATER STORAGE	1.224	(0.0000)	4441.65	2.780

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.21851	793.19189
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.073	
MAXIMUM HEAD ON TOP OF LAYER 8	0.144	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	2.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	11.0014	0.0764
3	3.5432	0.2953
4	7.3889	0.0770
5	14.0817	0.2934
6	6.1266	0.2553
7	0.0015	0.0100
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 2.5 LIFTS

Floor slope 4%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF2-5S4.OUT


TIME:  12:18     DATE:   6/24/2020


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     TITLE:  MID FILL @ 2.5 LIFTS, S = 4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3847	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.524	INCHES
TOTAL INITIAL WATER	=	43.524	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.9012	1.1466	0.7137	0.4618	0.5032	0.3054
FROM LAYER 7	0.2817	0.3397	0.2222	0.9906	2.3483	1.0461
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.031	0.010	0.006	0.004	0.004	0.003
TOP OF LAYER 8	0.002	0.003	0.002	0.008	0.020	0.008
STD. DEVIATION OF DAILY	0.013	0.002	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.011	0.007	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63

EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	12.2605	44505.512	27.86
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0084		
CHANGE IN WATER STORAGE	1.181	4286.642	2.68
SOIL WATER AT START OF YEAR	43.582	158201.812	
SOIL WATER AT END OF YEAR	44.763	162488.453	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.088	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.9012	1.1466	0.7137	0.4618	0.5032	0.3054
	0.2817	0.3397	0.2222	0.9906	2.3483	1.0461
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0314	0.0102	0.0058	0.0038	0.0041	0.0025
	0.0023	0.0027	0.0019	0.0080	0.0196	0.0084
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.26047	(0.00000)	44505.512	27.85838
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.008	(0.000)		
CHANGE IN WATER STORAGE	1.181	(0.0000)	4286.64	2.683

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.22109	802.55194
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.055	
MAXIMUM HEAD ON TOP OF LAYER 8	0.110	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.5 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	10.9399	0.0760
3	3.5335	0.2945
4	7.4407	0.0775
5	14.0822	0.2934
6	6.1021	0.2543
7	0.0015	0.0101
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 2.5 LIFTS

Floor slope 5%

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF2-5S5.OUT


TIME:  12:22     DATE:   6/24/2020


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     TITLE:  MID FILL @ 2.5 LIFTS, S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3089	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.513	INCHES
TOTAL INITIAL WATER	=	43.513	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.8921	1.1459	0.7130	0.4619	0.5028	0.3053
FROM LAYER 7	0.2817	0.3398	0.2220	0.9961	2.3442	1.0444
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.025	0.008	0.005	0.003	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.006	0.016	0.007
STD. DEVIATION OF DAILY	0.010	0.002	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.009	0.006	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63

EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	12.2491	44464.262	27.83
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0067		
CHANGE IN WATER STORAGE	1.192	4327.893	2.71
SOIL WATER AT START OF YEAR	43.559	158119.266	
SOIL WATER AT END OF YEAR	44.751	162447.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.085	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.8921	1.1459	0.7130	0.4619	0.5028	0.3053
	0.2817	0.3398	0.2220	0.9961	2.3442	1.0444
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0251	0.0082	0.0046	0.0031	0.0032	0.0020
	0.0018	0.0022	0.0015	0.0064	0.0156	0.0067
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.24911	(0.00000)	44464.262	27.83256
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.007	(0.000)		
CHANGE IN WATER STORAGE	1.192	(0.0000)	4327.89	2.709

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.21628	785.11383
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.043	
MAXIMUM HEAD ON TOP OF LAYER 8	0.088	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	10.9399	0.0760
3	3.5335	0.2945
4	7.4407	0.0775
5	14.0822	0.2934
6	6.1021	0.2543
7	0.0015	0.0100
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 2.5 LIFTS

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF2-5S6.OUT


TIME:  12:26     DATE:   6/24/2020


**************************************************************************

     TITLE:  MID FILL @ 2.5 LIFTS, S = 6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2186	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2831	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2704	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2611	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.539	INCHES
TOTAL INITIAL WATER	=	43.539	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	3.8917	1.1609	0.7181	0.4645	0.5036	0.3023
FROM LAYER 7	0.2769	0.3473	0.2158	0.9383	2.3799	1.0664
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.021	0.007	0.004	0.003	0.003	0.002
TOP OF LAYER 8	0.001	0.002	0.001	0.005	0.013	0.006
STD. DEVIATION OF DAILY	0.008	0.001	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.007	0.005	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.063	7488.505	4.69

EVAPOTRANSPIRATION	28.539	103595.297	64.85
DRAINAGE COLLECTED FROM LAYER 7	12.2657	44524.312	27.87
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0056		
CHANGE IN WATER STORAGE	1.143	4148.140	2.60
SOIL WATER AT START OF YEAR	43.578	158189.187	
SOIL WATER AT END OF YEAR	44.721	162337.328	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.033	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.8917	1.1609	0.7181	0.4645	0.5036	0.3023
	0.2769	0.3473	0.2158	0.9383	2.3799	1.0664
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0209	0.0069	0.0039	0.0026	0.0027	0.0017
	0.0015	0.0019	0.0012	0.0051	0.0132	0.0057
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.063	(0.0000)	7488.51	4.687
EVAPOTRANSPIRATION	28.539	(0.0000)	103595.30	64.846
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.26565	(0.00000)	44524.312	27.87015
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.006	(0.000)		
CHANGE IN WATER STORAGE	1.143	(0.0000)	4148.14	2.597

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.706	6193.2847
DRAINAGE COLLECTED FROM LAYER 7	0.23045	836.54144
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.038	
MAXIMUM HEAD ON TOP OF LAYER 8	0.075	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	5.9 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6243	0.2187
2	11.1493	0.0774
3	3.5579	0.2965
4	7.1679	0.0747
5	14.3057	0.2980
6	5.8752	0.2448
7	0.0015	0.0100
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 2.5 LIFTS

Floor slope 33%

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**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF2-5S33.OUT


TIME:  10: 3     DATE:   6/26/2020


**************************************************************************

     TITLE:  MID FILL @ 2.5 LIFTS; S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2221	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0782	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2814	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0269	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	43.846	INCHES
TOTAL INITIAL WATER	=	43.846	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
EVAPOTRANSPIRATION	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
LATERAL DRAINAGE COLLECTED	4.1508	1.1800	0.7543	0.4974	0.3264	0.4383
FROM LAYER 7	0.5095	0.2737	0.3501	2.3087	2.4550	1.0777
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.100	7622.630	4.77

EVAPOTRANSPIRATION	26.873	97548.234	61.06
DRAINAGE COLLECTED FROM LAYER 7	14.3220	51988.867	32.54
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0004		
CHANGE IN WATER STORAGE	0.715	2596.461	1.63
SOIL WATER AT START OF YEAR	43.850	159175.625	
SOIL WATER AT END OF YEAR	44.565	161772.078	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.093	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.1508	1.1800	0.7543	0.4974	0.3264	0.4383
	0.5095	0.2737	0.3501	2.3087	2.4550	1.0777
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0013	0.0004	0.0002	0.0002	0.0001	0.0001
	0.0002	0.0001	0.0001	0.0007	0.0008	0.0003
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.100	(0.0000)	7622.63	4.771
EVAPOTRANSPIRATION	26.873	(0.0000)	97548.23	61.061
LATERAL DRAINAGE COLLECTED FROM LAYER 7	14.32200	(0.00000)	51988.867	32.54261
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.715	(0.0000)	2596.46	1.625

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.652	5996.8691
DRAINAGE COLLECTED FROM LAYER 7	0.27591	1001.54266
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.003	
MAXIMUM HEAD ON TOP OF LAYER 8	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3770

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6622	0.2218
2	11.2623	0.0782
3	3.5404	0.2950
4	7.2076	0.0751
5	14.3951	0.2999
6	5.4919	0.2288
7	0.0019	0.0125
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 4 LIFTS

Floor slope 2%

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**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF4S2.OUT


TIME:  12:48     DATE:   6/24/2020


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     TITLE:  MID FILL @ 4 LIFTS, S = 2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2680	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7418	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	54.390	INCHES
TOTAL INITIAL WATER	=	54.390	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.9895	1.3185	0.7396	0.5050	0.5312	0.2895
FROM LAYER 7	0.2806	0.3643	0.2171	1.1468	2.3268	1.0348
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.064	0.024	0.012	0.008	0.009	0.005
TOP OF LAYER 8	0.005	0.006	0.004	0.018	0.039	0.017
STD. DEVIATION OF DAILY	0.028	0.005	0.003	0.002	0.002	0.001
HEAD ON TOP OF LAYER 8	0.001	0.000	0.001	0.032	0.015	0.005

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	12.7438	46259.895	28.96
PERC./LEAKAGE THROUGH LAYER 8	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0174		
CHANGE IN WATER STORAGE	0.829	3010.469	1.88
SOIL WATER AT START OF YEAR	54.501	197838.266	
SOIL WATER AT END OF YEAR	55.330	200848.734	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.012	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	3.9895	1.3185	0.7396	0.5050	0.5312	0.2895
	0.2806	0.3643	0.2171	1.1468	2.3268	1.0348
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0642	0.0235	0.0119	0.0084	0.0086	0.0048
	0.0045	0.0059	0.0036	0.0185	0.0387	0.0167
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.74377	(0.00000)	46259.895	28.95654
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.017	(0.000)		
CHANGE IN WATER STORAGE	0.829	(0.0000)	3010.47	1.884

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.23105	838.70520
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 8	0.115	
MAXIMUM HEAD ON TOP OF LAYER 8	0.226	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	4.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	22.0744	0.0766
3	3.5137	0.2928
4	7.3397	0.0765
5	14.2005	0.2958
6	5.5157	0.2298
7	0.0175	0.1168
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 4 LIFTS

Floor slope 3%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF4S3.OUT


TIME:  12:52     DATE:   6/24/2020


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     TITLE:  MID FILL @ 4 LIFTS, S = 3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2679	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4879	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	54.349	INCHES
TOTAL INITIAL WATER	=	54.349	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.9579	1.3149	0.7365	0.5059	0.5298	0.2892
FROM LAYER 7	0.2807	0.3650	0.2161	1.1683	2.3100	1.0333
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.042	0.016	0.008	0.006	0.006	0.003
TOP OF LAYER 8	0.003	0.004	0.002	0.013	0.026	0.011
STD. DEVIATION OF DAILY	0.019	0.003	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.001	0.022	0.010	0.004

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	12.7076	46128.418	28.87
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0116		
CHANGE IN WATER STORAGE	0.866	3141.964	1.97
SOIL WATER AT START OF YEAR	54.422	197553.047	
SOIL WATER AT END OF YEAR	55.288	200695.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.005	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.9579	1.3149	0.7365	0.5059	0.5298	0.2892
	0.2807	0.3650	0.2161	1.1683	2.3100	1.0333
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0425	0.0156	0.0079	0.0056	0.0057	0.0032
	0.0030	0.0039	0.0024	0.0125	0.0256	0.0111
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.70755	(0.00000)	46128.418	28.87424
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.012	(0.000)		
CHANGE IN WATER STORAGE	0.866	(0.0000)	3141.96	1.967

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.22910	831.61786
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.076	
MAXIMUM HEAD ON TOP OF LAYER 8	0.151	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	2.6 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	22.0744	0.0766
3	3.5137	0.2928
4	7.3397	0.0765
5	14.2005	0.2958
6	5.5157	0.2298
7	0.0133	0.0884
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 4 LIFTS

Floor slope 4%

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF4S4.OUT


TIME:  12:55     DATE:   6/24/2020


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     TITLE:  MID FILL @ 4 LIFTS, S = 4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2171 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0760	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2945	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0775	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2543	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0101	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.954	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	55.655	INCHES
TOTAL INITIAL WATER	=	55.655	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70

76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.808	1.879	2.771	2.254	1.951	4.917
	1.762	3.459	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	5.0739	1.4470	0.7542	0.5364	0.5165	0.3130
FROM LAYER 7	0.2874	0.3331	0.2286	0.7464	2.5734	1.0746
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.041	0.013	0.006	0.004	0.004	0.003
TOP OF LAYER 8	0.002	0.003	0.002	0.006	0.021	0.009
STD. DEVIATION OF DAILY	0.017	0.003	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.011	0.009	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT

PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.457	4.63
EVAPOTRANSPIRATION	28.526	103548.383	64.82
DRAINAGE COLLECTED FROM LAYER 7	13.8844	50400.195	31.55
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0095		
CHANGE IN WATER STORAGE	-0.438	-1589.801	-1.00
SOIL WATER AT START OF YEAR	55.657	202033.422	
SOIL WATER AT END OF YEAR	55.219	200443.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.052	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.808	1.879	2.771	2.254	1.951	4.917
	1.762	3.459	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	5.0739	1.4470	0.7542	0.5364	0.5165	0.3130
	0.2874	0.3331	0.2286	0.7464	2.5734	1.0746
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0409	0.0129	0.0061	0.0045	0.0042	0.0026
	0.0023	0.0027	0.0019	0.0060	0.0214	0.0087
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.46	4.630
EVAPOTRANSPIRATION	28.526	(0.0000)	103548.38	64.816
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.88435	(0.00000)	50400.195	31.54818
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001

AVERAGE HEAD ON TOP OF LAYER 8	0.010	(0.000)		
CHANGE IN WATER STORAGE	-0.438	(0.0000)	-1589.80	-0.995

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.27842	1010.65479
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.070	
MAXIMUM HEAD ON TOP OF LAYER 8	0.138	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	1.3 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	21.9203	0.0761
3	3.5029	0.2919
4	7.5255	0.0784
5	14.1772	0.2954
6	5.4768	0.2282
7	0.0093	0.0623
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 4 LIFTS

Floor slope 5%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF4S5.OUT


TIME:  13: 0     DATE:   6/24/2020


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     TITLE:  MID FILL @ 4 LIFTS, S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3089	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	54.385	INCHES
TOTAL INITIAL WATER	=	54.385	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.9747	1.3228	0.7412	0.5147	0.5126	0.3096
FROM LAYER 7	0.2849	0.3412	0.2218	0.7454	2.5673	1.0743
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.026	0.009	0.005	0.003	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.005	0.017	0.007
STD. DEVIATION OF DAILY	0.011	0.002	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.009	0.007	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63

EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	12.6105	45776.020	28.65
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0069		
CHANGE IN WATER STORAGE	0.831	3016.147	1.89
SOIL WATER AT START OF YEAR	54.431	197584.641	
SOIL WATER AT END OF YEAR	55.262	200600.781	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.074	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.9747	1.3228	0.7412	0.5147	0.5126	0.3096
	0.2849	0.3412	0.2218	0.7454	2.5673	1.0743
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0256	0.0094	0.0048	0.0034	0.0033	0.0021
	0.0018	0.0022	0.0015	0.0048	0.0171	0.0069
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.61047	(0.00000)	45776.020	28.65366
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.007	(0.000)		
CHANGE IN WATER STORAGE	0.831	(0.0000)	3016.15	1.888

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.23067	837.33032
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.046	
MAXIMUM HEAD ON TOP OF LAYER 8	0.090	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	5.2 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	21.9203	0.0761
3	3.5029	0.2919
4	7.5255	0.0784
5	14.1773	0.2954
6	5.4767	0.2282
7	0.0077	0.0516
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 4 LIFTS

Floor slope 6%

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**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF4S6.OUT


TIME:  13: 4     DATE:   6/24/2020


**************************************************************************

     TITLE:  MID FILL @ 4 LIFTS, S = 6%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2186	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2831	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2704	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2611	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	54.411	INCHES
TOTAL INITIAL WATER	=	54.411	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	3.9817	1.3350	0.7452	0.5143	0.5128	0.3064
FROM LAYER 7	0.2802	0.3488	0.2155	0.6969	2.5951	1.0564
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.021	0.008	0.004	0.003	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.004	0.014	0.006
STD. DEVIATION OF DAILY	0.009	0.002	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.007	0.006	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.063	7488.505	4.69

EVAPOTRANSPIRATION	28.539	103595.297	64.85
DRAINAGE COLLECTED FROM LAYER 7	12.5884	45695.930	28.60
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0058		
CHANGE IN WATER STORAGE	0.820	2976.557	1.86
SOIL WATER AT START OF YEAR	54.450	197654.562	
SOIL WATER AT END OF YEAR	55.270	200631.109	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	3.9817	1.3350	0.7452	0.5143	0.5128	0.3064
	0.2802	0.3488	0.2155	0.6969	2.5951	1.0564
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

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DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0214	0.0080	0.0040	0.0029	0.0028	0.0017
	0.0015	0.0019	0.0012	0.0038	0.0144	0.0057
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	2.063 (0.0000)	7488.51	4.687
EVAPOTRANSPIRATION	28.539 (0.0000)	103595.30	64.846
LATERAL DRAINAGE COLLECTED FROM LAYER 7	12.58841 (0.00000)	45695.930	28.60352
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.006 (0.000)		
CHANGE IN WATER STORAGE	0.820 (0.0000)	2976.56	1.863

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.706	6193.2847
DRAINAGE COLLECTED FROM LAYER 7	0.23525	853.96918
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.039	
MAXIMUM HEAD ON TOP OF LAYER 8	0.077	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	5.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6243	0.2187
2	22.2813	0.0774
3	3.4930	0.2911
4	7.2628	0.0757
5	14.2196	0.2962
6	5.3422	0.2226
7	0.0079	0.0528
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 4 LIFTS

Floor slope 33%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF4S33.OUT


TIME:  10:39     DATE:   6/26/2020


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     TITLE:  MID FILL @ 4 LIFTS; S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2221	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0782	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2814	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0269	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	54.718	INCHES
TOTAL INITIAL WATER	=	54.718	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
EVAPOTRANSPIRATION	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
LATERAL DRAINAGE COLLECTED	4.2507	1.3503	0.7796	0.5350	0.3401	0.4495
FROM LAYER 7	0.5111	0.2744	0.3474	2.0054	2.7316	1.0724
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.100	7622.630	4.77

EVAPOTRANSPIRATION	26.873	97548.234	61.06
DRAINAGE COLLECTED FROM LAYER 7	14.6476	53170.883	33.28
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0004		
CHANGE IN WATER STORAGE	0.390	1414.479	0.89
SOIL WATER AT START OF YEAR	54.722	198640.969	
SOIL WATER AT END OF YEAR	55.112	200055.453	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.061	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	4.2507	1.3503	0.7796	0.5350	0.3401	0.4495
	0.5111	0.2744	0.3474	2.0054	2.7316	1.0724
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0014	0.0005	0.0003	0.0002	0.0001	0.0002
	0.0002	0.0001	0.0001	0.0007	0.0009	0.0003
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.100	(0.0000)	7622.63	4.771
EVAPOTRANSPIRATION	26.873	(0.0000)	97548.23	61.061
LATERAL DRAINAGE COLLECTED FROM LAYER 7	14.64763	(0.00000)	53170.883	33.28250
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.390	(0.0000)	1414.48	0.885

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.652	5996.8691
DRAINAGE COLLECTED FROM LAYER 7	0.27591	1001.53583
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.003	
MAXIMUM HEAD ON TOP OF LAYER 8	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3770

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6622	0.2218
2	22.4278	0.0779
3	3.4588	0.2882
4	7.3624	0.0767
5	13.8701	0.2890
6	5.3248	0.2219
7	0.0015	0.0102
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 6.5 LIFTS

Floor slope 2%

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**                                                                                  **
**                                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                           **
**                    USAE WATERWAYS EXPERIMENT STATION                             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                      **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF6-5S2.OUT


TIME:  13:13     DATE:   6/24/2020


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     TITLE:  MID FILL @ 6.5 LIFTS, S = 2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   6
          THICKNESS                   =     12.00   INCHES
          POROSITY                    =      0.4530 VOL/VOL
          FIELD CAPACITY              =      0.1900 VOL/VOL
          WILTING POINT               =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT  =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2680	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7418	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.510	INCHES
TOTAL INITIAL WATER	=	72.510	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.2913	1.5346	0.7668	0.5467	0.5373	0.2924
FROM LAYER 7	0.2833	0.3650	0.2178	0.5604	2.8352	1.0863
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.069	0.027	0.012	0.009	0.009	0.005
TOP OF LAYER 8	0.005	0.006	0.004	0.009	0.047	0.017
STD. DEVIATION OF DAILY	0.027	0.006	0.003	0.001	0.002	0.001
HEAD ON TOP OF LAYER 8	0.001	0.000	0.001	0.020	0.023	0.005

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT

PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59
EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	13.3168	48340.027	30.26
PERC./LEAKAGE THROUGH LAYER 8	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0183		
CHANGE IN WATER STORAGE	0.256	930.376	0.58
SOIL WATER AT START OF YEAR	72.621	263613.844	
SOIL WATER AT END OF YEAR	72.877	264544.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.026	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.2913	1.5346	0.7668	0.5467	0.5373	0.2924
	0.2833	0.3650	0.2178	0.5604	2.8352	1.0863
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0691	0.0274	0.0123	0.0091	0.0086	0.0049
	0.0046	0.0059	0.0036	0.0090	0.0472	0.0175
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.31681	(0.00000)	48340.027	30.25861
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001

AVERAGE HEAD ON TOP OF LAYER 8	0.018	(0.000)		
CHANGE IN WATER STORAGE	0.256	(0.0000)	930.38	0.582

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.24331	883.21838
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 8	0.121	
MAXIMUM HEAD ON TOP OF LAYER 8	0.238	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	4.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	40.2548	0.0762
3	3.4776	0.2898
4	7.2711	0.0757
5	13.8495	0.2885
6	5.3530	0.2230
7	0.0024	0.0157
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 6.5 LIFTS

Floor slope 3%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF6-5S3.OUT


TIME:  13:16     DATE:   6/24/2020


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     TITLE:  MID FILL @ 6.5 LIFTS, S = 3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2679	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4879	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.469	INCHES
TOTAL INITIAL WATER	=	72.469	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.2622	1.5286	0.7638	0.5475	0.5358	0.2921
FROM LAYER 7	0.2833	0.3656	0.2168	0.5891	2.8117	1.0809
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.046	0.018	0.008	0.006	0.006	0.003
TOP OF LAYER 8	0.003	0.004	0.002	0.006	0.031	0.012
STD. DEVIATION OF DAILY	0.018	0.004	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.001	0.014	0.015	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	13.2772	48196.180	30.17
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0121		
CHANGE IN WATER STORAGE	0.296	1074.277	0.67
SOIL WATER AT START OF YEAR	72.542	263328.656	
SOIL WATER AT END OF YEAR	72.838	264402.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.081	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.2622	1.5286	0.7638	0.5475	0.5358	0.2921
	0.2833	0.3656	0.2168	0.5891	2.8117	1.0809
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0458	0.0182	0.0082	0.0061	0.0058	0.0032
	0.0030	0.0039	0.0024	0.0063	0.0312	0.0116
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.27718	(0.00000)	48196.180	30.16856
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.012	(0.000)		
CHANGE IN WATER STORAGE	0.296	(0.0000)	1074.28	0.672

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.25451	923.86218
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.085	
MAXIMUM HEAD ON TOP OF LAYER 8	0.168	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	2.5 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	40.2548	0.0762
3	3.4776	0.2898
4	7.2711	0.0757
5	13.8495	0.2885
6	5.3530	0.2230
7	0.0015	0.0101
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 6.5 LIFTS

Floor slope 4%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF6-5S4.OUT


TIME:  13:20     DATE:   6/24/2020


**************************************************************************

     TITLE:  MID FILL @ 6.5 LIFTS, S = 4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3847	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.497	INCHES
TOTAL INITIAL WATER	=	72.497	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70

76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.2675	1.5386	0.7697	0.5554	0.5193	0.3127
FROM LAYER 7	0.2872	0.3423	0.2226	0.2553	2.9542	1.1343
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.034	0.014	0.006	0.005	0.004	0.003
TOP OF LAYER 8	0.002	0.003	0.002	0.002	0.025	0.009
STD. DEVIATION OF DAILY	0.014	0.003	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.012	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT

PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63
EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	13.1591	47767.617	29.90
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0090		
CHANGE IN WATER STORAGE	0.282	1024.593	0.64
SOIL WATER AT START OF YEAR	72.555	263373.062	
SOIL WATER AT END OF YEAR	72.837	264397.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.2675	1.5386	0.7697	0.5554	0.5193	0.3127
	0.2872	0.3423	0.2226	0.2553	2.9542	1.1343
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0344	0.0137	0.0062	0.0046	0.0042	0.0026
	0.0023	0.0028	0.0019	0.0021	0.0246	0.0091
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.15912	(0.00000)	47767.617	29.90030
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001

AVERAGE HEAD ON TOP OF LAYER 8	0.009	(0.000)		
CHANGE IN WATER STORAGE	0.282	(0.0000)	1024.59	0.641

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.23096	838.37311
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.058	
MAXIMUM HEAD ON TOP OF LAYER 8	0.114	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	1.7 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	40.0935	0.0759
3	3.4778	0.2898
4	7.4697	0.0778
5	13.8454	0.2884
6	5.2832	0.2201
7	0.0043	0.0289
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 6.5 LIFTS

Floor slope 5%

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF6-5S5.OUT


TIME:  13:23     DATE:   6/24/2020


**************************************************************************

     TITLE:  MID FILL @ 6.5 LIFTS, S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3809	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.516	INCHES
TOTAL INITIAL WATER	=	72.516	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.2878	1.5384	0.7691	0.5555	0.5188	0.3126
FROM LAYER 7	0.2872	0.3424	0.2225	0.2549	2.9562	1.1327
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.028	0.011	0.005	0.004	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.002	0.020	0.007
STD. DEVIATION OF DAILY	0.011	0.003	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.009	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63

EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	13.1782	47836.762	29.94
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0072		
CHANGE IN WATER STORAGE	0.263	955.440	0.60
SOIL WATER AT START OF YEAR	72.573	263438.625	
SOIL WATER AT END OF YEAR	72.836	264394.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.040	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.2878	1.5384	0.7691	0.5555	0.5188	0.3126
	0.2872	0.3424	0.2225	0.2549	2.9562	1.1327
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0277	0.0110	0.0050	0.0037	0.0033	0.0021
	0.0019	0.0022	0.0015	0.0016	0.0197	0.0073
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.17817	(0.00000)	47836.762	29.94358
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.007	(0.000)		
CHANGE IN WATER STORAGE	0.263	(0.0000)	955.44	0.598

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.23816	864.52887
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.048	
MAXIMUM HEAD ON TOP OF LAYER 8	0.095	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	40.0935	0.0759
3	3.4778	0.2898
4	7.4697	0.0778
5	13.8454	0.2884
6	5.2832	0.2201
7	0.0039	0.0261
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 6.5 LIFTS

Floor slope 6%

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**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF6-5S6.OUT


TIME:  13:26     DATE:   6/24/2020


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     TITLE:  MID FILL @ 6.5 LIFTS, S = 6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2186	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2831	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2704	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2611	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.531	INCHES
TOTAL INITIAL WATER	=	72.531	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	4.2894	1.5469	0.7723	0.5544	0.5189	0.3094
FROM LAYER 7	0.2826	0.3500	0.2159	0.2473	2.9442	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.023	0.009	0.004	0.003	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.001	0.016	0.006
STD. DEVIATION OF DAILY	0.009	0.002	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.008	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.063	7488.505	4.69

EVAPOTRANSPIRATION	28.539	103595.297	64.85
DRAINAGE COLLECTED FROM LAYER 7	13.1604	47772.082	29.90
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0060		
CHANGE IN WATER STORAGE	0.248	900.438	0.56
SOIL WATER AT START OF YEAR	72.570	263430.094	
SOIL WATER AT END OF YEAR	72.818	264330.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.037	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	4.2894	1.5469	0.7723	0.5544	0.5189	0.3094
	0.2826	0.3500	0.2159	0.2473	2.9442	1.1291
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0231	0.0092	0.0042	0.0031	0.0028	0.0017
	0.0015	0.0019	0.0012	0.0013	0.0164	0.0061
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	2.063 (0.0000)	7488.51	4.687
EVAPOTRANSPIRATION	28.539 (0.0000)	103595.30	64.846
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.16035 (0.00000)	47772.082	29.90310
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.006 (0.000)		
CHANGE IN WATER STORAGE	0.248 (0.0000)	900.44	0.564

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.706	6193.2847
DRAINAGE COLLECTED FROM LAYER 7	0.23173	841.17187
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.039	
MAXIMUM HEAD ON TOP OF LAYER 8	0.079	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6243	0.2187
2	40.5144	0.0767
3	3.4260	0.2855
4	7.2066	0.0751
5	13.6685	0.2848
6	5.3378	0.2224
7	0.0015	0.0100
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 6.5 LIFTS

Floor slope 33%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF6-5S33.OUT


TIME:  11: 4     DATE:   6/26/2020


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     TITLE:  MID FILL @ 6.5 LIFTS; S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2221	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0782	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2814	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0269	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.838	INCHES
TOTAL INITIAL WATER	=	72.838	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
EVAPOTRANSPIRATION	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
LATERAL DRAINAGE COLLECTED	4.5609	1.5614	0.8036	0.5683	0.3514	0.4580
FROM LAYER 7	0.5124	0.2748	0.3498	1.2149	3.4135	1.1621
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 8	0.000	0.000	0.000	0.000	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.000	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.100	7622.630	4.77

EVAPOTRANSPIRATION	26.873	97548.234	61.06
DRAINAGE COLLECTED FROM LAYER 7	15.2312	55289.234	34.61
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0004		
CHANGE IN WATER STORAGE	-0.194	-703.861	-0.44
SOIL WATER AT START OF YEAR	72.842	264416.531	
SOIL WATER AT END OF YEAR	72.648	263712.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.048	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	4.5609	1.5614	0.8036	0.5683	0.3514	0.4580
	0.5124	0.2748	0.3498	1.2149	3.4135	1.1621
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0015	0.0006	0.0003	0.0002	0.0001	0.0002
	0.0002	0.0001	0.0001	0.0004	0.0011	0.0004
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.100	(0.0000)	7622.63	4.771
EVAPOTRANSPIRATION	26.873	(0.0000)	97548.23	61.061
LATERAL DRAINAGE COLLECTED FROM LAYER 7	15.23119	(0.00000)	55289.234	34.60849
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.000)		
CHANGE IN WATER STORAGE	-0.194	(0.0000)	-703.86	-0.441

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.652	5996.8691
DRAINAGE COLLECTED FROM LAYER 7	0.27590	1001.53326
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.003	
MAXIMUM HEAD ON TOP OF LAYER 8	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3770

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6622	0.2218
2	40.6901	0.0771
3	3.3795	0.2816
4	7.3393	0.0765
5	13.2675	0.2764
6	5.3036	0.2210
7	0.0019	0.0125
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 8.5 LIFTS

Floor slope 2%

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF8-5S2.OUT


TIME:  13:37     DATE:   6/24/2020


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     TITLE:  MID FILL @ 8.5 LIFTS, S = 2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2680	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.7418	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	87.006	INCHES
TOTAL INITIAL WATER	=	87.006	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.5604	1.6857	0.7875	0.5765	0.5412	0.2944
FROM LAYER 7	0.2852	0.3654	0.2182	0.2781	3.0659	1.1275
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.073	0.030	0.013	0.010	0.009	0.005
TOP OF LAYER 8	0.005	0.006	0.004	0.004	0.051	0.018
STD. DEVIATION OF DAILY	0.026	0.008	0.003	0.001	0.002	0.001
HEAD ON TOP OF LAYER 8	0.001	0.000	0.001	0.003	0.025	0.004

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	13.7861	50043.457	31.32
PERC./LEAKAGE THROUGH LAYER 8	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0189		
CHANGE IN WATER STORAGE	-0.213	-773.098	-0.48
SOIL WATER AT START OF YEAR	87.117	316234.312	
SOIL WATER AT END OF YEAR	86.904	315461.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.5604	1.6857	0.7875	0.5765	0.5412	0.2944
	0.2852	0.3654	0.2182	0.2781	3.0659	1.1275
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0734	0.0300	0.0127	0.0096	0.0087	0.0049
	0.0046	0.0059	0.0036	0.0045	0.0510	0.0182
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.78608	(0.00000)	50043.457	31.32487
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.019	(0.000)		
CHANGE IN WATER STORAGE	-0.213	(0.0000)	-773.10	-0.484

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.24371	884.65076
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 8	0.122	
MAXIMUM HEAD ON TOP OF LAYER 8	0.239	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	4.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	54.5663	0.0758
3	3.4513	0.2876
4	7.2273	0.0753
5	13.6372	0.2841
6	5.3496	0.2229
7	0.0035	0.0230
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 8.5 LIFTS

Floor slope 3%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF8-5S3.OUT


TIME:  13:40     DATE:   6/24/2020


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     TITLE:  MID FILL @ 8.5 LIFTS, S = 3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2148	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2857	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2680	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.4879	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	86.968	INCHES
TOTAL INITIAL WATER	=	86.968	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.5358	1.6777	0.7845	0.5772	0.5396	0.2942
FROM LAYER 7	0.2852	0.3661	0.2173	0.2869	3.0626	1.1229
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.049	0.020	0.008	0.006	0.006	0.003
TOP OF LAYER 8	0.003	0.004	0.002	0.003	0.034	0.012
STD. DEVIATION OF DAILY	0.018	0.005	0.002	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.001	0.002	0.017	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.022	7340.542	4.59

EVAPOTRANSPIRATION	28.415	103145.367	64.56
DRAINAGE COLLECTED FROM LAYER 7	13.7499	49912.102	31.24
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0126		
CHANGE IN WATER STORAGE	-0.177	-641.714	-0.40
SOIL WATER AT START OF YEAR	87.041	315957.875	
SOIL WATER AT END OF YEAR	86.864	315316.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.012	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.040	1.702	0.046	0.000	0.224
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.921
	1.729	3.442	1.119	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.5358	1.6777	0.7845	0.5772	0.5396	0.2942
	0.2852	0.3661	0.2173	0.2869	3.0626	1.1229
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0487	0.0199	0.0084	0.0064	0.0058	0.0033
	0.0031	0.0039	0.0024	0.0031	0.0340	0.0121
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.022	(0.0000)	7340.54	4.595
EVAPOTRANSPIRATION	28.415	(0.0000)	103145.37	64.564
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.74989	(0.00000)	49912.102	31.24265
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.013	(0.000)		
CHANGE IN WATER STORAGE	-0.177	(0.0000)	-641.71	-0.402

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.702	6179.5317
DRAINAGE COLLECTED FROM LAYER 7	0.25364	920.71338
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.084	
MAXIMUM HEAD ON TOP OF LAYER 8	0.167	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	2.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5575	0.2131
2	54.5663	0.0758
3	3.4513	0.2876
4	7.2273	0.0753
5	13.6372	0.2841
6	5.3496	0.2229
7	0.0016	0.0104
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID-HEIGHT – 8.5 LIFTS

Floor slope 4%

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**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF8-5S4.OUT


TIME:  13:43     DATE:   6/24/2020


**************************************************************************

     TITLE:  MID FILL @ 8.5 LIFTS, S = 4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3847	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	87.012	INCHES
TOTAL INITIAL WATER	=	87.012	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.5527	1.6926	0.7910	0.5848	0.5234	0.3149
FROM LAYER 7	0.2889	0.3430	0.2228	0.2814	2.8655	1.1806
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.037	0.015	0.006	0.005	0.004	0.003
TOP OF LAYER 8	0.002	0.003	0.002	0.002	0.024	0.010
STD. DEVIATION OF DAILY	0.013	0.004	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.013	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63

EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	13.6416	49519.062	31.00
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0094		
CHANGE IN WATER STORAGE	-0.200	-726.903	-0.46
SOIL WATER AT START OF YEAR	87.070	316063.281	
SOIL WATER AT END OF YEAR	86.870	315336.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.081	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.5527	1.6926	0.7910	0.5848	0.5234	0.3149
	0.2889	0.3430	0.2228	0.2814	2.8655	1.1806
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0367	0.0151	0.0064	0.0049	0.0042	0.0026
	0.0023	0.0028	0.0019	0.0023	0.0239	0.0095
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.64161	(0.00000)	49519.062	30.99663
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.009	(0.000)		
CHANGE IN WATER STORAGE	-0.200	(0.0000)	-726.90	-0.455

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.22933	832.46790
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 8	0.057	
MAXIMUM HEAD ON TOP OF LAYER 8	0.113	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	2.9 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	54.4117	0.0756
3	3.4554	0.2879
4	7.4253	0.0773
5	13.6183	0.2837
6	5.2938	0.2206
7	0.0022	0.0144
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 8.5 LIFTS

Floor slope 5%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF8-5S5.OUT


TIME:  13:46     DATE:   6/24/2020


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     TITLE:  MID FILL @ 8.5 LIFTS, S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2164	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2707	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3089	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	87.001	INCHES
TOTAL INITIAL WATER	=	87.001	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
EVAPOTRANSPIRATION	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.5454	1.6902	0.7903	0.5848	0.5229	0.3149
FROM LAYER 7	0.2890	0.3431	0.2227	0.2810	2.8677	1.1789
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.029	0.012	0.005	0.004	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.002	0.019	0.008
STD. DEVIATION OF DAILY	0.011	0.003	0.001	0.001	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.010	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.038	7397.054	4.63

EVAPOTRANSPIRATION	28.531	103566.992	64.83
DRAINAGE COLLECTED FROM LAYER 7	13.6306	49479.215	30.97
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0075		
CHANGE IN WATER STORAGE	-0.189	-686.967	-0.43
SOIL WATER AT START OF YEAR	87.047	315980.687	
SOIL WATER AT END OF YEAR	86.858	315293.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.043	1.705	0.045	0.000	0.233
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.879	2.771	2.254	1.951	4.910
	1.762	3.475	1.126	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7						
TOTALS	4.5454	1.6902	0.7903	0.5848	0.5229	0.3149
	0.2890	0.3431	0.2227	0.2810	2.8677	1.1789
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 8						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8						
AVERAGES	0.0293	0.0121	0.0051	0.0039	0.0034	0.0021
	0.0019	0.0022	0.0015	0.0018	0.0191	0.0076
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.038	(0.0000)	7397.05	4.630
EVAPOTRANSPIRATION	28.531	(0.0000)	103566.99	64.828
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.63064	(0.00000)	49479.215	30.97169
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.007	(0.000)		
CHANGE IN WATER STORAGE	-0.189	(0.0000)	-686.97	-0.430

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.705	6189.2476
DRAINAGE COLLECTED FROM LAYER 7	0.23231	843.29980
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.046	
MAXIMUM HEAD ON TOP OF LAYER 8	0.093	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6051	0.2171
2	54.4117	0.0756
3	3.4554	0.2879
4	7.4253	0.0773
5	13.6183	0.2837
6	5.2938	0.2206
7	0.0018	0.0119
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

MID-HEIGHT – 8.5 LIFTS

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF8-5S6.OUT


TIME:  13:49     DATE:   6/24/2020


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     TITLE:  MID FILL @ 8.5 LIFTS, S = 6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

              TYPE 1 - VERTICAL PERCOLATION LAYER
                  MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2186	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2831	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2704	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2611	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	87.027	INCHES
TOTAL INITIAL WATER	=	87.027	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	4.5562	1.7001	0.7933	0.5838	0.5230	0.3116
FROM LAYER 7	0.2844	0.3508	0.2161	0.2750	2.8554	1.1841
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.025	0.010	0.004	0.003	0.003	0.002
TOP OF LAYER 8	0.002	0.002	0.001	0.001	0.016	0.006
STD. DEVIATION OF DAILY	0.009	0.003	0.001	0.000	0.001	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.001	0.009	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.063	7488.505	4.69

EVAPOTRANSPIRATION	28.539	103595.297	64.85
DRAINAGE COLLECTED FROM LAYER 7	13.6338	49490.711	30.98
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0063		
CHANGE IN WATER STORAGE	-0.225	-818.212	-0.51
SOIL WATER AT START OF YEAR	87.066	316050.594	
SOIL WATER AT END OF YEAR	86.841	315232.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.012	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.010
	0.000	0.046	1.706	0.046	0.000	0.253
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.804	1.891	2.770	2.246	1.962	4.890
	1.762	3.477	1.127	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	4.5562	1.7001	0.7933	0.5838	0.5230	0.3116
	0.2844	0.3508	0.2161	0.2750	2.8554	1.1841
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0245	0.0101	0.0043	0.0032	0.0028	0.0017
	0.0015	0.0019	0.0012	0.0015	0.0159	0.0064
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	2.063 (0.0000)	7488.51	4.687
EVAPOTRANSPIRATION	28.539 (0.0000)	103595.30	64.846
LATERAL DRAINAGE COLLECTED FROM LAYER 7	13.63380 (0.00000)	49490.711	30.97888
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000 (0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.006 (0.000)		
CHANGE IN WATER STORAGE	-0.225 (0.0000)	-818.21	-0.512

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.706	6193.2847
DRAINAGE COLLECTED FROM LAYER 7	0.23206	842.37317
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.039	
MAXIMUM HEAD ON TOP OF LAYER 8	0.075	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	6.7 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6243	0.2187
2	54.8452	0.0762
3	3.3828	0.2819
4	7.1743	0.0747
5	13.4217	0.2796
6	5.3481	0.2228
7	0.0052	0.0349
8	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

MID -HEIGHT – 8.5 LIFTS

Floor slope 33%

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**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\MF8-5S33.OUT


TIME:  11:23     DATE:   6/26/2020


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     TITLE:  MID FILL @ 8.5 LIFTS; S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2221	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0782	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2814	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2791	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0269	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 8

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	50.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	72.838	INCHES
TOTAL INITIAL WATER	=	72.838	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
EVAPOTRANSPIRATION	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
LATERAL DRAINAGE COLLECTED	4.5609	1.5614	0.8036	0.5683	0.3514	0.4580
FROM LAYER 7	0.5124	0.2748	0.3498	1.2149	3.4135	1.1621
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 8	0.000	0.000	0.000	0.000	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 8	0.000	0.000	0.000	0.000	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	2.100	7622.630	4.77

EVAPOTRANSPIRATION	26.873	97548.234	61.06
DRAINAGE COLLECTED FROM LAYER 7	15.2312	55289.234	34.61
PERC./LEAKAGE THROUGH LAYER 8	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 8	0.0004		
CHANGE IN WATER STORAGE	-0.194	-703.861	-0.44
SOIL WATER AT START OF YEAR	72.842	264416.531	
SOIL WATER AT END OF YEAR	72.648	263712.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.048	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.011
	0.000	0.055	1.652	0.046	0.002	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.825	1.860	2.422	2.070	1.747	4.392
	1.480	3.464	0.920	3.065	2.340	1.287
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

LATERAL DRAINAGE COLLECTED FROM LAYER 7

TOTALS	4.5609	1.5614	0.8036	0.5683	0.3514	0.4580
	0.5124	0.2748	0.3498	1.2149	3.4135	1.1621
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

PERCOLATION/LEAKAGE THROUGH LAYER 8

TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 8

AVERAGES	0.0015	0.0006	0.0003	0.0002	0.0001	0.0002
	0.0002	0.0001	0.0001	0.0004	0.0011	0.0004
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	2.100	(0.0000)	7622.63	4.771
EVAPOTRANSPIRATION	26.873	(0.0000)	97548.23	61.061
LATERAL DRAINAGE COLLECTED FROM LAYER 7	15.23119	(0.00000)	55289.234	34.60849
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 8	0.000	(0.000)		
CHANGE IN WATER STORAGE	-0.194	(0.0000)	-703.86	-0.441

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	1.652	5996.8691
DRAINAGE COLLECTED FROM LAYER 7	0.27590	1001.53326
PERCOLATION/LEAKAGE THROUGH LAYER 8	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 8	0.003	
MAXIMUM HEAD ON TOP OF LAYER 8	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 7 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.3770

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6622	0.2218
2	40.6901	0.0771
3	3.3795	0.2816
4	7.3393	0.0765
5	13.2675	0.2764
6	5.3036	0.2210
7	0.0019	0.0125
8	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – FIVE LIFTS

Floor slope 2%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY           **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF5S2.OUT


TIME:  18:46     DATE:   7/ 7/2020


**************************************************************************

     TITLE:  FULL FILL @5 LIFTS; S = 2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2131	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2953	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0770	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2553	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0110	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC

SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.418	INCHES
TOTAL INITIAL WATER	=	65.418	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%

AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.9051	1.4461	0.9416	0.4864	0.5786	0.3905
FROM LAYER 9	0.3082	0.2732	0.3215	0.2786	1.7875	1.1426

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.165	0.026	0.015	0.008	0.009	0.006
TOP OF LAYER 10	0.005	0.004	0.005	0.004	0.030	0.018
STD. DEVIATION OF DAILY	0.493	0.007	0.003	0.002	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.001	0.002	0.002	0.017	0.006

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	12.8598	46681.000	29.22
PERC./LEAKAGE THROUGH LAYER 10	0.000003	0.010	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0248		
CHANGE IN WATER STORAGE	-0.351	-1272.821	-0.80
SOIL WATER AT START OF YEAR	65.420	237474.781	
SOIL WATER AT END OF YEAR	65.069	236201.969	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.016	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.9051	1.4461	0.9416	0.4864	0.5786	0.3905
	0.3082	0.2732	0.3215	0.2786	1.7875	1.1426
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.1653	0.0258	0.0152	0.0081	0.0093	0.0065
	0.0050	0.0044	0.0053	0.0045	0.0297	0.0184
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

0.0000 0.0000 0.0000 0.0000 0.0000 0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01 (0.000)	159756.3	100.00
RUNOFF	3.077 (0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424 (0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	12.85978 (0.00000)	46681.000	29.22013
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000 (0.00000)	0.010	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.025 (0.000)		
CHANGE IN WATER STORAGE	-0.351 (0.0000)	-1272.82	-0.797

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.28407	1031.15833
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00116
AVERAGE HEAD ON TOP OF LAYER 10	2.818	
MAXIMUM HEAD ON TOP OF LAYER 10	4.487	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	38.5 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

****

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	18.4037	0.0767
3	3.5210	0.2934
4	11.1676	0.0776
5	3.4971	0.2914
6	7.8630	0.0819
7	12.6868	0.2643
8	5.3622	0.2234
9	0.0147	0.0980
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

FULL -HEIGHT – FIVE LIFTS

Floor slope 3%

```
*******************************************************************************
*******************************************************************************
**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF5S3.OUT


TIME:  18:49     DATE:   7/ 7/2020


*******************************************************************************

     TITLE:  FULL FILL @5 LIFTS; S = 3%

*******************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```



```
                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    240.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2131 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    144.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0764 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2953 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0770	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2553	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0110	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.418	INCHES
TOTAL INITIAL WATER	=	65.418	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.9167	1.4402	0.9392	0.4850	0.5792	0.3895

FROM LAYER 9	0.3079	0.2733	0.3210	0.2798	1.7929	1.1425
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.053	0.017	0.010	0.005	0.006	0.004
TOP OF LAYER 10	0.003	0.003	0.004	0.003	0.020	0.012
STD. DEVIATION OF DAILY	0.021	0.004	0.002	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.000	0.001	0.001	0.011	0.004

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	12.8672	46708.004	29.24
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0117		
CHANGE IN WATER STORAGE	-0.358	-1299.823	-0.81
SOIL WATER AT START OF YEAR	65.420	237474.781	
SOIL WATER AT END OF YEAR	65.062	236174.969	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.9167	1.4402	0.9392	0.4850	0.5792	0.3895
	0.3079	0.2733	0.3210	0.2798	1.7929	1.1425
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0528	0.0171	0.0101	0.0054	0.0062	0.0043
	0.0033	0.0029	0.0036	0.0030	0.0199	0.0123

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	12.86722	(0.00000)	46708.004	29.23704
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.012	(0.000)		
CHANGE IN WATER STORAGE	-0.358	(0.0000)	-1299.82	-0.814

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.29491	1070.51770
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.098	
MAXIMUM HEAD ON TOP OF LAYER 10	0.194	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	18.4037	0.0767
3	3.5210	0.2934
4	11.1676	0.0776
5	3.4971	0.2914
6	7.8630	0.0819
7	12.6868	0.2643
8	5.3622	0.2234
9	0.0073	0.0484
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – FIVE LIFTS

Floor slope 4%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
**************************************************************************************
**************************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF5S4.OUT


TIME:  18:52     DATE:   7/ 7/2020


**************************************************************************************

     TITLE:  FULL FILL @5 LIFTS; S = 4%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2171	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0760	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2945	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0775	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2543	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0101	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.423	INCHES
TOTAL INITIAL WATER	=	65.423	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY	= 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	= 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	= 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	= 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.8789	1.4629	0.9477	0.4872	0.5771	0.3935

FROM LAYER 9	0.3127	0.2958	0.2898	0.2521	1.6586	1.1702
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.039	0.013	0.008	0.004	0.005	0.003
TOP OF LAYER 10	0.003	0.002	0.002	0.002	0.014	0.009
STD. DEVIATION OF DAILY	0.015	0.003	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.009	0.003

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	12.7264	46196.918	28.92
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0087		
CHANGE IN WATER STORAGE	-0.349	-1267.725	-0.79
SOIL WATER AT START OF YEAR	65.425	237491.266	
SOIL WATER AT END OF YEAR	65.075	236223.547	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.026	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8789	1.4629	0.9477	0.4872	0.5771	0.3935
	0.3127	0.2958	0.2898	0.2521	1.6586	1.1702
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0393	0.0131	0.0076	0.0041	0.0047	0.0033
	0.0025	0.0024	0.0024	0.0020	0.0138	0.0094

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	12.72642	(0.00000)	46196.918	28.91712
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.009	(0.000)		
CHANGE IN WATER STORAGE	-0.349	(0.0000)	-1267.72	-0.794

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.28312	1027.72229
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.071	
MAXIMUM HEAD ON TOP OF LAYER 10	0.140	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.4 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	18.3020	0.0763
3	3.4908	0.2909
4	11.2310	0.0780
5	3.5648	0.2971
6	7.8654	0.0819
7	12.6277	0.2631
8	5.3686	0.2237
9	0.0115	0.0765
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – FIVE LIFTS

Floor slope 5%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF5S5.OUT


TIME:  18:54     DATE:   7/ 7/2020


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     TITLE:  FULL FILL @5 LIFTS; S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                               LAYER  2
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    240.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                               LAYER  3
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2171 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                               LAYER  4
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    144.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0760 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                               LAYER  5
                               --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2945 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0775	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2543	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0101	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.423	INCHES
TOTAL INITIAL WATER	=	65.423	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.8825	1.4610	0.9467	0.4871	0.5772	0.3931

FROM LAYER 9	0.3126	0.2959	0.2897	0.2525	1.6601	1.1701
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.032	0.010	0.006	0.003	0.004	0.003
TOP OF LAYER 10	0.002	0.002	0.002	0.002	0.011	0.008
STD. DEVIATION OF DAILY	0.012	0.003	0.001	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.007	0.002

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	12.7286	46204.820	28.92
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0070		
CHANGE IN WATER STORAGE	-0.351	-1275.646	-0.80
SOIL WATER AT START OF YEAR	65.425	237491.266	
SOIL WATER AT END OF YEAR	65.073	236215.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8825	1.4610	0.9467	0.4871	0.5772	0.3931
	0.3126	0.2959	0.2897	0.2525	1.6601	1.1701
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0315	0.0104	0.0061	0.0032	0.0037	0.0026
	0.0020	0.0019	0.0019	0.0016	0.0111	0.0076

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	12.72860	(0.00000)	46204.820	28.92207
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.007	(0.000)		
CHANGE IN WATER STORAGE	-0.351	(0.0000)	-1275.65	-0.798

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.28329	1028.34924
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.057	
MAXIMUM HEAD ON TOP OF LAYER 10	0.112	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	3.1 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	18.3020	0.0763
3	3.4908	0.2909
4	11.2310	0.0780
5	3.5648	0.2971
6	7.8654	0.0819
7	12.6277	0.2631
8	5.3686	0.2237
9	0.0093	0.0620
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – FIVE LIFTS

Floor slope 6%

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**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF5S6.OUT


TIME:  18:57     DATE:   7/ 7/2020


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     TITLE:  FULL FILL @5 LIFTS; S = 6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


FF5S6.OUT                                                        Page 1 of 10
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0774	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2965	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0747	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2980	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2448	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.392	INCHES
TOTAL INITIAL WATER	=	65.392	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY	= 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	= 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	= 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	= 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	4.8052	1.4964	0.9528	0.4892	0.5756	0.3944

FROM LAYER 9	0.3123	0.2851	0.2977	0.2493	1.6604	1.1780
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.026 0.002	0.009 0.002	0.005 0.002	0.003 0.001	0.003 0.009	0.002 0.006
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.012 0.000	0.002 0.000	0.001 0.000	0.001 0.001	0.000 0.006	0.000 0.002

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.103	11263.241	7.05
EVAPOTRANSPIRATION	28.542	103605.773	64.85
DRAINAGE COLLECTED FROM LAYER 9	12.6962	46087.301	28.85
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0058		
CHANGE IN WATER STORAGE	-0.331	-1200.067	-0.75
SOIL WATER AT START OF YEAR	65.393	237377.906	
SOIL WATER AT END OF YEAR	65.063	236177.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.033	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.001 0.000	0.000 0.070	0.000 2.562	0.000 0.069	0.000 0.001	0.016 0.385
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.804 1.762	1.891 3.479	2.770 1.128	2.244 3.025	1.962 2.302	4.893 1.281
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8052 0.3123	1.4964 0.2851	0.9528 0.2977	0.4892 0.2493	0.5756 1.6604	0.3944 1.1780
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0259 0.0017	0.0089 0.0015	0.0051 0.0017	0.0027 0.0013	0.0031 0.0092	0.0022 0.0063

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.103	(0.0000)	11263.24	7.050
EVAPOTRANSPIRATION	28.542	(0.0000)	103605.77	64.852
LATERAL DRAINAGE COLLECTED FROM LAYER 9	12.69623	(0.00000)	46087.301	28.84850
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.006	(0.000)		
CHANGE IN WATER STORAGE	-0.331	(0.0000)	-1200.07	-0.751

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.562	9301.0596
DRAINAGE COLLECTED FROM LAYER 9	0.30182	1095.60193
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.050	
MAXIMUM HEAD ON TOP OF LAYER 10	0.101	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4501
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6247	0.2187
2	18.5408	0.0773
3	3.4967	0.2914
4	11.1363	0.0773
5	3.5829	0.2986
6	7.7993	0.0812
7	12.4904	0.2602
8	5.3857	0.2244
9	0.0045	0.0297
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – FIVE LIFTS

Floor slope 33%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF5S33.OUT


TIME:  11:54     DATE:   6/26/2020


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     TITLE:  FULL FILL @5 LIFTS, S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    240.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2218 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    144.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0782 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2950 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0751	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2999	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2288	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0125	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	65.272	INCHES
TOTAL INITIAL WATER	=	65.272	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
EVAPOTRANSPIRATION	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
LATERAL DRAINAGE COLLECTED	4.6126	1.5438	0.9825	0.5220	0.4809	0.3798

FROM LAYER 9	0.2846	0.4570	0.2326	0.5734	3.0209	1.2533
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.148	11428.088	7.15
EVAPOTRANSPIRATION	26.832	97400.617	60.97
DRAINAGE COLLECTED FROM LAYER 9	14.3435	52066.855	32.59
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0004		
CHANGE IN WATER STORAGE	-0.314	-1139.277	-0.71
SOIL WATER AT START OF YEAR	65.274	236945.047	
SOIL WATER AT END OF YEAR	64.960	235805.766	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.003	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.6126	1.5438	0.9825	0.5220	0.4809	0.3798
	0.2846	0.4570	0.2326	0.5734	3.0209	1.2533
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0015	0.0006	0.0003	0.0002	0.0002	0.0001
	0.0001	0.0001	0.0001	0.0002	0.0010	0.0004

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.148	(0.0000)	11428.09	7.153
EVAPOTRANSPIRATION	26.832	(0.0000)	97400.62	60.968
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.34349	(0.00000)	52066.855	32.59143
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	(0.000)		
CHANGE IN WATER STORAGE	-0.314	(0.0000)	-1139.28	-0.713

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.478	8995.4043
DRAINAGE COLLECTED FROM LAYER 9	0.26918	977.11505
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.003	
MAXIMUM HEAD ON TOP OF LAYER 10	0.027	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3698	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6619	0.2218
2	18.6546	0.0777
3	3.4569	0.2881
4	11.2443	0.0781
5	3.6521	0.3043
6	7.5693	0.0788
7	12.2927	0.2561
8	5.4249	0.2260
9	0.0018	0.0117
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – EIGHT (8) LIFTS

Floor slope 2%

```
**************************************************************************************
**************************************************************************************
**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
**************************************************************************************
**************************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF8S2.OUT


TIME:  14:41     DATE:   6/24/2020


**************************************************************************************

     TITLE:  FULL FILL @8 LIFTS; S = 2%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	384.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2131	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0766	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2928	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0765	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2958	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2298	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1168	VOL/VOL

EFFECTIVE SAT. HYD. COND. = 4.42000008000 CM/SEC
SLOPE = 2.00 PERCENT
DRAINAGE LENGTH = 250.0 FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	86.791	INCHES
TOTAL INITIAL WATER	=	86.791	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.8495	1.7506	0.9811	0.5152	0.6024	0.3927

FROM LAYER 9	0.3104	0.2751	0.3222	0.2586	1.6998	1.2295
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.078 0.005	0.031 0.004	0.016 0.005	0.009 0.004	0.010 0.028	0.007 0.020
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.035 0.000	0.009 0.001	0.004 0.002	0.001 0.002	0.001 0.020	0.001 0.006

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	13.1871	47869.066	29.96
PERC./LEAKAGE THROUGH LAYER 10	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0181		
CHANGE IN WATER STORAGE	-0.678	-2460.813	-1.54
SOIL WATER AT START OF YEAR	86.808	315113.687	
SOIL WATER AT END OF YEAR	86.130	312652.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.060	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.000 0.000	0.000 0.060	0.000 2.600	0.000 0.069	0.000 0.001	0.015 0.332
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.811 1.729	1.893 3.442	2.700 1.131	2.247 3.011	1.953 2.305	4.919 1.282
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8495 0.3104	1.7506 0.2751	0.9811 0.3222	0.5152 0.2586	0.6024 1.6998	0.3927 1.2295
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0781 0.0050	0.0312 0.0044	0.0158 0.0054	0.0086 0.0042	0.0097 0.0283	0.0065 0.0198

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.18707	(0.00000)	47869.066	29.96381
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.018	(0.000)		
CHANGE IN WATER STORAGE	-0.678	(0.0000)	-2460.81	-1.540

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.26524	962.80597
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00005
AVERAGE HEAD ON TOP OF LAYER 10	0.132	
MAXIMUM HEAD ON TOP OF LAYER 10	0.259	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	4.9 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	29.4314	0.0766
3	3.5007	0.2917
4	22.3261	0.0775
5	3.5000	0.2917
6	7.3269	0.0763
7	12.0617	0.2513
8	5.4004	0.2250
9	0.0140	0.0934
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – EIGHT (8) LIFTS

Floor slope 3%

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                  **
**                     USAE WATERWAYS EXPERIMENT STATION                    **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF8S3.OUT


TIME:  14:46     DATE:   6/24/2020


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     TITLE:  FULL FILL @8 LIFTS; S =3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    384.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2131 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    288.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0766 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2928 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0765	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2958	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2298	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0884	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	86.786	INCHES
TOTAL INITIAL WATER	=	86.786	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.8600	1.7422	0.9780	0.5140	0.6027	0.3917
FROM LAYER 9	0.3101	0.2752	0.3217	0.2587	1.7073	1.2253
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.052	0.021	0.011	0.006	0.006	0.004
TOP OF LAYER 10	0.003	0.003	0.004	0.003	0.019	0.013
STD. DEVIATION OF DAILY	0.024	0.006	0.003	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.000	0.001	0.001	0.013	0.004

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	13.1870	47868.914	29.96
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0121		
CHANGE IN WATER STORAGE	-0.678	-2460.646	-1.54
SOIL WATER AT START OF YEAR	86.800	315082.781	
SOIL WATER AT END OF YEAR	86.122	312622.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.073	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8600	1.7422	0.9780	0.5140	0.6027	0.3917
	0.3101	0.2752	0.3217	0.2587	1.7073	1.2253
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0522	0.0207	0.0105	0.0057	0.0065	0.0043
	0.0033	0.0030	0.0036	0.0028	0.0189	0.0132

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.18703	(0.00000)	47868.914	29.96371
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.012	(0.000)		
CHANGE IN WATER STORAGE	-0.678	(0.0000)	-2460.65	-1.540

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.26942	978.00031
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.090	
MAXIMUM HEAD ON TOP OF LAYER 10	0.177	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.7 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	29.4314	0.0766
3	3.5007	0.2917
4	22.3261	0.0775
5	3.5000	0.2917
6	7.3269	0.0763
7	12.0617	0.2513
8	5.4004	0.2250
9	0.0098	0.0653
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – EIGHT (8) LIFTS

Floor slope 4%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
**************************************************************************************
**************************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF8S4.OUT


TIME:  14:50     DATE:   6/24/2020


**************************************************************************************

     TITLE:  FULL FILL @8 LIFTS; S = 4%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	384.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2171	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0761	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2919	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0784	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2954	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2282	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0623	VOL/VOL

EFFECTIVE SAT. HYD. COND. = 4.42000008000 CM/SEC
SLOPE = 4.00 PERCENT
DRAINAGE LENGTH = 250.0 FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	= 0.06	INCHES
POROSITY	= 0.0000	VOL/VOL
FIELD CAPACITY	= 0.0000	VOL/VOL
WILTING POINT	= 0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	= 0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	= 0.00	HOLES/ACRE
FML PLACEMENT QUALITY	= 1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	= 86.00	
FRACTION OF AREA ALLOWING RUNOFF	= 75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	= 1.000	ACRES
EVAPORATIVE ZONE DEPTH	= 9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	= 1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	= 4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	= 0.765	INCHES
INITIAL SNOW WATER	= 0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	= 86.801	INCHES
TOTAL INITIAL WATER	= 86.801	INCHES
TOTAL SUBSURFACE INFLOW	= 0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	= 39.18	DEGREES
MAXIMUM LEAF AREA INDEX	= 0.00	
START OF GROWING SEASON (JULIAN DATE)	= 102	
END OF GROWING SEASON (JULIAN DATE)	= 300	
EVAPORATIVE ZONE DEPTH	= 9.0	INCHES
AVERAGE ANNUAL WIND SPEED	= 9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.8580	1.7445	0.9847	0.5154	0.5976	0.3960

FROM LAYER 9	0.3146	0.2973	0.2905	0.2497	1.5381	1.2753
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.039 0.003	0.016 0.002	0.008 0.002	0.004 0.002	0.005 0.013	0.003 0.010
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.018 0.000	0.004 0.000	0.002 0.000	0.001 0.001	0.000 0.010	0.000 0.003

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.0616	47413.543	29.68
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0090		
CHANGE IN WATER STORAGE	-0.684	-2484.353	-1.56
SOIL WATER AT START OF YEAR	86.810	315119.781	
SOIL WATER AT END OF YEAR	86.125	312635.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.000 0.000	0.000 0.064	0.000 2.589	0.000 0.068	0.000 0.001	0.016 0.353
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.805 1.762	1.880 3.476	2.771 1.136	2.254 3.011	1.951 2.304	4.909 1.282
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8580 0.3146	1.7445 0.2973	0.9847 0.2905	0.5154 0.2497	0.5976 1.5381	0.3960 1.2753
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0391 0.0025	0.0156 0.0024	0.0079 0.0024	0.0043 0.0020	0.0048 0.0128	0.0033 0.0103

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.06158	(0.00000)	47413.543	29.67867
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.009	(0.000)		
CHANGE IN WATER STORAGE	-0.684	(0.0000)	-2484.35	-1.555

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.26875	975.55267
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.067	
MAXIMUM HEAD ON TOP OF LAYER 10	0.134	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	1.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	29.2900	0.0763
3	3.4721	0.2893
4	22.5424	0.0783
5	3.5467	0.2956
6	7.2014	0.0750
7	12.0332	0.2507
8	5.4118	0.2255
9	0.0064	0.0427
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – EIGHT (8) LIFTS

Floor slope 5%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF8S5.OUT


TIME:  14:53     DATE:   6/24/2020


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     TITLE:  FULL FILL @8 LIFTS; S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    384.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2171 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    288.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0761 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2919 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0784	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2954	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2282	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0516	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	86.799	INCHES
TOTAL INITIAL WATER	=	86.799	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.8608	1.7420	0.9836	0.5154	0.5976	0.3957

FROM LAYER 9	0.3145	0.2974	0.2904	0.2496	1.5404	1.2737
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.031	0.012	0.006	0.003	0.004	0.003
TOP OF LAYER 10	0.002	0.002	0.002	0.002	0.010	0.008
STD. DEVIATION OF DAILY	0.015	0.004	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.008	0.002

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.0609	47411.168	29.68
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0072		
CHANGE IN WATER STORAGE	-0.684	-2481.999	-1.55
SOIL WATER AT START OF YEAR	86.807	315108.094	
SOIL WATER AT END OF YEAR	86.123	312626.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.047	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.8608	1.7420	0.9836	0.5154	0.5976	0.3957
	0.3145	0.2974	0.2904	0.2496	1.5404	1.2737
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0314	0.0124	0.0063	0.0034	0.0039	0.0026
	0.0020	0.0019	0.0019	0.0016	0.0103	0.0082

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.06093	(0.00000)	47411.168	29.67719
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.007	(0.000)		
CHANGE IN WATER STORAGE	-0.684	(0.0000)	-2482.00	-1.554

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.26987	979.63843
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.054	
MAXIMUM HEAD ON TOP OF LAYER 10	0.108	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	29.2900	0.0763
3	3.4721	0.2893
4	22.5424	0.0783
5	3.5467	0.2956
6	7.2014	0.0750
7	12.0332	0.2507
8	5.4118	0.2255
9	0.0054	0.0363
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – EIGHT (8) LIFTS

Floor slope 6%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                      USAE WATERWAYS EXPERIMENT STATION                           **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF8S6.OUT


TIME:  15: 3     DATE:   6/24/2020


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     TITLE:  FULL FILL @8 LIFTS; S = 6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	384.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0774	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2911	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2962	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2226	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0528	VOL/VOL

EFFECTIVE SAT. HYD. COND. = 4.42000008000 CM/SEC
SLOPE = 6.00 PERCENT
DRAINAGE LENGTH = 250.0 FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	86.828	INCHES
TOTAL INITIAL WATER	=	86.828	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	4.7205	1.8848	1.0002	0.5204	0.5976	0.3971

FROM LAYER 9	0.3143	0.2868	0.2983	0.2483	1.5358	1.2828
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.025 0.002	0.011 0.002	0.005 0.002	0.003 0.001	0.003 0.009	0.002 0.007
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.013 0.000	0.004 0.000	0.001 0.000	0.001 0.001	0.000 0.007	0.000 0.002

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.103	11263.241	7.05
EVAPOTRANSPIRATION	28.542	103605.773	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.0870	47505.680	29.74
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0060		
CHANGE IN WATER STORAGE	-0.721	-2618.451	-1.64
SOIL WATER AT START OF YEAR	86.836	315213.969	
SOIL WATER AT END OF YEAR	86.114	312595.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.036	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.001 0.000	0.000 0.070	0.000 2.562	0.000 0.069	0.000 0.001	0.016 0.385
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.804 1.762	1.891 3.479	2.770 1.128	2.244 3.025	1.962 2.302	4.893 1.281
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.7205 0.3143	1.8848 0.2868	1.0002 0.2983	0.5204 0.2483	0.5976 1.5358	0.3971 1.2828
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0254 0.0017	0.0112 0.0015	0.0054 0.0017	0.0029 0.0013	0.0032 0.0085	0.0022 0.0069

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.103	(0.0000)	11263.24	7.050
EVAPOTRANSPIRATION	28.542	(0.0000)	103605.77	64.852
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.08696	(0.00000)	47505.680	29.73634
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.006	(0.000)		
CHANGE IN WATER STORAGE	-0.721	(0.0000)	-2618.45	-1.639

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.562	9301.0596
DRAINAGE COLLECTED FROM LAYER 9	0.26002	943.87512
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.043	
MAXIMUM HEAD ON TOP OF LAYER 10	0.088	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4501
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6247	0.2187
2	29.6053	0.0771
3	3.4608	0.2884
4	22.3189	0.0775
5	3.5583	0.2965
6	7.1260	0.0742
7	12.0090	0.2502
8	5.3961	0.2248
9	0.0074	0.0496
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – EIGHT (8) LIFTS

Floor slope 33%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF8S33.OUT


TIME:  12:17     DATE:   6/26/2020


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     TITLE:  FULL FILL @8 LIFTS, S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    384.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2884 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    288.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0775 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2965 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0742	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2502	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2248	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0496	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	85.458	INCHES
TOTAL INITIAL WATER	=	85.458	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
EVAPOTRANSPIRATION	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
LATERAL DRAINAGE COLLECTED	2.7481	2.3877	1.0788	0.5675	0.5050	0.3884

FROM LAYER 9	0.2900	0.4587	0.2297	0.4304	3.0332	1.3731
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000
STD. DEVIATION OF DAILY	0.001	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.148	11428.088	7.15
EVAPOTRANSPIRATION	26.832	97400.617	60.97
DRAINAGE COLLECTED FROM LAYER 9	13.4904	48970.156	30.65
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0004		
CHANGE IN WATER STORAGE	0.539	1957.462	1.23
SOIL WATER AT START OF YEAR	85.466	310240.250	
SOIL WATER AT END OF YEAR	86.005	312197.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.041	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	2.7481	2.3877	1.0788	0.5675	0.5050	0.3884
	0.2900	0.4587	0.2297	0.4304	3.0332	1.3731
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0009	0.0009	0.0004	0.0002	0.0002	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0010	0.0004

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.148	(0.0000)	11428.09	7.153
EVAPOTRANSPIRATION	26.832	(0.0000)	97400.62	60.968
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.49040	(0.00000)	48970.156	30.65304
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.539	(0.0000)	1957.46	1.225

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.478	8995.4043
DRAINAGE COLLECTED FROM LAYER 9	0.28392	1030.63098
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.003	
MAXIMUM HEAD ON TOP OF LAYER 10	0.005	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3698	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6619	0.2218
2	29.7133	0.0774
3	3.4100	0.2842
4	22.3859	0.0777
5	3.5208	0.2934
6	7.0153	0.0731
7	11.8624	0.2471
8	5.4262	0.2261
9	0.0016	0.0105
10	0.0000	0.0000
SNOW WATER	0.000	

PHASE III PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

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SECTION 10
(continued)

LEACHATE MANAGEMENT SYSTEM

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 10A (continued)

Leachate Generation Rates (per acre)

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 2%

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**************************************************************************************
**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S2.OUT


TIME:  15:23     DATE:   6/24/2020


**************************************************************************************

     TITLE:  FULL FILL @13 LIFTS; S = 2%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	624.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2131	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0762	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2898	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2885	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2230	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0157	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	122.442	INCHES
TOTAL INITIAL WATER	=	122.442	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.2406	2.7871	1.0568	0.5803	0.6351	0.3957

FROM LAYER 9	0.3135	0.2777	0.3231	0.2750	1.4684	1.3930
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.068	0.050	0.017	0.010	0.010	0.007
TOP OF LAYER 10	0.005	0.004	0.005	0.004	0.024	0.022
STD. DEVIATION OF DAILY	0.041	0.023	0.005	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.001	0.002	0.002	0.023	0.007

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	13.7463	49899.180	31.23
PERC./LEAKAGE THROUGH LAYER 10	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0190		
CHANGE IN WATER STORAGE	-1.237	-4491.000	-2.81
SOIL WATER AT START OF YEAR	122.444	444472.719	
SOIL WATER AT END OF YEAR	121.207	439981.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2406	2.7871	1.0568	0.5803	0.6351	0.3957
	0.3135	0.2777	0.3231	0.2750	1.4684	1.3930
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0683	0.0497	0.0170	0.0097	0.0102	0.0066
	0.0050	0.0045	0.0054	0.0044	0.0244	0.0224

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.74633	(0.00000)	49899.180	31.23456
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.019	(0.000)		
CHANGE IN WATER STORAGE	-1.237	(0.0000)	-4491.00	-2.811

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.29146	1058.01111
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 10	0.145	
MAXIMUM HEAD ON TOP OF LAYER 10	0.285	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.2 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

****

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	47.4658	0.0761
3	3.4622	0.2885
4	39.9106	0.0756
5	3.4034	0.2836
6	7.0505	0.0734
7	11.9465	0.2489
8	5.4053	0.2252
9	0.0088	0.0588
10	0.0000	0.0000
SNOW WATER	0.000	

****
****

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 3%

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**********************************************************************************
**********************************************************************************
**                                                                              **
**                                                                              **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                  **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                      USAE WATERWAYS EXPERIMENT STATION                       **
**                FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                              **
**                                                                              **
**********************************************************************************
**********************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S3.OUT


TIME:  15:26     DATE:   6/24/2020


**********************************************************************************

     TITLE:  FULL FILL @13 LIFTS; S = 3%

**********************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```



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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    624.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2131 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    528.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0762 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2898 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0757	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2885	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2230	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0101	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	122.441	INCHES
TOTAL INITIAL WATER	=	122.441	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	4.2719	2.7625	1.0528	0.5792	0.6351	0.3947
FROM LAYER 9	0.3133	0.2778	0.3226	0.2753	1.4773	1.3848
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.046	0.033	0.011	0.006	0.007	0.004
TOP OF LAYER 10	0.003	0.003	0.004	0.003	0.016	0.015
STD. DEVIATION OF DAILY	0.028	0.015	0.003	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.000	0.001	0.001	0.015	0.005

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	13.7473	49902.805	31.24
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0126		
CHANGE IN WATER STORAGE	-1.238	-4494.628	-2.81
SOIL WATER AT START OF YEAR	122.443	444466.625	
SOIL WATER AT END OF YEAR	121.204	439972.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.020	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2719	2.7625	1.0528	0.5792	0.6351	0.3947
	0.3133	0.2778	0.3226	0.2753	1.4773	1.3848
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0459	0.0328	0.0113	0.0064	0.0068	0.0044
	0.0034	0.0030	0.0036	0.0030	0.0164	0.0149

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.74733	(0.00000)	49902.805	31.23683
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.013	(0.000)		
CHANGE IN WATER STORAGE	-1.238	(0.0000)	-4494.63	-2.813

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.29260	1062.12488
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.097	
MAXIMUM HEAD ON TOP OF LAYER 10	0.192	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.9 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	47.4658	0.0761
3	3.4622	0.2885
4	39.9106	0.0756
5	3.4034	0.2836
6	7.0505	0.0734
7	11.9465	0.2489
8	5.4053	0.2252
9	0.0070	0.0465
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 4%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S4.OUT


TIME:  15:30     DATE:   6/24/2020


**************************************************************************************

     TITLE:  FULL FILL @13 LIFTS; S = 4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	624.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2171	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0759	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2898	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0778	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2884	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2201	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0289	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	122.461	INCHES
TOTAL INITIAL WATER	=	122.461	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.2472	2.7901	1.0628	0.5821	0.6278	0.3999

FROM LAYER 9	0.3174	0.2996	0.2908	0.2664	1.2843	1.4432
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.034 0.003	0.025 0.002	0.009 0.002	0.005 0.002	0.005 0.011	0.003 0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.022 0.000	0.012 0.000	0.002 0.000	0.001 0.001	0.000 0.011	0.000 0.004

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.6116	49410.078	30.93
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0094		
CHANGE IN WATER STORAGE	-1.234	-4480.892	-2.80
SOIL WATER AT START OF YEAR	122.465	444548.031	
SOIL WATER AT END OF YEAR	121.231	440067.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.000 0.000	0.000 0.064	0.000 2.589	0.000 0.068	0.000 0.001	0.016 0.353
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.805 1.762	1.880 3.476	2.771 1.136	2.254 3.011	1.951 2.304	4.909 1.282
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2472 0.3174	2.7901 0.2996	1.0628 0.2908	0.5821 0.2664	0.6278 1.2843	0.3999 1.4432
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0342 0.0026	0.0249 0.0024	0.0086 0.0024	0.0048 0.0021	0.0051 0.0107	0.0033 0.0116

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.61159	(0.00000)	49410.078	30.92841
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.009	(0.000)		
CHANGE IN WATER STORAGE	-1.234	(0.0000)	-4480.89	-2.805

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.30676	1113.52625
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.077	
MAXIMUM HEAD ON TOP OF LAYER 10	0.152	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	1.3 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	47.3083	0.0758
3	3.4348	0.2862
4	40.2308	0.0762
5	3.4091	0.2841
6	7.0173	0.0731
7	11.7788	0.2454
8	5.4300	0.2263
9	0.0051	0.0343
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 5%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S5.OUT


TIME:  15:33     DATE:   6/24/2020


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     TITLE:  FULL FILL @13 LIFTS; S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```



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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    624.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2171 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    528.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0759 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2898 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0778	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2884	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2201	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0261	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	122.460	INCHES
TOTAL INITIAL WATER	=	122.460	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	4.2562	2.7829	1.0614	0.5821	0.6278	0.3996

FROM LAYER 9	0.3173	0.2996	0.2907	0.2664	1.2872	1.4406
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.027	0.020	0.007	0.004	0.004	0.003
TOP OF LAYER 10	0.002	0.002	0.002	0.002	0.009	0.009
STD. DEVIATION OF DAILY	0.017	0.009	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.009	0.003

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.6118	49410.684	30.93
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0075		
CHANGE IN WATER STORAGE	-1.235	-4481.474	-2.81
SOIL WATER AT START OF YEAR	122.464	444544.969	
SOIL WATER AT END OF YEAR	121.230	440063.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.008	0.00

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	4.2562	2.7829	1.0614	0.5821	0.6278	0.3996
	0.3173	0.2996	0.2907	0.2664	1.2872	1.4406
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0275	0.0199	0.0068	0.0039	0.0041	0.0027
	0.0020	0.0019	0.0019	0.0017	0.0086	0.0093

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.61176	(0.00000)	49410.684	30.92879
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.008	(0.000)		
CHANGE IN WATER STORAGE	-1.235	(0.0000)	-4481.47	-2.805

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.30584	1110.21704
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.061	
MAXIMUM HEAD ON TOP OF LAYER 10	0.122	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.4 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	47.3083	0.0758
3	3.4348	0.2862
4	40.2308	0.0762
5	3.4091	0.2841
6	7.0173	0.0731
7	11.7788	0.2454
8	5.4300	0.2263
9	0.0046	0.0304
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S6.OUT


TIME:  15:36     DATE:   6/24/2020


**************************************************************************

     TITLE:  FULL FILL @13 LIFTS; S = 6%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	624.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0767	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2855	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0751	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2848	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2221	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0100	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	122.464	INCHES
TOTAL INITIAL WATER	=	122.464	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	3.9390	3.0638	1.0835	0.5920	0.6298	0.4013

FROM LAYER 9	0.3174	0.2893	0.2988	0.2633	1.2797	1.4717
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.021	0.018	0.006	0.003	0.003	0.002
TOP OF LAYER 10	0.002	0.002	0.002	0.001	0.007	0.008
STD. DEVIATION OF DAILY	0.014	0.009	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.008	0.003

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.103	11263.241	7.05
EVAPOTRANSPIRATION	28.542	103605.773	64.85
DRAINAGE COLLECTED FROM LAYER 9	13.6296	49475.574	30.97
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0063		
CHANGE IN WATER STORAGE	-1.264	-4588.320	-2.87
SOIL WATER AT START OF YEAR	122.465	444549.250	
SOIL WATER AT END OF YEAR	121.201	439960.906	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.012	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.9390	3.0638	1.0835	0.5920	0.6298	0.4013
	0.3174	0.2893	0.2988	0.2633	1.2797	1.4717
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0212	0.0183	0.0058	0.0033	0.0034	0.0022
	0.0017	0.0016	0.0017	0.0014	0.0071	0.0079

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.103	(0.0000)	11263.24	7.050
EVAPOTRANSPIRATION	28.542	(0.0000)	103605.77	64.852
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.62963	(0.00000)	49475.574	30.96941
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.006	(0.000)		
CHANGE IN WATER STORAGE	-1.264	(0.0000)	-4588.32	-2.872

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.562	9301.0596
DRAINAGE COLLECTED FROM LAYER 9	0.25693	932.63879
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.043	
MAXIMUM HEAD ON TOP OF LAYER 10	0.086	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4501
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6247	0.2187
2	47.6658	0.0764
3	3.3994	0.2833
4	39.8127	0.0754
5	3.4003	0.2834
6	7.0080	0.0730
7	11.8486	0.2468
8	5.4385	0.2266
9	0.0018	0.0121
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – THIRTEEN (13) LIFTS

Floor slope 33%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF13S33.OUT


TIME:  12:42     DATE:   6/26/2020


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     TITLE:  FULL FILL @13 LIFTS, S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    624.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2862 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    528.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0762 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2841 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0731	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2454	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2263	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0304	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	121.014	INCHES
TOTAL INITIAL WATER	=	121.014	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
EVAPOTRANSPIRATION	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
LATERAL DRAINAGE COLLECTED	1.5979	3.8179	1.1801	0.6472	0.5369	0.3999
FROM LAYER 9	0.2972	0.4609	0.2281	0.4172	2.8133	1.5718
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.148	11428.088	7.15
EVAPOTRANSPIRATION	26.832	97400.617	60.97
DRAINAGE COLLECTED FROM LAYER 9	13.9684	50705.457	31.74
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0004		
CHANGE IN WATER STORAGE	0.061	222.139	0.14
SOIL WATER AT START OF YEAR	121.018	439296.344	
SOIL WATER AT END OF YEAR	121.079	439518.469	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.020	0.00

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	1.5979	3.8179	1.1801	0.6472	0.5369	0.3999
	0.2972	0.4609	0.2281	0.4172	2.8133	1.5718
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0005	0.0014	0.0004	0.0002	0.0002	0.0001
	0.0001	0.0001	0.0001	0.0001	0.0009	0.0005

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.148	(0.0000)	11428.09	7.153
EVAPOTRANSPIRATION	26.832	(0.0000)	97400.62	60.968
LATERAL DRAINAGE COLLECTED FROM LAYER 9	13.96845	(0.00000)	50705.457	31.73926
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	(0.000)		
CHANGE IN WATER STORAGE	0.061	(0.0000)	222.14	0.139

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.478	8995.4043
DRAINAGE COLLECTED FROM LAYER 9	0.28205	1023.83862
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.003	
MAXIMUM HEAD ON TOP OF LAYER 10	0.007	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3698	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6619	0.2218
2	47.7646	0.0765
3	3.3418	0.2785
4	39.7701	0.0753
5	3.2540	0.2712
6	7.0080	0.0730
7	11.8216	0.2463
8	5.4512	0.2271
9	0.0017	0.0112
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 2%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S2.OUT


TIME:  15:47     DATE:   6/24/2020


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     TITLE:  FULL FILL @17 LIFTS; S = 2%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2131	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0758	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2876	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0753	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2841	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2229	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0230	VOL/VOL

EFFECTIVE SAT. HYD. COND. = 4.42000008000 CM/SEC
SLOPE = 2.00 PERCENT
DRAINAGE LENGTH = 250.0 FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	= 0.06	INCHES
POROSITY	= 0.0000	VOL/VOL
FIELD CAPACITY	= 0.0000	VOL/VOL
WILTING POINT	= 0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	= 0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	= 0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	= 0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	= 0.00	HOLES/ACRE
FML PLACEMENT QUALITY	= 1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	= 86.00	
FRACTION OF AREA ALLOWING RUNOFF	= 75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	= 1.000	ACRES
EVAPORATIVE ZONE DEPTH	= 9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	= 1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	= 4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	= 0.765	INCHES
INITIAL SNOW WATER	= 0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	= 151.003	INCHES
TOTAL INITIAL WATER	= 151.003	INCHES
TOTAL SUBSURFACE INFLOW	= 0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	= 39.18	DEGREES
MAXIMUM LEAF AREA INDEX	= 0.00	
START OF GROWING SEASON (JULIAN DATE)	= 102	
END OF GROWING SEASON (JULIAN DATE)	= 300	
EVAPORATIVE ZONE DEPTH	= 9.0	INCHES
AVERAGE ANNUAL WIND SPEED	= 9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.6322	3.7138	1.1496	0.6613	0.6626	0.3985

FROM LAYER 9	0.3165	0.2801	0.3237	0.2737	1.3412	1.4883
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.058	0.066	0.019	0.011	0.011	0.007
TOP OF LAYER 10	0.005	0.005	0.005	0.004	0.022	0.024
STD. DEVIATION OF DAILY	0.040	0.031	0.005	0.002	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.001	0.002	0.002	0.024	0.008

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	14.2417	51697.254	32.36
PERC./LEAKAGE THROUGH LAYER 10	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0198		
CHANGE IN WATER STORAGE	-1.733	-6289.024	-3.94
SOIL WATER AT START OF YEAR	151.006	548153.437	
SOIL WATER AT END OF YEAR	149.274	541864.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.035	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6322	3.7138	1.1496	0.6613	0.6626	0.3985
	0.3165	0.2801	0.3237	0.2737	1.3412	1.4883
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0585	0.0662	0.0185	0.0110	0.0107	0.0066
	0.0051	0.0045	0.0054	0.0044	0.0223	0.0240

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.24167	(0.00000)	51697.254	32.36007
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.020	(0.000)		
CHANGE IN WATER STORAGE	-1.733	(0.0000)	-6289.02	-3.937

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.27871	1011.71722
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00006
AVERAGE HEAD ON TOP OF LAYER 10	0.139	
MAXIMUM HEAD ON TOP OF LAYER 10	0.272	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	61.7159	0.0756
3	3.4370	0.2864
4	53.8051	0.0747
5	3.3627	0.2802
6	7.0274	0.0732
7	11.9370	0.2487
8	5.4241	0.2260
9	0.0097	0.0645
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 3%

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**                                                                          **
**                                                                          **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE               **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                  **
**                     USAE WATERWAYS EXPERIMENT STATION                    **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY              **
**                                                                          **
**                                                                          **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S3.OUT


TIME:  15:50     DATE:   6/24/2020


******************************************************************************

     TITLE:  FULL FILL @17 LIFTS; S = 3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    816.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2131 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    720.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0758 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2876 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0753	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2841	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2229	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0230	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	151.003	INCHES
TOTAL INITIAL WATER	=	151.003	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
EVAPOTRANSPIRATION	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
LATERAL DRAINAGE COLLECTED	3.6496	3.7049	1.1453	0.6600	0.6623	0.3975

FROM LAYER 9	0.3162	0.2803	0.3232	0.2741	1.3511	1.4794
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.039	0.044	0.012	0.007	0.007	0.004
TOP OF LAYER 10	0.003	0.003	0.004	0.003	0.015	0.016
STD. DEVIATION OF DAILY	0.027	0.021	0.003	0.001	0.001	0.001
HEAD ON TOP OF LAYER 10	0.000	0.000	0.001	0.001	0.016	0.005

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.077	11168.417	6.99
EVAPOTRANSPIRATION	28.424	103179.672	64.59
DRAINAGE COLLECTED FROM LAYER 9	14.2438	51704.973	32.36
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0132		
CHANGE IN WATER STORAGE	-1.735	-6296.778	-3.94
SOIL WATER AT START OF YEAR	151.006	548153.437	
SOIL WATER AT END OF YEAR	149.272	541856.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.000	0.00

****

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.015
	0.000	0.060	2.600	0.069	0.001	0.332
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.811	1.893	2.700	2.247	1.953	4.919
	1.729	3.442	1.131	3.011	2.305	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6496	3.7049	1.1453	0.6600	0.6623	0.3975
	0.3162	0.2803	0.3232	0.2741	1.3511	1.4794
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0392	0.0440	0.0123	0.0073	0.0071	0.0044
	0.0034	0.0030	0.0036	0.0029	0.0150	0.0159

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.077	(0.0000)	11168.42	6.991
EVAPOTRANSPIRATION	28.424	(0.0000)	103179.67	64.586
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.24379	(0.00000)	51704.973	32.36491
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.013	(0.000)		
CHANGE IN WATER STORAGE	-1.735	(0.0000)	-6296.78	-3.941

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.600	9439.0186
DRAINAGE COLLECTED FROM LAYER 9	0.28167	1022.45868
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00004
AVERAGE HEAD ON TOP OF LAYER 10	0.094	
MAXIMUM HEAD ON TOP OF LAYER 10	0.186	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.2 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL) 0.4530

MINIMUM VEG. SOIL WATER (VOL/VOL) 0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.5515	0.2126
2	61.7159	0.0756
3	3.4370	0.2864
4	53.8051	0.0747
5	3.3627	0.2802
6	7.0274	0.0732
7	11.9370	0.2487
8	5.4241	0.2260
9	0.0075	0.0502
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 4%

```
**************************************************************************
**************************************************************************
**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
**************************************************************************
**************************************************************************

PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S4.OUT

TIME:  15:53     DATE:   6/24/2020

**************************************************************************

     TITLE:  FULL FILL @17 LIFTS; S = 4%

**************************************************************************

     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.

                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2171	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0756	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2879	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0773	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2837	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2206	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0144	VOL/VOL

EFFECTIVE SAT. HYD. COND. = 4.42000008000 CM/SEC
SLOPE = 4.00 PERCENT
DRAINAGE LENGTH = 250.0 FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	151.027	INCHES
TOTAL INITIAL WATER	=	151.027	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

****

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.6789	3.6791	1.1574	0.6654	0.6536	0.4036

FROM LAYER 9	0.3201	0.3017	0.2911	0.2672	1.1527	1.5393
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.030 0.003	0.033 0.002	0.009 0.002	0.006 0.002	0.005 0.010	0.003 0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.021 0.000	0.016 0.000	0.003 0.000	0.001 0.001	0.000 0.011	0.000 0.004

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	14.1101	51219.730	32.06
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0098		
CHANGE IN WATER STORAGE	-1.733	-6290.519	-3.94
SOIL WATER AT START OF YEAR	151.029	548235.625	
SOIL WATER AT END OF YEAR	149.296	541945.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.005	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.000 0.000	0.000 0.064	0.000 2.589	0.000 0.068	0.000 0.001	0.016 0.353
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.805 1.762	1.880 3.476	2.771 1.136	2.254 3.011	1.951 2.304	4.909 1.282
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6789 0.3201	3.6791 0.3017	1.1574 0.2911	0.6654 0.2672	0.6536 1.1527	0.4036 1.5393
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0296 0.0026	0.0328 0.0024	0.0093 0.0024	0.0055 0.0022	0.0053 0.0096	0.0034 0.0124

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.11012	(0.00000)	51219.730	32.06116
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.010	(0.000)		
CHANGE IN WATER STORAGE	-1.733	(0.0000)	-6290.52	-3.938

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.28375	1030.02466
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00003
AVERAGE HEAD ON TOP OF LAYER 10	0.071	
MAXIMUM HEAD ON TOP OF LAYER 10	0.140	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	2.0 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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                FINAL WATER STORAGE AT END OF YEAR    1
     ---------------------------------------------------------------------
                     LAYER        (INCHES)       (VOL/VOL)
                     -----        --------       ---------
                       1            2.6121         0.2177
                       2           61.5611         0.0754
                       3            3.4102         0.2842
                       4           54.1334         0.0752
                       5            3.3466         0.2789
                       6            7.0080         0.0730
                       7           11.7641         0.2451
                       8            5.4530         0.2272
                       9            0.0054         0.0361
                      10            0.0000         0.0000
                  SNOW WATER        0.000

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HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 5%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                     USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S5.OUT


TIME:  15:57     DATE:   6/24/2020


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     TITLE:  FULL FILL @17 LIFTS; S = 5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    816.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2171 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    720.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0756 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2879 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0773	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2837	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2206	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0119	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	151.027	INCHES
TOTAL INITIAL WATER	=	151.027	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
EVAPOTRANSPIRATION	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
LATERAL DRAINAGE COLLECTED	3.6822	3.6779	1.1559	0.6653	0.6535	0.4032
FROM LAYER 9	0.3200	0.3018	0.2911	0.2672	1.1559	1.5365
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.024	0.026	0.007	0.004	0.004	0.003
TOP OF LAYER 10	0.002	0.002	0.002	0.002	0.008	0.010
STD. DEVIATION OF DAILY	0.017	0.012	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.001	0.009	0.003

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.091	11220.854	7.02
EVAPOTRANSPIRATION	28.542	103606.211	64.85
DRAINAGE COLLECTED FROM LAYER 9	14.1104	51220.727	32.06
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0078		
CHANGE IN WATER STORAGE	-1.733	-6291.461	-3.94
SOIL WATER AT START OF YEAR	151.028	548232.875	
SOIL WATER AT END OF YEAR	149.295	541941.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.047	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.000	0.000	0.000	0.000	0.000	0.016
	0.000	0.064	2.589	0.068	0.001	0.353
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.805	1.880	2.771	2.254	1.951	4.909
	1.762	3.476	1.136	3.011	2.304	1.282
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.6822	3.6779	1.1559	0.6653	0.6535	0.4032
	0.3200	0.3018	0.2911	0.2672	1.1559	1.5365
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0238	0.0263	0.0075	0.0044	0.0042	0.0027
	0.0021	0.0019	0.0019	0.0017	0.0077	0.0099

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.091	(0.0000)	11220.85	7.024
EVAPOTRANSPIRATION	28.542	(0.0000)	103606.21	64.853
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.11039	(0.00000)	51220.727	32.06179
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.008	(0.000)		
CHANGE IN WATER STORAGE	-1.733	(0.0000)	-6291.46	-3.938

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.589	9398.5059
DRAINAGE COLLECTED FROM LAYER 9	0.28293	1027.03223
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.057	
MAXIMUM HEAD ON TOP OF LAYER 10	0.113	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4530	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6121	0.2177
2	61.5611	0.0754
3	3.4102	0.2842
4	54.1334	0.0752
5	3.3466	0.2789
6	7.0080	0.0730
7	11.7641	0.2451
8	5.4530	0.2272
9	0.0048	0.0318
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 6%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                      USAE WATERWAYS EXPERIMENT STATION                           **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
**************************************************************************************
**************************************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S6.OUT


TIME:  16: 1     DATE:   6/24/2020


**************************************************************************************

     TITLE:  FULL FILL @17 LIFTS; S = 6%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0755	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 3

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 4

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0762	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2819	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0747	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2795	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2228	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0349	VOL/VOL

EFFECTIVE SAT. HYD. COND. = 4.42000008000 CM/SEC
SLOPE = 6.00 PERCENT
DRAINAGE LENGTH = 250.0 FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	151.011	INCHES
TOTAL INITIAL WATER	=	151.011	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.016
	0.000	0.070	2.562	0.069	0.001	0.385
EVAPOTRANSPIRATION	1.804	1.891	2.770	2.244	1.962	4.893
	1.762	3.479	1.128	3.025	2.302	1.281
LATERAL DRAINAGE COLLECTED	3.3033	3.9749	1.1951	0.6820	0.6570	0.4052

FROM LAYER 9	0.3203	0.2918	0.2994	0.2644	1.1448	1.5714
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 10	0.018 0.002	0.024 0.002	0.006 0.002	0.004 0.001	0.004 0.006	0.002 0.008
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 10	0.013 0.000	0.011 0.000	0.002 0.000	0.001 0.001	0.000 0.008	0.000 0.003

ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.103	11263.241	7.05
EVAPOTRANSPIRATION	28.542	103605.773	64.85
DRAINAGE COLLECTED FROM LAYER 9	14.1096	51217.770	32.06
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0066		
CHANGE IN WATER STORAGE	-1.744	-6330.399	-3.96
SOIL WATER AT START OF YEAR	151.016	548188.187	
SOIL WATER AT END OF YEAR	149.272	541857.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.102	0.00

AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00 2.02	1.42 3.97	3.53 7.14	1.61 4.15	2.69 3.78	4.35 7.35
STD. DEVIATIONS	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00	0.00 0.00
RUNOFF						
TOTALS	0.001 0.000	0.000 0.070	0.000 2.562	0.000 0.069	0.000 0.001	0.016 0.385
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION						
TOTALS	1.804 1.762	1.891 3.479	2.770 1.128	2.244 3.025	1.962 2.302	4.893 1.281
STD. DEVIATIONS	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.3033 0.3203	3.9749 0.2918	1.1951 0.2994	0.6820 0.2644	0.6570 1.1448	0.4052 1.5714
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
STD. DEVIATIONS	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0178 0.0017	0.0237 0.0016	0.0064 0.0017	0.0038 0.0014	0.0035 0.0064	0.0023 0.0085

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

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AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.103	(0.0000)	11263.24	7.050
EVAPOTRANSPIRATION	28.542	(0.0000)	103605.77	64.852
LATERAL DRAINAGE COLLECTED FROM LAYER 9	14.10958	(0.00000)	51217.770	32.05994
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.007	(0.000)		
CHANGE IN WATER STORAGE	-1.744	(0.0000)	-6330.40	-3.963

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PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.562	9301.0596
DRAINAGE COLLECTED FROM LAYER 9	0.27127	984.71674
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.045	
MAXIMUM HEAD ON TOP OF LAYER 10	0.088	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	5.3 FEET	
SNOW WATER	0.77	2798.9209

MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.4501
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

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FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6247	0.2187
2	61.9250	0.0759
3	3.3629	0.2802
4	53.6667	0.0745
5	3.3406	0.2784
6	7.0080	0.0730
7	11.8811	0.2475
8	5.4556	0.2273
9	0.0023	0.0150
10	0.0000	0.0000
SNOW WATER	0.000	

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HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 33%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY                    **
**                    USAE WATERWAYS EXPERIMENT STATION                      **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\FF17S33.OUT


TIME:  13: 3     DATE:   6/26/2020


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     TITLE:  FULL FILL @17 LIFTS, S = 33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2160 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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                                LAYER  2
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    816.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0755 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  3
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2218 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC


                                LAYER  4
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER  19
          THICKNESS                    =    720.00   INCHES
          POROSITY                     =      0.1680 VOL/VOL
          FIELD CAPACITY               =      0.0730 VOL/VOL
          WILTING POINT                =      0.0190 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0771 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.100000005000E-02 CM/SEC


                                LAYER  5
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
          FIELD CAPACITY               =      0.1900 VOL/VOL
          WILTING POINT                =      0.0850 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2816 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.720000011000E-03 CM/SEC
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LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0765	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2210	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0125	VOL/VOL

EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	75.0	FEET

LAYER 10

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	86.00	
FRACTION OF AREA ALLOWING RUNOFF	=	75.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	1.944	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.077	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	0.765	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	151.670	INCHES
TOTAL INITIAL WATER	=	151.670	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH

AVERAGE 1ST QUARTER RELATIVE HUMIDITY = 62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY = 65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY = 71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY = 68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
EVAPOTRANSPIRATION	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
LATERAL DRAINAGE COLLECTED	3.3942	4.4312	1.2790	0.7227	0.5600	0.4085

FROM LAYER 9	0.3026	0.4626	0.2280	0.4091	2.6686	1.6880
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.002	0.000	0.000	0.000	0.000
TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.001
STD. DEVIATION OF DAILY	0.001	0.001	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 10	0.000	0.000	0.000	0.000	0.001	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	3.148	11428.088	7.15
EVAPOTRANSPIRATION	26.832	97400.617	60.97
DRAINAGE COLLECTED FROM LAYER 9	16.5546	60093.148	37.62
PERC./LEAKAGE THROUGH LAYER 10	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 10	0.0005		
CHANGE IN WATER STORAGE	-2.525	-9165.396	-5.74
SOIL WATER AT START OF YEAR	151.672	550568.250	
SOIL WATER AT END OF YEAR	149.147	541402.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.176	0.00

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AVERAGE MONTHLY VALUES IN INCHES FOR YEARS 1 THROUGH 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION						
TOTALS	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
STD. DEVIATIONS	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00
RUNOFF						
TOTALS	0.001	0.000	0.000	0.000	0.000	0.017
	0.000	0.083	2.478	0.070	0.003	0.497
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION						
TOTALS	1.826	1.852	2.705	2.062	1.728	4.375
	1.390	3.389	0.869	3.032	2.314	1.288
STD. DEVIATIONS	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
LATERAL DRAINAGE COLLECTED FROM LAYER 9						
TOTALS	3.3942	4.4312	1.2790	0.7227	0.5600	0.4085
	0.3026	0.4626	0.2280	0.4091	2.6686	1.6880
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 10						
TOTALS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGES OF MONTHLY AVERAGED DAILY HEADS (INCHES)

DAILY AVERAGE HEAD ON TOP OF LAYER 10						
AVERAGES	0.0011	0.0016	0.0004	0.0002	0.0002	0.0001
	0.0001	0.0002	0.0001	0.0001	0.0009	0.0005

STD. DEVIATIONS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

AVERAGE ANNUAL TOTALS & (STD. DEVIATIONS) FOR YEARS 1 THROUGH 1

	INCHES		CU. FEET	PERCENT
PRECIPITATION	44.01	(0.000)	159756.3	100.00
RUNOFF	3.148	(0.0000)	11428.09	7.153
EVAPOTRANSPIRATION	26.832	(0.0000)	97400.62	60.968
LATERAL DRAINAGE COLLECTED FROM LAYER 9	16.55459	(0.00000)	60093.148	37.61551
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.00000	(0.00000)	0.009	0.00001
AVERAGE HEAD ON TOP OF LAYER 10	0.000	(0.000)		
CHANGE IN WATER STORAGE	-2.525	(0.0000)	-9165.40	-5.737

PEAK DAILY VALUES FOR YEARS 1 THROUGH 1

	(INCHES)	(CU. FT.)
PRECIPITATION	6.16	22360.799
RUNOFF	2.478	8995.4043
DRAINAGE COLLECTED FROM LAYER 9	0.27350	992.81702
PERCOLATION/LEAKAGE THROUGH LAYER 10	0.000000	0.00002
AVERAGE HEAD ON TOP OF LAYER 10	0.003	
MAXIMUM HEAD ON TOP OF LAYER 10	0.034	
LOCATION OF MAXIMUM HEAD IN LAYER 9 (DISTANCE FROM DRAIN)	0.0 FEET	
SNOW WATER	0.77	2798.9209
MAXIMUM VEG. SOIL WATER (VOL/VOL)	0.3698	
MINIMUM VEG. SOIL WATER (VOL/VOL)	0.0850	

*** Maximum heads are computed using McEnroe's equations. ***

Reference: Maximum Saturated Depth over Landfill Liner
by Bruce M. McEnroe, University of Kansas
ASCE Journal of Environmental Engineering
Vol. 119, No. 2, March 1993, pp. 262-270.

FINAL WATER STORAGE AT END OF YEAR 1

LAYER	(INCHES)	(VOL/VOL)
1	2.6619	0.2218
2	62.0183	0.0760
3	3.3049	0.2754
4	53.5971	0.0744
5	3.2067	0.2672
6	7.0080	0.0730
7	11.8742	0.2474
8	5.4721	0.2280
9	0.0017	0.0113
10	0.0000	0.0000
SNOW WATER	0.000	

HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 2%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S2.OUT


TIME:  16:27     DATE:   6/26/2020


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     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2126	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0767	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0766	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2849 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0735 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2433 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2239 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0480 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.852	INCHES
TOTAL INITIAL WATER	=	71.852	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	2.0601	1.8750	0.9683	0.6009	0.4643	0.3585
	0.3176	0.3180	0.2653	0.2046	0.2207	0.1756
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.033	0.033	0.016	0.010	0.007	0.006
	0.005	0.005	0.004	0.003	0.004	0.003
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.032	0.011	0.002	0.001	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.8290	28419.262	17.79
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0108		
CHANGE IN WATER STORAGE	-7.827	-28411.191	-17.78
SOIL WATER AT START OF YEAR	74.410	270108.594	
SOIL WATER AT END OF YEAR	66.583	241697.406	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.036	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1239	0.0856	0.0762	0.0610	0.0536	0.0450
	0.0409	0.0365	0.0318	0.0299	0.0266	0.0253
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6362	2309.430	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.191	-695.103	-0.45
SOIL WATER AT START OF YEAR	66.583	241697.406	
SOIL WATER AT END OF YEAR	65.725	238580.969	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0234	0.0198	0.0205	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2029	736.422	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.287	-4671.320	-2.51
SOIL WATER AT START OF YEAR	65.725	238580.969	
SOIL WATER AT END OF YEAR	64.707	234887.500	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.019	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0138	0.0129	0.0115	0.0110	0.0099	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1345	488.349	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.010	-4.88

SOIL WATER AT START OF YEAR	64.707	234887.500	
SOIL WATER AT END OF YEAR	63.257	229622.969	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	295.053	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6798.205	4.06
SOIL WATER AT START OF YEAR	63.257	229622.969	
SOIL WATER AT END OF YEAR	65.130	236421.172	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0006	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0150	54.497	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-765.869	-0.55
SOIL WATER AT START OF YEAR	65.130	236421.172	
SOIL WATER AT END OF YEAR	64.919	235655.297	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.919	235655.297	
SOIL WATER AT END OF YEAR	65.315	237093.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.315	237093.187	
SOIL WATER AT END OF YEAR	65.400	237403.422	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	65.400	237403.422	
SOIL WATER AT END OF YEAR	64.206	233068.453	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.206	233068.453	
SOIL WATER AT END OF YEAR	65.370	237293.828	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 3%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S3.OUT


TIME:  16:44     DATE:   6/26/2020


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     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
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                               LAYER  2
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                               LAYER  3
                               --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                               LAYER  4
                               --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                               LAYER  5
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
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FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0767 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2934 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    144.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0766 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2849 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0735 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2433 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2239 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0480	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.852	INCHES
TOTAL INITIAL WATER	=	71.852	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	2.0771	1.8637	0.9657	0.6002	0.4637	0.3583
FROM LAYER 13	0.3174	0.3179	0.2649	0.2044	0.2209	0.1753
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.022	0.022	0.010	0.007	0.005	0.004
TOP OF LAYER 14	0.003	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.022	0.007	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.8297	28421.635	17.79
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0072		
CHANGE IN WATER STORAGE	-7.827	-28413.545	-17.79
SOIL WATER AT START OF YEAR	74.410	270108.594	
SOIL WATER AT END OF YEAR	66.583	241695.047	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1237	0.0855	0.0761	0.0609	0.0535	0.0449
FROM LAYER 13	0.0409	0.0365	0.0318	0.0299	0.0265	0.0253
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.001	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6357	2307.454	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.191	-693.164	-0.45
SOIL WATER AT START OF YEAR	66.583	241695.047	
SOIL WATER AT END OF YEAR	65.725	238580.547	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0234	0.0198	0.0205	0.0186	0.0182	0.0166
FROM LAYER 13	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2028	736.229	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4671.126	-2.51
SOIL WATER AT START OF YEAR	65.725	238580.547	
SOIL WATER AT END OF YEAR	64.707	234887.266	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0138	0.0129	0.0115	0.0110	0.0099	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1345	488.296	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6707.941	-4.88

SOIL WATER AT START OF YEAR	64.707	234887.266	
SOIL WATER AT END OF YEAR	63.257	229622.812	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.011	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	294.987	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6798.274	4.06
SOIL WATER AT START OF YEAR	63.257	229622.812	
SOIL WATER AT END OF YEAR	65.130	236421.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0006	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0150	54.411	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-765.786	-0.55
SOIL WATER AT START OF YEAR	65.130	236421.094	
SOIL WATER AT END OF YEAR	64.919	235655.297	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.004	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.919	235655.297	
SOIL WATER AT END OF YEAR	65.315	237093.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.315	237093.187	
SOIL WATER AT END OF YEAR	65.400	237403.422	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	65.400	237403.422	
SOIL WATER AT END OF YEAR	64.206	233068.453	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.206	233068.453	
SOIL WATER AT END OF YEAR	65.370	237293.828	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 4%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S4.OUT


TIME:  16:59     DATE:   6/26/2020


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     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2177	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0763	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2909	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0770	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2868	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0731	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2389	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2241	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0382	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.621	INCHES
TOTAL INITIAL WATER	=	71.621	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.8408	1.8377	0.9615	0.5991	0.4642	0.3580
	0.3198	0.3180	0.2740	0.2107	0.2150	0.1832
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.015	0.016	0.008	0.005	0.004	0.003
	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.014	0.005	0.001	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.5818	27522.086	17.23
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0053		
CHANGE IN WATER STORAGE	-7.580	-27513.994	-17.22
SOIL WATER AT START OF YEAR	74.239	269488.031	
SOIL WATER AT END OF YEAR	66.660	241974.047	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1283	0.0880	0.0780	0.0622	0.0545	0.0456
	0.0415	0.0369	0.0322	0.0302	0.0268	0.0255
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6500	2359.378	1.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.205	-745.064	-0.49
SOIL WATER AT START OF YEAR	66.660	241974.047	
SOIL WATER AT END OF YEAR	65.787	238807.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.040	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0236	0.0199	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2042	741.219	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.084	-2.51
SOIL WATER AT START OF YEAR	65.787	238807.656	
SOIL WATER AT END OF YEAR	64.768	235109.406	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.015	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0134	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.661	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.326	-4.88

SOIL WATER AT START OF YEAR	64.768	235109.406	
SOIL WATER AT END OF YEAR	63.318	229843.562	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0817	296.712	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.872	6796.529	4.06
SOIL WATER AT START OF YEAR	63.318	229843.562	
SOIL WATER AT END OF YEAR	65.190	236640.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.023	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0011	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0156	56.619	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-767.974	-0.55
SOIL WATER AT START OF YEAR	65.190	236640.094	
SOIL WATER AT END OF YEAR	64.979	235872.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.016	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.979	235872.125	
SOIL WATER AT END OF YEAR	65.375	237310.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.375	237310.000	
SOIL WATER AT END OF YEAR	65.460	237620.234	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.460	237620.234	
SOIL WATER AT END OF YEAR	64.266	233285.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	64.266	233285.250	
SOIL WATER AT END OF YEAR	65.430	237510.656	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 5%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S5.OUT


TIME:  17:13     DATE:   6/26/2020


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     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
```



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                               LAYER  2
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                               LAYER  3
                               --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                               LAYER  4
                               --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                               LAYER  5
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
```

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FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2909 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    144.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0770 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2868 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2389 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2241 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0333	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.620	INCHES
TOTAL INITIAL WATER	=	71.620	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.8450	1.8345	0.9608	0.5988	0.4640	0.3579
FROM LAYER 13	0.3197	0.3179	0.2739	0.2107	0.2150	0.1831
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.012	0.013	0.006	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.011	0.004	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.5813	27520.152	17.23
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0042		
CHANGE IN WATER STORAGE	-7.579	-27512.055	-17.22
SOIL WATER AT START OF YEAR	74.238	269482.719	
SOIL WATER AT END OF YEAR	66.659	241970.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.008	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1283	0.0880	0.0780	0.0622	0.0545	0.0456
FROM LAYER 13	0.0415	0.0369	0.0322	0.0302	0.0268	0.0255
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6498	2358.760	1.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.205	-744.455	-0.49
SOIL WATER AT START OF YEAR	66.659	241970.656	
SOIL WATER AT END OF YEAR	65.786	238804.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.032	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0236	0.0199	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2042	741.161	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.028	-2.51
SOIL WATER AT START OF YEAR	65.786	238804.875	
SOIL WATER AT END OF YEAR	64.768	235106.703	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.011	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0134	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.646	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.326	-4.88

SOIL WATER AT START OF YEAR	64.768	235106.703	
SOIL WATER AT END OF YEAR	63.317	229840.859	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.046	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0817	296.692	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.557	4.06
SOIL WATER AT START OF YEAR	63.317	229840.859	
SOIL WATER AT END OF YEAR	65.189	236637.406	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.015	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0011	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0156	56.594	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-767.946	-0.55
SOIL WATER AT START OF YEAR	65.189	236637.406	
SOIL WATER AT END OF YEAR	64.978	235869.469	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.978	235869.469	
SOIL WATER AT END OF YEAR	65.374	237307.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.374	237307.344	
SOIL WATER AT END OF YEAR	65.459	237617.578	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.459	237617.578	
SOIL WATER AT END OF YEAR	64.265	233282.578	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	64.265	233282.578	
SOIL WATER AT END OF YEAR	65.429	237508.000	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S6.OUT


TIME:  17:28     DATE:   6/26/2020


**************************************************************************

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=6%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	240.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0773	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2914	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	144.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0766	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2851	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2399	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2251	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0129	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	71.860	INCHES
TOTAL INITIAL WATER	=	71.860	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.9747	1.9095	0.9762	0.6045	0.4672	0.3597
	0.3209	0.3181	0.2754	0.2111	0.2150	0.1847
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.011	0.011	0.005	0.003	0.003	0.002
	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.010	0.004	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	7.8171	28376.209	17.76
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0036		
CHANGE IN WATER STORAGE	-7.815	-28368.127	-17.76
SOIL WATER AT START OF YEAR	74.486	270384.000	
SOIL WATER AT END OF YEAR	66.671	242015.891	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.024	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1292	0.0885	0.0784	0.0625	0.0547	0.0458
	0.0416	0.0370	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6527	2369.454	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.208	-755.173	-0.49
SOIL WATER AT START OF YEAR	66.671	242015.891	
SOIL WATER AT END OF YEAR	65.796	238839.391	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2045	742.168	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4677.053	-2.51
SOIL WATER AT START OF YEAR	65.796	238839.391	
SOIL WATER AT END OF YEAR	64.777	235140.172	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.006	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0133	0.0131	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	489.919	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.575	-4.88

SOIL WATER AT START OF YEAR	64.777	235140.172	
SOIL WATER AT END OF YEAR	63.326	229874.094	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.022	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0818	297.040	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.225	4.06
SOIL WATER AT START OF YEAR	63.326	229874.094	
SOIL WATER AT END OF YEAR	65.198	236670.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0012	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	57.037	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.390	-0.55
SOIL WATER AT START OF YEAR	65.198	236670.312	
SOIL WATER AT END OF YEAR	64.987	235901.922	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	64.987	235901.922	
SOIL WATER AT END OF YEAR	65.383	237339.797	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.383	237339.797	
SOIL WATER AT END OF YEAR	65.468	237650.047	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.468	237650.047	
SOIL WATER AT END OF YEAR	64.274	233315.047	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.274	233315.047	
SOIL WATER AT END OF YEAR	65.438	237540.422	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – FIVE LIFTS

Floor slope 33%

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**********************************************************************
**********************************************************************
**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                   USAE WATERWAYS EXPERIMENT STATION              **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
**********************************************************************


PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF5S33.OUT


TIME:  17:45     DATE:   6/26/2020


**********************************************************************

     TITLE:  CLOSED FILL @5 LIFTS (TOP=33%), S=33%

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
```



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                               LAYER  2
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     18.00   INCHES
          POROSITY                     =      0.4190 VOL/VOL
          FIELD CAPACITY               =      0.3070 VOL/VOL
          WILTING POINT                =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


                               LAYER  3
                               --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      0.25   INCHES
          POROSITY                     =      0.8500 VOL/VOL
          FIELD CAPACITY               =      0.0100 VOL/VOL
          WILTING POINT                =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =   12.8000002000     CM/SEC
          SLOPE                        =     33.00   PERCENT
          DRAINAGE LENGTH              =     95.0    FEET


                               LAYER  4
                               --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                    =      0.06   INCHES
          POROSITY                     =      0.0000 VOL/VOL
          FIELD CAPACITY               =      0.0000 VOL/VOL
          WILTING POINT                =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY          =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY        =  4 - POOR


                               LAYER  5
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    240.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0777 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2881 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    144.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0781 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.3043 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0788 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2561 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2260 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0117	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	73.756	INCHES
TOTAL INITIAL WATER	=	73.756	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.8101	1.9370	0.9839	0.6084	0.4696	0.3623
FROM LAYER 13	0.3211	0.3176	0.2780	0.2131	0.2148	0.1886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.018	0.010	0.005	0.003	0.002	0.002
TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.014	0.003	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.7046	35227.555	22.05
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0040		
CHANGE IN WATER STORAGE	-9.702	-35219.379	-22.05
SOIL WATER AT START OF YEAR	76.419	277400.094	
SOIL WATER AT END OF YEAR	66.716	242180.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1316	0.0898	0.0793	0.0631	0.0552	0.0461
FROM LAYER 13	0.0419	0.0372	0.0325	0.0305	0.0270	0.0257
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6598	2395.044	1.57
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.215	-780.735	-0.51
SOIL WATER AT START OF YEAR	66.716	242180.719	
SOIL WATER AT END OF YEAR	65.834	238978.672	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0238	0.0200	0.0208	0.0189	0.0184	0.0168
FROM LAYER 13	0.0164	0.0156	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2051	744.557	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4679.435	-2.51
SOIL WATER AT START OF YEAR	65.834	238978.672	
SOIL WATER AT END OF YEAR	64.815	235277.078	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
	0.0131	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1351	490.569	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.212	-4.88

SOIL WATER AT START OF YEAR	64.815	235277.078	
SOIL WATER AT END OF YEAR	63.364	230010.344	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0821	297.869	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.394	4.06
SOIL WATER AT START OF YEAR	63.364	230010.344	
SOIL WATER AT END OF YEAR	65.236	236805.734	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.009	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0015	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0160	58.084	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.470	-0.55
SOIL WATER AT START OF YEAR	65.236	236805.734	
SOIL WATER AT END OF YEAR	65.024	236036.266	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	65.024	236036.266	
SOIL WATER AT END OF YEAR	65.420	237474.172	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	65.420	237474.172	
SOIL WATER AT END OF YEAR	65.505	237784.406	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	65.505	237784.406	
SOIL WATER AT END OF YEAR	64.311	233449.422	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	64.311	233449.422	
SOIL WATER AT END OF YEAR	65.475	237674.797	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 2%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S2.OUT


TIME:   9:12     DATE:   6/27/2020


**************************************************************************************

     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=2%

**************************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
```

LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2126	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	384.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0766	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2917	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0775	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2917	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0763	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2513	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2250	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.895	INCHES
TOTAL INITIAL WATER	=	94.895	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	3.2090	2.5783	1.0715	0.6322	0.4788	0.3656
	0.3218	0.3197	0.2670	0.2053	0.2200	0.1767
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.052	0.046	0.017	0.011	0.008	0.006
	0.005	0.005	0.004	0.003	0.004	0.003
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.051	0.021	0.003	0.001	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8459	35740.457	22.37
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0136		
CHANGE IN WATER STORAGE	-9.844	-35732.398	-22.37
SOIL WATER AT START OF YEAR	97.460	353780.125	
SOIL WATER AT END OF YEAR	87.616	318047.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.046	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1245	0.0859	0.0765	0.0612	0.0537	0.0451
	0.0410	0.0365	0.0319	0.0300	0.0266	0.0253
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6382	2316.546	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.193	-702.248	-0.46
SOIL WATER AT START OF YEAR	87.616	318047.719	
SOIL WATER AT END OF YEAR	86.756	314924.156	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0205	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2031	737.114	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.287	-4671.985	-2.51
SOIL WATER AT START OF YEAR	86.756	314924.156	
SOIL WATER AT END OF YEAR	85.738	311230.031	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.009	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0137	0.0129	0.0115	0.0110	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1346	488.540	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.190	-4.88

SOIL WATER AT START OF YEAR	85.738	311230.031	
SOIL WATER AT END OF YEAR	84.288	305965.312	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	295.293	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.969	4.06
SOIL WATER AT START OF YEAR	84.288	305965.312	
SOIL WATER AT END OF YEAR	86.161	312763.281	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0007	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0151	54.804	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.174	-0.55
SOIL WATER AT START OF YEAR	86.161	312763.281	
SOIL WATER AT END OF YEAR	85.950	311997.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	85.950	311997.094	
SOIL WATER AT END OF YEAR	86.346	313435.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.346	313435.000	
SOIL WATER AT END OF YEAR	86.431	313745.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	86.431	313745.219	
SOIL WATER AT END OF YEAR	85.237	309410.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.237	309410.250	
SOIL WATER AT END OF YEAR	86.401	313635.625	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 3%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S3.OUT


TIME:   9:26     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
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                                LAYER  2
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                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                                LAYER  3
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                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                                LAYER  4
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                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    384.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0766 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2917 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    288.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0775 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2917 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2513 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2250 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0934	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.895	INCHES
TOTAL INITIAL WATER	=	94.895	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.2387	2.5552	1.0685	0.6312	0.4782	0.3653
FROM LAYER 13	0.3215	0.3196	0.2666	0.2051	0.2202	0.1764
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.035	0.030	0.011	0.007	0.005	0.004
TOP OF LAYER 14	0.003	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.034	0.014	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8465	35742.852	22.37
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0091		
CHANGE IN WATER STORAGE	-9.844	-35734.805	-22.37
SOIL WATER AT START OF YEAR	97.460	353780.125	
SOIL WATER AT END OF YEAR	87.616	318045.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1243	0.0858	0.0764	0.0611	0.0537	0.0450
FROM LAYER 13	0.0410	0.0365	0.0319	0.0300	0.0266	0.0253
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.001	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6376	2314.556	1.51
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.193	-700.254	-0.46
SOIL WATER AT START OF YEAR	87.616	318045.312	
SOIL WATER AT END OF YEAR	86.756	314923.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0205	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0154	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2030	736.922	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4671.791	-2.51
SOIL WATER AT START OF YEAR	86.756	314923.750	
SOIL WATER AT END OF YEAR	85.738	311229.781	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0137	0.0129	0.0115	0.0110	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1346	488.487	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.107	-4.88

SOIL WATER AT START OF YEAR	85.738	311229.781	
SOIL WATER AT END OF YEAR	84.288	305965.156	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.013	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0813	295.226	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6798.025	4.06
SOIL WATER AT START OF YEAR	84.288	305965.156	
SOIL WATER AT END OF YEAR	86.161	312763.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0007	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0151	54.719	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.091	-0.55
SOIL WATER AT START OF YEAR	86.161	312763.187	
SOIL WATER AT END OF YEAR	85.950	311997.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	85.950	311997.094	
SOIL WATER AT END OF YEAR	86.346	313435.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.346	313435.000	
SOIL WATER AT END OF YEAR	86.431	313745.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	86.431	313745.219	
SOIL WATER AT END OF YEAR	85.237	309410.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.237	309410.250	
SOIL WATER AT END OF YEAR	86.401	313635.625	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 4%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S4.OUT


TIME:   9:42     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2177	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	384.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0763	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2893	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0783	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2956	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0750	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2507	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2255	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0427	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.940	INCHES
TOTAL INITIAL WATER	=	94.940	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	3.3047	2.5110	1.0618	0.6278	0.4775	0.3645
	0.3235	0.3194	0.2750	0.2109	0.2150	0.1840
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.027	0.022	0.009	0.005	0.004	0.003
	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.026	0.010	0.001	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8752	35846.984	22.44
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0069		
CHANGE IN WATER STORAGE	-9.873	-35838.937	-22.43
SOIL WATER AT START OF YEAR	97.559	354138.781	
SOIL WATER AT END OF YEAR	87.686	318299.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1288	0.0883	0.0782	0.0623	0.0546	0.0457
	0.0416	0.0370	0.0322	0.0303	0.0268	0.0256
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6514	2364.603	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.207	-750.299	-0.49
SOIL WATER AT START OF YEAR	87.686	318299.844	
SOIL WATER AT END OF YEAR	86.812	315128.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.031	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0199	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2043	741.711	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.583	-2.51
SOIL WATER AT START OF YEAR	86.812	315128.219	
SOIL WATER AT END OF YEAR	85.793	311429.469	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.008	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0133	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.795	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.464	-4.88

SOIL WATER AT START OF YEAR	85.793	311429.469	
SOIL WATER AT END OF YEAR	84.343	306163.500	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.035	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0818	296.882	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.872	6796.335	4.06
SOIL WATER AT START OF YEAR	84.343	306163.500	
SOIL WATER AT END OF YEAR	86.215	312959.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.047	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0012	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	56.836	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.140	-0.55
SOIL WATER AT START OF YEAR	86.215	312959.812	
SOIL WATER AT END OF YEAR	86.003	312191.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.066	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	86.003	312191.687	
SOIL WATER AT END OF YEAR	86.399	313629.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.399	313629.562	
SOIL WATER AT END OF YEAR	86.485	313939.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.485	313939.812	
SOIL WATER AT END OF YEAR	85.291	309604.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	85.291	309604.812	
SOIL WATER AT END OF YEAR	86.455	313830.219	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 5%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S5.OUT


TIME:   9:57     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                                LAYER  3
                                --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
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FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    384.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0763 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2893 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    288.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0783 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2956 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0750 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2507 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2255 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0363	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.939	INCHES
TOTAL INITIAL WATER	=	94.939	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.3121	2.5046	1.0609	0.6275	0.4773	0.3644
FROM LAYER 13	0.3234	0.3194	0.2750	0.2109	0.2150	0.1839
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.022	0.018	0.007	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.021	0.008	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8745	35844.258	22.44
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0055		
CHANGE IN WATER STORAGE	-9.872	-35836.195	-22.43
SOIL WATER AT START OF YEAR	97.557	354131.781	
SOIL WATER AT END OF YEAR	87.685	318295.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1288	0.0883	0.0782	0.0623	0.0546	0.0457
FROM LAYER 13	0.0416	0.0370	0.0322	0.0303	0.0268	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6512	2363.979	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.207	-749.662	-0.49
SOIL WATER AT START OF YEAR	87.685	318295.594	
SOIL WATER AT END OF YEAR	86.811	315124.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.044	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0199	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2043	741.653	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4676.527	-2.51
SOIL WATER AT START OF YEAR	86.811	315124.625	
SOIL WATER AT END OF YEAR	85.792	311425.937	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.005	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0133	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1349	489.779	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.464	-4.88

SOIL WATER AT START OF YEAR	85.792	311425.937	
SOIL WATER AT END OF YEAR	84.342	306159.937	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.051	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0818	296.862	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.363	4.06
SOIL WATER AT START OF YEAR	84.342	306159.937	
SOIL WATER AT END OF YEAR	86.214	312956.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.039	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0012	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	56.810	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.113	-0.55
SOIL WATER AT START OF YEAR	86.214	312956.312	
SOIL WATER AT END OF YEAR	86.002	312188.187	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.068	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	86.002	312188.187	
SOIL WATER AT END OF YEAR	86.398	313626.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.398	313626.094	
SOIL WATER AT END OF YEAR	86.484	313936.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.484	313936.312	
SOIL WATER AT END OF YEAR	85.290	309601.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	85.290	309601.312	
SOIL WATER AT END OF YEAR	86.454	313826.719	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S6.OUT


TIME:  10:11     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	384.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0771	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2884	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	288.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0775	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2965	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0742	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2502	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2248	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0496	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.912	INCHES
TOTAL INITIAL WATER	=	94.912	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	3.0468	2.6931	1.0859	0.6357	0.4819	0.3671
FROM LAYER 13	0.3250	0.3197	0.2765	0.2115	0.2150	0.1856
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.017	0.016	0.006	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.017	0.008	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8439	35733.266	22.37
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0046		
CHANGE IN WATER STORAGE	-9.842	-35725.281	-22.36
SOIL WATER AT START OF YEAR	97.544	354085.312	
SOIL WATER AT END OF YEAR	87.702	318360.031	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.119	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1298	0.0888	0.0786	0.0626	0.0548	0.0459
FROM LAYER 13	0.0417	0.0371	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6544	2375.441	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.210	-761.127	-0.50
SOIL WATER AT START OF YEAR	87.702	318360.031	
SOIL WATER AT END OF YEAR	86.826	315177.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.040	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2046	742.729	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4677.635	-2.51
SOIL WATER AT START OF YEAR	86.826	315177.594	
SOIL WATER AT END OF YEAR	85.807	311477.812	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.027	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0132	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	490.070	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.686	-4.88

SOIL WATER AT START OF YEAR	85.807	311477.812	
SOIL WATER AT END OF YEAR	84.356	306211.594	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.233	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.003	4.06
SOIL WATER AT START OF YEAR	84.356	306211.594	
SOIL WATER AT END OF YEAR	86.228	313007.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30 1.78	1.63 7.20	4.04 1.41	1.69 2.67	5.28 3.69	4.73 2.16
RUNOFF	0.385 0.000	0.053 0.159	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.082 2.826	1.502 4.685	3.191 2.762	2.328 0.888	3.428 2.139	3.647 1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775 0.2383	0.6474 0.9040	1.2704 0.3469	0.4325 0.1568	1.0953 1.3753	0.4987 0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0052 0.0000	0.0045 0.0000	0.0048 0.0000	0.0013 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002 0.001	0.002 0.002	0.003 0.001	0.001 0.000	0.003 0.003	0.001 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001 0.000	0.002 0.002	0.002 0.000	0.000 0.000	0.003 0.004	0.001 0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0158	57.283	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.611	-0.55
SOIL WATER AT START OF YEAR	86.228	313007.594	
SOIL WATER AT END OF YEAR	86.016	312239.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.043	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	86.016	312239.000	
SOIL WATER AT END OF YEAR	86.412	313676.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.412	313676.875	
SOIL WATER AT END OF YEAR	86.498	313987.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.498	313987.094	
SOIL WATER AT END OF YEAR	85.304	309652.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.304	309652.125	
SOIL WATER AT END OF YEAR	86.468	313877.500	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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ADVANCED GeoServices
a Montrose Environmental Group company

HELP MODEL PRINTOUTS

CLOSED – EIGHT (8) LIFTS

Floor slope 33%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY          **
**                     USAE WATERWAYS EXPERIMENT STATION            **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF8S33.OUT


TIME:  10:25     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @8 LIFTS (TOP=33%), S=33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
```



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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                                LAYER  3
                                --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
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FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    384.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0774 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2842 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    288.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0777 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2934 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2471 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2261 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0105	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	94.806	INCHES
TOTAL INITIAL WATER	=	94.806	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	2.7723	2.8131	1.1024	0.6416	0.4854	0.3709
FROM LAYER 13	0.3248	0.3192	0.2789	0.2143	0.2147	0.1900
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.013	0.015	0.005	0.003	0.002	0.002
TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.015	0.007	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.7277	35311.586	22.10
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0040		
CHANGE IN WATER STORAGE	-9.725	-35303.543	-22.10
SOIL WATER AT START OF YEAR	97.469	353811.812	
SOIL WATER AT END OF YEAR	87.743	318508.281	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.072	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1324	0.0903	0.0797	0.0633	0.0553	0.0463
FROM LAYER 13	0.0420	0.0373	0.0325	0.0305	0.0270	0.0257
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6624	2404.437	1.57
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.218	-790.096	-0.52
SOIL WATER AT START OF YEAR	87.743	318508.281	
SOIL WATER AT END OF YEAR	86.859	315296.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.059	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0238	0.0201	0.0208	0.0189	0.0184	0.0168
FROM LAYER 13	0.0164	0.0156	0.0144	0.0142	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2054	745.421	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4680.293	-2.51
SOIL WATER AT START OF YEAR	86.859	315296.844	
SOIL WATER AT END OF YEAR	85.839	311594.406	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
	0.0130	0.0131	0.0117	0.0112	0.0101	0.0098
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1352	490.801	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.433	-4.88

SOIL WATER AT START OF YEAR	85.839	311594.406	
SOIL WATER AT END OF YEAR	84.388	306327.437	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0082	0.0075	0.0073	0.0068
FROM LAYER 13	0.0067	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0821	298.167	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.062	4.06
SOIL WATER AT START OF YEAR	84.388	306327.437	
SOIL WATER AT END OF YEAR	86.260	313122.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0016	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0161	58.462	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.802	-0.55
SOIL WATER AT START OF YEAR	86.260	313122.500	
SOIL WATER AT END OF YEAR	86.048	312352.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.029	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	86.048	312352.719	
SOIL WATER AT END OF YEAR	86.444	313790.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	86.444	313790.625	
SOIL WATER AT END OF YEAR	86.529	314100.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	86.529	314100.844	
SOIL WATER AT END OF YEAR	85.335	309765.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	85.335	309765.844	
SOIL WATER AT END OF YEAR	86.499	313991.219	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 2%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                      USAE WATERWAYS EXPERIMENT STATION                           **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S2.OUT


TIME:  10:44     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2126	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	624.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0761	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2885	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0756	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2836	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0734	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2489	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2252	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0588	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	2.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.034	INCHES
TOTAL INITIAL WATER	=	130.034	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.6931	3.9161	1.2438	0.6854	0.5022	0.3768
	0.3284	0.3223	0.2696	0.2069	0.2186	0.1784
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.027	0.070	0.020	0.011	0.008	0.006
	0.005	0.005	0.004	0.003	0.004	0.003
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.031	0.036	0.005	0.001	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9414	36087.379	22.59
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0140		
CHANGE IN WATER STORAGE	-9.939	-36079.273	-22.58
SOIL WATER AT START OF YEAR	132.594	481316.594	
SOIL WATER AT END OF YEAR	122.655	445237.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1255	0.0865	0.0769	0.0614	0.0539	0.0452
	0.0411	0.0366	0.0320	0.0301	0.0266	0.0254
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6412	2327.613	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.197	-713.326	-0.47
SOIL WATER AT START OF YEAR	122.655	445237.312	
SOIL WATER AT END OF YEAR	121.791	442102.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.013	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0155	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2034	738.185	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.287	-4673.065	-2.51
SOIL WATER AT START OF YEAR	121.791	442102.656	
SOIL WATER AT END OF YEAR	120.773	438407.437	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.834	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.439	-4.88

SOIL WATER AT START OF YEAR	120.773	438407.437	
SOIL WATER AT END OF YEAR	119.323	433142.469	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0814	295.663	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.554	4.06
SOIL WATER AT START OF YEAR	119.323	433142.469	
SOIL WATER AT END OF YEAR	121.196	439940.031	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.046	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0152	55.279	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.645	-0.55
SOIL WATER AT START OF YEAR	121.196	439940.031	
SOIL WATER AT END OF YEAR	120.984	439173.406	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.005	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	120.984	439173.406	
SOIL WATER AT END OF YEAR	121.381	440611.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.381	440611.312	
SOIL WATER AT END OF YEAR	121.466	440921.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.466	440921.531	
SOIL WATER AT END OF YEAR	120.272	436586.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.272	436586.531	
SOIL WATER AT END OF YEAR	121.436	440811.906	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 3%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE       **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                   USAE WATERWAYS EXPERIMENT STATION              **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
**********************************************************************
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S3.OUT


TIME:  10:59     DATE:   6/27/2020


**********************************************************************

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=3%

**********************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
```



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                               LAYER  2
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                               LAYER  3
                               --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                               LAYER  4
                               --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                               LAYER  5
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    624.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0761 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2885 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    528.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0756 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2836 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0734 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2489 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2252 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0588	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.034	INCHES
TOTAL INITIAL WATER	=	130.034	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.7233	3.8942	1.2394	0.6842	0.5015	0.3765
FROM LAYER 13	0.3281	0.3222	0.2692	0.2066	0.2189	0.1781
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.019	0.046	0.013	0.008	0.005	0.004
TOP OF LAYER 14	0.004	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.021	0.024	0.003	0.001	0.001	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9421	36089.762	22.59
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0093		
CHANGE IN WATER STORAGE	-9.940	-36081.684	-22.59
SOIL WATER AT START OF YEAR	132.594	481316.594	
SOIL WATER AT END OF YEAR	122.654	445234.906	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.026	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1253	0.0864	0.0768	0.0614	0.0539	0.0452
FROM LAYER 13	0.0411	0.0366	0.0320	0.0300	0.0266	0.0254
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.001	0.001
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6407	2325.603	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.196	-711.332	-0.46
SOIL WATER AT START OF YEAR	122.654	445234.906	
SOIL WATER AT END OF YEAR	121.791	442102.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0155	0.0142	0.0140	0.0130	0.0128
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2033	737.991	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4672.871	-2.51
SOIL WATER AT START OF YEAR	121.791	442102.250	
SOIL WATER AT END OF YEAR	120.773	438407.219	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.781	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.356	-4.88

SOIL WATER AT START OF YEAR	120.773	438407.219	
SOIL WATER AT END OF YEAR	119.323	433142.344	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.058	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0814	295.596	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.609	4.06
SOIL WATER AT START OF YEAR	119.323	433142.344	
SOIL WATER AT END OF YEAR	121.196	439939.969	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.058	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0152	55.193	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.562	-0.55
SOIL WATER AT START OF YEAR	121.196	439939.969	
SOIL WATER AT END OF YEAR	120.984	439173.406	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	120.984	439173.406	
SOIL WATER AT END OF YEAR	121.381	440611.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.381	440611.312	
SOIL WATER AT END OF YEAR	121.466	440921.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.466	440921.531	
SOIL WATER AT END OF YEAR	120.272	436586.531	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.272	436586.531	
SOIL WATER AT END OF YEAR	121.436	440811.906	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 4%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S4.OUT


TIME:  11:13     DATE:   6/27/2020


**************************************************************************

     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=4%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2177	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	624.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0758	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2862	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0762	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2841	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0731	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2454	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2263	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0343	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	4.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.029	INCHES
TOTAL INITIAL WATER	=	130.029	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.7671	3.8415	1.2254	0.6748	0.4988	0.3750
FROM LAYER 13	0.3294	0.3217	0.2765	0.2115	0.2150	0.1852
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.014	0.034	0.010	0.006	0.004	0.003
TOP OF LAYER 14	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY	0.016	0.018	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9218	36015.992	22.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0070		
CHANGE IN WATER STORAGE	-9.920	-36007.934	-22.54
SOIL WATER AT START OF YEAR	132.647	481507.750	
SOIL WATER AT END OF YEAR	122.727	445499.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.046	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1295	0.0887	0.0785	0.0625	0.0547	0.0458
	0.0416	0.0370	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6536	2372.502	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.209	-758.247	-0.50
SOIL WATER AT START OF YEAR	122.727	445499.812	
SOIL WATER AT END OF YEAR	121.851	442320.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2045	742.453	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4677.275	-2.51
SOIL WATER AT START OF YEAR	121.851	442320.219	
SOIL WATER AT END OF YEAR	120.832	438620.812	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.057	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0133	0.0131	0.0116	0.0112	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	489.996	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.658	-4.88

SOIL WATER AT START OF YEAR	120.832	438620.812	
SOIL WATER AT END OF YEAR	119.381	433354.625	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.138	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.872	6796.086	4.06
SOIL WATER AT START OF YEAR	119.381	433354.625	
SOIL WATER AT END OF YEAR	121.254	440150.719	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.040	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	57.162	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.500	-0.55
SOIL WATER AT START OF YEAR	121.254	440150.719	
SOIL WATER AT END OF YEAR	121.042	439382.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.032	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	121.042	439382.219	
SOIL WATER AT END OF YEAR	121.438	440820.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.438	440820.125	
SOIL WATER AT END OF YEAR	121.524	441130.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.524	441130.344	
SOIL WATER AT END OF YEAR	120.329	436795.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.329	436795.344	
SOIL WATER AT END OF YEAR	121.493	441020.750	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 5%

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**                                                                           **
**                                                                           **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                 **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY                   **
**                     USAE WATERWAYS EXPERIMENT STATION                     **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY               **
**                                                                           **
**                                                                           **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S5.OUT


TIME:  11:26     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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                                LAYER  2
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                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     18.00   INCHES
          POROSITY                     =      0.4190 VOL/VOL
          FIELD CAPACITY               =      0.3070 VOL/VOL
          WILTING POINT                =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


                                LAYER  3
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                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      0.25   INCHES
          POROSITY                     =      0.8500 VOL/VOL
          FIELD CAPACITY               =      0.0100 VOL/VOL
          WILTING POINT                =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =   12.8000002000     CM/SEC
          SLOPE                        =     33.00   PERCENT
          DRAINAGE LENGTH              =     95.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                    =      0.06   INCHES
          POROSITY                     =      0.0000 VOL/VOL
          FIELD CAPACITY               =      0.0000 VOL/VOL
          WILTING POINT                =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY          =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY        =  4 - POOR


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
```

FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19
THICKNESS = 624.00 INCHES
POROSITY = 0.1680 VOL/VOL
FIELD CAPACITY = 0.0730 VOL/VOL
WILTING POINT = 0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0758 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6
THICKNESS = 12.00 INCHES
POROSITY = 0.4530 VOL/VOL
FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2862 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19
THICKNESS = 528.00 INCHES
POROSITY = 0.1680 VOL/VOL
FIELD CAPACITY = 0.0730 VOL/VOL
WILTING POINT = 0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0762 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS = 12.00 INCHES
POROSITY = 0.4530 VOL/VOL
FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2841 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19
THICKNESS = 96.00 INCHES
POROSITY = 0.1680 VOL/VOL
FIELD CAPACITY = 0.0730 VOL/VOL
WILTING POINT = 0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0731 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6
THICKNESS = 48.00 INCHES
POROSITY = 0.4530 VOL/VOL
FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2454 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5
THICKNESS = 24.00 INCHES
POROSITY = 0.4570 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2263 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0304	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.029	INCHES
TOTAL INITIAL WATER	=	130.029	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.7789	3.8314	1.2241	0.6745	0.4986	0.3749
FROM LAYER 13	0.3293	0.3216	0.2764	0.2114	0.2150	0.1851
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.011	0.027	0.008	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.013	0.014	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9214	36014.629	22.54
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0056		
CHANGE IN WATER STORAGE	-9.919	-36006.574	-22.54
SOIL WATER AT START OF YEAR	132.646	481503.531	
SOIL WATER AT END OF YEAR	122.726	445496.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.050	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1295	0.0887	0.0785	0.0625	0.0547	0.0458
FROM LAYER 13	0.0416	0.0370	0.0323	0.0303	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6534	2371.877	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.209	-757.610	-0.50
SOIL WATER AT START OF YEAR	122.726	445496.937	
SOIL WATER AT END OF YEAR	121.851	442318.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2045	742.394	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.288	-4677.219	-2.51
SOIL WATER AT START OF YEAR	121.851	442318.000	
SOIL WATER AT END OF YEAR	120.832	438618.625	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.054	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
	0.0133	0.0131	0.0116	0.0112	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	489.980	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.658	-4.88

SOIL WATER AT START OF YEAR	120.832	438618.625	
SOIL WATER AT END OF YEAR	119.381	433352.469	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.044	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.117	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.114	4.06
SOIL WATER AT START OF YEAR	119.381	433352.469	
SOIL WATER AT END OF YEAR	121.253	440148.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.032	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0157	57.136	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.473	-0.55
SOIL WATER AT START OF YEAR	121.253	440148.562	
SOIL WATER AT END OF YEAR	121.041	439380.094	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.034	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	121.041	439380.094	
SOIL WATER AT END OF YEAR	121.437	440818.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.437	440818.000	
SOIL WATER AT END OF YEAR	121.523	441128.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.523	441128.250	
SOIL WATER AT END OF YEAR	120.329	436793.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.329	436793.250	
SOIL WATER AT END OF YEAR	121.493	441018.625	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 6%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S6.OUT


TIME:  11:40     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=6%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                  TYPE 1 - VERTICAL PERCOLATION LAYER
                      MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	624.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0764	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2833	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	528.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0754	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2834	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2468	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00	INCHES
POROSITY	=	0.4570	VOL/VOL
FIELD CAPACITY	=	0.1310	VOL/VOL
WILTING POINT	=	0.0580	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2266	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0121	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	6.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	130.012	INCHES
TOTAL INITIAL WATER	=	130.012	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.5045	4.0152	1.2646	0.6864	0.5050	0.3786
	0.3313	0.3222	0.2780	0.2123	0.2150	0.1870
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.008	0.024	0.007	0.004	0.003	0.002
	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.009	0.012	0.001	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9001	35937.242	22.50
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0047		
CHANGE IN WATER STORAGE	-9.898	-35929.195	-22.49
SOIL WATER AT START OF YEAR	132.638	481474.844	
SOIL WATER AT END OF YEAR	122.740	445545.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1306	0.0893	0.0789	0.0628	0.0550	0.0460
FROM LAYER 13	0.0418	0.0372	0.0324	0.0304	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6569	2384.573	1.56
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.212	-770.239	-0.50
SOIL WATER AT START OF YEAR	122.740	445545.625	
SOIL WATER AT END OF YEAR	121.861	442354.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.060	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0208	0.0188	0.0183	0.0168
FROM LAYER 13	0.0164	0.0156	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2048	743.579	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4678.466	-2.51
SOIL WATER AT START OF YEAR	121.861	442354.062	
SOIL WATER AT END OF YEAR	120.841	438653.437	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.007	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
FROM LAYER 13	0.0132	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1351	490.300	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.935	-4.88

SOIL WATER AT START OF YEAR	120.841	438653.437	
SOIL WATER AT END OF YEAR	119.390	433387.000	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.001	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0820	297.527	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.698	4.06
SOIL WATER AT START OF YEAR	119.390	433387.000	
SOIL WATER AT END OF YEAR	121.262	440182.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.039	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30 1.78	1.63 7.20	4.04 1.41	1.69 2.67	5.28 3.69	4.73 2.16
RUNOFF	0.385 0.000	0.053 0.159	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.082 2.826	1.502 4.685	3.191 2.762	2.328 0.888	3.428 2.139	3.647 1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775 0.2383	0.6474 0.9040	1.2704 0.3469	0.4325 0.1568	1.0953 1.3753	0.4987 0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0052 0.0000	0.0045 0.0000	0.0048 0.0000	0.0014 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002 0.001	0.002 0.002	0.003 0.001	0.001 0.000	0.003 0.003	0.001 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001 0.000	0.002 0.002	0.002 0.000	0.000 0.000	0.003 0.004	0.001 0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0159	57.657	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.999	-0.55
SOIL WATER AT START OF YEAR	121.262	440182.687	
SOIL WATER AT END OF YEAR	121.051	439413.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.028	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	121.051	439413.687	
SOIL WATER AT END OF YEAR	121.447	440851.594	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.447	440851.594	
SOIL WATER AT END OF YEAR	121.532	441161.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.659	0.17
SOIL WATER AT START OF YEAR	121.532	441161.812	
SOIL WATER AT END OF YEAR	120.338	436826.844	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.120	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	120.338	436826.844	
SOIL WATER AT END OF YEAR	121.502	441052.219	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – THIRTEEN (13) LIFTS

Floor slope 33%

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**                                                                              **
**                                                                              **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                  **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                   **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                     **
**                      USAE WATERWAYS EXPERIMENT STATION                       **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                 **
**                                                                              **
**                                                                              **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF13S33.OUT


TIME:  11:54     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @13 LIFTS (TOP=33%), S=33%

**********************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                                LAYER  3
                                --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
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FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    624.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0765 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2785 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    528.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0753 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2712 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2463 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2271 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0112	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	129.842	INCHES
TOTAL INITIAL WATER	=	129.842	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.3085	4.0198	1.2687	0.6869	0.5061	0.3813
FROM LAYER 13	0.3302	0.3215	0.2796	0.2150	0.2147	0.1906
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.006	0.022	0.006	0.003	0.002	0.002
TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.007	0.011	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.7229	35294.078	22.09
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0041		
CHANGE IN WATER STORAGE	-9.721	-35286.016	-22.09
SOIL WATER AT START OF YEAR	132.505	480994.656	
SOIL WATER AT END OF YEAR	122.785	445708.656	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.051	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1328	0.0905	0.0798	0.0634	0.0554	0.0463
FROM LAYER 13	0.0420	0.0374	0.0325	0.0305	0.0271	0.0258
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6635	2408.522	1.57
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.219	-794.195	-0.52
SOIL WATER AT START OF YEAR	122.785	445708.656	
SOIL WATER AT END OF YEAR	121.899	442493.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.046	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0238	0.0201	0.0208	0.0189	0.0184	0.0168
FROM LAYER 13	0.0164	0.0156	0.0144	0.0142	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2055	745.795	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4680.681	-2.51
SOIL WATER AT START OF YEAR	121.899	442493.125	
SOIL WATER AT END OF YEAR	120.879	438790.281	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.015	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
	0.0130	0.0132	0.0117	0.0112	0.0101	0.0098
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1352	490.901	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.489	-4.88

SOIL WATER AT START OF YEAR	120.879	438790.281	
SOIL WATER AT END OF YEAR	119.428	433523.281	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.038	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0082	0.0075	0.0073	0.0068
FROM LAYER 13	0.0067	0.0064	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0822	298.296	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6794.923	4.06
SOIL WATER AT START OF YEAR	119.428	433523.281	
SOIL WATER AT END OF YEAR	121.300	440318.219	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0016	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0162	58.626	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.968	-0.55
SOIL WATER AT START OF YEAR	121.300	440318.219	
SOIL WATER AT END OF YEAR	121.088	439548.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.026	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.881	1.00
SOIL WATER AT START OF YEAR	121.088	439548.250	
SOIL WATER AT END OF YEAR	121.484	440986.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.002	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	121.484	440986.125	
SOIL WATER AT END OF YEAR	121.569	441296.344	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	121.569	441296.344	
SOIL WATER AT END OF YEAR	120.375	436961.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.219	-0.29
SOIL WATER AT START OF YEAR	120.375	436961.375	
SOIL WATER AT END OF YEAR	121.539	441186.781	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.013	0.00

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HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 2%

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**                                                                                  **
**                                                                                  **
**               HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE                      **
**                 HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)                       **
**                    DEVELOPED BY ENVIRONMENTAL LABORATORY                         **
**                     USAE WATERWAYS EXPERIMENT STATION                            **
**               FOR USEPA RISK REDUCTION ENGINEERING LABORATORY                    **
**                                                                                  **
**                                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S2.OUT


TIME:  12: 9     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=2%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                TYPE 1 - VERTICAL PERCOLATION LAYER
                    MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2126	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0756	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2864	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0747	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2802 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0732 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2487 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2260 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0645 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	2.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	158.030	INCHES
TOTAL INITIAL WATER	=	158.030	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.1652	4.2577	1.3390	0.7138	0.5141	0.3825
	0.3318	0.3236	0.2708	0.2078	0.2177	0.1792
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.019	0.076	0.022	0.012	0.008	0.006
	0.005	0.005	0.005	0.003	0.004	0.003
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.014	0.034	0.005	0.001	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9033	35948.809	22.50
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0140		
CHANGE IN WATER STORAGE	-9.901	-35940.746	-22.50
SOIL WATER AT START OF YEAR	160.591	582944.000	
SOIL WATER AT END OF YEAR	150.690	547003.250	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.043	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1260	0.0867	0.0771	0.0616	0.0540	0.0453
	0.0412	0.0367	0.0320	0.0301	0.0267	0.0254
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
	0.001	0.001	0.001	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6427	2333.127	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0009		
CHANGE IN WATER STORAGE	-0.198	-718.810	-0.47
SOIL WATER AT START OF YEAR	150.690	547003.250	
SOIL WATER AT END OF YEAR	149.825	543863.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.043	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0167
FROM LAYER 13	0.0163	0.0155	0.0143	0.0141	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2035	738.716	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-1.288	-4673.702	-2.51
SOIL WATER AT START OF YEAR	149.825	543863.125	
SOIL WATER AT END OF YEAR	148.806	540167.250	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.107	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0136	0.0130	0.0116	0.0111	0.0100	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.979	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.848	-6708.522	-4.88

SOIL WATER AT START OF YEAR	148.806	540167.250	
SOIL WATER AT END OF YEAR	147.356	534902.250	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.090	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0815	295.847	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.388	4.06
SOIL WATER AT START OF YEAR	147.356	534902.250	
SOIL WATER AT END OF YEAR	149.229	541699.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0009	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0153	55.514	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.866	-0.55
SOIL WATER AT START OF YEAR	149.229	541699.625	
SOIL WATER AT END OF YEAR	149.017	540932.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.018	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.017	540932.750	
SOIL WATER AT END OF YEAR	149.413	542370.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.413	542370.687	
SOIL WATER AT END OF YEAR	149.499	542680.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.499	542680.875	
SOIL WATER AT END OF YEAR	148.305	538345.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.305	538345.875	
SOIL WATER AT END OF YEAR	149.469	542571.312	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 3%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S3.OUT


TIME:  12:24     DATE:   6/27/2020


**********************************************************************

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=3%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
```



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                               LAYER  2
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                               LAYER  3
                               --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                               LAYER  4
                               --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                               LAYER  5
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
```

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FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2126 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    816.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0756 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2864 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    720.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0747 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2802 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0732 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2487 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2260 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0502	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	3.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	158.028	INCHES
TOTAL INITIAL WATER	=	158.028	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.1679	4.2622	1.3338	0.7125	0.5134	0.3821
FROM LAYER 13	0.3315	0.3235	0.2705	0.2075	0.2181	0.1789
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.013	0.051	0.014	0.008	0.006	0.004
TOP OF LAYER 14	0.004	0.003	0.003	0.002	0.002	0.002
STD. DEVIATION OF DAILY	0.010	0.022	0.003	0.001	0.001	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9018	35943.449	22.50
PERC./LEAKAGE THROUGH LAYER 14	0.000003	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0093		
CHANGE IN WATER STORAGE	-9.900	-35935.371	-22.49
SOIL WATER AT START OF YEAR	160.586	582928.375	
SOIL WATER AT END OF YEAR	150.687	546993.000	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.029	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1258	0.0866	0.0770	0.0615	0.0540	0.0453
FROM LAYER 13	0.0412	0.0367	0.0320	0.0301	0.0267	0.0254
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.001	0.001	0.001
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6422	2331.107	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0006		
CHANGE IN WATER STORAGE	-0.197	-716.760	-0.47
SOIL WATER AT START OF YEAR	150.687	546993.000	
SOIL WATER AT END OF YEAR	149.822	543854.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.073	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0167
FROM LAYER 13	0.0163	0.0155	0.0143	0.0140	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2034	738.522	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0002		
CHANGE IN WATER STORAGE	-1.287	-4673.480	-2.51
SOIL WATER AT START OF YEAR	149.822	543854.937	
SOIL WATER AT END OF YEAR	148.804	540159.312	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.079	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.926	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.522	-4.88

SOIL WATER AT START OF YEAR	148.804	540159.312	
SOIL WATER AT END OF YEAR	147.354	534894.250	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.037	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0815	295.780	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.443	4.06
SOIL WATER AT START OF YEAR	147.354	534894.250	
SOIL WATER AT END OF YEAR	149.226	541691.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0051	0.0045	0.0048	0.0008	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0153	55.428	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.755	-0.55
SOIL WATER AT START OF YEAR	149.226	541691.687	
SOIL WATER AT END OF YEAR	149.015	540924.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.043	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.015	540924.937	
SOIL WATER AT END OF YEAR	149.411	542362.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.411	542362.875	
SOIL WATER AT END OF YEAR	149.497	542673.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.497	542673.062	
SOIL WATER AT END OF YEAR	148.303	538338.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.303	538338.125	
SOIL WATER AT END OF YEAR	149.467	542563.500	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 4%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S4.OUT


TIME:  12:38     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=4%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2127	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0754	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2842	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0752	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2789 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2451 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2272 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0361 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	4.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	158.018	INCHES
TOTAL INITIAL WATER	=	158.018	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.1642	4.2852	1.3175	0.7071	0.5107	0.3808
	0.3306	0.3231	0.2700	0.2071	0.2184	0.1786
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.009	0.038	0.011	0.006	0.004	0.003
	0.003	0.003	0.002	0.002	0.002	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.007	0.018	0.003	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.8933	35912.512	22.48
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0070		
CHANGE IN WATER STORAGE	-9.891	-35904.352	-22.47
SOIL WATER AT START OF YEAR	160.576	582891.250	
SOIL WATER AT END OF YEAR	150.685	546986.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.054	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1256	0.0865	0.0769	0.0615	0.0539	0.0452
	0.0412	0.0367	0.0320	0.0301	0.0267	0.0254
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.001	0.001	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6415	2328.732	1.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.197	-714.434	-0.47
SOIL WATER AT START OF YEAR	150.685	546986.875	
SOIL WATER AT END OF YEAR	149.821	543851.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0235	0.0198	0.0206	0.0187	0.0182	0.0166
FROM LAYER 13	0.0163	0.0155	0.0142	0.0140	0.0130	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2034	738.293	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.287	-4673.148	-2.51
SOIL WATER AT START OF YEAR	149.821	543851.125	
SOIL WATER AT END OF YEAR	148.803	540155.812	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.024	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0123	0.0111	0.0114	0.0106	0.0106	0.0099
FROM LAYER 13	0.0136	0.0130	0.0116	0.0111	0.0100	0.0096
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1347	488.863	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6708.578	-4.88

SOIL WATER AT START OF YEAR	148.803	540155.812	
SOIL WATER AT END OF YEAR	147.353	534890.687	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.081	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0090	0.0077	0.0081	0.0074	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0058	0.0058	0.0054	0.0053
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0815	295.701	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	1.873	6797.665	4.06
SOIL WATER AT START OF YEAR	147.353	534890.687	
SOIL WATER AT END OF YEAR	149.225	541688.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.102	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30 1.78	1.63 7.20	4.04 1.41	1.69 2.67	5.28 3.69	4.73 2.16
RUNOFF	0.385 0.000	0.053 0.159	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
EVAPOTRANSPIRATION	1.082 2.826	1.502 4.685	3.191 2.762	2.328 0.888	3.428 2.139	3.647 1.417
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.8775 0.2383	0.6474 0.9040	1.2704 0.3469	0.4325 0.1568	1.0953 1.3753	0.4987 0.4435
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0051 0.0000	0.0045 0.0000	0.0048 0.0000	0.0008 0.0000	0.0000 0.0000	0.0000 0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000	0.0000 0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002 0.001	0.002 0.002	0.003 0.001	0.001 0.000	0.003 0.003	0.001 0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.001 0.000	0.002 0.002	0.002 0.000	0.000 0.000	0.003 0.004	0.001 0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000	0.000 0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0152	55.327	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.211	-766.700	-0.55
SOIL WATER AT START OF YEAR	149.225	541688.375	
SOIL WATER AT END OF YEAR	149.014	540921.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.003	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.014	540921.687	
SOIL WATER AT END OF YEAR	149.410	542359.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.410	542359.562	
SOIL WATER AT END OF YEAR	149.496	542669.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.496	542669.812	
SOIL WATER AT END OF YEAR	148.302	538334.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.302	538334.812	
SOIL WATER AT END OF YEAR	149.466	542560.187	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 5%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                  DEVELOPED BY ENVIRONMENTAL LABORATORY           **
**                    USAE WATERWAYS EXPERIMENT STATION             **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S5.OUT


TIME:  12:52     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=5%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
               WERE SPECIFIED BY THE USER.


                                LAYER  1
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                     =      6.00   INCHES
          POROSITY                      =      0.5010 VOL/VOL
          FIELD CAPACITY                =      0.2840 VOL/VOL
          WILTING POINT                 =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.190000006000E-03 CM/SEC
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                                LAYER  2
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =     18.00   INCHES
          POROSITY                      =      0.4190 VOL/VOL
          FIELD CAPACITY                =      0.3070 VOL/VOL
          WILTING POINT                 =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.999999975000E-05 CM/SEC


                                LAYER  3
                                --------

                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                     =      0.25   INCHES
          POROSITY                      =      0.8500 VOL/VOL
          FIELD CAPACITY                =      0.0100 VOL/VOL
          WILTING POINT                 =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =   12.8000002000     CM/SEC
          SLOPE                         =     33.00   PERCENT
          DRAINAGE LENGTH               =     95.0    FEET


                                LAYER  4
                                --------

                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                     =      0.06   INCHES
          POROSITY                      =      0.0000 VOL/VOL
          FIELD CAPACITY                =      0.0000 VOL/VOL
          WILTING POINT                 =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT    =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.     =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY           =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS      =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY         =  4 - POOR


                                LAYER  5
                                --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                     =     12.00   INCHES
          POROSITY                      =      0.4530 VOL/VOL
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FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2177 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19
THICKNESS = 816.00 INCHES
POROSITY = 0.1680 VOL/VOL
FIELD CAPACITY = 0.0730 VOL/VOL
WILTING POINT = 0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0754 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6
THICKNESS = 12.00 INCHES
POROSITY = 0.4530 VOL/VOL
FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2842 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19
THICKNESS = 720.00 INCHES
POROSITY = 0.1680 VOL/VOL
FIELD CAPACITY = 0.0730 VOL/VOL
WILTING POINT = 0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0752 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS = 12.00 INCHES
POROSITY = 0.4530 VOL/VOL
FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2789 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19
THICKNESS = 96.00 INCHES
POROSITY = 0.1680 VOL/VOL
FIELD CAPACITY = 0.0730 VOL/VOL
WILTING POINT = 0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6
THICKNESS = 48.00 INCHES
POROSITY = 0.4530 VOL/VOL
FIELD CAPACITY = 0.1900 VOL/VOL
WILTING POINT = 0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2451 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.720000011000E-03 CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5
THICKNESS = 24.00 INCHES
POROSITY = 0.4570 VOL/VOL
FIELD CAPACITY = 0.1310 VOL/VOL
WILTING POINT = 0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT = 0.2272 VOL/VOL
EFFECTIVE SAT. HYD. COND. = 0.100000005000E-02 CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0318	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	5.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	158.078	INCHES
TOTAL INITIAL WATER	=	158.078	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.1602	4.3087	1.3266	0.7032	0.5113	0.3811
FROM LAYER 13	0.3328	0.3230	0.2773	0.2118	0.2150	0.1858
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.008	0.031	0.009	0.005	0.003	0.003
TOP OF LAYER 14	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.006	0.014	0.002	0.001	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9368	36070.723	22.58
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0056		
CHANGE IN WATER STORAGE	-9.935	-36062.547	-22.57
SOIL WATER AT START OF YEAR	160.695	583322.187	
SOIL WATER AT END OF YEAR	150.760	547259.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.071	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1299	0.0889	0.0786	0.0626	0.0548	0.0459
FROM LAYER 13	0.0417	0.0371	0.0323	0.0304	0.0269	0.0256
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.001	0.001	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6547	2376.627	1.55
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0004		
CHANGE IN WATER STORAGE	-0.210	-762.346	-0.50
SOIL WATER AT START OF YEAR	150.760	547259.625	
SOIL WATER AT END OF YEAR	149.883	544075.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.008	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0237	0.0200	0.0207	0.0188	0.0183	0.0167
FROM LAYER 13	0.0164	0.0155	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2046	742.838	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4677.690	-2.51
SOIL WATER AT START OF YEAR	149.883	544075.937	
SOIL WATER AT END OF YEAR	148.864	540376.062	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.027	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0111	0.0114	0.0107	0.0106	0.0099
	0.0132	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1350	490.100	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6709.741	-4.88

SOIL WATER AT START OF YEAR	148.864	540376.062	
SOIL WATER AT END OF YEAR	147.413	535109.812	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.008	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0819	297.271	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6796.003	4.06
SOIL WATER AT START OF YEAR	147.413	535109.812	
SOIL WATER AT END OF YEAR	149.285	541905.812	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0013	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0158	57.332	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-768.694	-0.55
SOIL WATER AT START OF YEAR	149.285	541905.812	
SOIL WATER AT END OF YEAR	149.074	541137.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.008	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.074	541137.125	
SOIL WATER AT END OF YEAR	149.470	542575.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.470	542575.062	
SOIL WATER AT END OF YEAR	149.555	542885.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.555	542885.312	
SOIL WATER AT END OF YEAR	148.361	538550.312	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.361	538550.312	
SOIL WATER AT END OF YEAR	149.525	542775.687	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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HELP MODEL PRINTOUTS

CLOSED – SEVENTEEN (17) LIFTS

Floor slope 6%

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**                                                                      **
**                                                                      **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE            **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)            **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY              **
**                     USAE WATERWAYS EXPERIMENT STATION                **
**              FOR USEPA RISK REDUCTION ENGINEERING LABORATORY          **
**                                                                      **
**                                                                      **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S6.OUT


TIME:  13: 5     DATE:   6/27/2020


**************************************************************************

     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=6%

**************************************************************************


     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                              LAYER  1
                              --------

               TYPE 1 - VERTICAL PERCOLATION LAYER
                   MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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LAYER 2

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	18.00	INCHES
POROSITY	=	0.4190	VOL/VOL
FIELD CAPACITY	=	0.3070	VOL/VOL
WILTING POINT	=	0.1800	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.3967	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.999999975000E-05	CM/SEC

LAYER 3

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.25	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.1630	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	12.8000002000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	95.0	FEET

LAYER 4

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 36

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.399999993000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	4 - POOR	

LAYER 5

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL

FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2187	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 6

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	816.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0759	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 7

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00	INCHES
POROSITY	=	0.4530	VOL/VOL
FIELD CAPACITY	=	0.1900	VOL/VOL
WILTING POINT	=	0.0850	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2802	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03	CM/SEC

LAYER 8

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	720.00	INCHES
POROSITY	=	0.1680	VOL/VOL
FIELD CAPACITY	=	0.0730	VOL/VOL
WILTING POINT	=	0.0190	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0745	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02	CM/SEC

LAYER 9

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	12.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2784 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 10

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 19

THICKNESS	=	96.00 INCHES
POROSITY	=	0.1680 VOL/VOL
FIELD CAPACITY	=	0.0730 VOL/VOL
WILTING POINT	=	0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 11

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 6

THICKNESS	=	48.00 INCHES
POROSITY	=	0.4530 VOL/VOL
FIELD CAPACITY	=	0.1900 VOL/VOL
WILTING POINT	=	0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2475 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.720000011000E-03 CM/SEC

LAYER 12

TYPE 1 - VERTICAL PERCOLATION LAYER
MATERIAL TEXTURE NUMBER 5

THICKNESS	=	24.00 INCHES
POROSITY	=	0.4570 VOL/VOL
FIELD CAPACITY	=	0.1310 VOL/VOL
WILTING POINT	=	0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.2273 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.100000005000E-02 CM/SEC

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15 INCHES
POROSITY	=	0.8500 VOL/VOL
FIELD CAPACITY	=	0.0100 VOL/VOL
WILTING POINT	=	0.0050 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0150 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000 CM/SEC
SLOPE	=	6.00 PERCENT
DRAINAGE LENGTH	=	250.0 FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06 INCHES
POROSITY	=	0.0000 VOL/VOL
FIELD CAPACITY	=	0.0000 VOL/VOL
WILTING POINT	=	0.0000 VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000 VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12 CM/SEC
FML PINHOLE DENSITY	=	0.00 HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00 HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	158.055	INCHES
TOTAL INITIAL WATER	=	158.055	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18 DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00
START OF GROWING SEASON (JULIAN DATE)	=	102
END OF GROWING SEASON (JULIAN DATE)	=	300
EVAPORATIVE ZONE DEPTH	=	9.0 INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30 MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00 %
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00 %
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00 %
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00 %

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35
RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	1.1964	4.1621	1.3766	0.7171	0.5187	0.3855
	0.3349	0.3237	0.2788	0.2129	0.2150	0.1879
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.000	0.000	0.000
	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.000	0.000	0.000	0.000
	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.006	0.025	0.007	0.004	0.003	0.002
	0.002	0.002	0.002	0.001	0.001	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.004	0.012	0.002	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.9095	35971.379	22.52
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0047		
CHANGE IN WATER STORAGE	-9.907	-35963.289	-22.51
SOIL WATER AT START OF YEAR	160.681	583273.437	
SOIL WATER AT END OF YEAR	150.774	547310.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.015	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED FROM LAYER 3	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.1311	0.0896	0.0791	0.0630	0.0551	0.0461
	0.0418	0.0372	0.0324	0.0304	0.0270	0.0257
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.003	0.001	0.003	0.001	0.006	0.003
	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.004	0.000	0.004	0.001	0.006	0.003
	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.001	0.001	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6585	2390.189	1.56
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.214	-775.861	-0.51
SOIL WATER AT START OF YEAR	150.774	547310.125	
SOIL WATER AT END OF YEAR	149.893	544112.937	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	-0.055	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0238	0.0200	0.0208	0.0189	0.0184	0.0168
FROM LAYER 13	0.0164	0.0156	0.0143	0.0141	0.0131	0.0129
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2050	744.100	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.289	-4679.020	-2.51
SOIL WATER AT START OF YEAR	149.893	544112.937	
SOIL WATER AT END OF YEAR	148.874	540411.750	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
FROM LAYER 3	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0124	0.0111	0.0115	0.0107	0.0106	0.0099
FROM LAYER 13	0.0131	0.0131	0.0117	0.0112	0.0101	0.0097
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.003	0.002	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY	0.000	0.002	0.001	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1351	490.440	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.848	-6710.018	-4.88

SOIL WATER AT START OF YEAR	148.874	540411.750	
SOIL WATER AT END OF YEAR	147.423	535145.250	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.056	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0091	0.0078	0.0081	0.0075	0.0073	0.0067
FROM LAYER 13	0.0066	0.0063	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0820	297.706	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000002	0.009	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6795.504	4.06
SOIL WATER AT START OF YEAR	147.423	535145.250	
SOIL WATER AT END OF YEAR	149.295	541940.750	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.053	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0015	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0159	57.885	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000001	0.003	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-769.193	-0.55
SOIL WATER AT START OF YEAR	149.295	541940.750	
SOIL WATER AT END OF YEAR	149.083	541171.562	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.063	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.854	1.00
SOIL WATER AT START OF YEAR	149.083	541171.562	
SOIL WATER AT END OF YEAR	149.479	542609.375	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	0.026	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.479	542609.375	
SOIL WATER AT END OF YEAR	149.565	542919.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000

EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
FROM LAYER 3	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.002	0.001	0.003	0.001	0.002	0.005
TOP OF LAYER 4	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY	0.002	0.001	0.003	0.001	0.002	0.004
HEAD ON TOP OF LAYER 4	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.565	542919.625	
SOIL WATER AT END OF YEAR	148.370	538584.625	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.370	538584.625	
SOIL WATER AT END OF YEAR	149.534	542810.000	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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ADVANCED GeoServices
a Montrose Environmental Group company

HELP MODEL PRINTOUTS

FULL -HEIGHT – SEVENTEEN (17) LIFTS

Floor slope 33%

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**                                                                  **
**                                                                  **
**              HYDROLOGIC EVALUATION OF LANDFILL PERFORMANCE        **
**                HELP MODEL VERSION 3.07  (1 NOVEMBER 1997)        **
**                   DEVELOPED BY ENVIRONMENTAL LABORATORY          **
**                     USAE WATERWAYS EXPERIMENT STATION            **
**             FOR USEPA RISK REDUCTION ENGINEERING LABORATORY       **
**                                                                  **
**                                                                  **
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PRECIPITATION DATA FILE:    C:\DATA4.D4
TEMPERATURE DATA FILE:      C:\DATA7.D7
SOLAR RADIATION DATA FILE:  C:\DATA13.D13
EVAPOTRANSPIRATION DATA:    C:\DATA11.D11
SOIL AND DESIGN DATA FILE:  C:\DATA10.D10
OUTPUT DATA FILE:           C:\CF17S33.OUT


TIME:  13:21     DATE:   6/27/2020


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     TITLE:  CLOSED FILL @17 LIFTS (TOP=33%), S=33%

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     NOTE:  INITIAL MOISTURE CONTENT OF THE LAYERS AND SNOW WATER
              WERE SPECIFIED BY THE USER.


                               LAYER  1
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   9
          THICKNESS                    =      6.00   INCHES
          POROSITY                     =      0.5010 VOL/VOL
          FIELD CAPACITY               =      0.2840 VOL/VOL
          WILTING POINT                =      0.1350 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.2710 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.190000006000E-03 CM/SEC
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                               LAYER  2
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                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =     18.00   INCHES
          POROSITY                     =      0.4190 VOL/VOL
          FIELD CAPACITY               =      0.3070 VOL/VOL
          WILTING POINT                =      0.1800 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.3967 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.999999975000E-05 CM/SEC


                               LAYER  3
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                    TYPE 2 - LATERAL DRAINAGE LAYER
                        MATERIAL TEXTURE NUMBER   0
          THICKNESS                    =      0.25   INCHES
          POROSITY                     =      0.8500 VOL/VOL
          FIELD CAPACITY               =      0.0100 VOL/VOL
          WILTING POINT                =      0.0050 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.1630 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =   12.8000002000     CM/SEC
          SLOPE                        =     33.00   PERCENT
          DRAINAGE LENGTH              =     95.0    FEET


                               LAYER  4
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                    TYPE 4 - FLEXIBLE MEMBRANE LINER
                        MATERIAL TEXTURE NUMBER  36
          THICKNESS                    =      0.06   INCHES
          POROSITY                     =      0.0000 VOL/VOL
          FIELD CAPACITY               =      0.0000 VOL/VOL
          WILTING POINT                =      0.0000 VOL/VOL
          INITIAL SOIL WATER CONTENT   =      0.0000 VOL/VOL
          EFFECTIVE SAT. HYD. COND.    =  0.399999993000E-12 CM/SEC
          FML PINHOLE DENSITY          =      0.00   HOLES/ACRE
          FML INSTALLATION DEFECTS     =      0.00   HOLES/ACRE
          FML PLACEMENT QUALITY        =  4 - POOR


                               LAYER  5
                               --------

                    TYPE 1 - VERTICAL PERCOLATION LAYER
                        MATERIAL TEXTURE NUMBER   6
          THICKNESS                    =     12.00   INCHES
          POROSITY                     =      0.4530 VOL/VOL
```

```
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2218 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 6

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    816.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0760 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 7

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2754 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 8

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =    720.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0744 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 9

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
```



```
THICKNESS                   =     12.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2672 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 10

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER  19
THICKNESS                   =     96.00   INCHES
POROSITY                    =      0.1680 VOL/VOL
FIELD CAPACITY              =      0.0730 VOL/VOL
WILTING POINT               =      0.0190 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.0730 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 11

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   6
THICKNESS                   =     48.00   INCHES
POROSITY                    =      0.4530 VOL/VOL
FIELD CAPACITY              =      0.1900 VOL/VOL
WILTING POINT               =      0.0850 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2474 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.720000011000E-03 CM/SEC
```

LAYER 12

```
         TYPE 1 - VERTICAL PERCOLATION LAYER
             MATERIAL TEXTURE NUMBER   5
THICKNESS                   =     24.00   INCHES
POROSITY                    =      0.4570 VOL/VOL
FIELD CAPACITY              =      0.1310 VOL/VOL
WILTING POINT               =      0.0580 VOL/VOL
INITIAL SOIL WATER CONTENT  =      0.2280 VOL/VOL
EFFECTIVE SAT. HYD. COND.   =  0.100000005000E-02 CM/SEC
```

LAYER 13

TYPE 2 - LATERAL DRAINAGE LAYER
MATERIAL TEXTURE NUMBER 0

THICKNESS	=	0.15	INCHES
POROSITY	=	0.8500	VOL/VOL
FIELD CAPACITY	=	0.0100	VOL/VOL
WILTING POINT	=	0.0050	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0113	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	4.42000008000	CM/SEC
SLOPE	=	33.00	PERCENT
DRAINAGE LENGTH	=	250.0	FEET

LAYER 14

TYPE 4 - FLEXIBLE MEMBRANE LINER
MATERIAL TEXTURE NUMBER 35

THICKNESS	=	0.06	INCHES
POROSITY	=	0.0000	VOL/VOL
FIELD CAPACITY	=	0.0000	VOL/VOL
WILTING POINT	=	0.0000	VOL/VOL
INITIAL SOIL WATER CONTENT	=	0.0000	VOL/VOL
EFFECTIVE SAT. HYD. COND.	=	0.199999996000E-12	CM/SEC
FML PINHOLE DENSITY	=	0.00	HOLES/ACRE
FML INSTALLATION DEFECTS	=	0.00	HOLES/ACRE
FML PLACEMENT QUALITY	=	1 - PERFECT	

GENERAL DESIGN AND EVAPORATIVE ZONE DATA

NOTE: SCS RUNOFF CURVE NUMBER WAS USER-SPECIFIED.

SCS RUNOFF CURVE NUMBER	=	69.00	
FRACTION OF AREA ALLOWING RUNOFF	=	100.0	PERCENT
AREA PROJECTED ON HORIZONTAL PLANE	=	1.000	ACRES
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
INITIAL WATER IN EVAPORATIVE ZONE	=	2.816	INCHES
UPPER LIMIT OF EVAPORATIVE STORAGE	=	4.263	INCHES
LOWER LIMIT OF EVAPORATIVE STORAGE	=	1.350	INCHES
INITIAL SNOW WATER	=	0.000	INCHES
INITIAL WATER IN LAYER MATERIALS	=	157.921	INCHES
TOTAL INITIAL WATER	=	157.921	INCHES
TOTAL SUBSURFACE INFLOW	=	0.00	INCHES/YEAR

EVAPOTRANSPIRATION AND WEATHER DATA

NOTE: EVAPOTRANSPIRATION DATA WAS OBTAINED FROM
BALTIMORE MARYLAND

STATION LATITUDE	=	39.18	DEGREES
MAXIMUM LEAF AREA INDEX	=	0.00	
START OF GROWING SEASON (JULIAN DATE)	=	102	
END OF GROWING SEASON (JULIAN DATE)	=	300	
EVAPORATIVE ZONE DEPTH	=	9.0	INCHES
AVERAGE ANNUAL WIND SPEED	=	9.30	MPH
AVERAGE 1ST QUARTER RELATIVE HUMIDITY	=	62.00	%
AVERAGE 2ND QUARTER RELATIVE HUMIDITY	=	65.00	%
AVERAGE 3RD QUARTER RELATIVE HUMIDITY	=	71.00	%
AVERAGE 4TH QUARTER RELATIVE HUMIDITY	=	68.00	%

NOTE: PRECIPITATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY PRECIPITATION (INCHES)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
3.47	3.02	3.93	3.00	3.89	3.43
3.85	3.74	3.98	3.16	3.12	3.35

NOTE: TEMPERATURE DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND

NORMAL MEAN MONTHLY TEMPERATURE (DEGREES FAHRENHEIT)

JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
32.40	35.50	43.70	53.20	62.80	71.70
76.50	74.50	67.40	55.30	45.50	36.60

NOTE: SOLAR RADIATION DATA WAS SYNTHETICALLY GENERATED USING
COEFFICIENTS FOR BALTIMORE MARYLAND
AND STATION LATITUDE = 39.18 DEGREES

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MONTHLY TOTALS (IN INCHES) FOR YEAR 1

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.00	1.42	3.53	1.61	2.69	4.35
	2.02	3.97	7.14	4.15	3.78	7.35

RUNOFF	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	4.173	0.000	0.000	0.573
EVAPOTRANSPIRATION	1.833	2.097	2.964	2.218	1.993	4.944
	1.724	3.594	1.231	3.100	2.343	1.288
LATERAL DRAINAGE COLLECTED	1.3421	0.3250	0.1830	0.1138	0.0001	0.0033
FROM LAYER 3	0.0034	0.4224	0.2873	2.1071	0.3056	4.8415
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	1.2055	3.9763	1.3936	0.7200	0.5215	0.3901
FROM LAYER 13	0.3333	0.3230	0.2802	0.2166	0.2145	0.1920
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.000	0.000	0.000	0.000
TOP OF LAYER 4	0.000	0.001	0.001	0.005	0.001	0.012
STD. DEVIATION OF DAILY	0.004	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.000	0.005	0.000	0.010
AVERAGE DAILY HEAD ON	0.006	0.021	0.007	0.004	0.003	0.002
TOP OF LAYER 14	0.002	0.002	0.001	0.001	0.001	0.001
STD. DEVIATION OF DAILY	0.004	0.011	0.002	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 1

	INCHES	CU. FEET	PERCENT
PRECIPITATION	44.01	159756.297	100.00
RUNOFF	4.746	17226.219	10.78
EVAPOTRANSPIRATION	29.328	106459.836	66.64
DRAINAGE COLLECTED FROM LAYER 3	9.9345	36062.125	22.57
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0020		

DRAINAGE COLLECTED FROM LAYER 13	9.7667	35452.973	22.19
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0041		
CHANGE IN WATER STORAGE	-9.764	-35444.789	-22.19
SOIL WATER AT START OF YEAR	160.584	582920.875	
SOIL WATER AT END OF YEAR	150.820	547476.062	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.070	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 2

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.34	3.29	4.39	6.53	6.65	1.73
	2.90	0.64	6.81	1.56	1.53	3.78
RUNOFF	0.000	2.063	3.416	0.000	0.000	0.000
	0.000	0.000	2.802	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.206	0.755	2.121	3.251	4.338	2.361
	3.743	0.317	1.780	2.269	1.620	0.732
LATERAL DRAINAGE COLLECTED	1.3916	0.2059	1.1493	0.4217	2.6773	1.2558
FROM LAYER 3	0.2311	0.0654	0.5398	0.7612	0.1991	0.0323
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.1336	0.0910	0.0801	0.0636	0.0556	0.0464
FROM LAYER 13	0.0421	0.0374	0.0326	0.0306	0.0271	0.0258
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.003	0.001	0.003	0.001	0.006	0.003
TOP OF LAYER 4	0.001	0.000	0.001	0.002	0.000	0.000
STD. DEVIATION OF DAILY	0.004	0.000	0.004	0.001	0.006	0.003
HEAD ON TOP OF LAYER 4	0.000	0.000	0.003	0.001	0.000	0.000
AVERAGE DAILY HEAD ON	0.001	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 2

	INCHES	CU. FEET	PERCENT
PRECIPITATION	42.15	153004.484	100.00
RUNOFF	8.281	30061.650	19.65
EVAPOTRANSPIRATION	24.493	88911.148	58.11
DRAINAGE COLLECTED FROM LAYER 3	8.9304	32417.410	21.19
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.6661	2417.872	1.58
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0003		
CHANGE IN WATER STORAGE	-0.221	-803.611	-0.53
SOIL WATER AT START OF YEAR	150.820	547476.062	
SOIL WATER AT END OF YEAR	149.931	544251.125	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.667	2421.326	1.58
ANNUAL WATER BUDGET BALANCE	0.0000	0.020	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 3

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	6.68	3.73	2.65	2.18	4.82	7.74
	7.73	4.48	4.80	1.86	2.74	1.93
RUNOFF	1.002	0.000	0.000	0.000	0.132	0.263
	3.590	0.145	0.039	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.522	1.629	2.362	1.498	3.507	5.862
	3.764	2.834	2.452	2.917	1.241	1.034
LATERAL DRAINAGE COLLECTED	5.1067	0.7695	3.5188	0.3294	0.4095	1.9031
FROM LAYER 3	0.9838	1.2587	0.3027	1.4652	0.2780	0.3077
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0239	0.0201	0.0209	0.0189	0.0184	0.0168
FROM LAYER 13	0.0165	0.0156	0.0144	0.0142	0.0131	0.0130
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.012	0.002	0.008	0.001	0.001	0.005
TOP OF LAYER 4	0.002	0.003	0.001	0.003	0.001	0.001
STD. DEVIATION OF DAILY	0.009	0.001	0.007	0.000	0.001	0.004
HEAD ON TOP OF LAYER 4	0.002	0.003	0.000	0.002	0.000	0.001
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 3

	INCHES	CU. FEET	PERCENT
PRECIPITATION	51.34	186364.234	100.00
RUNOFF	5.171	18769.648	10.07
EVAPOTRANSPIRATION	30.620	111151.008	59.64
DRAINAGE COLLECTED FROM LAYER 3	16.6332	60378.445	32.40
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0034		
DRAINAGE COLLECTED FROM LAYER 13	0.2057	746.648	0.40
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.290	-4681.512	-2.51
SOIL WATER AT START OF YEAR	149.931	544251.125	
SOIL WATER AT END OF YEAR	148.911	540547.437	
SNOW WATER AT START OF YEAR	0.667	2421.326	1.30
SNOW WATER AT END OF YEAR	0.398	1443.482	0.77
ANNUAL WATER BUDGET BALANCE	0.0000	-0.007	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 4

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.95	2.56	3.08	2.29	3.37	2.73
	2.86	4.59	5.84	3.84	0.69	1.07
RUNOFF	3.431	0.105	0.000	0.000	0.000	0.000
	0.000	0.000	0.676	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.536	1.938	2.873	3.152	2.590	2.597
	3.602	3.821	2.422	2.112	1.633	1.065
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.3232	1.0984	0.9018	0.2109	0.2116	0.1214
	0.0012	0.1251	1.5640	0.8341	1.3986	0.2395

PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0124	0.0112	0.0115	0.0107	0.0107	0.0099
	0.0129	0.0132	0.0117	0.0112	0.0101	0.0098
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.001	0.003	0.002	0.001	0.001	0.000
	0.000	0.000	0.004	0.002	0.003	0.001
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.000	0.002	0.001	0.000	0.000	0.000
	0.000	0.000	0.007	0.002	0.003	0.000
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 4

	INCHES	CU. FEET	PERCENT
PRECIPITATION	37.87	137468.094	100.00
RUNOFF	4.211	15287.419	11.12
EVAPOTRANSPIRATION	28.342	102882.305	74.84
DRAINAGE COLLECTED FROM LAYER 3	7.0298	25517.994	18.56
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0014		
DRAINAGE COLLECTED FROM LAYER 13	0.1353	491.129	0.36
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0001		
CHANGE IN WATER STORAGE	-1.849	-6710.738	-4.88

SOIL WATER AT START OF YEAR	148.911	540547.437	
SOIL WATER AT END OF YEAR	147.460	535280.187	
SNOW WATER AT START OF YEAR	0.398	1443.482	1.05
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.017	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 5

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.44	4.42	5.55	2.77	3.55	4.66
	3.83	5.75	2.91	5.56	2.87	2.78
RUNOFF	0.042	2.039	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	2.167	0.000	0.000
EVAPOTRANSPIRATION	0.583	0.974	3.159	2.870	2.815	3.235
	4.616	3.903	2.536	2.657	2.234	1.572
LATERAL DRAINAGE COLLECTED	0.0541	0.0001	3.4641	0.3706	1.1867	0.2554
FROM LAYER 3	0.7414	1.0178	0.3547	0.9097	0.2184	0.1597
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0092	0.0078	0.0082	0.0075	0.0073	0.0068
FROM LAYER 13	0.0067	0.0064	0.0059	0.0058	0.0054	0.0054
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.000	0.000	0.008	0.001	0.003	0.001
TOP OF LAYER 4	0.002	0.002	0.001	0.002	0.001	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.008	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.001	0.003	0.000	0.002	0.000	0.000

AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 5

	INCHES	CU. FEET	PERCENT
PRECIPITATION	46.09	167306.734	100.00
RUNOFF	4.249	15422.673	9.22
EVAPOTRANSPIRATION	31.154	113090.609	67.59
DRAINAGE COLLECTED FROM LAYER 3	8.7328	31700.187	18.95
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0018		
DRAINAGE COLLECTED FROM LAYER 13	0.0823	298.590	0.18
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	1.872	6794.674	4.06
SOIL WATER AT START OF YEAR	147.460	535280.187	
SOIL WATER AT END OF YEAR	149.332	542074.875	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.008	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 6

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	2.30	1.63	4.04	1.69	5.28	4.73
	1.78	7.20	1.41	2.67	3.69	2.16
RUNOFF	0.385	0.053	0.000	0.000	0.000	0.000
	0.000	0.159	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	1.082	1.502	3.191	2.328	3.428	3.647
	2.826	4.685	2.762	0.888	2.139	1.417
LATERAL DRAINAGE COLLECTED	0.8775	0.6474	1.2704	0.4325	1.0953	0.4987
FROM LAYER 3	0.2383	0.9040	0.3469	0.1568	1.3753	0.4435
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0052	0.0045	0.0048	0.0017	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
AVERAGE DAILY HEAD ON	0.002	0.002	0.003	0.001	0.003	0.001
TOP OF LAYER 4	0.001	0.002	0.001	0.000	0.003	0.001
STD. DEVIATION OF DAILY	0.001	0.002	0.002	0.000	0.003	0.001
HEAD ON TOP OF LAYER 4	0.000	0.002	0.000	0.000	0.004	0.000
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 6

	INCHES	CU. FEET	PERCENT
PRECIPITATION	38.58	140045.437	100.00
RUNOFF	0.597	2166.094	1.55
EVAPOTRANSPIRATION	29.893	108510.109	77.48

DRAINAGE COLLECTED FROM LAYER 3	8.2867	30080.602	21.48
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.001	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0017		
DRAINAGE COLLECTED FROM LAYER 13	0.0163	58.998	0.04
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.212	-770.356	-0.55
SOIL WATER AT START OF YEAR	149.332	542074.875	
SOIL WATER AT END OF YEAR	149.120	541304.500	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.010	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 7

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	3.35	0.34	5.57	3.12	3.15	0.65
	2.44	4.10	6.51	0.48	5.44	4.59
RUNOFF	0.118	0.081	0.663	0.000	0.000	0.000
	0.000	0.000	0.281	0.000	0.326	0.000
EVAPOTRANSPIRATION	0.885	0.073	2.862	3.856	1.530	2.116
	1.544	4.135	3.359	1.073	1.877	1.422
LATERAL DRAINAGE COLLECTED	2.1131	0.2787	2.8819	0.5631	0.2159	0.0799
FROM LAYER 3	0.0000	0.5513	1.1864	0.9222	1.2595	3.0924
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.005	0.001	0.007	0.001	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.007
STD. DEVIATION OF DAILY	0.005	0.000	0.007	0.001	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.003	0.005
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 7

	INCHES	CU. FEET	PERCENT
PRECIPITATION	39.74	144256.203	100.00
RUNOFF	1.468	5328.843	3.69
EVAPOTRANSPIRATION	24.732	89775.508	62.23
DRAINAGE COLLECTED FROM LAYER 3	13.1443	47713.977	33.08
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0027		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.396	1437.909	1.00
SOIL WATER AT START OF YEAR	149.120	541304.500	
SOIL WATER AT END OF YEAR	149.516	542742.437	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00

ANNUAL WATER BUDGET BALANCE	0.0000	-0.030	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 8

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	4.38	5.10	6.91	3.50	2.75	1.58
	5.18	0.81	8.56	1.94	3.48	5.14
RUNOFF	1.485	0.001	0.949	0.000	0.000	0.000
	0.000	0.000	3.191	0.000	0.000	3.325
EVAPOTRANSPIRATION	1.886	1.946	3.288	4.485	2.508	1.394
	4.531	1.498	2.528	1.342	1.980	0.747
LATERAL DRAINAGE COLLECTED	3.0113	2.0913	0.5667	2.2517	0.3800	0.1302
FROM LAYER 3	0.0702	0.2509	1.0223	0.8642	0.3926	1.1291
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.007	0.005	0.001	0.006	0.001	0.000
TOP OF LAYER 4	0.000	0.001	0.003	0.002	0.001	0.003
STD. DEVIATION OF DAILY	0.008	0.007	0.001	0.006	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.000	0.002	0.002	0.001	0.002
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 8

	INCHES	CU. FEET	PERCENT
PRECIPITATION	49.33	179067.875	100.00
RUNOFF	8.952	32494.725	18.15
EVAPOTRANSPIRATION	28.132	102120.203	57.03
DRAINAGE COLLECTED FROM LAYER 3	12.1605	44142.727	24.65
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.085	310.236	0.17
SOIL WATER AT START OF YEAR	149.516	542742.437	
SOIL WATER AT END OF YEAR	149.601	543052.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	-0.014	0.00

MONTHLY TOTALS (IN INCHES) FOR YEAR 9

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.07	3.04	5.00	2.51	10.82	5.02
	4.49	6.50	1.42	3.33	5.09	2.58
RUNOFF	0.084	0.000	2.900	0.000	2.805	0.140
	0.000	0.000	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.874	1.461	2.224	3.142	4.226	4.739
	3.701	4.770	2.144	2.456	1.980	1.037
LATERAL DRAINAGE COLLECTED FROM LAYER 3	0.9442	0.4829	1.4047	0.5002	0.7154	1.9361
	1.7458	0.8275	0.2365	0.3729	1.1452	1.7886
PERCOLATION/LEAKAGE THROUGH LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.005
	0.004	0.002	0.001	0.001	0.003	0.004
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 4	0.002	0.001	0.003	0.001	0.002	0.004
	0.003	0.001	0.000	0.001	0.002	0.003
AVERAGE DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000

ANNUAL TOTALS FOR YEAR 9

	INCHES	CU. FEET	PERCENT
PRECIPITATION	50.87	184658.047	100.00
RUNOFF	5.929	21521.275	11.65
EVAPOTRANSPIRATION	32.755	118899.586	64.39
DRAINAGE COLLECTED FROM LAYER 3	12.1002	43923.652	23.79
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0025		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00

PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	0.086	313.631	0.17
SOIL WATER AT START OF YEAR	149.601	543052.687	
SOIL WATER AT END OF YEAR	148.407	538717.687	
SNOW WATER AT START OF YEAR	0.000	0.000	0.00
SNOW WATER AT END OF YEAR	1.281	4648.627	2.52
ANNUAL WATER BUDGET BALANCE	0.0000	-0.093	0.00

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MONTHLY TOTALS (IN INCHES) FOR YEAR 10

	JAN/JUL	FEB/AUG	MAR/SEP	APR/OCT	MAY/NOV	JUN/DEC
PRECIPITATION	1.52	3.11	3.60	2.39	4.78	3.56
	2.86	9.31	1.68	0.98	3.02	3.50
RUNOFF	0.900	0.000	0.000	0.000	0.000	0.000
	0.000	1.402	0.000	0.000	0.000	0.000
EVAPOTRANSPIRATION	0.560	1.553	2.980	2.596	3.038	4.721
	2.408	5.045	1.522	0.848	1.569	0.906
LATERAL DRAINAGE COLLECTED	0.3972	1.9663	1.8063	0.3124	0.2482	0.2793
FROM LAYER 3	0.1653	2.4549	0.6103	0.1891	0.0104	1.9386
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LATERAL DRAINAGE COLLECTED	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
FROM LAYER 13	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
PERCOLATION/LEAKAGE THROUGH	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
LAYER 14	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

MONTHLY SUMMARIES FOR DAILY HEADS (INCHES)

AVERAGE DAILY HEAD ON	0.001	0.005	0.004	0.001	0.001	0.001
TOP OF LAYER 4	0.000	0.006	0.002	0.000	0.000	0.005
STD. DEVIATION OF DAILY	0.000	0.004	0.003	0.000	0.000	0.000
HEAD ON TOP OF LAYER 4	0.000	0.008	0.001	0.000	0.000	0.003
AVERAGE DAILY HEAD ON	0.000	0.000	0.000	0.000	0.000	0.000
TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000
STD. DEVIATION OF DAILY	0.000	0.000	0.000	0.000	0.000	0.000
HEAD ON TOP OF LAYER 14	0.000	0.000	0.000	0.000	0.000	0.000

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ANNUAL TOTALS FOR YEAR 10

	INCHES	CU. FEET	PERCENT
PRECIPITATION	40.31	146325.312	100.00
RUNOFF	2.302	8356.229	5.71
EVAPOTRANSPIRATION	27.746	100718.898	68.83
DRAINAGE COLLECTED FROM LAYER 3	10.3783	37673.387	25.75
PERC./LEAKAGE THROUGH LAYER 4	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 4	0.0021		
DRAINAGE COLLECTED FROM LAYER 13	0.0000	0.000	0.00
PERC./LEAKAGE THROUGH LAYER 14	0.000000	0.000	0.00
AVG. HEAD ON TOP OF LAYER 14	0.0000		
CHANGE IN WATER STORAGE	-0.117	-423.246	-0.29
SOIL WATER AT START OF YEAR	148.407	538717.687	
SOIL WATER AT END OF YEAR	149.571	542943.062	
SNOW WATER AT START OF YEAR	1.281	4648.627	3.18
SNOW WATER AT END OF YEAR	0.000	0.000	0.00
ANNUAL WATER BUDGET BALANCE	0.0000	0.041	0.00

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ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 10B

Geocomposite Drainage Layer Permeability

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Leachate Collection System, Geocomposite Drainage Net Requirements		
	Job No. 2018-3854	**Made by:** JCA	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 1

Reviewed by PGS 08/29/2021

Objective:

Estimate the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the tri-planar geocomposite drainage net (GDN) portion of the geocomposite drainage layer in the leachate collection system.

Design Approach:

1. Using various design parameters and estimated material characteristics, estimate the vertical load imposed on the GDN.
2. Consider manufacturer's data for a high compressive strength, high flow geocomposite drainage net (GDN) product for use in the leachate collection system. (Reference 3)
3. Select reduction factors for use in calculating the allowable transmissivity and final thickness of the GDN to account for creep deformation of the GDN core, intrusion of the geotextile into the GDN core, chemical clogging of the GDN core and/or geotextile, and biological clogging of the GDN core and/or geotextile. (Reference 1, same reduction factors as bi-planar GDN)
4. Use the manufacturer's data (Reference 3) and selected reduction factors to estimate the allowable transmissivity, final thickness, and allowable permeability (hydraulic conductivity) of the GDN.

Calculation:

Based on the attached calculation sheet, the allowable transmissivity for this design is $5.25 \times 10^{-3} m^2/sec$. This corresponds to an estimated allowable permeability (hydraulic conductivity) of 9.84 cm/sec. Using a Factor of Safety (FS) of 2, the required permeability is 4.92 cm/sec. Additionally, the final thickness after loading is estimated to be 0.15 inch.

Conclusion:

Use the allowable permeability (hydraulic conductivity) and final thickness values in the modeling of the leachate production.

References:

1. *"Geotechnical Aspects of Landfill Design and Construction";* Qian, Koerner, and Gray; 1st Ed., 2002; Sect 8.4.3.
2. Project waste density analysis.
3. Manufacturer's data, various.
4. Site specific data, estimated.

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Project:			
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By:	JCA	**Date:**	06/19/20
Checked:	VEF	**Date:**	07/15/20
Subject:	Leachate Collection System Geocomposite Drainage Net Requirements		

Reviewed by PGS 08/29/2021

Leachate Collection System Geocomposite Drainage Net

Description

Estimate the transmissivity and hydraulic conductivity of the geocomposite drainage net for the leachate collection system.

Vertical Loads

Cap System Thickness, D1 =	3 ~~4~~	ft	
Overall Cap System Unit Weight, $\gamma 1$ =	115	pcf	
Approximate Overall Cap System Pressure, $\sigma 1$ =	~~345~~ 460	psf	
Maximum Waste Thickness, D2 =	~~144~~ 120	ft	
Approximate Waste Unit Weight, $\gamma 2$ =	48.7	pcf	
Approximate Waste Pressure, $\sigma 2$ =	~~7,013~~	psf	
Protective Cover Layer Thickness, D3 =	4	ft	
Approximate Protective Cover Layer Unit Weight, $\gamma 3$ =	115	pcf	
Approximate Protective Cover Layer Pressure, $\sigma 3$ =	460	psf	
Leachate Collection Layer Thickness, D4 =	2	ft	
Approximate Leachate Collection Layer Unit Weight, $\gamma 4$ =	115	pcf	
Approximate Leachate Collection Layer Pressure, $\sigma 4$ =	230	psf	
Approximate Total Vertical Pressure, $\sigma T = \sum \sigma$ =	6,994 ~~8,048~~	psf =	345 ~~385~~ kPa

Landfill Bottom Slope

Landfill Bottom Slope, S =	3.0	%	=	0.03 ft/ft

Geocomposite Drainage Net Product *(Reference 3)*

Product Type =	GSE TenDrain 300	
Estimated Transmissivity from 1-hr Seat Time, $\theta 1$ =	5.25E-03	m^2/sec
Set Ultimate Transmissivity, $\theta U = \theta 1$ =	5.25E-03	m^2/sec

Reduction Factors *(Reference 1)*

Creep deformation of the drainage core itself and/or intrusion of the adjacent geotextile into the dranage core space, RF_{CR} =	2.00	>>>>	*Range: 1.4 to 2.0*
Elastic deformation of the adjacent geotextile intruding into the drainage core space, RF_{IN} =	2.00	>>>>	*Range: 1.5 to 2.0*
Chemical clogging of the adjacent geotextile or the drainage core space, RF_{CC} =	2.00	>>>>	*Range: 1.5 to 2.0*
Biological clogging of the adjacent geotextile or the drainage core space, RF_{BC} =	1.75	>>>>	*Range: 1.5 to 2.0*

Mathematical product of all RFs, XRF = 14.0

Allowable Transmissivity *(Reference 1)*

Allowable transmissivity, $\theta all = \theta U / XRF$ = 3.75E-04 m^2/sec = 3.75E+00 cm^2/sec

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Project:			
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Subject:	Leachate Collection System Geocomposite Drainage Net Requirements		

Reviewed by PGS 08/29/2021

Geocomposite Drainage Net Thickness *(References 1 and 3)*

Starting thickness, Ti =	300.0	mil	=	0.30	in
Final thickness, Tf = Ti/RF $_{CR}$ =	0.150	in	=	0.38	cm

Hydraulic Conductivity *(Reference 1)*

Allowable hydraulic conductivity, K $_{all}$ = θ all/Tf =	9.84 ✓	cm/sec
Factor of Safety =	2.0	
Required hydraulic conductivity, K $_{req'd}$ = K $_{all}$ / FS =	4.92 ✓	cm/sec

References:

1 *"Geotechnical Aspects of Landfill Design and Construction"; Qian, Koerner,and Gray; 1st Ed., 2002; Sect 8.4.3.*
2 Project waste density analysis.
3 *Manufacturer's data, various.*
4 *Site specific data, estimated.*

REFERENCE 1
Pg 1/1

RF_{IN} = reduction factor for elastic deformation, or intrusion, of the adjacent geosynthetics into the geonet's core space;
RF_{CR} = reduction factor for creep deformation of the geonet and adjacent geosynthetics into geonet's core space;
RF_{CC} = reduction factor for chemical clogging and/or precipitation of chemicals in the geonet's core space; and
RF_{BC} = reduction factor for biological clogging in the geonet's core space.

Some guidelines as to various reduction factors to be used in different situations are given in Table 8.8. Note that these values are based on preliminary and relatively sparse information. Other reduction factors, such as installation damage, viscosity effects and temperature effects, could also have been incorporated. If needed, they can be included on a site-specific basis. An example problem follows, which illustrates the use of geonets and points out that high factors of safety are warranted in critical situations.

EXAMPLE 8.2

What is the allowable geonet flow rate to be used in the design of a secondary leachate collection (i.e., leak detection) system? Assume that laboratory testing at proper design load and proper hydraulic gradient gave a short-term between-rigid-plate index value of 1.2 gal/min-ft (14.9 liter/min-m).

Solution: Average values from Table 8.8 are used (however, note the large resulting reduction):

$$q_{allow} = \frac{q_{ult}}{RF_{IN} \times RF_{CR} \times RF_{CC} \times RF_{BC}} \tag{8.17}$$

$$= \frac{1.2}{1.75 \times 1.7 \times 1.75 \times 1.75}$$

$$= \frac{1.2}{9.11} = 0.13 \text{ gal/min-ft (1.6 liter/min-m)}$$

TABLE 8.8 Recommended Preliminary Reduction Factors for Determining Allowable Flow Rate or Transmissivity of Biplanar Geonets (Koerner, 1998)

Application Area	Reduction Factor Values			
	RF_{IN}	RF_{CR}*	RF_{CC}	RF_{BC}
Sport fields	1.0 to 1.2	1.0 to 1.5	1.0 to 1.2	1.1 to 1.3
Capillary break	1.1 to 1.3	1.0 to 1.2	1.1 to 1.5	1.1 to 1.3
Roof and plaza decks	1.2 to 1.4	1.0 to 1.2	1.0 to 1.2	1.1 to 1.3
Retaining walls, seeping rock and soil slopes	1.3 to 1.5	1.2 to 1.4	1.1 to 1.5	1.0 to 1.5
Drainage blankets	1.3 to 1.5	1.2 to 1.4	1.0 to 1.2	1.0 to 1.2
Surface water drains for landfill caps	1.3 to 1.5	1.1 to 1.4	1.0 to 1.2	1.2 to 1.5
Secondary leachate collection (landfill)	1.5 to 2.0	1.4 to 2.0	1.5 to 2.0	1.5 to 2.0
Primary leachate collection (landfill)	1.5 to 2.0	1.4 to 2.0	1.5 to 2.0	1.5 to 2.0

*These values are sensitive to the density of the resin used in the geonet's manufacture. The higher the density, the lower the reduction factor. Creep of the covering geotextile(s) is a product-specific issue.

REFERENCE 3 pg 1/2

PRODUCT DATA SHEET

GSE TenDrain 300 mil Geocomposite

GSE TenDrain geocomposite consists of a 300 mil thick GSE TenDrain geonet heat-laminated on one or both sides with a GSE nonwoven needle-punched geotextile. TenDrain 300 is comprised of a tri-planar structure consisting of middle ribs that provide direct channelized flow, with diagonally placed top and bottom ribs. The geotextile is available in mass per unit area range of 6 oz/yd² to 16 oz/yd². TenDrain 300 geocomposite provides high transmissivity under high and low loads.

[*]

AT THE CORE:
A 300 mil thick TenDrain geonet heat-laminated on one or both sides with a nonwoven needlepunched geotextile.

Product Specifications

Tested Property	Test Method	Frequency	Minimum Average Roll Value[1]	
Geocomposite			6 oz/yd²	8 oz/yd²
Transmissivity[2], gal/min/ft, (m²/sec) at 1,000 psf Double-Sided Composite	ASTM D 4716	1/540,000 ft²	33.8 ($7x10^{-3}$)	33.8 ($7x10^{-3}$) *
Transmissivity[2], gal/min/ft, (m²/sec) at 15,000 psf Double-Sided Composite	ASTM D 4716	1/540,000 ft²	16.9 ($3.5x10^{-3}$)	16.9 ($3.5x10^{-3}$) *
Ply Adhesion, lb/in	ASTM D 7005	1/50,000 ft²	0.5	0.5
Geonet Core[1,3] – GSE TenDrain				
Geonet Core Thickness, mil	ASTM D 5199	1/50,000 ft²	300	300
Density, g/cm³	ASTM D 1505	1/50,000 ft²	0.94	0.94
Tensile Strength (MD), lb/in	ASTM D 7179	1/50,000 ft²	100	100
Carbon Black Content, %	ASTM D 4218	1/50,000 ft²	2.0	2.0
Creep Reduction Factor [4]	GRI-GC8	per formulation	1.1	1.1
Compressive Strength, psf	ASTM D 6364	1/540,000 ft²	80,000	80,000
Geotextile[1,3]				
Mass per Unit Area, oz/yd²	ASTM D 5261	1/90,000 ft²	6	8
Grab Tensile Strength, lb	ASTM D 4632	1/90,000 ft²	160	220
Grab Elongation, %	ASTM D 4632	1/90,000 ft²	50	50
CBR Puncture Strength, lb	ASTM D 6241	1/540,000 ft²	435	575
Trapezoidal Tear Strength, lb	ASTM D 4533	1/90,000 ft²	65	90
AOS, US sieve[1], (mm)	ASTM D 4751	1/540,000 ft²	70 (0.212)	80 (0.180)
Permittivity, sec^{-1}	ASTM D 4491	1/540,000 ft²	1.5	1.3
Water Flow Rate, gpm/ft²	ASTM D 4491	1/540,000 ft²	110	95
UV Resistance, % retained	ASTM D 4355 (after 500 hours)	per formulation	70	70
NOMINAL ROLL DIMENSIONS[5]				
Roll Width, ft			12.75	12.75
Roll Length, ft	Double-Sided Composite		152	152
Roll Area , ft²	Double-Sided Composite		1,938	1,938

NOTES:
- [1] All geotextile properties are minimum average roll values except AOS which is maximum average roll value and UV resistance is typical value. Geonet core thickness is minimum average value.
- [2] Gradient of 0.02, boundary condition: plate/sand/geocomposite/geomembrane/plate, water at 70°F for 1 hour.
- [3] Component properties prior to lamination.
- [4] 10,000 hour creep test under 15,000 psf at 40°C temperature.
- [5] Roll widths and lengths have a tolerance of ±1%.

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Reviewed by PGS 08/29/2021

Objective: Estimate the transmissivity (θ) of the geocomposite drainage net

Calculation

@ σ_V = 1,000 psf $\quad \theta = 7.0 \times 10^{-3}$ m²/sec

@ σ_V = 15,000 psf $\quad \theta = 3.5 \times 10^{-3}$ m²/sec

@ σ_V = 8048 psf :

$$\frac{8048 - 1000}{15{,}000 - 1{,}000} = 0.50$$

$$\theta = 7 - 0.50(7 - 3.5) = 7 - 1.75 = 5.25$$

$$\theta = 5.25 \times 10^{-3} \text{ m}^2/\text{sec}$$

2016-

SHEET 1	OF 1	PROJECT NO. 3084		PROJECT NAME	The Terrace
BY JCA		DATE 6/19/20		DESCRIPTION	GDN Transmissivity
CHK. BY VEJ		DATE 7/4/20			

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 10C

Leachate Collection Pipes Flow Capacity

Reviewed by PGS 08/29/2021

1. Purpose

The purpose of this analysis is to design the gravity leachate collection pipes with respect to flow.

2. Analysis Approach and Assumptions

a. The peak unit leachate flow from the project HELP modeling is used for both the lateral collection pipe, and the central, main leachate collection pipe.

b. Manning's Equation is used to calculate flow in each pipe. It is well-known that the roughness coefficient, n, used in Manning's Equation is not constant with flow depth. Therefore, the flow rate for a full-flow condition is calculated, and then adjusted to check actual flow conditions based on a graph that correlates the ratios of flow depth to pipe diameter (y/D) with the ratio of actual flow to full-flow (Q/Q_{full}), and the ratio of actual flow velocity to full-flow velocity (V/V_{full}). Such a graph is provided by Daugherty and Franzini (1977, Fig 11.8), and is based on *"Design and Construction of Sanitary and Storm Sewers"*, ASCE Manual of Engineering Practice, Vol 37, pg 94-95, 1960. This is taken from an earlier work by T.R. Camp entitled, *"Design of Sewers to Facilitate Flow"*, Sewage Works Journal, 18 (3), 1946.

c. Pipe perforations were designed based on orifice flow, a unit 1-foot length of pipe, the peak leachate flow, and the maximum leachate head build-up.

d. The longest collection lateral and the largest cell were chosen for collection lateral and the main collection pipe, respectively (largest contributing areas).

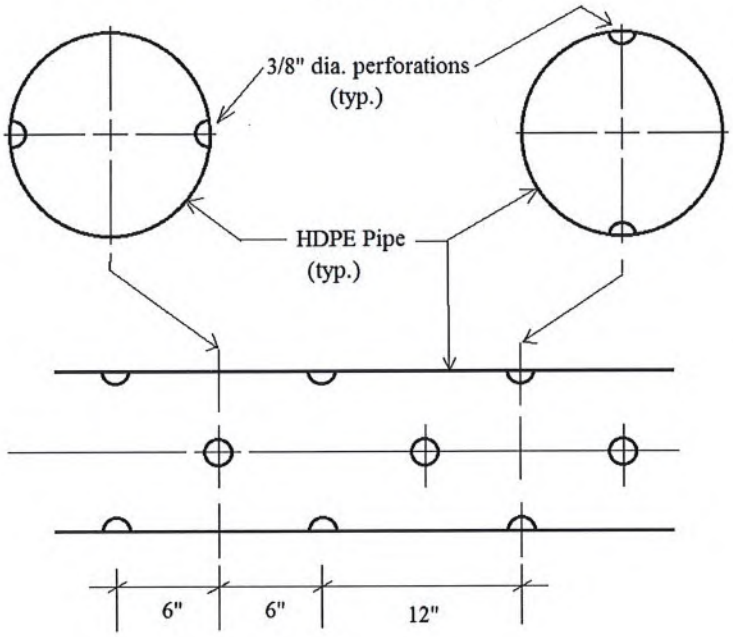
e. The factor of safety, FS, of the peak flow against flow capacity is also calculated.

3. Calculations

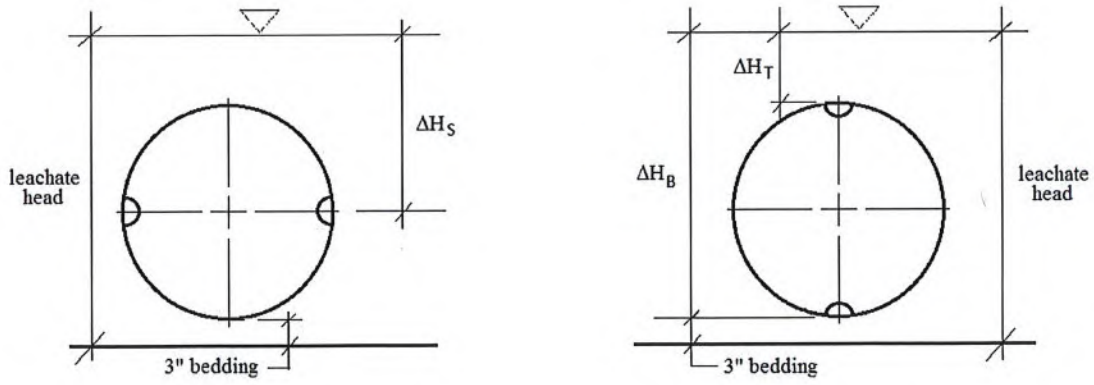
Pipe Information: the pipe chosen for design is SDR 11 solid-wall HDPE pipe. The main collection pipe in each cell is chosen to be 8-inch nominal diameter. The lateral collection pipes are chosen to be 6-inch nominal diameter. The perforation pattern chosen for design has two, 3/8-in (0.375 in) diameter perforations every 6 inches to provide 4 perforations per foot of pipe length. The locations of the perforations are alternated as shown in the following figure:

Reviewed by PGS 08/29/2021

Perforation Detail - Leachate Main & Lateral Collection Pipes



Based on orifice flow design, the following diagram depicts the positions of the orifices and the associated dimensions for head calculations:



(a) Perforations on side of pipe

(b) Perforations on top & bottom of pipe

Pipe Perforation Design

Reviewed by PGS 08/29/2021

Leachate Collection Lateral: The Using Manning's Equation, a roughness coefficient, n, of 0.012, and a pipe slope of 2% (minimum required), a full-flow capacity, Q_{full} of 0.59 cfs is calculated. The peak unit leachate flow from the project HELP modeling was estimated to be 9,724 gal/ac-day. The longest leachate collection lateral occurs in Cell 1, and is approximately 600 ft long. With a leachate pipe spacing of 250 ft, the contributing area is approximately 150,000 sf (3.44 ac). The peak flow, from this area is calculated to be 33,485 gal/day (0.052 cfs). The FS of the peak flow against the flow capacity is calculated as (0.59/0.052) cfs = 11.3. The flow depth, y, is estimated to be 1.07 in, and the flow velocity is estimated to be 1.77 fps.

Using a peak leachate head build-up of 12" (maximum allowable), the following flows are calculated for each orifice:

Top:	0.00239 cfs/ft of pipe
Side (each):	0.00365 cfs/ft of pipe
Bottom;	0.00458 cfs/ft of pipe

Based on these partial flows, a flow capacity of 0.01428 cfs/ft of pipe is provided. The lateral leachate collection pipe is estimated to need 0.000086 cfs/ft of pipe is needed. The FS against the flow capacity is calculated to be (0.01422/0.000086) = 165.4.

Leachate Collection Main (Header): The Using Manning's Equation, a roughness coefficient, n, of 0.012, and a pipe slope of 2% (minimum required), a full-flow capacity, Q_{full} of 1.17 cfs is calculated. The peak unit leachate flow from the project HELP modeling was estimated to be 9,724 gal/ac-day. The largest cell is Cell 1. This cell is 13.19 ac in size, but only 11.7 ac drains to the main leachate collection pipe. The balance (1.49 ac) drains to pipes located at the toe of the 3H:1V (33%) sideslopes. Using the 11.7-ac area, and the unit peak flow, a peak flow of 113,771 gal/day (0.176 cfs) is calculated. The FS of the peak flow against the flow capacity is calculated as (1.17/0.176) cfs = 6.6. The flow depth, y, is estimated to be 1.39 in, and the flow velocity is estimated to be 2.08 fps.

Using a peak leachate head build-up of 12" (maximum allowable), the following flows are calculated for each orifice:

Top:	0.00139 cfs/ft of pipe
Side (each):	0.00339 cfs/ft of pipe
Bottom;	0.00458 cfs/ft of pipe

Based on these partial flows, a flow capacity of 0.01275 cfs/ft of pipe is provided. The lateral leachate collection pipe is estimated to need 0.000191 cfs/ft of pipe is needed. The FS against the flow capacity is calculated to be (0.01275/0.000191) = 66.6.

4. Conclusions

Based on the foregoing, the following conclusions are offered:

a. The 6-inch HDPE SDR 11 solid-wall pipe provides adequate flow capacity for the lateral leachate collection pipe. Similarly, the 8-inch HDPE SDR 11 solid-wall pipe provides adequate flow capacity for the main leachate collection pipe.

b. The flow velocity in the lateral collection pipe is only slightly less than 2 fps, the minimum needed for the pipe to be "self-cleaning". The life of each landfill cell is relatively short, in most cases less than 12 months. The HELP modeling indicates the flow to diminish rapidly after closure. Consequently, the flow velocity in the lateral collection pipes is not considered critical. Therefore, cleanouts are not provided for the laterals. Additionally, the laterals are terminated in the deep parts of the landfill, making access to the up-gradient ends impractical.

c. The flow velocity in the central, main leachate collection pipe is estimated to be approximately 2.08 fps. This is equal to the minimum 2 fps flow velocity to be considered self-cleaning. The down-gradient end of the main collection pipes are provided with a clean-out to allow cleaning if needed.

5. References

1. Daugherty, Robert L., and Franzini, Joseph B.; *"Fluid Mechanics with Engineering Applications"*; McGraw-Hill Book Company, 1977.

2. Project HELP Modeling.

3. HDPE Pipe Manufacturer's Data.

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Project:			
P.N.:	2018-3084	**Page:**	1 of 1
By:	JCA	**Date:**	07/16/20
Checked:	VES	**Date:**	7/16/20
Subject:	Lateral Gravity Leachate Pipe Design		

Reviewed by PGS 08/29/2021

Objective *Design the gravity leachate collection pipes (lateral) for peak leachate flow.*

A. Pipe Capacity
Leachate Collection Pipe Data

Gravity Pipe Type:	Smooth-walled, solid HDPE, SDR 11						
Gravity Pipe Nominal Inside Diameter, D_N =	6	in					
Gravity Pipe Actual Inside Diameter, D =	5.349	in					
Full Flow Cross-Sectional Area, A =	22.46	in^2	=	0.16	ft^2		
Wetted Perimeter, Wp =	18.84	in	=	1.57	ft		
Hydraulic Radius, R_h =	1.19	in	=	0.10	ft	$R_h^{(2/3)}$ =	0.215
Slope, S =	2	%	=	0.020	ft/ft	$S^{(1/2)}$ =	0.141
Manning's Roughness Coefficient, n =	0.012						
Full-Flow Capacity, Q_{full} =	0.59	cfs					
Full-Flow Velocity, V_{full} =	3.8	fps					

Leachate Collection Pipe

Longest Lateral Leachate Collection Pipe, L =	600	ft >>>>>>>>>	(Cell 1)					
Lateral Leachate Collection Pipe Spacing, DL =	250	ft						
Drainage Area to Lateral Leachate Collection Pipe, DA =	150,000	ft^2	=	3.44	ac			
Leachate Flow/Unit Area, Q =	9,724	gal/ac-day						
Flow to Lateral Leachate Collection Pipe, Q =	33,485	gal/day	=	0.052	cfs	=	0.000086	cfs/ft of pipe
Factor of Safety Against Peak Flow, FS = Q_{full}/Q =	**11.3**							
Ratio Q/Q_{full} =	0.09							
Ratio y/D =	0.20							
Flow Depth, y =	1.07	in						
Ratio V/V_{full} =	0.47							
Flow Velocity, V =	1.77	fps						

B. Perforation Design
Pipe and Orifice data

Orifice Type =	(c)				
Coefficient, C_d =	0.86				
Gravity Pipe Nominal Inside Diameter, D_N =	6	in			
Gravity Pipe Actual Inside Diameter, D =	5.349	in			
Gravity Pipe Wall Thickness, t =	0.602	in			
Bedding Layer Thickness, B =	3	in			
Peak Leachate Head, LH =	12	in	=	1	ft
Gravitational Coefficient, g =	32.2	ft/sec^2			
Orifice Dia. =	0.375	in	=	0.03125	ft
Orifice Cross-Sectional Flow Area, A_o =	0.00077	ft^2			

Top Orifice Flow

ΔH_T = LH - B - 2t - D =	2.447	in	=	0.20	ft
Number of Top Orifices per Ft of Pipe =	1				
Top Orifice Flow, q_T =	0.00239	cfs/ft of pipe			
Total Top Orifice(s) Flow, Q_T =	0.00239	cfs/ft of pipe			

Side Orifice Flow

ΔH_S = LH - t - 0.5D =	5.724	in	=	0.48	ft
Number of Side Orifices per Ft of Pipe =	2				
Side Orifice Flow, q_S =	0.00365	cfs/ft of pipe			
Total Side Orifice(s) Flow, Q_S =	0.00731	cfs/ft of pipe			

Bottom Orifice Flow

ΔH_B = LH - B =	9.000	in	=	0.75	ft
Number of Bottom Orifices per Ft of Pipe =	1				
Bottom Orifice Flow, q_B =	0.00458	cfs/ft of pipe			
Total Bottom Orifice(s) Flow, Q_B =	0.00458	cfs/ft of pipe			

Total Orifice Flow

Total Unit Flow Capacity, $Q_t = Q_T + Q_S + Q_B$ =	0.01428	cfs/ft of pipe
Total Flow Capacity, Q =	0.000086	cfs/ft of pipe
Factor of Safety Against Peak Flow = FS = Qt/Q =	**165.4**	

References

1 Daugherty, Robert L., and Franzini, Joseph B.; *"Fluid Mechanics with Engineering Applications"*; McGraw-Hll Book Company, 1977.
2 Project HELP Modeling.
3 HDPE Pipe Manufacturer's Data.

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Project:			
P.N.:	2018-3084	**Page:**	1 of 1
By:	JCA	**Date:**	07/10/20
Checked:		**Date:**	7/16/20
Subject:	Main Gravity Leachate Pipe Design		

Reviewed by PGS 08/29/2021

Objective *Design the gravity leachate collection pipes (main) for peak leachate flow.*

A. Pipe Capacity

Leachate Collection Pipe Data

Gravity Pipe Type:	Smooth-walled, solid HDPE, SDR 11							
Gravity Pipe Nominal Inside Diameter, D_N =	8	in						
Gravity Pipe Actual Inside Diameter, D =	6.963	in						
Full Flow Cross-Sectional Area, A =	38.06	in^2	=	0.26	ft^2			
Wetted Perimeter, Wp =	25.12	in	=	2.09	ft			
Hydraulic Radius, R_h =	1.52	in	=	0.13	ft	$R_h^{(2/3)}$ =	0.252	
Slope, S =	2	%	=	0.020	ft/ft	$S^{(1/2)}$ =	0.141	
Manning's Roughness Coefficient, n =	0.012							
Full-Flow Capacity, Q_{full} =	1.17	cfs						
Full-Flow Velocity, V_{full} =	4.4	fps						

Leachate Collection Pipe

Longest Main Leachate Collection Pipie, L =	920	ft	(Cell 1)					
Drainage Area to Main Leachate Collection Pipe, DA =	11.70	ac	(Cell 1)					
Leachate Flow/Unit Area, Q =	9,724	gal/ac-day						
Flow to Lateral Leachate Collection Pipe, Q =	113,771	gal/day	=	0.176	cfs	=	0.000191	cfs/ft of pipe
Factor of Safety Against Peak Flow, FS = Q_{full}/Q =	**6.6**							
Ratio Q/Q_{full} =	0.15							
Ratio y/D =	0.20							
Flow Depth, y =	1.39	in						
Ratio V/V_{full} =	0.47							
Flow Velocity, V =	2.08	fps						

B. Perforation Design

Pipe and Orifice data

Orifice Type =	(c)				
Coefficient, C_d =	0.86				
Gravity Pipe Nominal Inside Diameter, D_N =	8	in			
Gravity Pipe Actual Inside Diameter, D =	6.963	in			
Gravity Pipe Wall Thickness, t =	0.602	in			
Bedding Layer Thickness, B =	3	in			
Peak Leachate Head, LH =	12	in	=	1	ft
Gravitational Coefficient, g =	32.2	ft/sec^2			
Orifice Dia. =	0.375	in	=	0.03125	ft
Orifice Cross-Sectional Area, A_o =	0.00077	ft^2			

Top Orifice Flow

ΔH_T = LH - B - 2t - D =	0.833	in	=	0.07	ft
Number of Top Orifices per Ft of Pipe =	1				
Top Orifice Flow, q_T =	0.00139	cfs			
Total Top Orifice(s) Flow, Q_T =	0.00139	cfs			

Side Orifice Flow

ΔH_S = LH - t - 0.5D =	4.917	in	=	0.41	ft
Number of Side Orifices per Ft of Pipe =	2				
Side Orifice Flow, q_S =	0.00339	cfs			
Total Side Orifice(s) Flow, Q_S =	0.00677	cfs			

Bottom Orifice Flow

ΔH_B = LH - B =	9.000	in	=	0.75	ft
Number of Bottom Orifices per Ft of Pipe =	1				
Bottom Orifice Flow, q_B =	0.00458	cfs			
Total Bottom Orifice(s) Flow, Q_B =	0.00458	cfs			

Total Orifice Flow

Total Unit Flow Capacity, $Q_t = Q_T + Q_S + Q_B$ =	0.01275	cfs/ft of pipe
Total Flow Capacity, Q =	0.000191	cfs/ft of pipe
Factor of Safety Against Peak Flow = FS = Qt/Q =	**66.6**	

References

1 Daugherty, Robert L., and Franzini, Joseph B.; *"Fluid Mechanics with Engineering Applications"*; McGraw-Hll Book Company, 1977.
2 Project HELP Modeling.
3 HDPE Pipe Manufacturer's Data.

REFERENCE 1

Pg 1/2

PIPE FLOW

Manning's Formula

$$V\,(\text{fps}) = \frac{1.49}{n} R_h^{(2/3)} S^{(1/2)} \qquad A = \pi D^2$$

$$Q\,(\text{cfs}) = \frac{1.49}{n} A R_h^{(2/3)} S^{(1/2)} \qquad R_h = A/W_p$$

$$W_p = \pi D$$

where,

V = flow velocity, fps
Q = flow, cfs
A = cross-sectional flow area, ft^2
D = Pipe inside diameter, ft
R_h = hydraulic radius, ft
Wp = wetted perimeter, ft

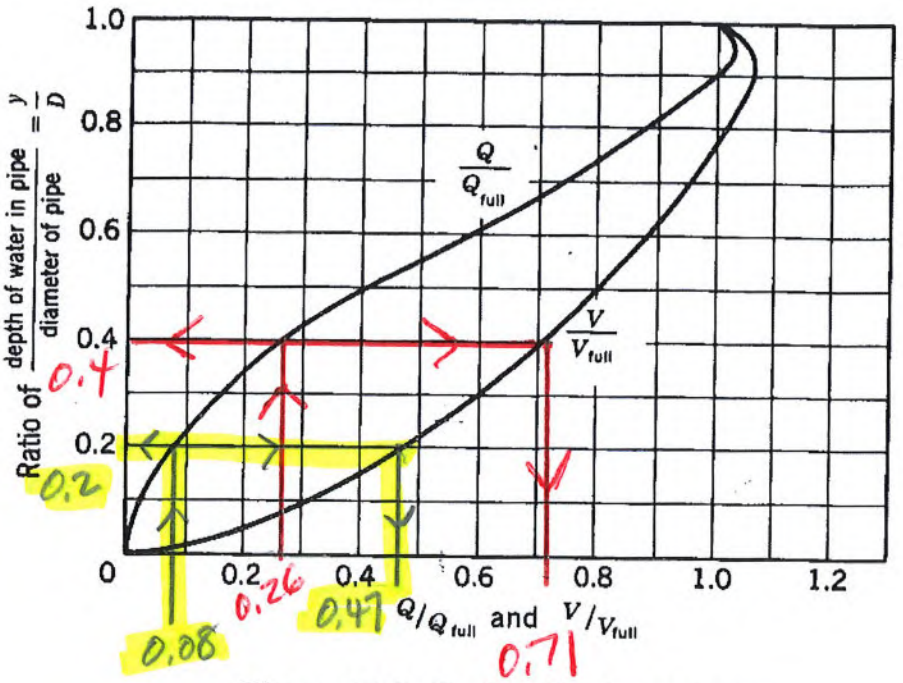
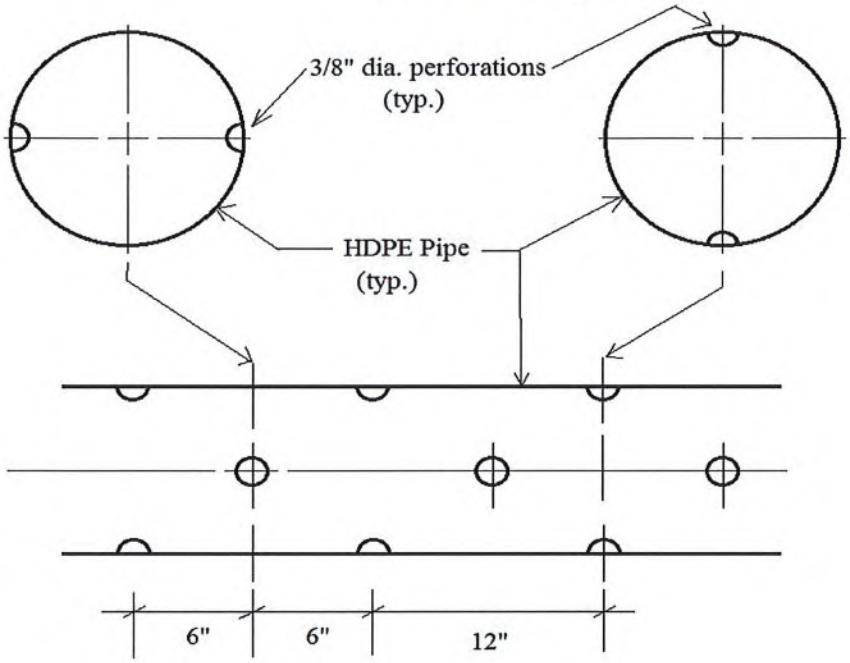
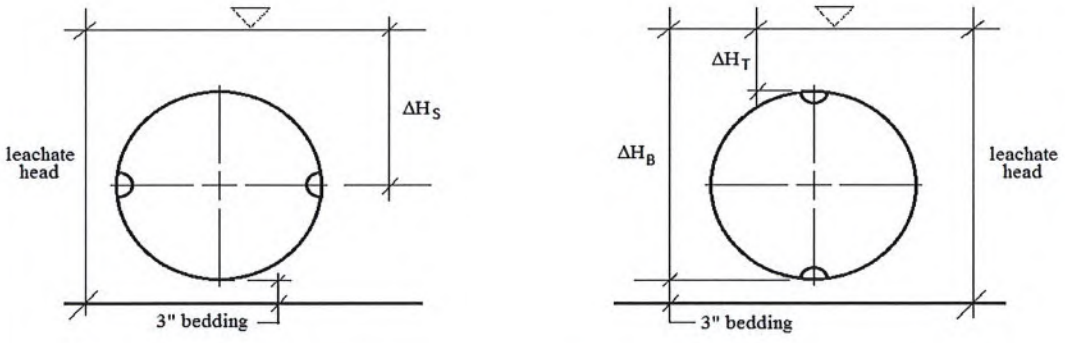


Figure 11.8. Hydraulic characteristics of circular pipe flowing partly full (*n* variable with depth).

Perforation Detail - Leachate Main & Lateral Collection Pipes





Pipe Perforation Design

REFERENCE 1

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ORIFICE FLOW

		Equation
Ideal flow rate	$Q_i = A_i V_i = A_o\sqrt{2g(\Delta H)}$	(12.8)
Actual flow rate	$Q = AV = C_c A_o(C_v\sqrt{2g(\Delta H)})$	(12.9)
and	$C_d = \frac{Q}{Q_i} = C_c C_v$	(12.10)

Combine Equations 12.9 and 12.10:

$$Q = C_d A_o(\sqrt{2g(\Delta H)})$$

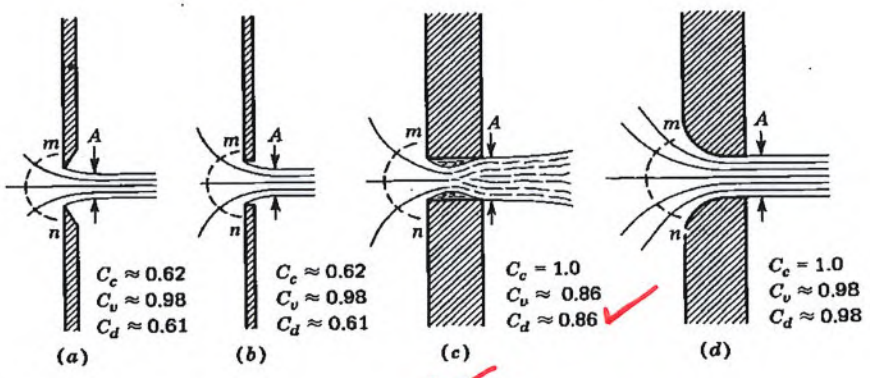


Figure 12.11. Types of orifice.

ATTACHMENT 10D

Leachate Collection Pipe Stress

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Buried Pipe Design		
	Job No. 2018-3854	Made by: JCA	Date 07/15/20
	Ref.	Checked by: VEF	Sheet 1 of 2

Reviewed by PGS 08/21/2021

1. Purpose

The purpose of this analysis is to design the leachate lateral and main collection pipes as buried pipes.

2. Analysis Approach and Assumptions

a. Two loading conditions are considered:

(1) final loading with completed landfill height; and,
(2) construction loading to account for heavy equipment usage.

Revised Landfill Height is lower, therefore Calculation still valid.

No change

b. Vehicle loading was assumed to be AASHTO H20 (32,000 rear axle on a panel truck).

c. The pipes considered for use 6-inch and 8-inch diameter, solid-wall HDPE pipes with SDR = 11, and 4, 3/8" diameter perforations per ft of pipe.. Pipe data was modified per Reference 2 to account for the perforations in the pipes.

d. Wall crushing (compressive ring thrust), deflection, and buckling are checked for the loading conditions. Maximum value for deflection was set at 7.5% per Reference 4.

3. Calculations

As indicated, the pipe data was modified to account for the perforations. This was accomplished by subtracting the cross-sectional area of the perforations from the pipe wall area. This results – *for the purposes of this calculation* – in a reduced pipe wall thickness, an increased SDR, an increased inside diameter, an increased mean diameter, and a reduced section moment of inertia. A comparison of the pipe data before and after modification is summarized in the following tables:

6" Pipe Data Modifications		
Before Modification	***Pipe Characteristic***	***After Modification***
6.553	Outside Diameter, in	6.553
5.349	Inside Diameter, in	5.402
0.602	Pipe Wall Thickness, in	0.575
11	SDR	11.4
2.976	Mean Radius, R, in	2.989
11.25	Pipe Wall Area, in^2	10.80
0.0182	Section Moment of Inertia, in^4/in	0.0159

Reviewed by PGS 08/21/2021

8" Pipe Data Modifications		
Before Modification	***Pipe Characteristic***	***After Modification***
8.531	Outside Diameter, in	8.531
6.963	Inside Diameter, in	7.017
0.784	Pipe Wall Thickness, in	0.757
11	SDR	11.3
3.874	Mean Radius, R, in	3.887
19.07	Pipe Wall Area, in^2	18.48
0.0402	Section Moment of Inertia, in^4/in	0.0362

The attached calculations provide the following factors of safety:

Pipe Stress Calculation Results		
6" Pipe	***Factor of safety for:***	***8" Pipe***
4.2	Compressive Ring Thrust Stress	4.4
2.4	Ring Deflection	2.5
2.6	Constrained Wall Buckling	2.7

4. Conclusions

Based on the foregoing, pipe product and backfill soils having engineering parameters consistent with the analysis, and installed consistent with the conditions described ion this analysis, should perform adequately with respect to compressive ring thrust stress, ring deflection, and constrained wall buckling.

5. Recommendations

Based on the foregoing, the following recommendations are offered:

a. The engineering properties of the pipe product and soil materials from this analysis should be incorporated into the Technical Specifications of the project.

b. If conditions, products, materials, and equipment during construction are not consistent with this analysis, additional analyses should be performed.

6. References

1. Performance Pipe Manufacturer's Data
2. Derivation of equations to modify basic pipe information to account for perforations.
3. Project design information.
4. Plastics Pipe Institute, *"Handbook of Polyethylene Pipe"*, 2nd Ed.

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Project:			
P.N.:	2018-3084	**Page:**	1 of 3
By:	JCA	**Date:**	07/15/20
Checked:	DEF	**Date:**	07-15-20
Subject:	6" Leachate Pipe Structural Design		

Reviewed by PGS 08/21/2021

Objective: *Check the structural adequacy of the leachate collection pipe.*

Basic Pipe Information (Solid Wall HDPE): *(Ref. 1)*

Material Code:	PE 4710	
Nominal Diameter =	6	in
Standard Dimension Ratio, SDR =	11	
Average Inside Diameter, ID =	5.349	in
Minimum Wall Thickness, t =	0.602	in
Outside Inside Diameter, OD = ID + 2t =	6.553	in
Moment of Inertia, $I = (t^3/12) =$	0.0182	in^4/in
Mean Radius, R = (OD - t) / 2 =	2.976	in
Area of Pipe Wall, = $A = 2\pi Rt =$	11.25	in^2

Modifiy Basic Pipe Information to Account for Pipe Perforations: *(Ref. 2)*

Diameter of Perforation(s), $d_P =$	0.375	in
Number of Perforations at Each Radial Axis , $N_P =$	2	
Area of Perforations, $A_P = N_P(t)\,d_P =$	0.452	in^2
Modified Pipe Wall Area, $A' = A - A_P =$	10.80	in^2
Modified Wall Thickness, $t' = (OD - \sqrt{((OD^2) - 4*A'/\pi)})/2$	0.575	in *(Ref. 2 p 1.)*
Modified Inside Diameter = ID' = OD - 2t'	5.402	in
Modified Moment of Inertia, $I' = (t'^3/12) =$	0.0159	in^4/in
Modified Mean Radius, R' = (OD - t') / 2 =	2.989	in
Modified SDR Designation, SDR' = (OD / t') =	11.4	

Static Load: *(Ref. 3)*

Fill height of cap above top of pipe, H =	3	ft
Soil Density, $\gamma =$	115	pcf
Fill height of waste above top of pipe, H =	144	ft
Waste Density, $\gamma =$	48.7	pcf
Fill height of protective cover layer above top of pipe, H =	4	ft
Soil Density, $\gamma =$	115	pcf
Fill height of leachate collection stone above top of pipe, H =	1	ft
Soil Density, $\gamma =$	125	pcf
Total Static Vertical Pressure on Top of Pipe, Ps = $\Sigma(H\gamma) =$	7,943	psf

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Project:
P.N.: 2018-3084 Page: 2 of 3
By: JCA Date: 07/15/20
Checked: VEJ Date: 07.15.20
Subject: 6" Leachate Pipe Structural Design

Reviewed by PGS 08/21/2021

Live Load: (Ref. 4, pp 199 & 203)

Axle Load, W_A =	32,000	lb			
Wheel Load, $W_W = W_A/2$	16,000	lb			
Vertical Depth over Pipe, H =	2.0	ft			
Impact Factor, I_F =	1.00				
Distance from Pipe Centerline to Wheel 1, X_1 =	0.0	ft			
Radial Distance from Wheel Load to Top of Pipe, r_1 =	2.00	ft			
Distance from Pipe Centerline to Wheel 2, X_2 =	6.0	ft			
Radial Distance from Wheel Load to Top of Pipe, r_2 =	6.32	ft			
Live Load from Wheel 1, P_{L1} =	1910.8	psf			
Live Load from Wheel 2, P_{L2} =	7.9	psf			
Design P_L =	1910.8	psf			

Internal Pressure Load:

Vacuum,Pressure, P_I =	0.0	psi	=	0	psf

Total Load

Total Load, $P_T = P_S + P_L + P_I$ =	9,854	psf	=	68.4	psi

Design for Compression Ring Thrust Stress: (Ref. 4, pp 227 - 228)

Outside Diameter of Pipe, $D_O = OD$ =	6.553	in				
Radius to Centroidal Axis of Pipe, $r_{CENT} = R'$ =	2.989	in				
One-Dimensional Soil Modulus, M_S =	2,610	psi				(Ref. 4, p 228, table 3-12)
Long Term Modulus of Elasticity of Pipe Material, E =	17,920	psi				(Ref. 4, p 99 table B.1.1 at 100 yr; p100 table B.1.2 at 110° F)
Pipe Wall Area, $A' = t'$ =	0.575	in^2/in				
Hoop Thrust Stiffness Ratio, S_A =	1.08					(Ref. 4, p 227, Eqn 3-22)
Vertical Arching Factor, VAF =	0.86					(Ref. 4, p 227, Eqn 3-21)
Vertical Pressure on Top of Pipe, $wH = P_S + P_I$ =	7,943	psf				
Radial Directed Earth Pressure, P_{RD} =	6,860	psf				(Ref. 4, p 228, Eqn 3-23)
Pipe Wall Compressive Stress, S =	271	psi	=	39,075	psf	(Ref. 4, p 229, from Eqn 3-14)
Allowable Compressive Stress, S_{ALL} =	1,150	psi	=	165,600	psf	(Ref. 4, p 102, table C.1)
Factor of Safety = $FS = S_{ALL}/S$ =	**4.2**	**> 1.0**		**Design Acceptable**		

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Project:			
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Subject:	6" Leachate Pipe Structural Design		

Reviewed by PGS 08/21/2021

Design for Ring Deflection:

Poisson's Ratio of Soil, μ =	0.15			*(Ref. 4, p 230, table 3-13, for coarse sand)*
Secant Modulus of Soil, E_S =	2,472	psi		*(Ref. 4, p 230, Eqn 3-26)*
Standard Dimension Ratio = SDR = SDR' =	11.4 ✓			
Long Term Modulus of Elasticity of Pipe Material, E =	17,920 ✓	psi		
Rigidity Factor, R_F =	1,857 ✓			*(Ref. 4, p 230, Eqn 3-24)*
Deformation Factor, D_F =	1.41 ✓			*(Ref. 4, p 231, Fig. 3-6)*
Soil Strain, ε_s =	2.23	%		*(Ref. 4, p 231, Eqn 3-27)*
Percent Ring Deflection, $(\Delta X/D_M)(100) = (D_F)(\varepsilon_s)$ =	3.15	%		*(Ref. 4, p 231, Eqn 3-28)*
Maximum Allowable Deflection, D_{MAX} =	7.5	%		*(Ref. 4, p 218)*
Factor of Safety, FS = $D_{MAX}/(D_F)(\varepsilon_S)$ =	**2.4**	**> 1.0**	**Design Acceptable**	

Design for Constrained Wall Buckling: *(Ref. 4, using Luscher's Equations to account for possible leachate head)*

Total Height of Cover on Top of Pipe, H =	152.0	ft				
Height of Water Above Top of Pipe, H_{GW} =	1.0	ft				
Buoyancy Factor, R =	1.0					*(Ref. 4, p 222, Eqn 3-17)*
Natural Log Base Number, e =	2.71828					
Elastic Soil Support Factor, B' =	1.0					*(Ref. 4, p 222, Eqn 3-18)*
Modulus of Soil Reaction for Pipe Bedding, E' =	3,000	psi				*(Ref. 4, p 214, table 3-7)*
Dimension Ration, DR = SDR' =	11.4					
Safety Factor, N =	2.0					*(Ref. 4, p 222)*
Allowable Constrained Buckling Pressure, P_{WC} =	178	psi	=	25,673	psf	*(Ref. 4, p 221, Eqn 3-15)*
Total Vertical Pressure, P_T =	68.4	psi	=	9,854	psf	
Factor of Safety, FS = P_{WC}/P_T =	**2.6**	**> 1.0**	**Design Acceptable**			

Reference(s)

1 *Performance Pipe Manufacturer's Data*
2 *Derivation of equations to modify basic pipe information to account for perforations.*
3 *Project design information.*
4 *Plastics Pipe Instutite, "Handbook of Polyehtylene Pipe", 2nd Ed.*

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Project:
P.N.: 2018-3084 **Page:** 1 of 3
By: JCA **Date:** 07/15/20
Checked: VEJ **Date:** 07.15.20
Subject: 8" Leachate Pipe Structural Design

Reviewed by PGS 08/21/2021

Objective: *Check the structural adequacy of the leachate collection pipe.*

Basic Pipe Information (Solid Wall HDPE): *(Ref. 1)*

Material Code:	PE 4710	
Nominal Diameter =	8	in
Standard Dimension Ratio, SDR =	11	
Average Inside Diameter, ID =	6.963	in
Minimum Wall Thickness, t =	0.784	in
Outside Inside Diameter, OD = ID + 2t =	8.531	in
Moment of Inertia, $I = (t^3 / 12) =$	0.0402	in^4/in
Mean Radius, R = (OD - t) / 2 =	3.874	in
Area of Pipe Wall, = $A = 2\pi Rt =$	19.07	in^2

Modifiy Basic Pipe Information to Account for Pipe Perforations: *(Ref. 2)*

Diameter of Perforation(s), $d_P =$	0.375	in
Number of Perforations at Each Radial Axis , $N_P =$	2	
Area of Perforations, $A_P = N_P (t) d_P =$	0.588	in^2
Modified Pipe Wall Area, $A' = A - A_P =$	18.48	in^2
Modified Wall Thickness, $t' = (OD - \sqrt{((OD^2)-4*A'/\pi)})/2$	0.757	in *(Ref. 2 p 1.)*
Modified Inside Diameter = ID' = OD - 2t'	7.017	in
Modified Moment of Inertia, $I' = (t'^3 / 12) =$	0.0362	in^4/in
Modified Mean Radius, R' = (OD - t') / 2 =	3.887	in
Modified SDR Designation, SDR' = (OD / t') =	11.3	

Static Load: *(Ref. 3)*

Fill height of cap above top of pipe, H =	3	ft
Soil Density, γ =	115	pcf
Fill height of waste above top of pipe, H =	144	ft
Waste Density, γ =	47.4	pcf
Fill height of protective cover layer above top of pipe, H =	4	ft
Soil Density, γ =	115	pcf
Fill height of leachate collection stone above top of pipe, H =	1	ft
Soil Density, γ =	125	pcf
Total Static Vertical Pressure on Top of Pipe, Ps = $\Sigma(H\gamma) =$	7,756	psf

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Project:
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Subject: 8" Leachate Pipe Structural Design

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Live Load: *(Ref. 4, pp 199 & 203)*

Axle Load, W_A =	32,000	lb
Wheel Load, $W_W = W_A / 2$	16,000	lb
Vertical Depth over Pipe, H =	2.0	ft
Impact Factor, I_F =	1.00	
Distance from Pipe Centerline to Wheel 1, X_1 =	0.0	ft
Radial Distance from Wheel Load to Top of Pipe, r_1 =	2.00	ft
Distance from Pipe Centerline to Wheel 2, X_2 =	6.0	ft
Radial Distance from Wheel Load to Top of Pipe, r_2 =	6.32	ft
Live Load from Wheel 1, P_{L1} =	1910.8	psf
Live Load from Wheel 2, P_{L2} =	7.9	psf
Design P_L =	1910.8	psf

Internal Pressure Load:

Vacuum,Pressure, P_I =	0.0	psi	=	0	psf

Total Load

Total Load, $P_T = P_S + P_L + P_I$ =	9,666	psf	=	67.1	psi

Design for Compression Ring Thrust Stress: *(Ref. 4, pp 227 - 228)*

Outside Diameter of Pipe, $D_O = OD$ =	8.531	in				
Radius to Centroidal Axis of Pipe, $r_{CENT} = R'$ =	3.887	in				
One-Dimensional Soil Modulus, M_S =	2,610	psi				(Ref. 4, p 228, table 3-12)
Long Term Modulus of Elasticity of Pipe Material, E =	17,920	psi				(Ref. 4, p 99 table B.1.1 at 100 yr; p100 table B.1.2 at 110° F)
Pipe Wall Area, $A' = t'$ =	0.757	in^2/in				
Hoop Thrust Stiffness Ratio, S_A =	1.07					(Ref. 4, p 227, Eqn 3-22)
Vertical Arching Factor, VAF =	0.87					(Ref. 4, p 227, Eqn 3-21)
Vertical Pressure on Top of Pipe, $wH = P_S + P_I$ =	7,756	psf				
Radial Directed Earth Pressure, P_{RD} =	6,718	psf				(Ref. 4, p 228, Eqn 3-23)
Pipe Wall Compressive Stress, S =	263	psi	=	37,845	psf	(Ref. 4, p 229, from Eqn 3-14)
Allowable Compressive Stress, S_{ALL} =	1,150	psi	=	165,600	psf	(Ref. 4, p 102, table C.1)
Factor of Safety = FS = S_{ALL}/S =	**4.4**	**> 1.0**		**Design Acceptable**		

ADVANCED GeoServices
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Project:
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By: JCA **Date:** 07/15/20
Checked: VEJ **Date:** 07-15-20
Subject: 8" Leachate Pipe Structural Design

Reviewed by PGS 08/21/2021

Design for Ring Deflection:

Poisson's Ratio of Soil, μ =	0.15			*(Ref. 4, p 230, table 3-13, for coarse sand)*
Secant Modulus of Soil, E_S =	2,472	psi		*(Ref. 4, p 230, Eqn 3-26)*
Standard Dimension Ratio = SDR = SDR' =	11.3			
Long Term Modulus of Elasticity of Pipe Material, E =	17,920	psi		
Rigidity Factor, R_F =	1,791			*(Ref. 4, p 230, Eqn 3-24)*
Deformation Factor, D_F =	1.40			*(Ref. 4, p 231, Fig. 3-6)*
Soil Strain, ε_s =	2.18	%		*(Ref. 4, p 231, Eqn 3-27)*
Percent Ring Deflection, $(\Delta X/D_M)(100) = (D_F)(\varepsilon_s)$ =	3.05	%		*(Ref. 4, p 231, Eqn 3-28)*
Maximum Allowable Deflection, D_{MAX} =	7.5	%		*(Ref. 4, p 218)*
Factor of Safety, FS = $D_{MAX}/(D_F)(\varepsilon_S)$ =	**2.5**	**> 1.0**	**Design Acceptable**	

Design for Constrained Wall Buckling: *(Ref. 4, using Luscher's Equations to account for possible leachate head)*

Total Height of Cover on Top of Pipe, H =	152.0	ft				
Height of Water Above Top of Pipe, H_{GW} =	1.0	ft				
Buoyancy Factor, R =	1.0					*(Ref. 4, p 222, Eqn 3-17)*
Natural Log Base Number, e =	2.71828					
Elastic Soil Support Factor, B' =	1.0					*(Ref. 4, p 222, Eqn 3-18)*
Modulus of Soil Reaction for Pipe Bedding, E' =	3,000	psi				*(Ref. 4, p 214, table 3-7)*
Dimension Ration, DR = SDR' =	11.3					
Safety Factor, N =	2.0					*(Ref. 4, p 222)*
Allowable Constrained Buckling Pressure, P_{WC} =	182	psi	=	26,144	psf	*(Ref. 4, p 221, Eqn 3-15)*
Total Vertical Pressure, P_T =	67.1	psi	=	9,666	psf	
Factor of Safety, FS = P_{WC}/P_T =	**2.7**	**> 1.0**	**Design Acceptable**			

Reference(s)

1 Performance Pipe Manufacturer's Data
2 Derivation of equations to modify basic pipe information to account for perforations.
3 Project design information.
4 Plastics Pipe Instutite, "Handbook of Polyehtylene Pipe", 2nd Ed.

PERFORMANCE PIPE
A Division of Chevron Phillips Chemical Company LP

Iron Pipe Size (IPS) and Dimension Data

PE4710 (PE3408)

DriscoPlex® Pipe for Municipal and Industrial Applications

Pressure Ratings are calculated using 0.63 design factor for HDS at 73°F as listed in PPI TR-4 for PE 4710 materials. HDPE can accomodate up to 1.5 times the pipe pressure rating for a recurring surge and up to 2.0 times the pipe pressure rating for an occasional surge. Temperature, Chemical, and Environmental use considerations may require use of additional design factors.

Pressure Rating		335 psi DR 7.0			250 psi DR 9.0			200 psi DR 11.0			160 psi DR 13.5			
Nominal Pipe Size	IPS OD (in)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Minimum Wall (in)	Average ID (in)	Weight (lbs/ft)	Nominal Pipe Size
1 1/4"	1.660	0.237	1.158	0.46	0.184	1.270	0.37	0.151	1.340	0.31	0.123	1.399	0.26	1 1/4"
1 1/2"	1.900	0.271	1.325	0.61	0.211	1.453	0.49	0.173	1.533	0.41	0.141	1.601	0.34	1 1/2"
2"	2.375	0.339	1.656	0.95	0.264	1.815	0.77	0.216	1.917	0.64	0.176	2.002	0.53	2"
3"	3.500	0.500	2.440	2.06	0.389	2.675	1.66	0.318	2.826	1.39	0.259	2.951	1.16	3"
4"	4.500	0.643	3.137	3.40	0.500	3.440	2.75	0.409	3.633	2.31	0.333	3.794	1.92	4"
6"	6.625	0.946	4.619	7.37	0.736	5.065	5.96	0.602	5.349	5.00	0.491	5.584	4.15	6"
8"	8.625	1.232	6.013	12.50	0.958	6.594	10.11	0.784	6.963	8.47	0.639	7.270	7.04	8"
10"	10.750	1.536	7.494	19.42	1.194	8.219	15.70	0.977	8.679	13.16	0.796	9.062	10.93	10"
12"	12.750	1.821	8.889	27.31	1.417	9.746	22.08	1.159	10.293	18.51	0.944	10.749	15.38	12"
14"	14.000	2.000	9.760	32.93	1.556	10.701	26.63	1.273	11.301	22.32	1.037	11.802	18.54	14"
16"	16.000	2.286	11.154	43.01	1.778	12.231	34.78	1.455	12.915	29.15	1.185	13.488	24.22	16"
18"	18.000	2.571	12.549	54.43	2.000	13.760	44.02	1.636	14.532	36.89	1.333	15.174	30.65	18"
20"	20.000	2.857	13.943	67.20	2.222	15.289	54.34	1.818	16.146	45.54	1.481	16.860	37.84	20"
22"	22.000	3.143	15.337	81.32	2.444	16.819	65.75	2.000	17.760	55.10	1.630	18.544	45.79	22"
24"	24.000	3.429	16.731	96.77	2.667	18.346	78.25	2.182	19.374	65.58	1.778	20.231	54.49	24"
26"	26.000				2.889	19.875	91.84	2.364	20.988	76.96	1.926	21.917	63.95	26"
28"	28.000				3.111	21.405	106.51	2.545	22.605	89.26	2.074	23.603	74.17	28"
30"	30.000				3.333	22.934	122.27	2.727	24.219	102.47	2.222	25.289	85.14	30"
32"	32.000				3.556	24.462	139.12	2.909	25.833	116.58	2.370	26.976	96.87	32"
34"	34.000				3.778	25.991	157.05	3.091	27.447	131.61	2.519	28.660	109.36	34"
36"	36.000				4.000	27.520	176.07	3.273	29.061	147.55	2.667	30.346	122.60	36"
42"	42.000							3.818	33.906	200.84	3.111	35.405	166.88	42"
48"	48.000													48"
54"	54.000													54"

This size and dimension chart is intended for reference purposes. It should not be used in place of the advice from a licensed Professional Engineer. Pipe weights are calculated in accordance with PPI TR-7. Average inside diameter is calculated using IPS OD and Minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary. When designing components to fit the pipe ID, refer to pipe dimension and tolerances in the applicable pipe manufacturing specification.

Visit www.performancepipe.com for the most current literature.

REFERENCE!

February 2015 Supersedes all previous publications
© 2001-2015 Chevron Phillips Chemical Company LP

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Pipe Data Modifications		
	Job No.	Made by: JCA	Date 07/09/20
	Ref.	Checked by: VED	Sheet 1 of 2

Reviewed by PGS 08/21/2021

1. Purpose

Perforated pipe is used for the collection of leachate in landfills. The purpose of this analysis is to derive equations for use in accounting for the perforations in pipe stress calculations.

2. Analysis Approach and Assumptions

The perforations result in a reduced cross-sectional area of the pipe at their location(s). Based on this reduced area, modified values for thickness (t'), inside diameter (ID'), mean radius (R'), moment of inertia (I'), and standard dimension ratio (SDR') are calculated.

3. Calculations

Starting with a pipe of inside diameter, ID, and wall thickness, t, various parameters are defined as:

Outside diameter, $OD = ID + 2t$ (1)
Mean Diameter, $R = (OD - t)/2$ (2)
Moment of Inertia, $I = t^3/12$ (3)
Standard Dimension Ratio, $SDR = OD/t$ (4)
Cross-sectional Area of Pipe, $A = 2\pi Rt$ (5)

A perforation, of diameter d, has a cross-sectional area equal to dt. The total amount of the perforation area, A_P, and the reduced pipe cross-sectional area, A', are defined as

$$A_P = (\text{number of perforations, } n)(dt) = ndt$$

$$A' = A - A_P$$

With a reduced pipe cross-sectional area, A', and the outside diameter, OD, staying constant, the other pipe parameters can be re-calculated. Substituting Equation (2) into Equation (5), one gets

$$A' = \frac{2\pi (OD - t')\, t'}{2} \qquad \text{or} \qquad t'^2 - OD\,t' + (A'/\pi) = 0$$

The quadratic solution is

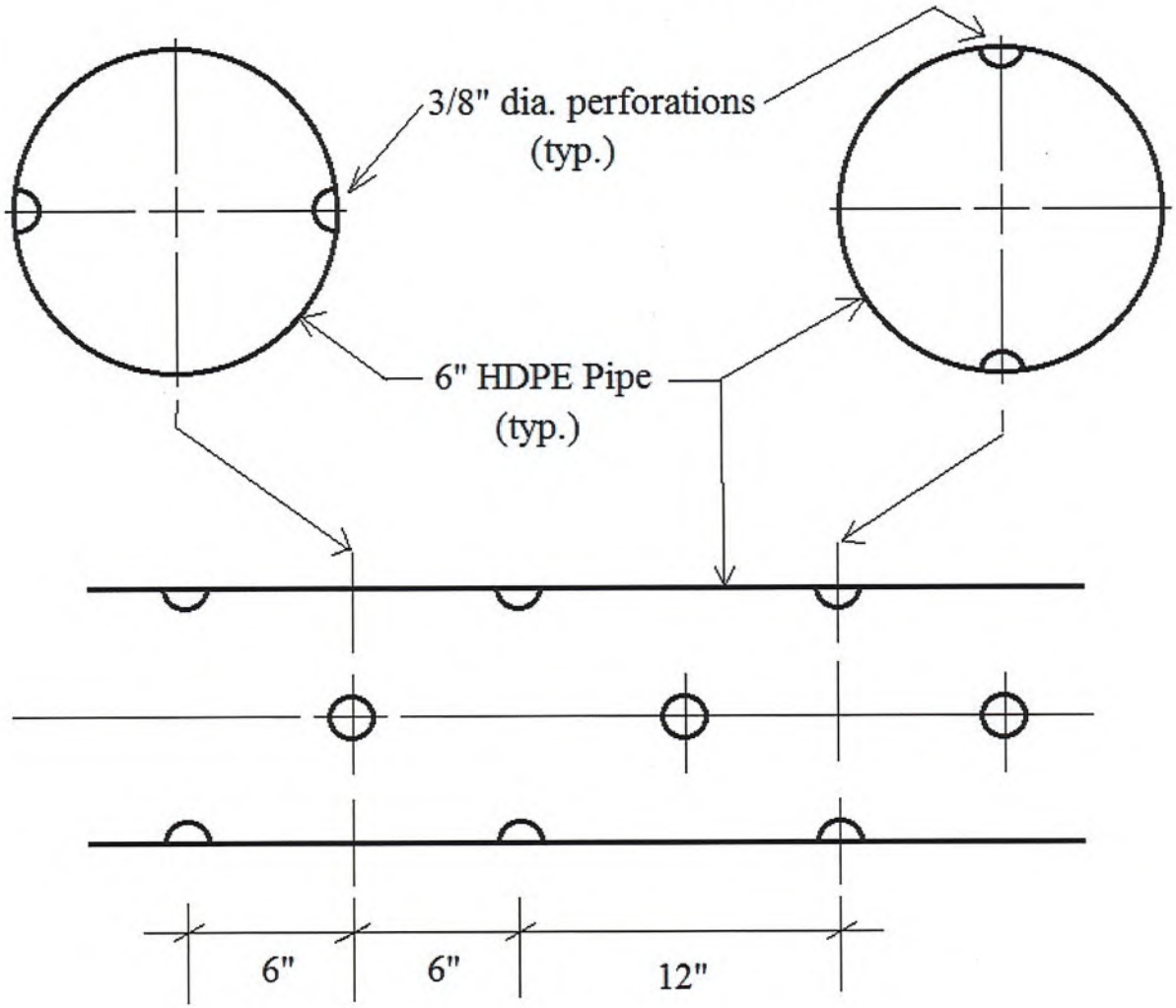
$$t' = \frac{-(-OD) - [(-OD)^2 - 4(A'/\pi)]^{(0.5)}}{2} \qquad (6)$$

Knowing t', the remaining modified parameters are:

Inside diameter, $ID' = OD - 2t'$ (7)
Mean Diameter, $R' = (OD - t')/2$ (8)
Moment of Inertia, $I' = t'^3/12$ (9)
Standard Dimension Ratio, $SDR' = OD/t'$ (10)

*****

Perforation Detail - Leachate Main & Lateral Collection Pipes



Plastics Pipe Institute® Handbook of Polyethylene Pipe

"The Plastics Pipe Institute® Handbook of Polyethylene Pipe" is a comprehensive guide to the use of smoothwall HDPE pipe and its applications. The handbook is available in PDF format at www.plasticpipe.org. For convenience, we have secured permission from PPI to activate hyperlinks to individual chapters. Click the links below to access the PPI website documents.

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Appendix B
Apparent Elastic Modulus

B.1 – Apparent Elastic Modulus for the Condition of Either a Sustained Constant Load or a Sustained Constant Deformation

B.1.1 – Design Values for the Base Temperature of 73°F (23°C)

TABLE B.1.1
Apparent Elastic Modulus for 73°F (23°C)

Duration of Sustained Loading	Design Values For 73°F (23°C) [1,2,3]					
	PE 2XXX		PE3XXX		PE4XXX	
	psi	MPa	psi	MPa	psi	MPa
0.5hr	62,000	428	78,000	538	82,000	565
1hr	59,000	407	74,000	510	78,000	538
2hr	57,000	393	71,000	490	74,000	510
10hr	50,000	345	62,000	428	65,000	448
12hr	48,000	331	60,000	414	63,000	434
24hr	46,000	317	57,000	393	60,000	414
100hr	42,000	290	52,000	359	55,000	379
1,000hr	35,000	241	44,000	303	46,000	317
1 year	30,000	207	38,000	262	40,000	276
10 years	26,000	179	32,000	221	34,000	234
50 years	22,000	152	28,000	193	29,000	200
100 years	21,000	145	27,000	186	28,000	193

(1) Although there are various factors that determine the exact apparent modulus response of a PE, a major factor is its ratio of crystalline to amorphous content – a parameter that is reflected by a PE's density. Hence, the major headings PE2XXX, PE3XXX and, PE4XXX, which are based on PE's Standard Designation Code. The first numeral of this code denotes the PE's density category in accordance with ASTM D3350 (An explanation of this code is presented in Chapter 5).

(2) The values in this table are applicable to both the condition of sustained and constant loading (under which the resultant strain increases with increased duration of loading) and that of constant strain (under which an initially generated stress gradually relaxes with increased time).

(3) The design values in this table are based on results obtained under uni-axial loading, such as occurs in a test bar that is being subjected to a pulling load. When a PE is subjected to multi-axial stressing its strain response is inhibited, which results in a somewhat higher apparent modulus. For example, the apparent modulus of a PE pipe that is subjected to internal hydrostatic pressure – a condition that induces bi-axial stressing – is about 25% greater than that reported by this table. Thus, the Uni-axial condition represents a conservative estimate of the value that is achieved in most applications.

It should also be kept in mind that these values are for the condition of continually sustained loading. If there is an interruption or a decrease in the loading this, effectively, results in a somewhat larger modulus.

In addition, the values in this table apply to a stress intensity ranging up to about 400psi, a value that is seldom exceeded under normal service conditions.

B.1.2 – Values for Other Temperatures

The multipliers listed in Table B.1.2 when applied to the base temperature value (Table B.1.1) yield the value for another temperature.

TABLE B.1.2
Temperature Compensating Multipliers for Determination of the Apparent Modulus of Elasticity at Temperatures Other than at 73°F (23°C)
Equally Applicable to All Stress-Rated PE's (e.g., All PE2xxx's, All PE3xxx's and All PE4xxx's)

Maximum Sustained Temperature of the Pipe °F (°C)	Compensating Multiplier
-20 (-29)	2.54
-10 (-23)	2.36
0 (-18)	2.18
10 (-12)	2.00
20 (-7)	1.81
30 (-1)	1.65
40 (4)	1.49
50 (10)	1.32
60 (16)	1.18
73.4 (23)	1.00
80 (27)	0.93
90 (32)	0.82
100 (38)	0.73
110 (43)	0.64
120 (49)	0.58
130 (54)	0.50
140 (60)	0.43



$E = (28{,}000)(0.64) = 17{,}920$

Appendix C
Allowable Compressive Stress

Table C.1 lists allowable compressive stress values for 73°F (23°C). Values for allowable compressive stress for other temperatures may be determined by application of the same multipliers that are used for pipe pressure rating (See Table A.2).

TABLE C.1
Allowable Compressive Stress for 73°F (23°C)

	Pe Pipe Material Designation Code[1]					
	PE 2406		PE3408		PE 4710	
	PE 2708		PE 3608			
			PE 3708			
			PE 3710			
			PE 4708			
	psi	MPa	psi	MPa	psi	MPa
Allowable Compressive Stress	800	5.52	1000	6.90	1150	7.93

(1) See Chapter 5 for an explanation of the PE Pipe Material Designation Code.

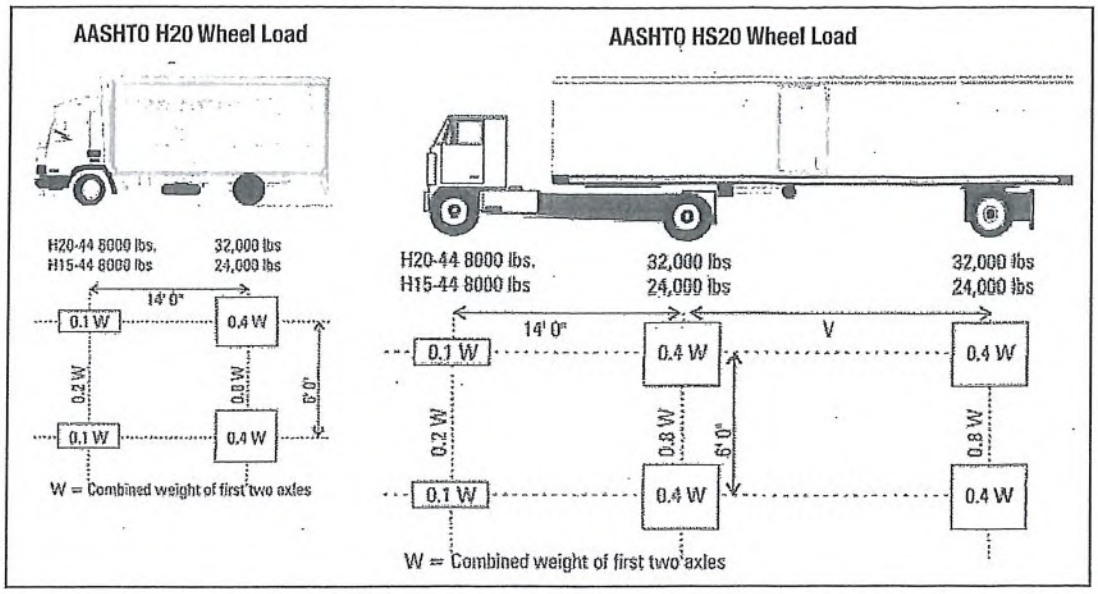


Figure 3-3 AASHTO H20 and HS20 Vehicle Loads

Boussinesq Equation

The Boussinesq Equation gives the pressure at any point in a soil mass under a concentrated surface load. The Boussinesq Equation may be used to find the pressure transmitted from a wheel load to a point that is not along the line of action of the load. Pavement effects are neglected.

(3-4) $$P'_L = \frac{3I_f W_w H^3}{2\pi r^5}$$

WHERE

P_L = vertical soil pressure due to live load lb/ft²

W_W = wheel load, lb

H = vertical depth to pipe crown, ft

I_f = impact factor

r = distance from the point of load application to pipe crown, ft

(3-5) $$r = \sqrt{X^2 + H^2}$$

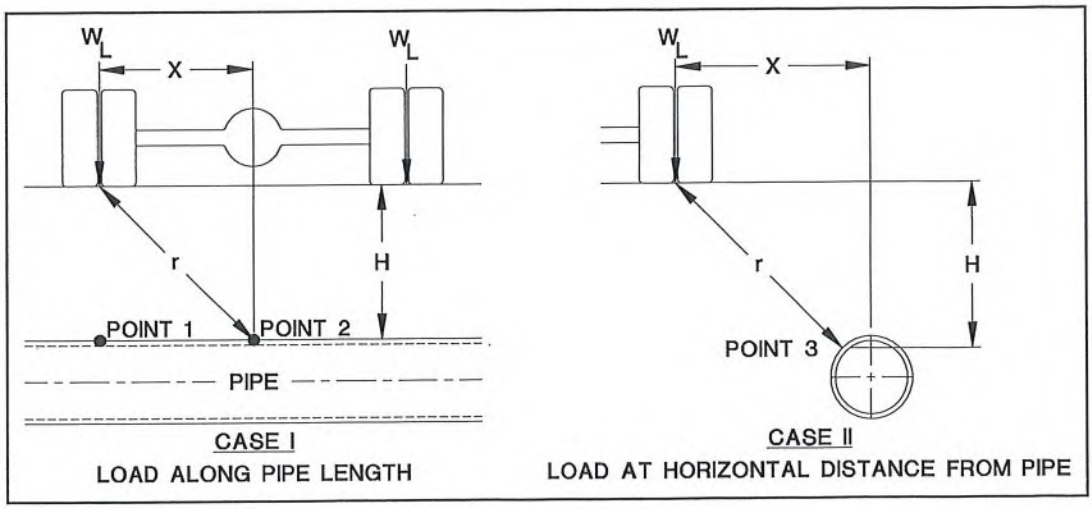


Figure 3-4 Illustration of Boussinesq Point Loading

Example Using Boussinesq Point Loading Technique

Determine the vertical soil pressure applied to a 12" pipe located 4 ft deep under a dirt road when two vehicles traveling over the pipe and in opposite lanes pass each other. Assume center lines of wheel loads are at a distance of 4 feet. Assume a wheel load of 16,000 lb.

TABLE 3-7
Values of E' for Pipe Embedment (See Howard [8])

Soil Type-pipe Embedment Material (Unified Classification System)[1]	E' for Degree of Embedment Compaction, lb/in²			
	Dumped	Slight, <85% Proctor, <40% Relative Density	Moderate, 85%-95% Proctor, 40%-70% Relative Density	High, >95% Proctor, >70% Relative Density
Fine-grained Soils (LL > 50)[2] Soils with medium to high plasticity; CH, MH, CH-MH	No data available: consult a competent soils engineer, otherwise, use E' = 0.			
Fine-grained Soils (LL < 50) Soils with medium to no plasticity, CL, ML, ML-CL, with less than 25% coarse grained particles.	50	200	400	1000
Fine-grained Soils (LL < 50) Soils with medium to no plasticity, CL, ML, ML-CL, with more than 25% coarse grained particles; Coarse-grained Soils with Fines, GM, GC, SM, SC[3] containing more than 12% fines.	100	400	1000	2000
Coarse-grained soils with Little or No Fines GW, GP, SW, SP[3] containing less than 12% fines	200	1000	2000	3000
Crushed Rock	1000	3000	3000	3000
Accuracy in Terms of Percentage Deflection[4]	±2%	±2%	±1%	±0.5%

[1] ASTM D-2487, USBR Designation E-3
[2] LL = Liquid Limit
[3] Or any borderline soil beginning with one of these symbols (i.e., GM-GC, GC-SC).
[4] For ±1% accuracy and predicted deflection of 3%, actual deflection would be between 2% and 4%.

Note: Values applicable only for fills less than 50 ft (15 m). Table does not include any safety factor. For use in predicting initial deflections only; appropriate Deflection Lag Factor must be applied for long-term deflections. If embedment falls on the borderline between two compaction categories, select lower E' value, or average the two values. Percentage Proctor based on laboratory maximum dry density from test standards using 12,500 ft-lb/cu ft (598,000 J/m²) (ASTM D-698, AASHTO T-99, USBR Designation E-11). 1 psi = 6.9 KPa.

crown may completely reverse its curvature inward and collapse. See Figure 3-1A. A deflection limit of 7.5% provides at least a 3 to 1 safety factor against reverse curvature.

Bending strain occurs in the pipe wall as a result of ring deflection—outer-fiber tensile strain at the pipe springline and outer-fiber compressive strain at the crown and invert. While strain limits of 5% have been proposed, Jansen [12] reported that, on tests of PE pipe manufactured from pressure-rated resins and subjected to soil pressure only, "no upper limit from a practical design point of view seems to exist for the bending strain." In other words, as deflection increases, the pipe's performance limit will not be overstraining but reverse curvature collapse.

Thus, for non-pressure applications, a 7.5 percent deflection limit provides a large safety factor against instability and strain and is considered a safe design deflection. Some engineers will design profile wall pipe and other non-pressure pipe applications to a 5% deflection limit, but allow spot deflections up to 7.5% during field inspection.

The deflection limits for pressurized pipe are generally lower than for non-pressurized pipe. This is primarily due to strain considerations. Hoop strain from pressurization adds to the outer-fiber tensile strain. But the internal pressure acts to reround the pipe and, therefore, Eq. 3-10 overpredicts the actual long-term deflection for pressurized pipe. Safe allowable deflections for pressurized pipe are given in Table 3-11. Spangler and Handy [13] give equations for correcting deflection to account for rerounding.

TABLE 3-11
Safe Deflection Limits for Pressurized Pipe

DR or SDR	Safe Deflection as % of Diameter
32.5	7.5
26	7.5
21	7.5
17	6.0
13.5	6.0
11	5.0
9	4.0
7.3	3.0

*Based on Long-Term Design Deflection of Buried Pressurized Pipe given in ASTM F1962.

raised to a power. Therefore the lower the DR, the higher the resistance. Buried pipe has an added resistance due to support (or constraint) from the surrounding soil.

Non-pressurized pipes or gravity flow pipes are most likely to have a net compressive stress in the pipe wall and, therefore, the allowable buckling pressure should be calculated and compared to the total (soil and ground water) pressure. For most pressure pipe applications, the fluid pressure in the pipe exceeds the external pressure, and the net stress in the pipe wall is tensile. Buckling needs only be considered for that time the pipe is not under pressure, such as during and immediately after construction and during system shut-downs and, in cases in which a surge pressure event can produce a temporary negative internal pressure. Under these circumstances the pipe will react much stiffer to buckling as its modulus is higher under short term loading. When designing, select a modulus appropriate for the duration of the negative external pressure. For pipe that are subjected to negative pressure due to surge, consideration should be given to selecting a DR that gives the pipe sufficient unconstrained collapse strength to resist the full applied negative pressure without support for the soil. This is to insure against construction affects that result in the embedment material not developing its full design strength.

This chapter gives two equations for calculating buckling. The modified Luscher Equation is for buried pipes that are beneath the ground water level, subject to vacuum pressure, or under live load with a shallow cover. These forces act to increase even the slightest eccentricity in the pipe wall by following deformation inward. While soil pressure alone can create instability, soil is less likely to follow deformation inward, particularly if it is granular. So, dry ground buckling is only considered for deep applications and is given by the Moore-Selig Equation found in the section, "Buckling of Pipes in Deep, Dry Fills".

Luscher Equation for Constrained Buckling Below Ground Water Level

For pipes below the ground water level, operating under a full or partial vacuum, or subject to live load, Luscher's equation may be used to determine the allowable constrained buckling pressure. Equation 3-15 and 3-16 are for DR and profile pipe respectively.

(3-15)
$$P_{WC} = \frac{5.65}{N}\sqrt{RB'E'\frac{E}{12(DR-1)^3}}$$

(3-16)
$$P_{WC} = \frac{5.65}{N}\sqrt{RB'E'\frac{EI}{D_M{}^3}}$$

WHERE
P_{WC} = allowable constrained buckling pressure, lb/in²
N = safety factor

(3-17) $$R = 1 - 0.33\frac{H_{GW}}{H}$$

WHERE
R = buoyancy reduction factor
H_{GW} = height of ground water above pipe, ft
H = depth of cover, ft

(3-18) $$B' = \frac{1}{1 + 4\,e^{(-0.065H)}}$$

WHERE
e = natural log base number, 2.71828
E' = soil reaction modulus, psi
E = apparent modulus of elasticity, psi
DR = Dimension Ratio
I = pipe wall moment of inertia, in⁴/in ($t^3/12$, if solid wall construction)
D_M = Mean diameter ($D_I + 2z$ or $D_O - t$), in

Although buckling occurs rapidly, long-term external pressure can gradually deform the pipe to the point of instability. This behavior is considered viscoelastic and can be accounted for in Equations 3-15 and 3-16 by using the apparent modulus of elasticity value for the appropriate time and temperature of the loading. For instance, a vacuum event is resisted by the short-term value of the modulus whereas continuous ground water pressure would be resisted by the 50 year value. For modulus values see Appendix, Chapter 3.

For pipes buried with less than 4 ft or a full diameter of cover, Equations 3-15 and 3-16 may have limited applicability. In this case the designer may want to use Equations 3-39 and 3-40.

The designer should apply a safety factor commensurate with the application. A safety factor of 2.0 has been used for thermoplastic pipe.

The allowable constrained buckling pressure should be compared to the total vertical stress acting on the pipe crown from the combined load of soil, and ground water or floodwater. It is prudent to check buckling resistance against a ground water level for a 100-year-flood. In this calculation the total vertical stress is typically taken as the prism load pressure for saturated soil, plus the fluid pressure of any floodwater above the ground surface.

Determine the earth pressure coefficient:

$$K = \frac{1+\sin(30)}{1-\sin(30)} = \frac{1+0.5}{1-0.5} = 3.0$$

The live load pressure incipient to failure equals:

$$P_{WAT} = \frac{(12)120(3.0*3.0)^2}{40.04} + \frac{7387*0.171}{40.04^2(1.44)}\left(3000 - \frac{120(40.04)3.0}{288*0.470}\right)$$

$$P_{WAT} = 2904 + 1584 = 4498\ psf$$

The resulting safety factor equals:

$$N = \frac{P_{WAT}}{p_L} = \frac{4498}{1697} = 2.65$$

Installation Category #3: Deep Fill Installation

The performance limits for pipes in a deep fill are the same as for any buried pipe. They include:

1. Compressive ring thrust stress
2. Ring deflection
3. Constrained pipe wall buckling

The suggested calculation method for pipe in deep fill applications involves the introduction of design routines for each performance limit that are different than those previously given.

Compressive ring thrust is calculated using soil arching. The arching calculation may also be used for profile pipe designs in standard trench applications. Profile pipes are relatively low stiffness pipes where significant arching may occur at relatively shallow depths of cover.

At a depth of around 50 feet or so it becomes impractical to use Spangler's equation as published in this chapter because it neglects the significant load reduction due to arching and the inherent stiffening of the embedment and consequential increase in E′ due to the increased lateral earth pressure applied to the embedment. This section gives an alternate deflection equation for use with PE pipes. It was first introduced by Watkins et al.[1] for metal pipes, but later Gaube extended its use to include PE pipes.[15]

Where deep fill applications are in dry soil, Luscher's equation (Eq. 3-15 or 3-16) may often be too conservative for design as it considers a radial driving force from ground water or vacuum. Moore and Selig[17] developed a constrained pipe wall buckling equation suitable for pipes in dry soils, which is given in a following section.

Considerable care should be taken in the design of deeply buried pipes whose failure may cause slope failure in earthen structures, or refuse piles or whose failure may have severe environmental or economical impact. These cases normally justify the use of methods beyond those given in this Chapter, including finite element analysis and field testing, along with considerable professional design review.

Compressive Ring Thrust and the Vertical Arching Factor

The combined horizontal and vertical earth load acting on a buried pipe creates a radially-directed compressive load acting around the pipe's circumference. When a PE pipe is subjected to ring compression, thrust stress develops around the pipe hoop, and the pipe's circumference will ever so slightly shorten. The shortening permits "thrust arching," that is, the pipe hoop thrust stiffness is less than the soil hoop thrust stiffness and, as the pipe deforms, less load follows the pipe. This occurs much like the vertical arching described by Marston.[18] Viscoelasticity enhances this effect. McGrath[19] has shown thrust arching to be the predominant form of arching with PE pipes.

Burns and Richard[6] have published equations that give the resulting stress occurring in a pipe due to arching. As discussed above, the arching is usually considered when calculating the ring compressive stress in profile pipes. For deeply buried pipes McGrath [19] has simplified the Burns and Richard's equations to derive a vertical arching factor as given by Equation 3-21.

(3-21)
$$VAF = 0.88 - 0.71\frac{S_A - 1}{S_A + 2.5}$$

WHERE
VAF = **Vertical Arching Factor**
S_A = **Hoop Thrust Stiffness Ratio**

(3-22)
$$S_A = \frac{1.43\, M_S\, r_{CENT}}{EA}$$

WHERE
r_{CENT} = **radius to centroidal axis of pipe, in**
M_s = **one-dimensional modulus of soil, psi**
E = **apparent modulus of elasticity of pipe material, psi (See Appendix, Chapter 3)**
A = **profile wall average cross-sectional area, in²/in, or wall thickness (in) for DR pipe**

One-dimensional modulus values for soil can be obtained from soil testing, geotechnical texts, or Table 3-12 which gives typical values. The typical values in Table 3-12 were obtained by converting values from McGrath[20].

TABLE 3-12
Typical Values of M_S, One-Dimensional Modulus of Soil

Vertical Soil Stress[1] (psi)	Gravelly Sand/Gravels 95% Std. Proctor (psi)	Gravelly Sand/Gravels 90% Std. Proctor (psi)	Gravelly Sand/Gravels 85% Std. Proctor (psi)
10	3000	1600	550
20	3500	1800	650
40	4200	2100	800
60	5000	2500	1000
80	6000	2900	1300
100	6500	3200	1450

* Adapted and extended from values given by McGrath[20]. For depths not shown in McGrath[20], the MS values were approximated using the hyperbolic soil model with appropriate values for K and n where n=0.4 and K=200, K=100, and K=45 for 95% Proctor, 90% Proctor, and 85% Proctor, respectively.

[1] Vertical Soil Stress (psi) = [soil depth (ft) x soil density (pcf)]/144

The radial directed earth pressure can be found by multiplying the prism load (pressure) by the vertical arching factor as shown in Eq. 3-23.

(3-23) $$P_{RD} = (VAF)wH$$

WHERE
P_{RD} = radial directed earth pressure, lb/ft²
W = unit weight of soil, pcf
H = depth of cover, ft

The ring compressive stress in the pipe wall can be found by substituting P_{RD} from Equation 3-23 for P_E in Equation 3-13 for DR pipe and Equation 3-14 for profile wall pipe.

Earth Pressure Example

Determine the earth pressure acting on a 36" profile wall pipe buried 30 feet deep. The following properties are for one unique 36" profile pipe made from PE3608 material. Other 36" profile pipe may have different properties. The pipe's cross-sectional area, A, equals 0.470 inches²/inch, its radius to the centroidal axis is 18.00 inches plus 0.58 inches, and its apparent modulus is 27,000 psi. Its wall height is 2.02 in and its D_o equals 36 in +2 (2.02 in) or 40.04 in. Assume the pipe is installed in a clean granular soil compacted to 90% Standard Proctor (Ms = 1875 psi), the insitu soil is as stiff as the embedment, and the backfill weighs 120 pcf. (Where the excavation

is in a stable trench, the stiffness of the insitu soil can generally be ignored in this calculation.) The following series of equations calculates the hoop compressive stress, S, in the pipe wall due to the earth pressure applied by the soil above the pipe. The earth pressure is reduced from the prism load by the vertical arching factor.

(From Equation 3-22)

$$S_A = \frac{1.43(1875\frac{lbs}{inch^2})(18.58 inch)}{(28250\frac{lbs}{inch^2})(0.470\frac{inch^2}{inch})} = 3.93$$

(From Equation 3-21)

$$VAF = 0.88 - 0.71\frac{3.75-1}{3.75+2.5} = 0.56$$

(From Equation 3-23)

$$P_{RD} = 0.57(120\ pcf)(30\ ft) = 2016\frac{lb}{ft^2}$$

(From Equation 3-14)

$$S = \frac{P_{RD}D_O}{288A} = \frac{2052\ psf(40.04\ in)}{288\ (0.470\ in^2/in)} = 596\ psi \leq 1000\ psi$$

(Allowable compressive stress per Table C.1, Appendix to Chapter 3)

Ring Deflection of Pipes Using Watkins-Gaube Graph

R. Watkins[1] developed an extremely straight-forward approach to calculating pipe deflection in a fill that does not rely on E'. It is based on the concept that the deflection of a pipe embedded in a layer of soil is proportional to the compression or settlement of the soil layer and that the constant of proportionality is a function of the relative stiffness between the pipe and soil. Watkins used laboratory testing to establish and graph proportionality constants, called Deformation Factors, D_F, for the stiffness ranges of metal pipes. Gaube[15, 16] extended Watkins' work by testing to include PE pipes. In order to predict deflection, the designer first determines the amount of compression in the layer of soil in which the pipe is installed using conventional geotechnical equations. Then, deflection equals the soil compression multiplied by the D_F factor. This bypasses some of the inherent problems associated with using the soil reaction modulus, E', values. The designer using the Watkins-Gaube Graph (Figure 3-6) should select conservative soil modulus values to accommodate variance due to installation. Two other factors to consider when using

this method is that it assumes a constant Deformation Factor independent of depth of cover and it does not address the effect of the presence of ground water on the Deformation Factor.

To use the Watkins-Gaube Graph, the designer first determines the relative stiffness between pipe and soil, which is given by the Rigidity Factor, R_F. Equation 3-24 and 3-25 are for DR pipe and for profile pipe respectively:

(3-24) $$R_F = \frac{12\,E_S\,(DR-1)^3}{E}$$

(3-25) $$R_F = \frac{E_S D_m^{\,3}}{EI}$$

WHERE

DR = **Dimension Ratio**

E_S = **Secant modulus of the soil, psi**

E = **Apparent modulus of elasticity of pipe material, psi**

I = **Pipe wall moment of inertia of pipe, in^4/in**

D_m = **Mean diameter (D_I + 2z or D_O – t), in**

The secant modulus of the soil may be obtained from testing or from a geotechnical engineer's evaluation. In lieu of a precise determination, the soil modulus may be related to the one-dimensional modulus, M_s, from Table 3-12 by the following equation where μ is the soil's Poisson ratio.

(3-26) $$E_S = M_S \frac{(1+\mu)(1-2\mu)}{(1-\mu)}$$

TABLE 3-13
Typical range of Poisson's Ratio for Soil (Bowles[21])

Soil Type	Poisson's Ratio, μ
Saturated Clay	0.4-0.5
Unsaturated Clay	0.1-0.3
Sandy Clay	0.2-0.3
Silt	0.3-0.35
Sand (Dense)	0.2-0.4
Coarse Sand (Void Ratio 0.4-0.7)	0.15
Fine-grained Sand (Void Ratio 0.4-0.7)	0.25

Next, the designer determines the Deformation Factor, D_F, by entering the Watkins-Gaube Graph with the Rigidity Factor. See Fig. 3-6. The Deformation Factor is the proportionality constant between vertical deflection (compression) of the soil layer containing the pipe and the deflection of the pipe. Thus, pipe deflection can be obtained by multiplying the proportionality constant D_F times the soil settlement. If D_F is less than 1.0 in Fig. 3-6, use 1.0.

The soil layer surrounding the pipe bears the entire load of the overburden above it without arching. Therefore, settlement (compression) of the soil layer is proportional to the prism load and not the radial directed earth pressure. Soil strain, ε_S, may be determined from geotechnical analysis or from the following equation:

(3-27)
$$\varepsilon_S = \frac{wH}{144E_S}(100)$$

Note the use of Eqn 3-27 on page 232.

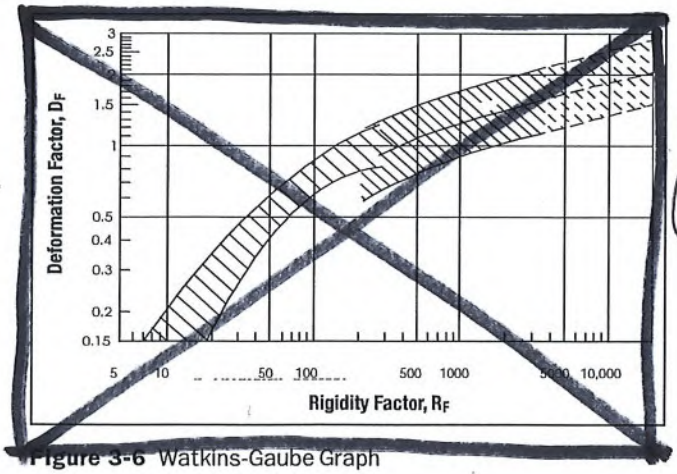
WHERE

w = unit weight of soil, pcf

H = depth of cover (height of fill above pipe crown), ft

E_S = secant modulus of the soil, psi

The designer can find the pipe deflection as a percent of the diameter by multiplying the soil strain, in percent, by the deformation factor:



SEE ATTACHED ENLARGED COPY

Figure 3-6 Watkins-Gaube Graph

(3-28)
$$\frac{\Delta X}{D_M}(100) = D_F\varepsilon_S$$

WHERE

$\Delta X/D_M$ multiplied by 100 gives percent deflection.

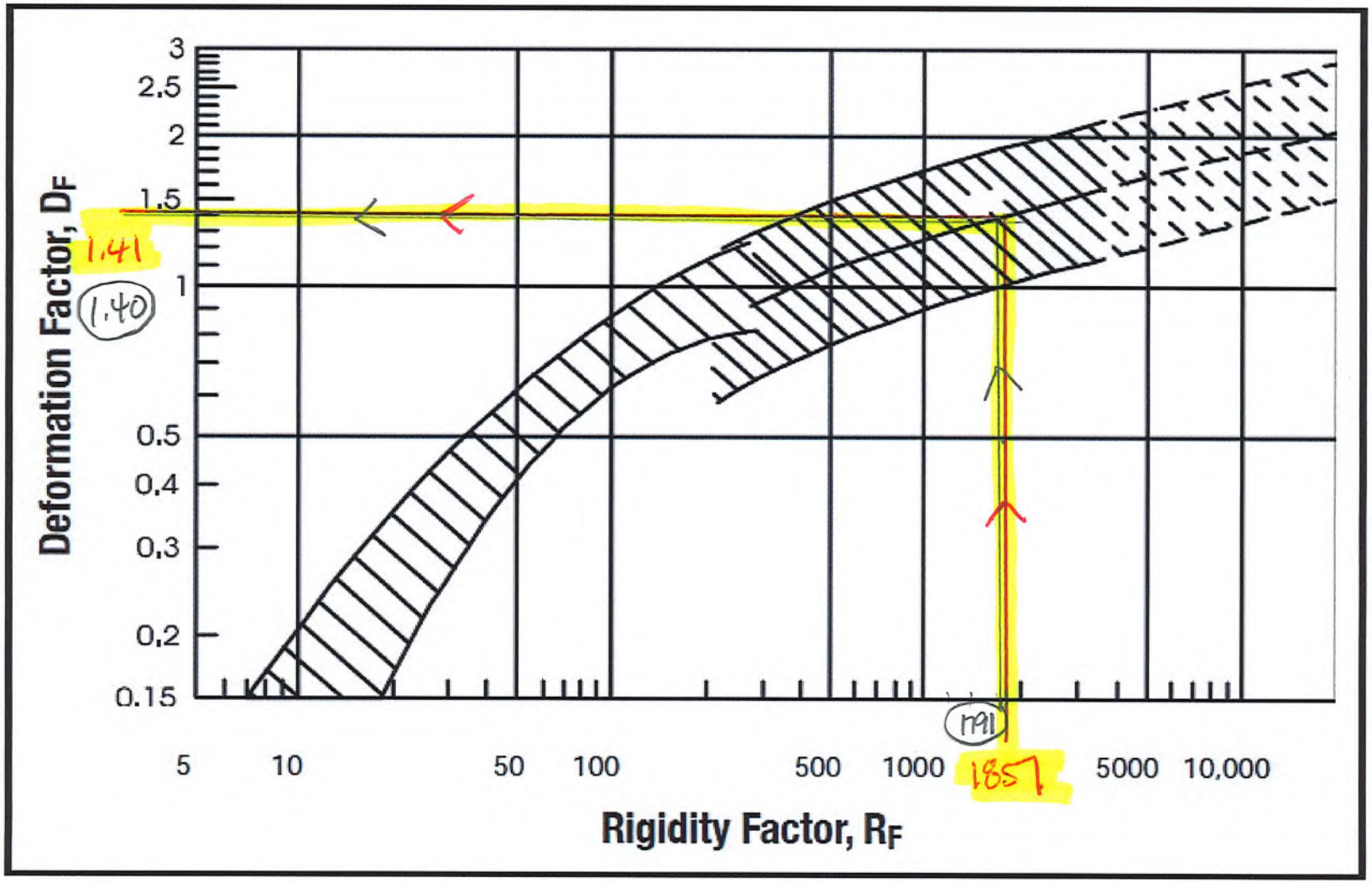


Figure 3-6 Watkins-Gaube Graph

Example of the Application of the Watkins-Gaube Calculation Technique

Find the deflection of a 6" SDR 11 pipe made from PE4710 materials under 140 ft of fill with granular embedment containing 12% or less fines, compacted at 90% of standard proctor. The fill weighs 75 pcf.

SOLUTION: First, calculate the vertical soil pressure equation, Eq. 3-1.

Eq. 3-1: $P_E = wH$

P_E = (75lb/ft³)(140 ft)

P_E = 10,500 lb/ft² or 72.9 psi

The M_S is obtained by interpolation from Table 3-12 and equals 2700. The secant modulus can be found assuming a Poisson's Ratio of 0.30.

$$E_S = \frac{2700\ psi(1+0.30)(1-2(0.30))}{(1-0.30)} = 2005\ psi$$

The rigidity factor is obtained from Equation 3-24.

$$R_F = \frac{12(2005)(11-1)^3}{29{,}000} = 830$$

Using Figure 3-6, the average value of the deformation factor is found to be 1.2. The soil strain is calculated by Equation 3-27.

$$\varepsilon_S = \frac{75pcf * 140ft}{144 * 2005\frac{lbs}{inch^2}} * 100 = 3.6\%$$

The deflection is found by multiplying the soil strain by the deformation factor:

$$\frac{\Delta X}{D_M}(100) = 1.2 * 3.6 = 4.4\%$$

Moore-Selig Equation for Constrained Buckling in Dry Ground

As discussed previously, a compressive thrust stress exists in buried pipe. When this thrust stress approaches a critical value, the pipe can experience a local instability or large deformation and collapse. In an earlier section of this chapter, Luscher's equation was given for constrained buckling under ground water. Moore and Selig[17] have used an alternate approach called the continuum theory to develop design equations for contrained buckling due to soil pressure (buckling of embedded pipes). The particular version of their equations given below is more appropriate for dry applications than Luscher's equation. Where ground water is present, Luscher's equation should be used.

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 10E

Peak Daily Flows from Each Cell

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Peak Leachate Volumes for Each Cell		
	Job No. 2018-3854	Made by: JCA	Date 07/17/20
	Ref.	Checked by: VEF	Sheet 1 of 4

Reviewed by PGS 08/28/2021

1. Purpose

The purpose of this analysis is to estimate the peak daily leachate volumes for each cell.

2. Analysis Approach

The HELP modeling for the project peak leachate flows based on a unit one acre. Values are provided for First Lift conditions, for floor and sideslope areas.

3. HELP Modeling Data

From the HELP modeling and analysis, the following peak daily unit leachate flow values were selected for design.

Active Landfill – Peak Daily Unit Leachate Flows				
Lift Condition	**Floor (cf/ac)**	***Floor (gal/ac)***	**Sideslope (cf/ac)**	***Sideslope (gal/ac)***
First Lift	1,300	*9,724*	1,655	*12,379*
Mid-Fill	1,011	*7,562*	1,001	*7,487*
Full-Fill	1,113	*8,325*	1,031	*7,712*

Also from, the HELP modeling and analysis, similar data for the Post-Closure Years 1 through 10 were provided. From this data, the following peak daily unit leachate values were selected for design.

Closed Landfill – Peak daily Unit Leachate Flows (Full-Fill Condition)				
Year	**Floor (cf/ac)**	***Floor (gal/ac)***	**Sideslope (cf/ac)**	***Sideslope (gal/ac)***
1	521	*3,897*	486	*3,635*
2	16	*120*	16	*120*
3	3	*22*	3	*22*
4	2	*15*	2	*15*
5	1	*7*	1	*7*
6	1	*7*	1	*7*
7	0	*0*	0	*0*
8	0	*0*	0	*0*
9	0	*0*	0	*0*
10	0	*0*	0	*0*

This data is now used with the respective acreage for each cell to calculate peak daily leachate flows from each cell. See attached Tables A and B.

Reviewed by PGS 08/28/2021

5. References

1. Project Design Information.
2. Related Project Design Calculations.

Revised by PGS 08/28/2021 for adjusted cell areas

TABLE A - PEAK DAILY UNIT LEACHATE FLOWS (GAL/AC-DAY)

Unit Flows	Active Landfill			Closed Landfill									
	First Lift Flow (gal/ac-day)	Mid-Fill Flow (gal/ac-day)	Full-Fill Flow (gal/ac-day)	Year 1 (gal/ac-day)	Year 2 (gal/ac-day)	Year 3 (gal/ac-day)	Year 4 (gal/ac-day)	Year 5 (gal/ac-day)	Year 6 (gal/ac-day)	Year 7 (gal/ac-day)	Year 8 (gal/ac-day)	Year 9 (gal/ac-day)	Year 10 (gal/ac-day)
Floor	9,724	7,562	8,325	3,897	120	22	15	7	7	0	0	0	0
Sideslope	12,379	7,487	7,712	3,635	120	22	15	7	7	0	0	0	0

TABLE B - PEAK LEACHATE FLOWS (GAL/DAY)

Cell		Size (ac)	Active Landfill			Closed Landfill									
			First Lift Flow (gal/day)	Mid-Fill Flow (gal/day)	Full-Fill Flow (gal/day)	Year 1 (gal/day)	Year 2 (gal/day)	Year 3 (gal/day)	Year 4 (gal/day)	Year 5 (gal/day)	Year 6 (gal/day)	Year 7 (gal/day)	Year 8 (gal/day)	Year 9 (gal/day)	Year 10 (gal/day)
1	*Floor:*	11.70	113,771	88,479	97,405	45,596	1,400	263	175	88	88	0	0	0	0
	Sideslope:	1.49	18,445	11,156	11,491	5,417	178	33	22	11	11	0	0	0	0
	Total:	**13.19**	**132,216**	**99,635**	**108,896**	**51,012**	**1,579**	**296**	**197**	**99**	**99**	**0**	**0**	**0**	**0**
2	*Floor:*	5.41	52,607	40,912	45,040	21,083	647	121	81	40	40	0	0	0	0
	Sideslope:	2.13	26,368	15,948	16,426	7,743	255	48	32	16	16	0	0	0	0
	Total:	**7.54**	**78,975**	**56,860**	**61,466**	**28,826**	**902**	**169**	**113**	**56**	**56**	**0**	**0**	**0**	**0**
3	*Floor:*	4.19	40,744	31,686	34,883	16,329	501	94	63	31	31	0	0	0	0
	Sideslope:	0.67	8,294	5,017	5,167	2,436	80	15	10	5	5	0	0	0	0
	Total:	**4.86**	**49,038**	**36,703**	**40,050**	**18,764**	**582**	**109**	**73**	**36**	**36**	**0**	**0**	**0**	**0**
4	*Floor:*	4.91	47,745	37,131	40,877	19,135	588	110	73	37	37	0	0	0	0
	Sideslope:	0.57	7,056	4,268	4,396	2,072	68	13	9	4	4	0	0	0	0
	Total:	**5.48**	**54,801**	**41,399**	**45,273**	**21,207**	**656**	**123**	**82**	**41**	**41**	**0**	**0**	**0**	**0**
5A	*Floor:*	3.94	38,313	29,795	32,801	15,354	472	88	59	29	29	0	0	0	0
	Sideslope:	1.72	21,293	12,878	13,264	6,253	206	39	26	13	13	0	0	0	0
	Total:	**5.66**	**59,605**	**42,674**	**46,066**	**21,607**	**677**	**127**	**85**	**42**	**42**	**0**	**0**	**0**	**0**

Revised by PGS 08/28/2021 for adjusted cell areas

TABLE B - PEAK LEACHATE FLOWS (GAL/AC) - CONT.

Cell		Size (ac)	Active Landfill			Closed Landfill									
			First Lift Flow (gal/day)	Mid-Fill Flow (gal/day)	Full-Fill Flow (gal/day)	Year 1 (cf/day)	Year 2 (cf/day)	Year 3 (cf/day)	Year 4 (cf/day)	Year 5 (cf/day)	Year 6 (cf/day)	Year 7 (cf/day)	Year 8 (cf/day)	Year 9 (cf/day)	Year 10 (cf/day)
5B	*Floor:*	2.40	23,338	18,149	19,981	9,353	287	54	36	18	18	0	0	0	0
	Sideslope:	0.97	12,008	7,263	7,481	3,526	116	22	15	7	7	0	0	0	0
	Total:	**3.37**	**35,346**	**25,412**	**27,461**	**12,879**	**403**	**76**	**50**	**25**	**25**	**0**	**0**	**0**	**0**
5C	*Floor:*	3.60	35,006	27,224	29,971	14,029	431	81	54	27	27	0	0	0	0
	Sideslope:	0.84	10,399	6,289	6,478	3,054	101	19	13	6	6	0	0	0	0
	Total:	**4.44**	**45,405**	**33,514**	**36,449**	**17,083**	**531**	**100**	**66**	**33**	**33**	**0**	**0**	**0**	**0**
5D	*Floor:*	2.36	22,949	17,847	19,648	9,197	282	53	35	18	18	0	0	0	0
	Sideslope:	0.51	6,313	3,819	3,933	1,854	61	11	8	4	4	0	0	0	0
	Total:	**2.87**	**29,262**	**21,666**	**23,581**	**11,051**	**343**	**64**	**43**	**21**	**21**	**0**	**0**	**0**	**0**
5E	*Floor:*	2.02	19,642	15,276	16,817	7,872	242	45	30	15	15	0	0	0	0
	Sideslope:	1.15	14,236	8,611	8,869	4,181	138	26	17	9	9	0	0	0	0
	Total:	**3.17**	**33,879**	**23,886**	**25,686**	**12,053**	**379**	**71**	**47**	**24**	**24**	**0**	**0**	**0**	**0**
5F	*Floor:*	1.01	9,821	7,638	8,408	3,936	121	23	15	8	8	0	0	0	0
	Sideslope:	0.57	7,056	4,268	4,396	2,072	68	13	9	4	4	0	0	0	0
	Total:	**1.58**	**16,877**	**11,906**	**12,804**	**6,008**	**189**	**35**	**24**	**12**	**12**	**0**	**0**	**0**	**0**
6	*Floor:*	2.01	19,545	15,200	16,734	7,833	241	45	30	15	15	0	0	0	0
	Sideslope:	3.17	39,243	23,735	24,447	11,524	379	71	47	24	24	0	0	0	0
	Total:	**5.18**	**58,788**	**38,935**	**41,180**	**19,357**	**620**	**116**	**77**	**39**	**39**	**0**	**0**	**0**	**0**
7	*Floor:*	2.21	21,490	16,713	18,399	8,613	264	50	33	17	17	0	0	0	0
	Sideslope:	4.47	55,336	33,469	34,472	16,250	535	100	67	33	33	0	0	0	0
	Total:	**6.68**	**76,826**	**50,182**	**52,871**	**24,862**	**799**	**150**	**100**	**50**	**50**	**0**	**0**	**0**	**0**
8	*Floor:*	4.64	45,119	35,089	38,629	18,082	555	104	69	35	35	0	0	0	0
	Sideslope:	1.39	17,207	10,408	10,720	5,053	166	31	21	10	10	0	0	0	0
	Total:	**6.03**	**62,327**	**45,497**	**49,349**	**23,135**	**722**	**135**	**90**	**45**	**45**	**0**	**0**	**0**	**0**
9	*Floor:*	2.59	25,185	19,586	21,562	10,093	310	58	39	19	19	0	0	0	0
	Sideslope:	1.30	16,093	9,734	10,025	4,726	156	29	19	10	10	0	0	0	0
	Total:	**3.89**	**41,278**	**29,320**	**31,588**	**14,819**	**466**	**87**	**58**	**29**	**29**	**0**	**0**	**0**	**0**

Revised by PGS 08/28/2021 for adjusted cell areas

TABLE B - PEAK LEACHATE FLOWS (GAL/AC) - CONT.

Cell		Size (ac)	Active Landfill			Closed Landfill									
			First Lift Flow (gal/day)	Mid-Fill Flow (gal/day)	Full-Fill Flow (gal/day)	Year 1 (cf/day)	Year 2 (cf/day)	Year 3 (cf/day)	Year 4 (cf/day)	Year 5 (cf/day)	Year 6 (cf/day)	Year 7 (cf/day)	Year 8 (cf/day)	Year 9 (cf/day)	Year 10 (cf/day)
10	*Floor:*	7.45	72,444	56,339	62,023	29,033	892	167	111	56	56	0	0	0	0
	Sideslope:	2.08	25,749	15,574	16,041	7,561	249	47	31	16	16	0	0	0	0
	Total:	**9.53**	**98,193**	**71,913**	**78,064**	**36,595**	**1,141**	**214**	**143**	**71**	**71**	**0**	**0**	**0**	**0**
11	*Floor:*	3.93	38,215	29,720	32,718	15,316	470	88	59	29	29	0	0	0	0
	Sideslope:	3.13	38,748	23,436	24,138	11,378	375	70	47	23	23	0	0	0	0
	Total:	**7.06**	**76,963**	**53,156**	**56,856**	**26,694**	**845**	**158**	**106**	**53**	**53**	**0**	**0**	**0**	**0**
12	*Floor:*	5.35	52,023	40,458	44,540	20,849	640	120	80	40	40	0	0	0	0
	Sideslope:	1.01	12,503	7,562	7,789	3,672	121	23	15	8	8	0	0	0	0
	Total:	**6.36**	**64,527**	**48,021**	**52,329**	**24,521**	**761**	**143**	**95**	**48**	**48**	**0**	**0**	**0**	**0**
13	*Floor:*	3.05	29,658	23,065	25,392	11,886	365	68	46	23	23	0	0	0	0
	Sideslope:	0.80	9,904	5,990	6,170	2,908	96	18	12	6	6	0	0	0	0
	Total:	**3.85**	**39,562**	**29,055**	**31,561**	**14,794**	**461**	**86**	**58**	**29**	**29**	**0**	**0**	**0**	**0**
14	*Floor:*	3.50	34,034	26,468	29,138	13,640	419	79	52	26	26	0	0	0	0
	Sideslope:	0.03	371	225	231	109	4	1	0	0	0	0	0	0	0
	Total:	**3.53**	**34,405**	**26,693**	**29,370**	**13,749**	**422**	**79**	**53**	**26**	**26**	**0**	**0**	**0**	**0**
15	*Floor:*	3.16	30,728	23,897	26,308	12,315	378	71	47	24	24	0	0	0	0
	Sideslope:	1.93	23,892	14,451	14,884	7,016	231	43	29	14	14	0	0	0	0
	Total:	**5.09**	**54,620**	**38,348**	**41,192**	**19,331**	**609**	**114**	**76**	**38**	**38**	**0**	**0**	**0**	**0**
16	*Floor:*	1.88	18,281	14,217	15,651	7,327	225	42	28	14	14	0	0	0	0
	Sideslope:	2.40	29,711	17,970	18,509	8,725	287	54	36	18	18	0	0	0	0
	Total:	**4.28**	**47,992**	**32,187**	**34,160**	**16,051**	**512**	**96**	**64**	**32**	**32**	**0**	**0**	**0**	**0**

ATTACHMENT 10F

Leachate Pump Sizing Calculations

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Leachate Sump Pump Sizing		
	Job No. 2018-3854	Made by: VEF	Date 7/14/20
	Ref. Ches Terrace	Checked by: TD	Sheet 1 of 2

Reviewed by PGS 08/28/2021

1. Purpose

The purpose is to select the pumps to convey the leachate from the sump in each cell to the leachate storage areas. Pumping leachate out of the cells as it is generated reduces the head that accumulates in the liner system.

2. Analysis Approach

Pumps area sized based on the flow rate they need to convey, the head they have to overcome, and the size of the pipe. With this information and pump curves from pump manufacturers, select the pumps which will satisfy the design criteria.

2.1 Design Data: There are several sources of data.

1) Use Reference 1 for Cell IDs {column (a) on attached table} and to obtain the following information:
    a. Sump Invert Elevation {column (b) on attached table}
    b. Elevation of crest of perimeter berm at sump sideslope riser pipes {column (c) on attached table}
    c. Elevation at road at pumphouse {column (d) on attached table}
2) Use Reference 2 to determine to which leachate storage facility the leachate from each cell is discharged {column (g) on attached table}
3) Use Reference 3, obtain
    a. The elevation at the base of the receiving tank {column (e) on attached table}
    b. The elevation at the inflow pipe at the receiving tank {column (f) on attached table}
    c. The force main ID# conveying flow from cell to leachate storage facility {column (i) on attached table}
    d. The length of the force main between the cell and the leachate storage facility, by measuring the length with a scale{column (h) on attached table}
4) From Reference 4, obtain the peak daily leachate generation rates for each cell {column (j) on attached table}. Convert that rate from gallons per day (gpd) to gallons per minute (gpm) {column (k) on attached table}.

2.2 Calculate Head. Assuming a 6-inch force main will be installed, determine the static head (elevation difference between pump location and discharge location) and the dynamic head (Hazen-Williams)

1) Static head = Elevation of inflow pipe at Tank (column f) – sump invert Column (b)

For Cell 1 --- Static Head = 207 – 100 = 107 feet

Reviewed by PGS 08/28/2021

2) Use Hazen-Williams to estimate dynamic head (or friction loss in the conveyance pipe)

hf = 0.002083 x L x (100/C)^1.85 x (gpm^1.85 / d^4.8655)

where:
hf = head loss in feet of water
L = length of pipe in feet
C = friction coefficient
gpm = gallons per minute (USA gallons not imperial gallons)
d = inside diameter of the pipe in inches
C= 140 for PE pipe

For Cell 1, hf = 0.002083 x 2400 x (100/140)^(1.85) x ({91.8}^1.85)/(6^4.8655) = 1.9

3) Total head = static head + dynamic head. For Cell 1, total head = 107 + 1.9 = 108.9 ft

2.3 Pump Selection. Based on pump curves for sideslope riser pumps produced by EPG, review pump options across multiple series are available. Based on the range of peak flows and the range of head, consider the Series 9, 14, and 18 SurePump™ pumps. Plot the total head vs peak flow on the pump curves for each cell. Please reference to the attached pumps curves for Series 9 and Series 18 pumps.

3. Conclusions

Select the pump associated with the curve immediately above the plotted head vs flow rate for each pump. Since the Series 18 can handle the entire range of flow rates and heads, specific Series 18 pumps. The pump model and horsepower for each cell is listed on the attached summary table.

When these cells are constructed, based on field performance of these pumps, a different make or model may be preferable to the model specified for a variety of reason. The objective is to meet the flow rate vs head considerations. Further, as cells are close and leachate production drops, the operators may choose to downsize pumps to accommodate much reduced flow rates.

4. References

1) Drawings entitled "Top of Subgrade Grading Plan – West Section" and "Top of Subgrade Grading Plan – East Section," prepared by Advanced GeoServices Corp dated July 2020.
2) Drawings entitled "Leachate Collection System Grading Plan and Layout – West Section" and "Leachate Collection System Grading Plan and Layout – East Section," prepared by Advanced GeoServices Corp dated July 2020.
3) Drawing entitled "Leachate Storage Tank Details (Sheet 1 of 2)," prepared by Advanced GeoServices Corp dated July 2020.
4) Calculation entitled "Peak Daily Leachate Generation Rates," prepared by Advanced GeoServices Corp dated July 2020.
5) EPG Companies, Series 9, 14, and 18 SurePump™ pump curves.

July 2020
Rev Aug 2021

Leachate Sump Pump SIzing Summary Table
Chesapeake Terrace Rubble Landfill, Odenton, Maryland

Project 2018-3854

Cell or Sub-cell ID	Sump Invert Elevation (ft)	Elevation of Crest of Perimeter Berm (ft)	Perimeter Road at Sump (ft)	Elevation of Tank at Base (ft)	Elevation of Inflow Pipe at Tank (ft)	Leachate Storage Area	Length of Force Main (ft)	Force Main ID#	Peak Leachate Generation (gpd)	Peak Leachate Generation (gpm)	Static Head (ft)	Dynamic Head (ft)	Total Head (ft)	Selected Pump
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)
1	103.0	130	127	164	207	2	2400	2	132,340.0	91.9	104.0	1.9	105.9	Model 18-4 HP 5.0
2	88.0	118	102	92	135	1	780	3	78,506.0	54.5	47.0	0.2	47.2	Model 18-2 HP 3.0
3	100.0	110	82	92	135	1	1620	3	49,506.0	34.4	35.0	0.2	35.2	Model 18-1 HP 1.5
4	102.5	114	82	164	135	1	2000	3	55,075.0	38.2	32.5	0.3	32.8	Model 18-1 HP 1.5
5A	115.0	156	156	164	207	2	2200	1	56,844.0	39.5	92.0	0.4	92.4	Model 18-2 HP 3.0
5B	118.5	148	148	164	207	2	3000	1	34,389.0	23.9	88.5	0.2	88.7	Model 18-2 HP 3.0
5C	120.0	142	142	164	207	2	3345	1	45,405.0	31.5	87.0	0.4	87.4	Model 18-2 HP 3.0
5D	121.5	134	132	164	207	2	3800	1	30,855.0	21.4	85.5	0.2	85.7	Model 18-2 HP 3.0
5E	121.5	134	122	164	207	2	4100	1	33,507.0	23.3	85.5	0.3	85.8	Model 18-2 HP 3.0
5F	120.0	134	120	164	207	2	4500	1	28,340.0	19.7	87.0	0.2	87.2	Model 18-3 HP 5.0
6	109.0	174	174	164	207	2	1500	1	58,788.0	40.8	98.0	0.3	98.3	Model 18-3 HP 5.0
7	102.0	172	172	164	207	2	300	1	76,826.0	53.4	105.0	0.1	105.1	Model 18-3 HP 5.0
8	108.0	155	155	164	207	2	750	2	62,327.0	43.3	99.0	0.1	99.1	Model 18-3 HP 5.0
9	111.2	150	150	164	207	2	1100	2	42,348.0	29.4	95.8	0.1	95.9	Model 18-2 HP 3.0
10	103.0	140	140	164	207	2	1800	2	98,193.0	68.2	104.0	0.8	104.8	Model 18-3 HP 5.0
11	73.0	88	88	92	135	1	660	5	76,963.0	53.4	62.0	0.2	62.2	Model 18-2 HP 3.0
12	73.5	91	84	92	135	1	1425	5	67,806.0	47.1	61.5	0.3	61.8	Model 18-2 HP 3.0
13	77.0	88	84	92	135	1	2280	5	35,186.0	24.4	58.0	0.2	58.2	Model 18-1 HP 1.5
14	79.0	91	91	92	135	1	2880	5	42,609.0	29.6	56.0	0.3	56.3	Model 18-1 HP 1.5
15	82.0	102	102	92	135	1	3500	5	50,748.0	35.2	53.0	0.5	53.5	Model 18-2 HP 3.0
16	80.0	140	138	92	135	1	1250	4	50,131.0	34.8	55.0	0.2	55.2	Model 18-1 HP 1.5

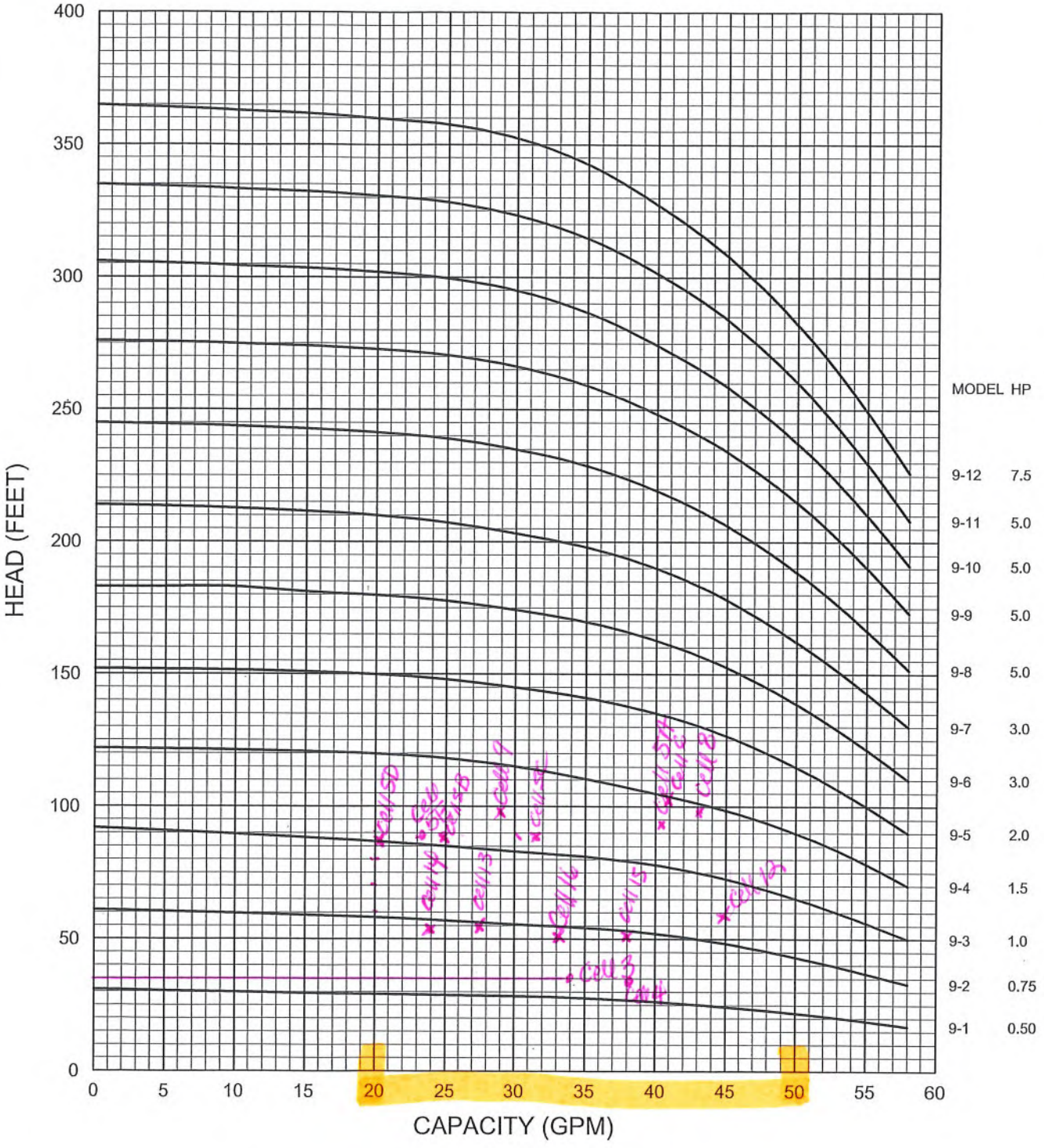
Revised for new Peak Leachate Generation by PGS 08/28/2021

0523

Series 9 SurePump™

Flow Range 20 - 50 GPM

60 Hz



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Manufacturer of Specialty Pumps, Controls and Sensors.

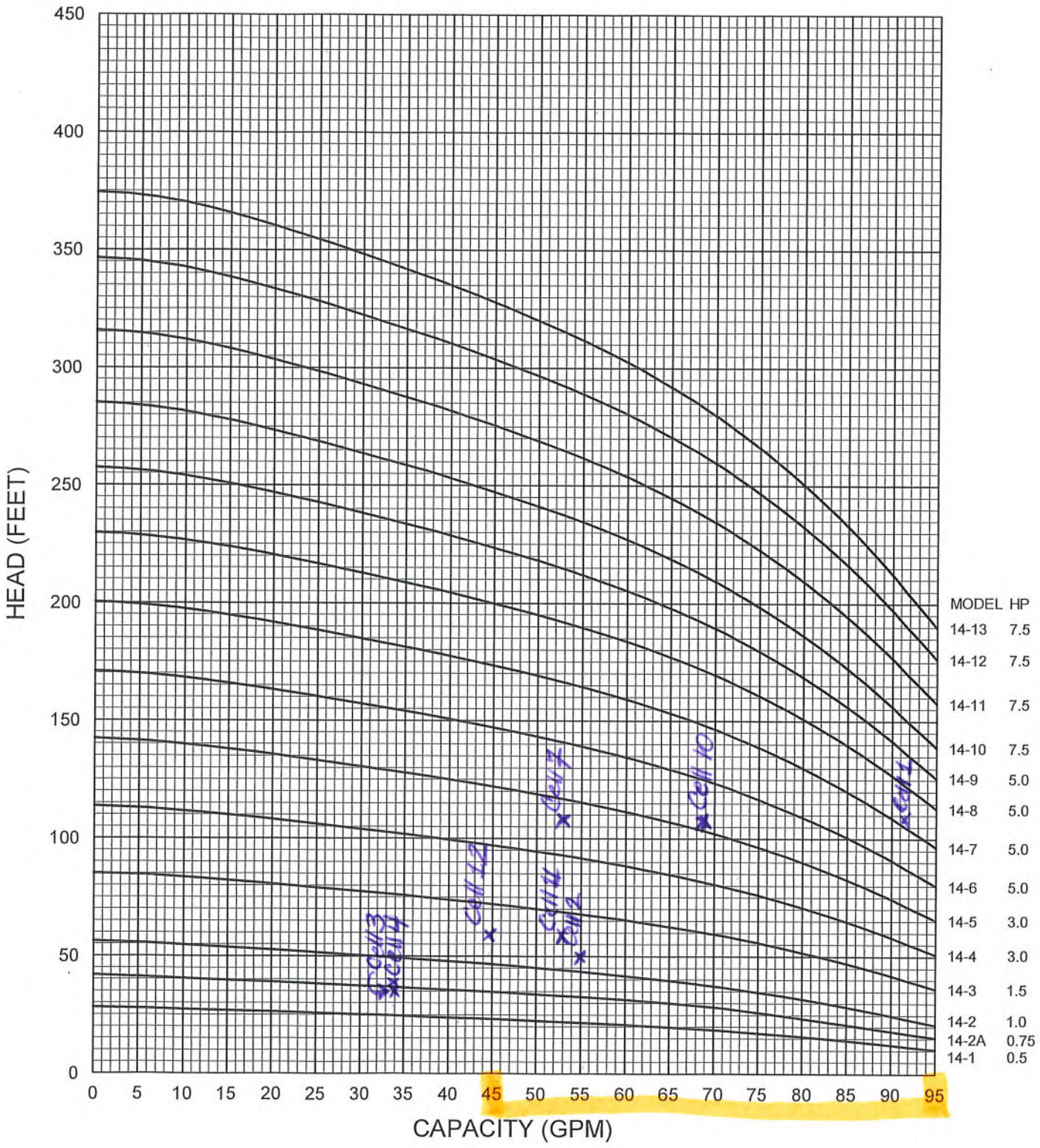
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EPG COMPANIES

Series 14 SurePump™

Flow Range 45 - 95 GPM

60 Hz



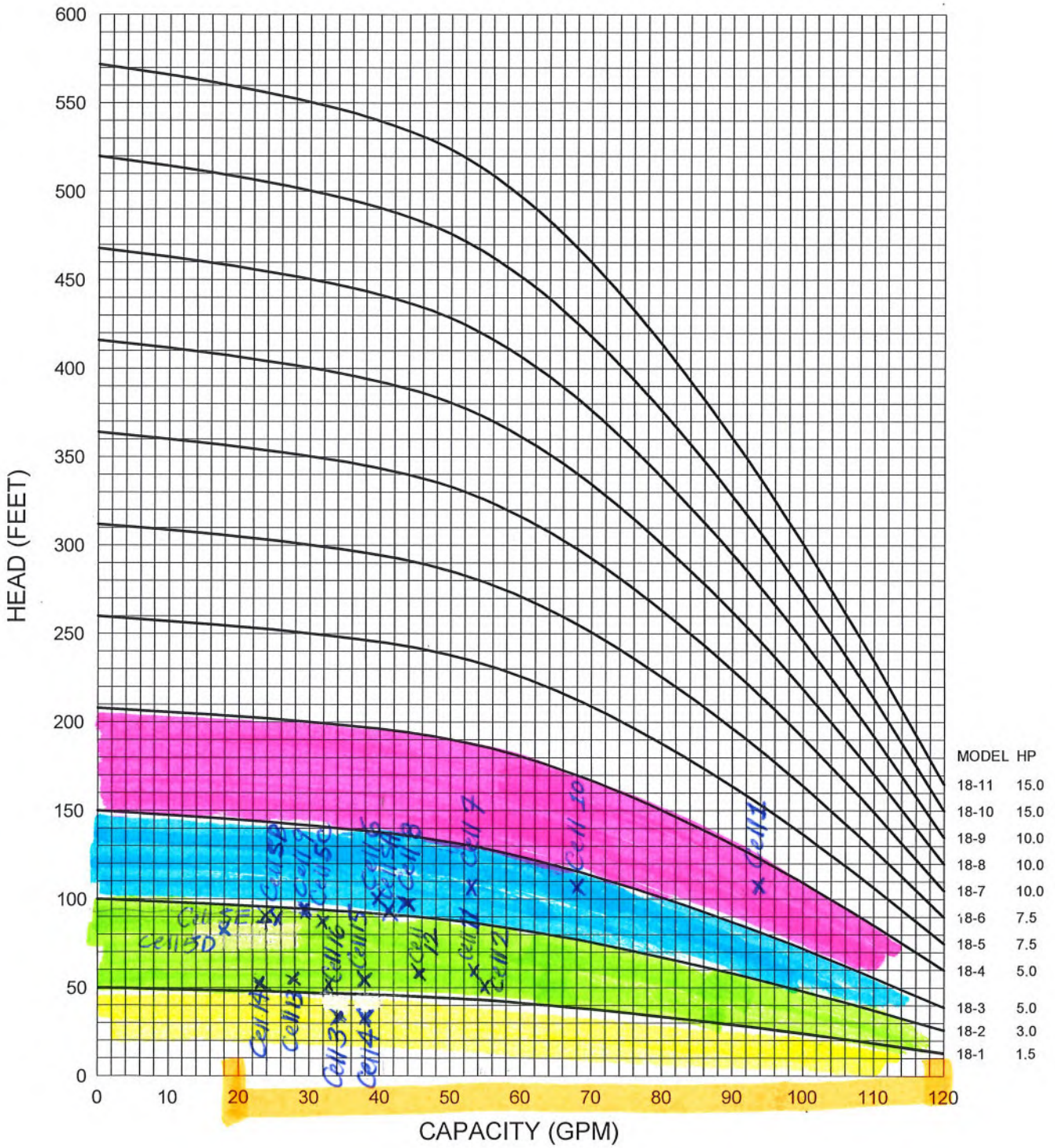
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

EPG COMPANIES

Series 18 SurePump™

Flow Range 20-120 GPM

60 Hz



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ATTACHMENT 10G

Leachate Generation over Landfill Life

Reviewed by PGS 08/28/2021

1. Purpose

The purpose of this analysis is to estimate the peak daily leachate volumes from the facility.

2. Analysis Approach

The HELP modeling for the project peak leachate flows based on a unit one acre. Values were provided for First Lift, Mid-Fill, Full-Fill, and Closed conditions, as well as for floor and sideslope areas. This data was used with the respective acreage for each cell to calculate peak daily leachate flows from each cell. The calculated flows are then used to develop a timeline to estimate the total peak daily flow from the facility.

3. Development of Leachate Timeline

1. Since the life of each cell is relatively brief (most a few months, some for two (2) years) planning for cell construction will require that multiple cells be "grouped together".

2. From the HELP modeling, each cell has peak daily flows for the First Lift, Mid-Fill, and Full-Fill conditions.

3. From the cell life estimates, each cell has an estimated life, and collectively they provide twelve (12) years of landfilling. For each cell, Mid-Fill is associated with Mid-Life, and Full-Fill is associated with maximum waste grades. Since each cell has a different life, each cell group will have a different total life.

4. The first cell is brought into service, and experiences the "First Lift" daily peak flow.

5. At mid-life in the first cell, the first cell experiences the "Mid-Life" peak daily flow. At the same time, the second cell in the group is brought into service, and experiences its "First Lift" peak daily flow.

6. At the Mid-Life of the second cell, it experiences its Mid-Life peak daily flow. At the same time, the third cell is brought into service with its "First Lift" peak daily flow.

7. At Mid-Life, the third cell experiences its "Mid-Fill" peak daily flow.

8. All of the cells in the group are presumed to experience their respective Full-Fill peak daily flows at the end of the total life for the group.

9. Between any of the calculated peak daily flows, between First Lift and Mid-Fill flows, and between Mid-Fill and Full-Fill flows, flow values were linearly interpolated.

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10. A closure construction period of 10 months was assumed. Between the calculated flows for Full-Fill and Post-Closure Year 1, peak daily flows for each month were interpolated.

11. Flows during post-closure months between calculated values were interpolated.

12. This arrangement is continued for each cell, each cell group, and through a minimum of 10 years after the last cell is closed. The HELP model output shows that leachate continues for several years after closure, but eventually ceases.

As an example of how this approach is applied, consider the following:

Step 1: The first cell group includes Cells 11, 16, and 12, in that order.

Step 4: Cell 11 is brought into service, and it has an estimated life of 8 months. In Month 1, the flow is the First Lift peak daily flow.

Step 5: At Month 4, the flow from Cell 11 is the Mid-Fill peak daily flow. Cell 16 is brought into service with its First Lift peak daily flow. Cell 16 has an estimated life of 5 months.

Step 6: At month 6, the flow from Cell 11 continues. The flow from Cell 16 is at its Mid-Fill peak daily flow. Cell 12 is brought into service with its First Lift peak daily flow. Cell 12 has an estimated life of 5 months.

Step 7: At month 8, the flows from Cells 11 and 16 continue. The flow from Cell 12 is at its Mid-Fill peak daily flow.

Step 8: In month 18, all three cells experience their respective Full-Fill peak daily flows. Cell 13 is brought into service with its First Lift peak daily flow. Cell 13 is the first cell planned in the next group of cells to be constructed.

Step 10: During the subsequent 10 months after Cells 11, 16, and 12 have been completely filled, closure construction takes place. Leachate flow from these three cells continue. Filling occurs in the next group of cells with their leachate flows.

Step 11: Once closure of Cells 11, 16, and 12 is complete, the leachate flow begins to taper off. By Post-Closure Year 7, modeling indicates flow will have ceased. Concurrently, filling and leachate flow continues from the next group of cells.

During the timeline, monthly flows are summed to estimate the total peak daily leachate flow from the facility. At some point, the facility will experience a maximum total flow that will be a combination of peak daily flows from cells under different fill conditions – active filling, closure construction, and post-closure.

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The attached Tables A provides a summary of peak daily flow each month for the 12-year life of the facility, and 10 years into post-closure. Groups of cells are arranged by the storage facility that will receive the leachate. The calculated flows are shown in **bold** font, and interpolated values are shown in regular font between those values. Black font is associated with the active landfilling years. Red font is associated with the closure construction time period. Green font is associated with the Post-Closure years.

For each month, the flows are summed to estimate the total flow from the facility. For the East leachate storage facility, the estimated peak daily volume is 254,933 gallons. For the West leachate storage facility, the estimated peak daily volume is 245,579 gallons.

8. References

1. Project Design Information.

2. Related Project Design Calculations.

Note by PGS08/28/2021: Calculations prepared to quantify peak daily leachate flows to leachate tanks over the operating life of the facility.

- The worst case flows to East tanks occurs when cells 11, 16 and 17 are fully capped, Cells 13,14 and 15 are being capped and cells 2, 3 and 4 are beginning operation.
- The worst case flows to West tanks occurs when Cells 1, 5E and 5F are about to start capping and Cell 10 is beginning operation.

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell

		Year 1												Year 2						
		1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
Cell 11	8	**76,963**	69,027	61,091	**53,156**	53,420	53,684	53,948	54,212	54,476	54,740	55,004	55,268	55,532	55,796	56,060	56,324	56,588	**56,856**	53,840
Cell 16	5				**47,992**	40,089	**32,187**	32,351	32,515	32,679	32,843	33,007	33,171	33,335	33,499	33,663	33,827	33,991	**34,160**	32,349
Cell 12	5						**64,527**	56,274	**48,021**	48,452	48,883	49,314	49,745	50,176	50,607	51,038	51,469	51,900	**52,329**	48,753
Cell 13	3																		**39,562**	**29,005**
Cell 14	3																			**34,405**
Cell 15	5																			
Cell 2	8																			
Cell 3	5																			
Cell 4	4																			
Total Peak Daily Flow (gal)		76,963	69,027	61,091	101,148	93,509	150,398	142,573	134,748	135,607	136,466	137,325	138,184	139,043	139,902	140,761	141,620	142,479	182,907	198,352

Cell 1	27
Cell 5E	3
Cell 5F	
Cell 10	15
Cell 9	6
Cell 5D	2
Cell 5C	4
Cell 5B	4
Cell 8	9
Cell 5A	8
Cell 7	12
Cell 6	10
Total Peak Daily Flow (gal)	

LEACHATE TIMELINE

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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

					Year 3																
8	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*
50,824	47,808	44,792	41,776	38,760	35,744	32,728	29,712	**26,694**	24,540	22,386	20,232	18,078	15,924	13,770	11,616	9,462	7,308	5,154	3,000	**845**	788
30,538	28,727	26,916	25,105	23,294	21,483	19,672	17,861	**16,051**	14,756	13,461	12,166	10,871	9,576	8,281	6,986	5,691	4,396	3,101	1,806	**512**	477
45,177	41,601	38,025	34,449	30,873	27,297	23,721	20,145	**16,568**	15,229	13,890	12,551	11,212	9,873	8,534	7,195	5,856	4,517	3,178	1,839	**500**	470
29,289	29,573	29,857	30,141	30,425	30,709	30,993	31,277	**31,561**	29,300	27,039	24,778	22,517	20,256	17,995	15,734	13,473	11,212	**8,947**	8,240	7,533	6,826
26,693	27,028	27,363	27,698	28,033	28,368	28,703	29,038	**29,370**	27,490	25,610	23,730	21,850	19,970	18,090	16,210	14,330	12,450	**10,574**	9,728	8,882	8,036
54,620	46,484	**38,348**	38,822	39,296	39,770	40,244	40,718	**41,192**	39,006	36,820	34,634	32,448	30,262	28,076	25,890	23,704	21,518	**19,331**	17,771	16,211	14,651
								78,975	71,603	64,231	**56,860**	57,214	57,568	57,922	58,276	58,630	58,984	59,338	59,692	60,046	60,400
											49,038	42,870	**36,703**	37,007	37,311	37,615	37,919	38,223	38,527	38,831	39,135
													54,801	48,100	**41,399**	41,829	42,259	42,689	43,119	43,549	43,979
237,141	**221,221**	**205,301**	**197,991**	**190,681**	**183,371**	**176,061**	**168,751**	**240,411**	**221,924**	**203,437**	**233,989**	**217,060**	**254,933**	**237,775**	**220,617**	**210,590**	**200,563**	**190,535**	**183,722**	**176,909**	**174,762**

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 4							Year 5														
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
731	674	617	560	503	446	389	332	275	218	**158**	154	150	146	142	138	134	130	126	122	118	114
442	407	372	337	302	267	232	197	162	127	**96**	93	90	87	84	81	78	75	72	69	66	63
440	410	380	350	320	290	260	230	200	170	**143**	139	135	131	127	123	119	115	111	107	103	99
6,119	5,412	4,705	3,998	3,291	2,584	1,877	1,170	**461**	430	399	368	337	306	275	244	213	182	151	120	**86**	84
7,190	6,344	5,498	4,652	3,806	2,960	2,114	1,268	**423**	394	365	336	307	278	249	220	191	162	133	104	**79**	77
13,091	11,531	9,971	8,411	6,851	5,291	3,731	2,171	**609**	568	527	486	445	404	363	322	281	240	199	158	**114**	111
60,754	61,108	**61,466**	58,202	54,938	51,674	48,410	45,146	41,882	38,618	35,354	32,090	**28,826**	28,666	28,506	28,346	28,186	28,026	27,866	27,706	27,546	27,386
39,439	39,743	**40,050**	37,921	35,792	33,663	31,534	29,405	27,276	25,147	23,018	20,889	**18,764**	17,249	15,734	14,219	12,704	11,189	9,674	8,159	6,644	5,129
44,409	44,839	**45,273**	42,866	40,459	38,052	35,645	33,238	30,831	28,424	26,017	23,610	**21,207**	19,495	17,783	16,071	14,359	12,647	10,935	9,223	7,511	5,799
172,615	**170,468**	**168,332**	**157,297**	**146,262**	**135,227**	**124,192**	**113,157**	**102,119**	**94,096**	**86,077**	**78,165**	**70,261**	**66,762**	**63,263**	**59,764**	**56,265**	**52,766**	**49,267**	**45,768**	**42,267**	**38,862**
132,216	129,710	127,204	124,698	122,192	119,686	117,180	114,674	112,168	109,662	107,156	104,650	102,144	**99,635**	100,214	100,793	101,372	101,951	102,530	103,109		
													33,879	28,882	**23,886**	24,014	24,142	24,270	24,398		
													16,877	14,391	**11,906**	11,970	12,034	12,098	12,162		
132,216	129,710	127,204	124,698	122,192	119,686	117,180	114,674	112,168	109,662	107,156	104,650	102,144	150,391	143,487	136,585	137,356	138,127	138,898	139,669		

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 6									Year 7												
4	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*
106	102	98	94	90	86	82	78	74	70	66	62	**53**	53	53	53	53	53	53	53	53	53
64	61	58	55	52	49	46	43	40	37	34	31	**32**	32	32	32	32	32	32	32	32	32
95	91	87	83	79	75	71	67	63	59	55	51	**48**	48	48	48	48	48	48	48	48	48
82	80	78	76	74	72	70	68	66	64	**57**	55	53	51	49	47	45	43	41	39	37	35
75	73	71	69	67	65	63	61	59	57	**53**	51	49	47	45	43	41	39	37	35	33	31
108	105	102	99	96	93	90	87	84	81	**76**	73	70	67	64	61	58	55	52	49	46	43
27,226	27,066	**902**	841	780	719	658	597	536	475	414	353	292	231	**169**	164	159	154	149	144	139	134
3,614	2,099	**582**	543	504	465	426	387	348	309	270	231	192	153	**109**	106	103	100	97	94	91	88
4,087	2,375	**656**	612	568	524	480	436	392	348	304	260	216	172	**123**	120	117	114	111	108	105	102
35,457	**32,052**	**2,634**	**2,472**	**2,310**	**2,148**	**1,986**	**1,824**	**1,662**	**1,500**	**1,329**	**1,167**	**1,005**	**854**	**692**	**674**	**656**	**638**	**620**	**602**	**584**	**566**
103,688	104,267	104,846	105,425	106,004	106,583	107,162	107,741	108,320	**108,896**	103,108	97,320	91,532	85,744	79,956	74,168	68,380	62,592	56,804	**51,012**	46,893	42,774
24,526	24,654	24,782	24,910	25,038	25,166	25,294	25,422	25,550	**25,686**	24,368	23,050	21,732	20,414	19,096	17,778	16,460	15,142	13,824	**12,053**	11,080	10,107
12,226	12,290	12,354	12,418	12,482	12,546	12,610	12,674	12,738	**12,804**	12,124	11,444	10,764	10,084	9,404	8,724	8,044	7,364	6,684	**6,008**	5,523	5,038
									98,193	94,439	90,685	86,931	83,177	79,423	75,669	**71,913**	72,386	72,859	73,332	73,805	74,278
																41,278	35,299	**29,320**	29,526	29,732	29,938
140,440	141,211	141,982	142,753	143,524	144,295	145,066	145,837	146,608	245,579	234,039	222,499	210,959	199,419	187,879	176,339	206,075	192,783	179,491	171,931	167,033	162,135

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 8											Year 9										
2	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***	***12***	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***	***9***	***10***	***11***
53	53	**53**	40	27	14	**0**															
32	32	**32**	24	16	8	**0**															
48	48	**48**	36	24	12	**0**															
28	28	28	28	28	28	28	28	28	28	28	28	28	**28**	21	14	7	**0**				
26	26	26	26	26	26	26	26	26	26	26	26	26	**26**	19	12	5	**0**				
38	38	38	38	38	38	38	38	38	38	38	38	38	**38**	29	20	11	**0**				
129	124	119	114	**113**	108	103	98	93	88	83	78	73	68	63	58	**56**	56	56	56	56	56
85	82	79	76	**73**	70	67	64	61	58	55	52	49	46	43	40	**36**	36	36	36	36	36
99	96	93	90	**82**	79	76	73	70	67	64	61	58	55	52	49	**41**	41	41	41	41	41
538	**527**	**516**	**472**	**427**	**383**	**338**	**327**	**316**	**305**	**294**	**283**	**272**	**261**	**227**	**193**	**156**	**133**	**133**	**133**	**133**	**133**
38,655	34,536	30,417	26,298	22,179	18,060	13,941	9,822	5,703	**1,579**	1,472	1,365	1,258	1,151	1,044	937	830	723	616	509	402	**296**
9,134	8,161	7,188	6,215	5,242	4,269	3,296	2,323	1,350	**379**	353	327	301	275	249	223	197	171	145	119	93	**71**
4,553	4,068	3,583	3,098	2,613	2,128	1,643	1,158	673	**189**	176	163	150	137	124	111	98	85	72	59	46	**35**
74,751	75,224	75,697	76,170	76,643	77,116	77,589	**78,064**	73,917	69,770	65,623	61,476	57,329	53,182	49,035	44,888	40,741	**36,595**	33,641	30,687	27,733	24,779
30,144	30,350	30,556	30,762	30,968	31,174	31,380	**31,588**	29,911	28,234	26,557	24,880	23,203	21,526	19,849	18,172	16,495	**14,819**	13,623	12,427	11,231	10,035
							29,262	**21,666**	21,879	22,092	22,305	22,518	22,731	22,944	23,157	23,370	**23,581**	22,328	21,075	19,822	18,569
								45,405	39,459	**33,514**	33,933	34,352	34,771	35,190	35,609	36,028	**36,449**	34,512	32,575	30,638	28,701
										35,346	30,379	**25,412**	25,822	26,232	26,642	27,052	**27,461**	26,003	24,545	23,087	21,629
																	62,327	58,120	53,913	49,706	**45,497**
																					59,605
157,237	152,339	147,441	142,543	137,645	132,747	127,849	152,217	178,625	161,489	185,133	174,828	164,523	159,595	154,667	149,739	144,811	202,211	189,060	175,909	162,758	209,217

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

	Year 10											Year 11								
12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
56	56	56	56	56	56	56	42	28	14	0											
36	36	36	36	36	36	36	30	24	18	0											
41	41	41	41	41	41	41	31	21	11	0											
133	133	133	133	133	133	133	103	73	43	0											
288	280	272	264	256	248	240	232	224	216	208	197	189	181	173	165	157	149	141	133	125	117
69	67	65	63	61	59	57	55	53	51	49	47	45	43	41	39	37	35	33	31	29	27
34	33	32	31	30	29	28	27	26	25	24	24	23	22	21	20	19	18	17	16	15	14
21,825	18,871	15,917	12,963	10,009	7,055	4,101	1,141	1,064	987	910	833	756	679	602	525	448	371	294	214	208	202
8,839	7,643	6,447	5,251	4,055	2,859	1,663	466	435	404	373	342	311	280	249	218	187	156	125	87	85	83
17,316	16,063	14,810	13,557	12,304	11,051	10,164	9,277	8,390	7,503	6,616	5,729	4,842	3,955	3,068	2,181	1,294	403	375	347	319	291
26,764	24,827	22,890	20,953	19,016	17,083	15,704	14,325	12,946	11,567	10,188	8,809	7,430	6,051	4,672	3,293	1,914	531	495	459	423	387
20,171	18,713	17,255	15,797	14,339	12,879	11,826	10,773	9,720	8,667	7,614	6,561	5,508	4,455	3,402	2,349	1,296	243	229	215	201	187
45,818	46,139	46,460	46,781	47,102	47,423	47,744	48,065	48,386	48,707	49,028	49,349	46,728	44,107	41,486	38,865	36,244	33,623	31,002	28,381	25,760	23,135
53,961	48,317	42,674	43,051	43,428	43,805	44,182	44,559	44,936	45,313	45,690	46,066	43,620	41,174	38,728	36,282	33,836	31,390	28,944	26,498	24,052	21,607
											76,826	71,497	66,168	60,839	55,510	50,182	50,350	50,518	50,686	50,854	51,022
																58,788	52,170	45,552	38,935	39,108	39,281
195,085	180,953	166,822	158,711	150,600	142,491	135,709	128,920	126,180	123,440	120,700	194,783	180,949	167,115	153,281	139,447	184,402	169,439	157,725	146,002	141,179	136,353

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

			Year 12												Year 13						
10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7
109	**99**	99	99	99	99	99	99	99	99	99	99	99	**99**	74	49	24	**0**				
25	**24**	24	24	24	24	24	24	24	24	24	24	24	**24**	18	12	6	**0**				
13	**12**	12	12	12	12	12	12	12	12	12	12	12	**12**	9	6	3	**0**				
196	190	184	178	172	166	160	154	148	**143**	137	131	125	119	113	107	101	95	89	83	77	**71**
81	79	77	75	73	71	69	67	65	**58**	56	54	52	50	48	46	44	42	40	38	36	**29**
263	235	207	179	151	123	95	**64**	62	60	58	56	54	52	50	48	46	44	42	**43**	41	39
351	315	279	243	207	171	135	**100**	97	94	91	88	85	82	79	76	73	70	67	**66**	63	60
173	159	145	131	117	103	89	**76**	74	72	70	68	66	64	62	60	58	56	54	**50**	48	46
21,267	19,399	17,531	15,663	13,795	11,927	10,059	8,191	6,323	4,455	2,587	**722**	673	624	575	526	477	428	379	330	281	232
19,863	18,119	16,375	14,631	12,887	11,143	9,399	7,655	5,911	4,167	2,423	**677**	631	585	539	493	447	401	355	309	263	217
51,190	51,358	51,526	51,694	51,862	52,030	52,198	52,366	52,534	52,702	**52,871**	50,070	47,269	44,468	41,667	38,866	36,065	33,264	30,463	27,662	**24,862**	22,857
39,454	39,627	39,800	39,973	40,146	40,319	40,492	40,665	40,838	41,011	**41,180**	38,998	36,816	34,634	32,452	30,270	28,088	25,906	23,724	21,542	**19,357**	17,796
132,985	129,616	126,259	122,902	119,545	116,188	112,831	109,473	106,187	102,897	99,608	90,999	85,906	80,813	75,686	70,559	65,432	60,306	55,213	50,123	45,028	41,347

LEACHATE TIMELINE
pg 8/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

					Year 14																
8	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*1*	*2*	*3*	*4*	*5*
71	71	71	71	71	71	71	71	71	71	71	**71**	53	35	17	**0**						
29	29	29	29	29	29	29	29	29	29	29	**29**	22	15	8	**0**						
37	35	33	31	29	27	25	23	21	**21**	21	21	21	21	21	21	21	21	21	21	21	**21**
57	54	51	48	45	42	39	36	33	**33**	33	33	33	33	33	33	33	33	33	33	33	**33**
44	42	40	38	36	34	32	30	28	**25**	25	25	25	25	25	25	25	25	25	25	25	**25**
183	**135**	131	127	123	119	115	111	107	103	99	95	91	**90**	86	82	78	74	70	66	62	58
171	**127**	124	121	118	115	112	109	106	103	100	97	94	**85**	81	77	73	69	65	61	57	53
20,852	18,847	16,842	14,837	12,832	10,827	8,822	6,817	4,812	2,807	**799**	745	691	637	583	529	475	421	367	313	259	205
16,235	14,674	13,113	11,552	9,991	8,430	6,869	5,308	3,747	2,186	**620**	578	536	494	452	410	368	326	284	242	200	158
37,679	34,014	30,434	26,854	23,274	19,694	16,114	12,534	8,954	5,378	1,797	1,694	1,566	1,435	1,306	1,177	1,073	969	865	761	657	553

LEACHATE TIMELINE
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Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 15							Year 16														
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
16	11	6	**0**																		
25	17	9	**0**																		
19	13	7	**0**																		
54	50	46	**45**	45	45	45	45	45	45	45	45	45	45	45	**45**	34	23	12	**0**		
49	45	43	**42**	42	42	42	42	42	42	42	42	42	42	42	**42**	32	22	12	**0**		
150	112	109	106	103	100	97	94	91	88	85	82	**100**	96	92	88	84	80	76	72	68	64
116	113	110	107	104	101	98	95	92	89	86	83	**77**	74	71	68	65	62	59	56	53	50
429	361	330	300	294	288	282	276	270	264	258	252	264	257	250	243	215	187	159	128	121	114

LEACHATE TIMELINE
PG 10/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 17									Year 18											
4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1
60	56	**50**	50	50	50	50	50	50	50	50	50	50	50	**50**	38	26	14	**0**	0	0	0
47	44	**39**	39	39	39	39	39	39	39	39	39	39	39	**39**	29	19	9	**0**	0	0	0
107	100	89	89	89	89	89	89	89	89	89	89	89	89	89	67	45	23	0	0	0	0

LEACHATE TIMELINE
PG 11/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

Year 19											Year 20										
2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11
0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LEACHATE TIMELINE
BJ 12/13

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

	Year 21												Year 22								
12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A - Timeline of Peak Daily Leachate Flows (gal) in each Cell (cont.)

10	11	12
0	0	0
0	0	0
0	0	0

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 10H

Leachate Storage Facility Secondary Containment

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Leachate Tanks Secondary Containment		
	Job No. 2018-3854	Made by: VEF VEF	Date 7/8/20
	Ref. Ches Terrace	Checked by: TD TD	Sheet 1 of 2

Reviewed by PGS 08/29/2021

1. Purpose

The purpose of these calculations is to determine the minimum dimensions of the secondary containment areas associated with the leachate storage areas.

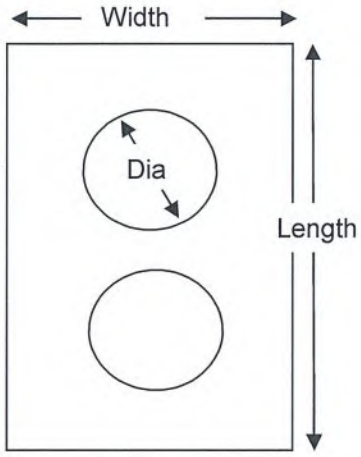
2. Analysis Approach

While 40 CFR 112.8(c)(2) is specifically applicable to containment for petroleum and non-petroleum oils, the purpose of the regulation is to prevent pollution. As such, we consider it relevant and appropriate for determining minimum secondary containment storage for the leachate tanks. 40CFR112.8 requires above-ground-tank secondary containment storage to contain the volume of the largest tank plus sufficient freeboard for precipitation.

2.1 Design Data: This is a function of tank size and the geometry of the secondary containment dimensions.

TABLE 1 – Design Data	
Parameter	**Value**
Tank Storage	500,000 gallons
Number of tank per storage area	Two
Diameter of tanks	45 feet
Length of Containment Area	140 feet*
Length available for secondary containment	138 feet
Width of Containment Area	80 feet*
Width available for secondary containment	78 feet

* assume concrete wall thickness of 1 foot for each wall



2.2 Calculation: The three liner systems were simulated for a five year, under first lift conditions, with the following results:

Volume = Area x D, where

Volume = 500,000 gallons x (1 c.f./7.48 gallons)
= 66844.9 c.f.

Area = (LxW) – π x(Dia/2)^2
= (140 x 80) - π x(45/2)^2
= 11,200 – 1589.6 s.f.
= 9610.4 s.f.

Depth = d (desired value)

Substituting, 66,844.9 c.f. = 9,610 s.f. x d
Solving for d: d = 66,844.9/9610 = 6.96 ft

Reviewed by PGS 08/29/2021

This assumes the entire space is open and available for storage, despite piping, stairs, and other access mechanisms, which occupy the same space. The precipitation depth that is usually applied in this application is the rainfall associated with a 25-year, 24 hour storm event – or 5.9 inches of rain per NOAA. Due to the nature of this facility, we recommend using the rainfall associated with a 100-year, 24 hour storm event – or 8.5 inches of rain per NOAA.

This provides a minimum required depth of 6.96 ft plus 8.5 inches for rainfall = 7.7 feet This does not provide any freeboard however. Adding a foot of freeboard, an adjusted minimum depths of 8.7 feet is required.

4. Conclusions

Based on the foregoing, a leachate secondary containment area measuring 140 ft x 80 ft x 9 feet deep is recommended.

discussion of conformance with the applicable requirements and other effective discharge prevention and containment procedures listed in this part or any applicable more stringent State rules, regulations, and guidelines.

Subpart B—Requirements for Petroleum Oils and Non-Petroleum Oils, Except Animal Fats and Oils and Greases, and Fish and Marine Mammal Oils; and Vegetable Oils (Including Oils from Seeds, Nuts, Fruits, and Kernels)

SOURCE: 67 FR 47146, July 17, 2002, unless otherwise noted.

§ 112.8 Spill Prevention, Control, and Countermeasure Plan requirements for onshore facilities (excluding production facilities).

If you are the owner or operator of an onshore facility (excluding a production facility), you must:

(a) Meet the general requirements for the Plan listed under §112.7, and the specific discharge prevention and containment procedures listed in this section.

(b) *Facility drainage.* (1) Restrain drainage from diked storage areas by valves to prevent a discharge into the drainage system or facility effluent treatment system, except where facility systems are designed to control such discharge. You may empty diked areas by pumps or ejectors; however, you must manually activate these pumps or ejectors and must inspect the condition of the accumulation before starting, to ensure no oil will be discharged.

(2) Use valves of manual, open-and-closed design, for the drainage of diked areas. You may not use flapper-type drain valves to drain diked areas. If your facility drainage drains directly into a watercourse and not into an on-site wastewater treatment plant, you must inspect and may drain uncontaminated retained stormwater, as provided in paragraphs (c)(3)(ii), (iii), and (iv) of this section.

(3) Design facility drainage systems from undiked areas with a potential for a discharge (such as where piping is located outside containment walls or where tank truck discharges may occur outside the loading area) to flow into ponds, lagoons, or catchment basins designed to retain oil or return it to the facility. You must not locate catchment basins in areas subject to periodic flooding.

(4) If facility drainage is not engineered as in paragraph (b)(3) of this section, equip the final discharge of all ditches inside the facility with a diversion system that would, in the event of an uncontrolled discharge, retain oil in the facility.

(5) Where drainage waters are treated in more than one treatment unit and such treatment is continuous, and pump transfer is needed, provide two "lift" pumps and permanently install at least one of the pumps. Whatever techniques you use, you must engineer facility drainage systems to prevent a discharge as described in §112.1(b) in case there is an equipment failure or human error at the facility.

(c) *Bulk storage containers.* (1) Not use a container for the storage of oil unless its material and construction are compatible with the material stored and conditions of storage such as pressure and temperature.

(2) Construct all bulk storage container installations so that you provide a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. You must ensure that diked areas are sufficiently impervious to contain discharged oil. Dikes, containment curbs, and pits are commonly employed for this purpose. You may also use an alternative system consisting of a drainage trench enclosure that must be arranged so that any discharge will terminate and be safely confined in a facility catchment basin or holding pond.

(3) Not allow drainage of uncontaminated rainwater from the diked area into a storm drain or discharge of an effluent into an open watercourse, lake, or pond, bypassing the facility treatment system unless you:

(i) Normally keep the bypass valve sealed closed.

(ii) Inspect the retained rainwater to ensure that its presence will not cause a discharge as described in §112.1(b).

(iii) Open the bypass valve and reseal it following drainage under responsible supervision; and

(iv) Keep adequate records of such events, for example, any records required under permits issued in accordance with §§122.41(j)(2) and 122.41(m)(3) of this chapter.

(4) Protect any completely buried metallic storage tank installed on or after January 10, 1974 from corrosion by coatings or cathodic protection compatible with local soil conditions. You must regularly leak test such completely buried metallic storage tanks.

(5) Not use partially buried or bunkered metallic tanks for the storage of oil, unless you protect the buried section of the tank from corrosion. You must protect partially buried and bunkered tanks from corrosion by coatings or cathodic protection compatible with local soil conditions.

(6) Test each aboveground container for integrity on a regular schedule, and whenever you make material repairs. The frequency of and type of testing must take into account container size and design (such as floating roof, skid-mounted, elevated, or partially buried). You must combine visual inspection with another testing technique such as hydrostatic testing, radiographic testing, ultrasonic testing, acoustic emissions testing, or another system of non-destructive shell testing. You must keep comparison records and you must also inspect the container's supports and foundations. In addition, you must frequently inspect the outside of the container for signs of deterioration, discharges, or accumulation of oil inside diked areas. Records of inspections and tests kept under usual and customary business practices will suffice for purposes of this paragraph.

(7) Control leakage through defective internal heating coils by monitoring the steam return and exhaust lines for contamination from internal heating coils that discharge into an open watercourse, or pass the steam return or exhaust lines through a settling tank, skimmer, or other separation or retention system.

(8) Engineer or update each container installation in accordance with good engineering practice to avoid discharges. You must provide at least one of the following devices:

(i) High liquid level alarms with an audible or visual signal at a constantly attended operation or surveillance station. In smaller facilities an audible air vent may suffice.

(ii) High liquid level pump cutoff devices set to stop flow at a predetermined container content level.

(iii) Direct audible or code signal communication between the container gauger and the pumping station.

(iv) A fast response system for determining the liquid level of each bulk storage container such as digital computers, telepulse, or direct vision gauges. If you use this alternative, a person must be present to monitor gauges and the overall filling of bulk storage containers.

(v) You must regularly test liquid level sensing devices to ensure proper operation.

(9) Observe effluent treatment facilities frequently enough to detect possible system upsets that could cause a discharge as described in §112.1(b).

(10) Promptly correct visible discharges which result in a loss of oil from the container, including but not limited to seams, gaskets, piping, pumps, valves, rivets, and bolts. You must promptly remove any accumulations of oil in diked areas.

(11) Position or locate mobile or portable oil storage containers to prevent a discharge as described in §112.1(b). You must furnish a secondary means of containment, such as a dike or catchment basin, sufficient to contain the capacity of the largest single compartment or container with sufficient freeboard to contain precipitation.

(d) *Facility transfer operations, pumping, and facility process.* (1) Provide buried piping that is installed or replaced on or after August 16, 2002, with a protective wrapping and coating. You must also cathodically protect such buried piping installations or otherwise satisfy the corrosion protection standards for piping in part 280 of this chapter or a State program approved under part 281 of this chapter. If a section of buried line is exposed for any reason, you must carefully inspect it for deterioration. If you find corrosion damage,

you must undertake additional examination and corrective action as indicated by the magnitude of the damage.

(2) Cap or blank-flange the terminal connection at the transfer point and mark it as to origin when piping is not in service or is in standby service for an extended time.

(3) Properly design pipe supports to minimize abrasion and corrosion and allow for expansion and contraction.

(4) Regularly inspect all aboveground valves, piping, and appurtenances. During the inspection you must assess the general condition of items, such as flange joints, expansion joints, valve glands and bodies, catch pans, pipeline supports, locking of valves, and metal surfaces. You must also conduct integrity and leak testing of buried piping at the time of installation, modification, construction, relocation, or replacement.

(5) Warn all vehicles entering the facility to be sure that no vehicle will endanger aboveground piping or other oil transfer operations.

§ 112.9 Spill Prevention, Control, and Countermeasure Plan requirements for onshore oil production facilities.

If you are the owner or operator of an onshore production facility, you must:

(a) Meet the general requirements for the Plan listed under § 112.7, and the specific discharge prevention and containment procedures listed under this section.

(b) *Oil production facility drainage.* (1) At tank batteries and separation and treating areas where there is a reasonable possibility of a discharge as described in § 112.1(b), close and seal at all times drains of dikes or drains of equivalent measures required under § 112.7(c)(1), except when draining uncontaminated rainwater. Prior to drainage, you must inspect the diked area and take action as provided in § 112.8(c)(3)(ii), (iii), and (iv). You must remove accumulated oil on the rainwater and return it to storage or dispose of it in accordance with legally approved methods.

(2) Inspect at regularly scheduled intervals field drainage systems (such as drainage ditches or road ditches), and oil traps, sumps, or skimmers, for an accumulation of oil that may have resulted from any small discharge. You must promptly remove any accumulations of oil.

(c) *Oil production facility bulk storage containers.* (1) Not use a container for the storage of oil unless its material and construction are compatible with the material stored and the conditions of storage.

(2) Provide all tank battery, separation, and treating facility installations with a secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. You must safely confine drainage from undiked areas in a catchment basin or holding pond.

(3) Periodically and upon a regular schedule visually inspect each container of oil for deterioration and maintenance needs, including the foundation and support of each container that is on or above the surface of the ground.

(4) Engineer or update new and old tank battery installations in accordance with good engineering practice to prevent discharges. You must provide at least one of the following:

(i) Container capacity adequate to assure that a container will not overfill if a pumper/gauger is delayed in making regularly scheduled rounds.

(ii) Overflow equalizing lines between containers so that a full container can overflow to an adjacent container.

(iii) Vacuum protection adequate to prevent container collapse during a pipeline run or other transfer of oil from the container.

(iv) High level sensors to generate and transmit an alarm signal to the computer where the facility is subject to a computer production control system.

(d) *Facility transfer operations, oil production facility.* (1) Periodically and upon a regular schedule inspect all aboveground valves and piping associated with transfer operations for the general condition of flange joints, valve glands and bodies, drip pans, pipe supports, pumping well polish rod stuffing boxes, bleeder and gauge valves, and other such items.

(2) Inspect saltwater (oil field brine) disposal facilities often, particularly

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 10I

Sideslope Riser & Force Main Loading Calculations

CHEASAPEAKE TERRACE RUBBLE LANDFILL
FORCE MAIN PIPE SELECTION
[for Century Engineering]

JCO
10-25-05

Design Criteria:
- 5 Separate Forcemains
- 16 Pumps/ Cells
- Use 6" HDPE SDR 11 Pipe
- Assume all pumps running/ full flow
- Use 2" or 3" pipe inside riser
- Top of riser for Pumps 1 & 16 located above top of tank

- Pump manufacturer's "Cell Pump List" for 16 cells and the following data were furnished by Century:

[Pump #]	[Static Head, ft.]	[Design Flow, GPM]	[Pipe Length, ft.]	[Pipe Size, in.]
1	28.5	50 {44 Actual}	1048	6
2	18.5	50 {29 " }	1135	6
3	48.5	100 {65 " }	2231	6
4	48.0	100 {73 " }	3058	6
5	119	100 {109 " }	688	6
6	118.5	50 {44 " }	1088	6
7	119.5	100 {94 " }	1306	6
8	117	50 {51 " }	1977	6
9	117	50 {44 " }	2909	6
10	117	100 {80 " }	3431	6
11	48.5	50 {51 " }	706	6
12	45.0	50 {44 " }	1587	6
13	45.5	50 {29 " }	2316	6
14	43.5	50 {36 " }	2962	6
15	42.0	50 {36 " }	3556	6
16	56.5	50 {29 " }	1305	6

Friction loss will be calculated using the following equation:
The Hazen-Williams formula
Ff = .2083 x [Q]1.85/ [d]4.8655 x [100/ C]1.85

Where: Ff = friction loss, ft./ 100 ft.
Q = flow, GPM
d = pipe I.D., in.
C = flow coefficient, use 150 for HDPE pipe
Therefore, Ff = .2083 x [Q]1.85/ [d]4.8655 x .47

6" SDR 11/ I.D. = 5.35 in.
3" SDR 11/ I.D. = 2.83 in.
2" SDR 11/ I.D. = 1.92 in.

[Forcemain #1]

{Pump #1}
- 6" Pipe @ 520 l.f. w/ 50 GPM, Ff = .2
- 6" Pipe @ 528 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 64 l.f. w/ 50 GPM, Ff = 3.6

Total TDH = 28.5 + .2 + 5.6 + 3.6 = 37.9

{Pump #2}
- 6" Pipe @ 609 l.f. w/ 250 GPM, Ff = 4.7
- 6" Pipe @ 526 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 20 l.f. w/ 50 GPM, Ff = 1.1

Total TDH = 18.5 + 4.7 + 5.6 + 1.1 = 29.9

{Pump #3}
- 6" Pipe @ 1096 l.f. w/ 200 GPM, Ff = 5.6
- 6" Pipe @ 609 l.f. w/ 250 GPM, Ff = 4.7
- 6" Pipe @ 526 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 42 l.f. w/ 50 GPM, Ff = 8.6

Total TDH = 48.5 + 5.6 + 4.7 + 5.6 + 8.6 = 73.0

{Pump #4}
- 6" Pipe @ 827 l.f. w/ 100 GPM, Ff = 1.2
- 6" Pipe @ 1096 l.f. w/ 200 GPM, Ff = 5.6
- 6" Pipe @ 512 l.f. w/ 250 GPM, Ff = 4.7
- 6" Pipe @ 526 l.f. w/ 300 GPM, Ff = 5.6
- 2" Pipe @ 94 l.f. w/ 100 GPM, Ff = 19.3

Total TDH = 48 + 1.2 + 5.6 + 4.7 + 5.6 + 19.3 = 84.4

[Forcemain #2]

{Pump #5}
- 6" Pipe @ 688 l.f. w/ 250 GPM, Ff = 5.3
- 3" Pipe @ 187 l.f. w/ 100 GPM, Ff = 5.8

Total TDH = 119 + 5.3 + 5.8 = 130.1

{Pump #6}
- 6" Pipe @ 400 l.f. w/ 150 GPM, Ff = 1.2
- 6" Pipe @ 688 l.f. w/ 250 GPM, Ff = 5.3
- 2" Pipe @ 175 l.f. w/ 50 GPM, Ff = 10.0

Total TDH = 118.5 + 1.2 + 5.3 + 10.0 = 135.0

{Pump #7}
- 6" Pipe @ 218 l.f. w/ 100 GPM, Ff = .3
- 6" Pipe @ 400 l.f. w/ 150 GPM, Ff = 1.2
- 6" Pipe @ 688 l.f. w/ 250 GPM, Ff = 5.3
- 3" Pipe @ 168 l.f. w/ 100 GPM, Ff = 5.2

Total TDH = 119.5 + .3 + 1.2 + 5.3 + 5.2 = 131.5

[Forcemain #3]

{Pump #8}
- 6" Pipe @ 1977 l.f. w/ 200 GPM, Ff = 10.0
- 2" Pipe @ 180 l.f. w/ 50 GPM, Ff = 10.3

Total TDH = 117 + 10.0 + 10.3 = 137.3

{Pump #9}
- 6" Pipe @ 932 l.f. w/ 150 GPM, Ff = 2.8
- 6" Pipe @ 1977 l.f .w/ 200 GPM, Ff = 10.0
- 2" Pipe @ 158 l.f. w/ 50 GPM, Ff = 9.0

Total TDH = 117 + 2.8 + 10.0 + 9.0 = 138.8

{Pump #10}
- 6" Pipe @ 522 l.f. w/ 100 GPM, Ff = .7
- 6" Pipe @ 932 l.f. w/ 150 GPM, Ff = 2.8
- 6" Pipe @ 1977 l.f. w/ 200 GPM, Ff = 10.0
- 3" Pipe @ 130 l.f. w/ 100 GPM, Ff = 4.0

Total TDH = 117 + .7 + 2.8 + 10.0 + 4.0 = 134.5

[Forcemain #4]

{Pump #11}

- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 22 l.f. w/ 50 GPM, Ff = 1.3

Total TDH = 40.5 + 5.4 + 1.3 = 47.2

{Pump #12}
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 22 l.f. w/ 50 GPM, Ff = 1.3

Total TDH = 45 + 4.4 + 5.4 + 1.3 = 56.1

{Pump #13}
- 6" Pipe @ 729 l.f. w/ 150 GPM, Ff = 2.2
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 21 l.f. w/ 50 GPM, Ff = 1.2

Total TDH = 45.5 + 2.2 + 4.4 + 5.4 + 1.2 = 58.7

{Pump #14}
- 6" Pipe @ 646 l.f. w/ 100 GPM, Ff = .9
- 6" Pipe @ 729 l.f. w/ 150 GPM, Ff = 2.2
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 37 l.f. w/ 50 GPM, Ff = 2.1

Total TDH = 43.5 + 9 + 2.2 + 4.4 + 5.4 + 2.1 = 58.5

{Pump #15}
- 6" Pipe @ 594 l.f. w/ 50 GPM, Ff = .2
- 6" Pipe @ 646 l.f. w/ 100 GPM, Ff = .9
- 6" Pipe @ 729 l.f. w/ 150 GPM, Ff = 2.2
- 6" Pipe @ 881 l.f. w/ 200 GPM, Ff = 4.4
- 6" Pipe @ 706 l.f. w/ 250 GPM, Ff = 5.4
- 2" Pipe @ 57 l.f w/ 50 GPM, Ff = 3.2

Total TDH = 42 + .2 + .9 + 2.2 + 4.4 + 5.4 + 3.2 = 58.3

[Forcemain #5]

{Pump #16}
- 6" Pipe @ 1305 l.f. w/ 50 GPM, Ff = .5
- 2" Pipe @ 126 l.f. w/ 50 GPM, Ff = 7.2

Total TDH = 56.5 + .5 + 7.2 = 64.2

Summary and Conclusion:

1. All flow calculations for TDH made using the Hazen-Williams formula.
2. The flow coefficient used was 150 for HDPE.

Based on above calculations and data from the pump manufacturer's "Cell Pump List", 6" HDPE will function properly for site's 5 forcemain systems.

ATTACHMENT 10J

Environmental Recovery Corp. Leachate Disposal Letter

ERC Acceptance Parameters

Liquid for WWT

- PH must be >2.01 and <12.49
- Flash Point must be >100°F
- Water - PCB's must be <3 ppb (case-by-case)
- Oil – PCB's must be <2 ppm
- Liquid <10% Solids

Pit Solidification

- PH must be >2.01 and <12.49
- Flash Point must be >140°F
- Water - with PCB's <35 ppm
- Oil - with PCB's >1 ppm
- Oxidizers will be rejected
- Waste cannot be reactive

Anything that ends in "OL" i.e. Glycol, Alcohol, are water soluble organics and won't treat due to raising the Biological Oxygen Demand (BOD) causing it to go to the Pit for Solidification. ERC limit is 300 ppm.

Glycol Limits

Non-Hazardous Treatable Water 0% - <10% Glycol – Treatable
Non-Hazardous Treatable Water 0% - >10% to <19% Glycol – Treatable
Non-Hazardous Treatable Water >19% Glycol – Pit Solidification

ERC can accept DOT shipping name
ERC cannot accept EPA regulated waste
ERC can accept Hazardous Material
ERC cannot process Hazardous Waste

Direct all questions to the Lab Manager

1076 Old Manheim Pike * Lancaster, PA 17601 * Phone (717) 393-2627 * Fax (717) 393-0432

7/26/2021

Proposal ID#: 003476 Quote ID# Q004407

Michael Baudinet
Montrose Environmental
1 Park Plaza unit 1000
Irvine CA 92614

Dear Michael,

Thank you for allowing Environmental Recovery Corporation (ERC) to provide this proposal, and thereby allowing us the opportunity to form a partnership with you and your organization. We look forward to sharing our knowledge of the industry to better serve your disposal and recycling sustainability goals.

Scope: Recycling/Processing/Disposal of Non-Hazardous (NH) Bulk Liquid Residual Waste by ERC – Disposal only- Leachate from Odenton, MD

Bulk Liquid Waste

Waste Water Treatment (WWT) NH Liquids **$0.21 / Gallon**

- All waste water loads containing oil will be subject to a $0/gallon surcharge based on the number of gallons of oil, ERC will notify the customer of the additional charges via change order.
- All loads are subject to a 1000-gallon minimum charge
- If the TX levels exceed 3,000PPM ERC will offer alternative processing options and will notify the customer of the additional charges via change order.
- All waste water loads containing 10% to 19% water soluble organics will be subject to a $0.35/ gallon surcharge, ERC will notify the customer of the additional charges via change order.
- If the PCB levels exceed 3 ppb customer will be notified of alternative processing options and price

Single Stream Treatment (SST) NH Liquids **$0.70 / Gallon**

- All loads are subject to a 1000-gallon minimum charge
- Liquid waste streams that are incompatible with our bulk WWT system may be a candidate for our SST, customized, treatment system for recycling
- If the PCB levels exceed 3 ppb customer will be notified of alternative processing options and price

Solidification (PIT) NH Liquid to Landfill **$0.80 / Gallon**

- All PIT loads will be redirected to our Lancaster, PA facility for service, based on availability. If you choose to pump off the waste at our Baltimore, MD facility it will be subject to a $0.15 per gallon transportation transfer charge.
- All loads are subject to a 300-gallon minimum charge
- The per gallon rate is based on the waste received weighing < 10lbs/gallon
- All PIT loads are subject to a scale fee of $15.00/load

Lab Fee **$78.00 / Load**

If a liquid bulk waste stream is received and determined to be "un-treatable" by the ERC PA Certified Laboratory bench test, a change order will be issued to your company contact outlining new pricing for the proper processing according to the Laboratory results. Your company contact will be required to approve the new pricing for processing prior to offloading. The customer will incur all additional charges that apply.

Materials profiled, manifested, and received at ERC as Non-Hazardous Waste and determined to be Hazardous will be rejected.

If the waste is determined to contain PCB's through the ERC PA Certified Laboratory, ERC reserves the right to apply surcharges accordingly and, in some cases, reject the load in its entirety. If the PCB content is <50ppm and is from a source that is <50ppm may be able to process the waste for landfill. If the waste is determined to contain >50 ppm ERC will reject the load, and, in all cases, the customer/generator will incur the Laboratory Fees.

Weekend Opening Fee **$510.00 / 1st 3 Hours**

- Must be prescheduled and is based on availability
- $155.00/hour will be billed in ¼ hour increments after first 3 hours

A signed copy of this Proposal and completed Waste Profile must be receive by ERC prior to accepting waste to be processed at our facility.

By signing below, you are agreeing to do business under the ERC Terms and Conditions. If you have not already signed and returned the ERC Terms and Conditions, you must do so prior to ERC providing proposed services.

Pricing referenced in this proposal is guaranteed for a period of thirty (30) days from date of the proposal indicated above.

We are truly grateful for the opportunity to present you with this proposal and look forward to working to provide total solutions in the quest to meet your sustainability goals. Please feel free to contact me with additional questions -or- service needs.



Sincerely,

Michelle Birmingham
Account Executive
443-517-7490
mbirmingham@ercofmd.com

Montrose Environmental

Proposal ID#: 003476 Quote ID# Q004407

Signature - Michelle Birmingham	Signature - Baudinet, Michael
Date	Date

SECTION 11

LANDFILL GAS MANAGEMENT PLAN

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11.0 LANDFILL GAS MANAGEMENT PLAN

11.1 General

This *Landfill Gas Management (LFG) Plan (LFGMP)* has been developed for the proposed Chesapeake Terrace Rubble Landfill to identify the landfill gas control and monitoring procedures and activities to be performed during the operation, closure, and post-closure periods of the landfill. The purpose of this LFGMP is to ensure that decomposition gases generated by the landfill are controlled to protect public health, safety, and the environment.

11.1.1 Nature and Composition of Landfill Decomposition Gases

Following placement of rubble fill in a disposal area, aerobic and anaerobic processes immediately begin degrading the waste. The degradation processes produce heat, water, and decomposition gases. A significant component of the decomposition gas is methane, which can account for approximately 40% of the decomposition gas that is generated. The remainder of decomposition gas is generally composed of carbon dioxide, hydrogen sulfide, carbon monoxide, nitrogen oxides, and trace amounts, typically less than 1% by volume, of contaminants known as "non-methane organic compounds" or NMOCs.

The methane component of landfill decomposition gas is generally the component of concern due to the relatively low explosive limit. In the pure form, methane is lighter than air, is clear and odorless. The lower explosive limit (LEL) for methane is 5% methane by volume and the upper explosive limit (UEL) is 15% by volume. Concentrations below 5% by volume will not ignite. Concentrations above 15% can ignite, but will not explode (NIOSH, 1997). The hydrogen sulfide component of rubble landfill decomposition gases may also be of concern due to the toxicity and odor.

11.1.2 Methane Compliance Limits

Pursuant to 26.04.07.21(5) of the Code of Maryland Regulations (COMAR), the compliance limits for methane gas are as follows:

- The Compliance Level for methane in facility structures, excluding gas control and recovery system components, is 25% of the LEL for methane, or 1.25% methane by volume; and,
- The Compliance Level for methane at the facility property boundary is 100% of the LEL for methane, or 5.0% methane by volume.

While this COMAR citation is for “municipal landfill”, LFG can be an issue at rubble landfills depending upon the mixture of rubble waste disposed at any facility. This LFG system has been designed to provide active extraction, collection, and removal. If, during the course of operating the landfill, less waste that would contribute to higher levels of methane is placed, National Waste Managers (NWM) may pursue a permit modifications to downgrade the LFG Management System to a passive system instead of the active system describe herein.

11.2 Landfill Gas Generation Potential

The proposed Chesapeake Terrace Rubble Landfill is a rubble, or construction and demolition debris, landfill located in Anne Arundel County, Maryland, approximately 3 miles northwest of Crofton on State Route 424. The landfill is separated into two areas, designated as the West Section and the East Section. In general, the landfill is bounded on the west by the Patuxent Research Refuge, to the north and east by Patuxent Road, and to the south by Conway Road, across which is agricultural land and residential development.

The proposed Chesapeake Terrace Rubble Landfill will accept construction and demolition (C&D) debris waste (e.g., soil, concrete, brick, wood, metal, green waste – Refer to Section 2). Approximately 114.4 acres of the property on which the landfill is sited are proposed for waste disposal activities. The permitted waste disposal area is divided into two separate footprints, the West Section comprising approximately 83.8 acres and the East Section comprising approximately 30.6 acres. NWM expects the Landfill to provide approximately 12 years of life for construction demolition debris (C&D) disposal.

The amount and rate of landfill gas production within a landfill is dependent on several factors including:

- The amount of waste in-place;
- Waste composition;
- Waste moisture content and pH;
- Waste temperature;
- Quantity and quality of nutrients in the waste; and,
- Composition and effectiveness of the cover and cap materials.

The typical municipal waste stream is high in cellulose content (food waste, office paper), will produce large amounts of landfill gas in a short period of time due to their rapid degradation. A rubble, or C&D landfill accepting the materials described above has a waste stream consisting of components with high lignin content that will produce lower volumes of landfill gas over a longer period of time.

The landfill gas generation rates have been predicted using the Landfill Gas Emissions Model (LandGEM) version 3.02 produced by the United States Environmental Protection Agency (USEPA). The model inputs include the anticipated refuse placement rates, a gas generation rate (k), a gas generation potential (L_o), and concentration of NMOCs (C_{NMOC}). The anticipated refuse placement rates are assumed to be 1,602 tons per day with 260 working days per year. The model was analyzed with the AP-42 default parameters as follows:

- $k = 0.04\ yr^{-1}$
- $L_o = 100\ m^3/Mg$
- C_{NMOC} = 600 parts per million (by volume) as hexane

It is assumed that the methane concentration is 40%. The results of the model are provided in Attachment 11A. The peak landfill gas generation occurs in 2036 (based on a start of filling in 2024), which coincides with the final closure cap construction period, and is 2,430 standard cubic feet per minute (SCFM) of landfill gas. The blowers and piping will be sized based on this maximum production rate corrected for collection efficiency of 75%, providing a conservative size for the majority of significant landfill gas production period.

11.3 Landfill Gas Monitoring System

Pursuant to COMAR 26.04.07.21(5), the LFG monitoring system for this facility has been designed to ensure the detection of decomposition gases prior to migration beyond the facility property boundary, into facility structures, or other structures located within the property boundary. To monitor this facility, a perimeter system of subsurface gas probes is proposed. The perimeter system (described in the following section) has been designed based on the subsurface conditions, surrounding property usage, the location of surface water bodies, the depth of the groundwater table, and in consideration of potential preferential flow pathways in the vadose zone, both natural and man-made. The perimeter system shall be in place prior to placement of waste in the landfill to ensure that landfill gas does not exceed the lower explosive limit (LEL) at the landfill property boundary or 25 percent of the LEL in facility structures.

11.3.1 Perimeter System

Pursuant to COMAR 26.04.07.21(5), solid waste disposal facilities are required to maintain a gas monitoring network capable of detecting the presence of decomposition gas in the vadose zone at the facility property boundary. The perimeter system proposed herein is designed to detect the presence of decomposition gases adjacent to the facility and within the facility property boundary. Gas probe spacing is at a maximum of 400 feet on center. The spacing of the gas probes is based on Maryland Department of the Environment (MDE) requirements. This landfill gas monitoring network consists of forty (40) gas probes to provide the necessary monitoring components for routinely determining compliance with COMAR 26.04.07.21(5) regulation. The gas monitoring probe plan is found on Drawing 85.

11.3.1.1 Perimeter Probe Construction

Boreholes for the proposed gas probes will be advanced using a mechanical drill rig equipped with 4.25-inch inside diameter hollow stem augers. During advancement of the soil borings, soil samples will be collected and logged in the field. Field descriptions will be transcribed to soil boring logs for future reference as needed. Boreholes will be advanced to the water table or the underlying low permeability clay confining layer, where present, to ensure that the entire vadose zone is monitored for the landfill decomposition gases.

The screened portions of the probes will be constructed from 1-inch inside diameter schedule 40 PVC casing slotted with two rows of 1/4-inch wide by 3-inch tall slots, 6 inches on-center, staggered, and offset 90 degrees. Following placement of the probe casing and screen, the annular space in the borehole will be backfilled to 3 feet below grade with washed pea gravel (minimum sieve size of 3/8-inch). Following placement of the gravel pack, a minimum 1-foot thick hydrated bentonite seal will be placed.

The remaining annular space in the borehole will be filled with concrete during placement of the locking well head and protective surface pad. The gas probes will be equipped with a 5/16-inch or similar size acetyl or polypropylene male quick-connect fitting with a built-in shut-off valve to facilitate instantaneous gas pressure readings during monitoring. Following placement of the protective casing, each probe will be affixed with a high visibility label identifying the probe number. Following construction of the probes, a surveyor licensed in the State of Maryland will locate the probes and obtain elevation data for the top of the PVC casings. Gas monitoring probe construction details are found on Drawing 88.

Soil boring and probe construction logs will be completed for the gas probes and retained with the facility's records. Soil boring logs will identify the method of drilling, subsurface soils and moisture conditions encountered during advancement of the soil borings, and total depth of the borings. Probe construction logs will identify materials used for construction of the probes, depth of the probe, top of the screen, and survey information.

11.3.2 Facility Structures

Pursuant to COMAR 26.04.07.21(5)(a), facility operators are required to include facility structures, exclusive of gas control or recovery system components, that are located on the waste mass or within 1,000 feet proximity to the waste mass. Based on these criteria, the monitored structures will include the equipment maintenance building(s), cell pump houses, Leachate Storage Facility control buildings, wheel wash building (if a closed building – or capable of being closed), and scale house(s).

11.3.3 LFG Monitoring Probe and Facility Structure Monitoring Procedures

The following sections outline the recommended procedures for performing required probe and facility structure monitoring for methane gas.

11.3.3.1 Monitoring Equipment

The GEM-500 or GEM-2000, or the latest version thereof, is the preferred monitoring device for monitoring probes and facility structures. Alternatively, a digital or analog manometer combined with a vacuum pump equipped monitoring device designed to measure methane gas concentrations (e.g., Industrial Scientific Gas Monitoring Meter) can be used for probe and facility structure monitoring.

In addition to the monitoring device(s), the following equipment and documents should be readily available during monitoring events.

- A copy of the facility's Landfill Gas Management Plan, and the project specific Health and Safety Plan. All documents should be reviewed by sampling personnel prior to leaving the office;
- Copy of the Standard Operating Guidance and the Operation Manual(s) for the equipment being used during monitoring;
- Blank copies of a Landfill Gas Monitoring Log. A sample Landfill Gas Monitoring Log is provided as Attachment 11DI;
- Calibration gas;
- Barometer (if available);
- Personal protection equipment (site specific);
- Field book;
- Waterproof pen;
- Calculator; and,
- Necessary keys (site specific).

11.3.3.2 Equipment Calibration

Gas monitoring equipment should be calibrated prior to each day's use in the field. Generally, one calibration per day is sufficient. In some instances where highly variable concentrations are being observed, it may be necessary to re-calibrate the monitoring device during the work day to ensure that instrument drift is minimal. Instrument drift can be checked with a calibration gas of known concentration. If more than a 3% differential is observed between the instrument reading and the gas standard during an instrument drift check, the unit should be recalibrated.

Calibration should be performed in accordance with the instrument manufacturer's recommendations using an approved gas standard. Generally, when monitoring probes, it is best to calibrate the unit with a standard composed of 15% or less methane. Calibration activities should be documented on a calibration log form or on the landfill gas monitoring log for future reference.

11.3.3.3 Field Observations

After calibrating the monitoring instrument, record the weather conditions at the site, including the barometric pressure and ambient temperature. The temperature and barometric pressure should be logged at the beginning and ending of each field day. Site specific barometric pressure readings are preferred. In the event that a barometer is not available, barometric pressure readings from a nearby weather station can be used.

Required monitoring measurements and observations should be recorded, in duplicate, on a monitoring log and in a field book, as a backup record keeping procedure. If the monitoring is performed with a device that electronically saves the monitoring measurements, the monitoring results should be recorded in a field book or on a field log after logging the data in the event that the monitoring device's memory is corrupted prior to downloading the information.

11.3.3.4 Reading Gas Levels at Probes and Facility Structures

Prior to monitoring the methane concentration in a probe or a facility structure, it is necessary to gauge the static pressure in the probe using a manometer. Ideally, the manometer, which must be "zeroed" prior to each usage, should measure pressure in inches of water. For monitoring probes, after zeroing the manometer, connect the quick connect fitting to the probe fitting and record the pressure on the monitoring log, noting if the pressure is negative or positive. For facility structures, place the monitoring device central to the facility or in the low point of the structure and take a reading with the quick connect fitting open to the atmosphere. In addition to quarterly monitoring of facility structures, a continuous methane monitoring device will be installed to alert occupants when 25% of the LEL is met or exceeded.

If the probe pressure is positive, connect the gas monitoring device to the probe using the quick-connect fitting, activate the vacuum pump, and record the steady-state concentrations of methane and any other gases of interest.

If the probe pressure is negative or zero, connect the gas monitoring device to the probe using the quick-connect fitting, activate the vacuum pump, and purge two casing volumes of air from the probe. After purging of the probe is complete, record the highest observed methane concentration, steady-state methane concentration and any other gases of interest.

Prior to mobilizing to the next probe, record the time of monitoring.

11.3.3.5 Monitoring Wrap-up

After required monitoring has been completed, a completed copy of the monitoring results should be placed in the facility's operating record.

If any exceedances of the methane compliance level are noted in a facility probe, the facility operator should be notified of the exceedances prior to leaving the site. If methane is detected above the 25% LEL limit in a facility structure, the facility operator should be notified as soon as possible.

11.3.4 Monitoring Parameters

Pursuant to COMAR, perimeter gas probes shall be monitored for methane and pressure, and facility structures shall be monitored for methane. The monitoring parameters for this facility are as follows:

- Instantaneous pressure (perimeter probes only);
- Percent methane;
- Percent oxygen; and,
- Percent carbon dioxide.

An example landfill gas probe monitoring log is presented in Attachment 11D.

11.3.5 Monitoring Frequency

In accordance with USEPA requirements, facility structures and perimeter probes that are part of the facility's landfill gas monitoring network shall be monitored on a quarterly (approximately every 3 months) basis. Monitoring results along with the probe location drawing will be forwarded to MDE on a semi-annual basis. Quarterly gas monitoring will continue throughout the

life of the facility and will continue, at a minimum, until the 5-year post-closure period has ended. The permittee may petition MDE for a reduction in sampling frequency after the 5-year post closure period, if a reduction is supported by the data.

In the event that the methane compliance level is exceeded, the monitoring frequency will increase to monthly until three consecutive months have passed without a methane compliance level exceedance, at which time the monitoring frequency will revert to quarterly.

11.4 Monitoring Results Evaluation and Response

Requirements for record keeping, and in the event of a methane compliance level exceedance, for notifications and mitigation are presented in the following sections.

11.4.1 Record Keeping Requirements

LFG monitoring results shall be maintained by the facility operator for the life of the facility and the post-closure care period. At a minimum, these records shall identify the following:

- Date and time of monitoring;
- Concentration of methane (maximum and steady state), oxygen, and carbon dioxide recorded in each gas probe and facility structure;
- Probe pressure, atmospheric temperature, and barometric pressure;
- A description of the weather conditions during the monitoring event;
- Name(s) of the personnel performing the monitoring activities;
- Description of the monitoring device used to perform the monitoring;
- Description of the procedures used to perform the monitoring activities; and,
- A number system to correlate monitoring results to specific locations.

11.4.2 Notification Requirements

If the compliance level for methane (25% of the LEL in facility structures and 100% of the LEL at the facility boundary) is exceeded based on steady state results, the facility operator shall perform the following activities:

- Take immediate steps, as necessary, to protect human health and safety. Depending on the location of the elevated methane gas concentration, immediate remedial action may consist of evacuation of impacted structures, venting of subsurface utility conduits or crawl spaces, or other measures deemed protective of human health and safety based on the risk level identified in association with the detected methane concentrations;
- Notify the MDE in writing within 24 hours, identifying the compliance level exceedance. The notification shall identify the location(s) of the exceedance(s) and activities that have been completed or are planned to mitigate the compliance level exceedance(s);
- Implement monthly monitoring of the affected probes until such time as three consecutive months have passed during which the methane gas concentration in the affected probes has been less than the methane compliance limit. In the event an on-site or off-site structure designed for human occupation is determined to be impacted, monitoring of the structure once the initial methane gas has been dispersed will be implemented with one, or more, real-time continuous ambient gas monitoring devices, as determined by the site engineer. The monitoring devices shall be equipped with a visual or audible alarm system that is designed to activate at 10% of the LEL for methane (0.5 percent by volume).

- In the event that a subsurface conduit, excluding conduits associated with the facility's leachate collection and LFG collection systems, has been impacted, monitoring of the ambient headspace within the conduit shall be conducted monthly, with more frequent monitoring performed as required by the site engineer in the event that access is required to the conduit by utility, contract, or site workers. Monitoring of the conduit will be conducted until three consecutive monthly readings with no exceedances of the methane regulatory limit have been recorded; and,
- Within 60 days of identifying the compliance level exceedance(s), implement a remediation plan for the methane gas releases and submit it to the MDE for approval and amendment of the facility's permit. The plan shall describe the nature and extent of the problem and the proposed remedy.

11.4.3 Landfill Gas Remediation Plan Requirements

Pursuant to industry standards, the *Landfill Gas Remediation Plan* shall identify the nature and extent of the landfill gas impacts and describe the proposed remedial action for mitigating the impacts. Gas control systems proposed in a *Landfill Gas Remediation Plan* shall be designed to:

- Prevent methane accumulation in on-site structures;
- Prevent methane compliance level exceedances at the facility boundary;
- Provide for the collection, treatment, and destruction/disposal of decomposition gases and condensate; and,
- Comply with Clean Air Act requirements, as applicable.

11.5 Gas Control System

Pursuant to COMAR 26.04.07.03B(9), an active LFG extraction system including ninety-nine (99) active gas wells is proposed to be constructed in the landfill rubble waste mass for the purpose of collecting and controlling landfill gas. As shown on Drawings 86 and 87, the landfill is separated into a West Section and an East Section that contain rubble cells 1 through 10 and 11 through 16 respectively. Blowers and flare will be located in the flare paddock, located as shown on the drawings. The blowers (including knock-out tank and filter), control panels and flare, will be pre-manufactured skid or modular units. Details of the system design are presented on Drawings 86 through 88, as described in the following sections.

11.5.1 Gas Well Construction Specifications

All landfill gas extraction (LFGE) well borehole locations will be surveyed prior to construction for accurate placement and calculation of drilling depths. Boreholes for construction of the gas wells will be advanced using a 36-inch-diameter borehole. The boreholes will extend from the landfill surface to 10 feet above the low permeability components (i.e., geomembrane) of the liner system. A preliminary table of the gas well construction is provided as Table 11-1.

LFGE wells will be constructed from 6-inch diameter SDR-11 high density polyethylene (HDPE) pipe and will be screened from 10 feet below the landfill surface to 1 foot above the bottom of the borehole. If wells are constructed in a closed area, the casings will be extend through the 40-mil closure system geomembrane and sealed with a manufactured or field fabricated geomembrane boot. The annular space around the well screen will be backfilled with 1" to 3" washed gravel to approximately 9 feet below the landfill surface. The remaining annular space will be backfilled on top of a geo-fabric donut with a bentonite seal 2 feet thick and clean backfill to grade. The wells' casings will be extended to a minimum of 4 feet above the landfill surface, and will then be tied into the header/lateral system using a well head equipped with sample ports and a control valve as depicted on Drawing 88.

Following completion of the gas wells, the gas wells will be surveyed and a well construction log for each gas well (identifying the method of borehole advancement, subsurface materials, excavated waste temperatures, and well construction details) will be prepared by the Quality Assurance Contractor for gas well construction.

11.5.2 Construction Schedule

The construction of gas wells will follow filling operations of areas brought to or near design grades. The owner, at his/her discretion, may expand the gas system as they find necessary provided the rubble waste is of sufficient thickness for gas well installation.

11.6 Blowers and Related Equipment

The centrifugal blower system acts as the driving force to transfer the landfill gas from the interior of the landfill through the piping network and into the flare system for subsequent combustion. The blower system will be equipped with two parallel blowers that may be operated independently to provide backup should the operating blower fail or operated together to provide increased capacity.

11.6.1 Blower Sizing

The breakdown of peak gas generation amount and year between the East and West Sections based on separate LandGEM modeling are 721 SCFM in 2027 for the East Section and 2,102 SCSM in 2037 for the West Section. When modeled together the peak generation rate is 2,430 SCFM in 2036. We have sized the Flare Paddock to accommodate separate modular or skid mounted gas recovery and destruction systems. Detailed design will be prepared by the landfill gas system manufacturer. The decision to utilize a combined system or separate systems (one for the East Section and one for the West Section) will be based on recommendations from the manufacturer. Assuming that a single combined system will be the preferred configuration, the blower will be specified to transfer 2,430 SCFM of landfill gas from the extraction wells to the flare unit for combustion. The modular/skid mounted unit(s) will include a pre-installed backup blower equal in size to the primary blower. The required size of the blower is determined by the total head loss (measured in inches of water column) generated from the friction encountered to remove and transfer the landfill gas through the piping network and into the flare unit. Microsoft Excel spreadsheet implementing Darcy-Weisbach equation for head loss was created to calculate the total head loss to determine the required vacuum. EPANET was used to model the piping network to understand the volume of LFG flow in each lateral and header as an input parameter in the Darcy-Weisbach equation. The model output is provided in Attachment 11B. The blower shall be sized to provide a vacuum of approximately 50 inches of water column at 87° F.

11.6.2 Blower Construction

The blowers shall be centrifugal type blowers. The advantages and specific design features of this type of blower are listed below:

- Constant efficiency; little wearing of internal parts; ample clearance throughout the blower.
- Since the centrifugal blowers all have outboard mounted bearings, no chance exists for lubricant to contaminate the air stream.
- Variable volume at constant speed - power varies directly with air volume requirement. No special bleed off devices are needed.
- Relatively constant pressure at constant speed.
- Centrifugal blowers produce unusually low noise; silencers are usually not required.
- Relatively lightweight; no special foundation is required.

- Centrifugal blowers produce a smooth non-pulsating air flow when operating at any point beyond the surge limit.
- Since horsepower is in direct proportion to the volumetric demand, an ammeter can be calibrated in CFM to indicate air flow when required.

11.7 Flare System

The flare system for the gas collection control system shall be an enclosed flare unit that meets the requirements of the Code of Federal Regulations, Title 40, Chapter 1, Section 60.18, 40 CFR 60.18. The flare shall guarantee over 98% destruction efficiency of NMOCs, and ensure a maximum exit velocity of 100 ft/sec. The flare is to be equipped with thermocouples mounted near the exit to monitor the flue LFG temperature and detect the presence of a flame. A flame arrestor will be installed in the landfill gas stream leading into the flare to prevent the flame from traveling upstream. The unit will be equipped with a fail-closed valve, which is actuated when a flame is not detected. Other features for the flare include:

- A temperature recorder;
- A flow meter and recorder; and,
- Propane pilot ignition system.

11.8 Landfill Gas System Operation

Operation of the LFGE system will consist primarily of regulating and adjusting the amount of vacuum available at each extraction well through the use of valves. This adjustment of vacuum, and therefore flow rate, is referred to as “balancing” or “tuning” the LFG system. A balanced system is one in which each well is adjusted to extract the maximum amount of LFG possible without causing excessive amounts of air to be pulled through the landfill cover and into the extraction system. Some of the tests performed to balance and ensure the efficient operation of the landfill gas system are:

- Flow rate into the flare;
- Percentage methane into the flare;
- Landfill gas temperature at the moisture separator;
- Percentage methane at each well;
- Vacuum at each well;
- Landfill gas temperature at each well; and,
- Flow rate at each well.

The proposed LFG system for the landfill will operated continuously, 24 hours a day, 365 days a year. A qualified operator will monitor the system operation as well as perform the testing, sampling, and adjustment as detailed on an item by item basis.

11.8.1 Wells

Because methane production in the landfill is dependent upon many factors, the amount of vacuum required to extract the LFG will vary by well and by time during the landfill life cycle. Generally, the vacuum is adjusted to maintain a level at or just below zero (i.e., from -1.0” wc to 0” wc).

In order to achieve and maintain a well-balanced system, vacuum, gas concentration, and LFG temperature are measured monthly at each well. In addition to these monthly tests, flow rates are to be periodically measured to help establish the correlation between vacuum and flow rate at each individual well.

Because LFG is generated at a mixture of approximately 40% methane, methane concentrations of less than 25% may be indicative of excessive air intrusion through the landfill cover.

Conversely, high methane concentrations indicate that more landfill gas is being generated than is being extracted by the well. Therefore, methane concentration is the primary test used to determine if the flow rate should be increased or decreased. Oxygen levels shall be maintained below 3% and wellhead temperatures maintained below 130°F.

Vacuum is measured to establish its relationship with gas concentration and extraction rate at each well. Records are kept of these relationships to aid in determining the optimal flow rate to maximize landfill gas extraction and minimize air intrusion at each well. Instantaneous vacuum readings are to be used to correctly adjust the wellhead valve to the desired vacuum. Abnormal vacuum readings are indicative of and will be used to locate pipe blockages or restrictions caused by pipe failure or water blockage.

Temperature of the LFG will be measured and recorded quarterly at each extraction well to help detect the onset of air intrusion and the corresponding possibility of spontaneous combustion within the landfill. Although temperatures will vary for each LFGE well, they should remain reasonably stable at a particular well. A sharp increase in landfill gas temperature accompanied by a decrease in methane concentration is indicative of combustion within the landfill.

11.8.2 Piping and Condensate Management

Due to the extremely corrosive conditions of the landfill environment, all underground laterals and headers are to be constructed of SDR-11 HDPE or SDR-17 HDPE pipe, or equivalent, piping. HDPE is resistant to the corrosive nature of the LFG and its associated condensate. Also, because of its' flexibility and durability, HDPE is well-suited to withstand the stresses imposed by differential settlement within the landfill.

Valves are located in the header pipe to isolate areas of the system when maintenance, repairs, or new construction is required. This allows the other portions of the system to continue to operate as normal, thereby minimizing system downtime.

The gas collection piping system will utilize condensate sumps to manage liquids accumulating in the gas collection system header pipe within the waste disposal areas. The condensate sumps will be configured as shown on Detail 4 on Drawing 88. Detail 4 on Drawing 88. The sumps will be located at the low spots of the landfill gas piping system. The 3-inch line will have a "J" trap at the connection with the header pipe and an isolation valve down slope of the J Trap. The sump will terminate at the ground surface with a bolted cover/flange connection with waterproof gasket. The bolted flange will be set into a concrete pad.

11.8.3 Blowers and Flare Equipment

A moisture separator (knock out chamber) is an expansion chamber located just upstream of the blowers. As LFG flows through the moisture separator, the decrease in pressure and the subsequent cooling of the LFG allows any remaining water vapor to condense. A liquid level switch on the moisture separator indicates when the liquid must be drained. The drained liquid will be transferred using a pump from the knock out chamber into polyethylene drum or tote (with secondary containment), transported to the leachate tanker loading area and transferred by pump into the leachate storage tanks for handling with the site leachate.

Operation of the blowers will be in accordance with the manufacturers recommended procedures and is to be controlled by switches on the flare control panel and valves located next to each blower unit. The redundant capacity of the blowers will allow the system to continue operating in the event of a mechanical problem in one of the blowers.

11.8.4 Flare System Operation

The system start-up will begin with a timed air purge cycle to remove any hydrocarbons from the flare enclosure. After the purge cycle is completed, the pilot flame is lit by an electrical spark.

Upon proving the pilot flame with the thermocouple, the LFG fail-closed valve is opened and the LFG blower is started, allowing the LFG to flow into the flare enclosure. This allows the use of landfill gas for system warm-up.

After the LFG fail-closed valve has been opened, the pilot gas will then shut off to limit the propane usage. If a flame is still detected on the main burner, the system will continue operation; however, if a flame is not detected, the system will shut down due to flame failure.

The system temperature will be monitored by a thermocouple. If the thermocouple detects a temperature outside a specified operating range, the system will shut itself off. When the blower shuts off, the fail-closed valve is automatically closed to prevent the release of landfill gas from the system. Under normal operating conditions, the system may be set up to attempt to restart automatically. In the event of a failure, the flare will be equipped with a remedial action (i.e., auto-dialer) that will notify the Owners specified officer, to respond within 24 hours of flare failure.

11.9 Maintenance

11.9.1 Wells

All wells are to be inspected quarterly during normal testing as follows:

- Proper operation of valves;
- Leaks in exposed piping, valves, and fittings;
- Settling around wells; and,
- Water buildup in the piping.

11.9.2 Laterals and Headers

Laterals and headers will be inspected yearly by the Owner. There are several issues that can affect the flow of LFG through the piping system. Typical issues are leaks, breaks, and water blockage. If any issues are discovered through testing, sight, or sound, they are to be repaired as soon as possible.

11.9.3 Condensate Drain

The condensate drainsshall be inspected semi-annually. The cover is to be removed, the inside of the inspected for standing liquid, integrity of the cover gasket and dirt buildup. Signs of leakage or damage identified during the inspections shall be repaired as soon as possible.

11.9.4 Blower Maintenance

Two blowers are to be installed to create a redundant capacity in the event that one should fail. Some of the important maintenance items are:

- Lubrication of bearings and motors;
- Inspection of bearing wear;
- Proper valve operation;
- Check for leaks in piping connections and valves;
- Check for vibrations and loose connections;
- Check electrical connections on blower motors and control panel; and,
- Other periodic maintenance recommended by manufacturer.

11.9.5 Flare

The maintenance required for the flare will normally be limited to checking and repairing any items that fail to function properly. The pilot fuel is to be checked monthly to ensure that an

adequate supply is always available. If compressed gas is used to actuate the fail-closed valve, the gas valve and the tank pressure will also be checked monthly.

11.10 References

EPA (United States Environmental Protection Agency), 1991. *Air Emissions from Municipal Solid Waste Landfills - Background Information for Proposed Standards and Guidelines*. EPA/450/3-90/011A. March 1991, 544 pages.

EPA, 2005. *Landfill Gas Emissions Model (LandGEM) Version 3.02 User's Guide*. EPA-600/R05/047. May.

NIOSH (National Institute for Occupational Safety and Health), 1997. *NIOSH Pocket Guide to Chemical Hazards*. United States Department of Health and Human Services, 440 pages.

COMAR (Relative Sections)

TABLES

TABLE 11-1
Landfill Gas Extraction Wells
Chesapeake Terrace Rubble Landfill
Anne Arundel County, Maryland

Well ID	Elevation for Top of Closure Cap (ft MSL)	Elevation for Top of Leachate Collection Layer (ft MSL)	Waste Thickness (feet)	Top of Screen (ft MSL)	Elevation for Bottom of Screen (ft MSL)	Length of Screen (feet)	Screen Length to Waste Depth (%)
EW-1	161	116	41	151	124	27	65.9
EW-2	160	109	47	150	117	33	70.2
EW-3	156	101	51	146	109	37	72.5
EW-4	190	118	68	180	126	54	79.4
EW-5	188	115	69	178	123	55	79.7
EW-6	150	96	50	140	104	36	72.0
EW-7	184	105	75	174	113	61	81.3
EW-8	140	101	35	130	109	21	60.0
EW-9	135	107	24	125	115	10	41.7
EW-10	130	106	20	120	114	6	30.0
EW-11	137	110	23	127	118	9	39.1
EW-12	144	113	27	134	121	13	48.1
EW-13	181	109	68	171	117	54	79.4
EW-14	168	112	52	158	120	38	73.1
EW-15	158	112	42	148	120	28	66.7
EW-16	192	114	74	182	122	60	81.1
EW-17	190	117	69	180	125	55	79.7
EW-18	180	119	57	170	127	43	75.4
EW-19	150	119	27	140	127	13	48.1
EW-20	197	128	65	187	136	51	78.5
EW-21	185	127	54	175	135	40	74.1
EW-22	151	122	25	141	130	11	44.0
EW-23	187	138	45	177	146	31	68.9
EW-24	154	126	24	144	134	10	41.7
EW-25	155	130	21	145	138	7	33.3
EW-26	196	127	65	186	135	51	78.5
EW-27	189	140	45	179	148	31	68.9
EW-28	158	128	26	148	136	12	46.2
EW-29	190	143	43	180	151	29	67.4
EW-30	163	129	30	153	137	16	53.3
EW-31	197	135	58	187	143	44	75.9
EW-32	165	137	24	155	145	10	41.7
EW-33	203	133	66	193	141	52	78.8
EW-34	170	126	40	160	134	26	65.0
EW-35	212	138	70	202	146	56	80.0
EW-36	175	127	44	165	135	30	68.2
EW-37	215	131	80	205	139	66	82.5
EW-38	178	128	46	168	136	32	69.6

TABLE 11-1
Landfill Gas Extraction Wells
Chesapeake Terrace Rubble Landfill
Anne Arundel County, Maryland

Well ID	Elevation for Top of Closure Cap (ft MSL)	Elevation for Top of Leachate Collection Layer (ft MSL)	Waste Thickness (feet)	Top of Screen (ft MSL)	Elevation for Bottom of Screen (ft MSL)	Length of Screen (feet)	Screen Length to Waste Depth (%)
EW-39	217	126	87	207	134	73	83.9
EW-40	180	126	50	170	134	36	72.0
EW-41	217	130	83	207	138	69	83.1
EW-42	184	123	57	174	131	43	75.4
EW-43	194	120	70	184	128	56	80.0
EW-44	205	121	80	195	129	66	82.5
EW-45	222	124	94	212	132	80	85.1
EW-46	224	125	95	214	133	81	85.3
EW-47	210	132	74	200	140	60	81.1
EW-48	224	119	101	214	127	87	86.1
EW-49	218	117	97	208	125	83	85.6
EW-50	212	129	79	202	137	65	82.3
EW-51	220	114	102	210	122	88	86.3
EW-52	187	114	69	177	122	55	79.7
EW-53	202	131	67	192	139	53	79.1
EW-54	192	110	78	182	118	64	82.1
EW-55	188	120	64	178	128	50	78.1
EW-56	217	124	89	207	132	75	84.3
EW-57	223	134	85	213	142	71	83.5
EW-58	182	126	52	172	134	38	73.1
EW-59	217	132	81	207	140	67	82.7
EW-60	182	119	59	172	127	45	76.3
EW-61	211	123	84	201	131	70	83.3
EW-62	210	139	67	200	147	53	79.1
EW-63	181	123	54	171	131	40	74.1
EW-64	206	133	69	196	141	55	79.7
EW-65	201	124	73	191	132	59	80.8
EW-66	206	130	72	196	138	58	80.6
EW-67	175	112	59	165	120	45	76.3
EW-68	192	115	73	182	123	59	80.8
EW-69	198	123	71	188	131	57	80.3
EW-70	198	131	63	188	139	49	77.8
EW-71	166	119	43	156	127	29	67.4
EW-72	189	123	62	179	131	48	77.4
EW-73	195	124	67	185	132	53	79.1
EW-74	197	129	64	187	137	50	78.1
EW-75	196	121	71	186	129	57	80.3
EW-76	126	87	35	116	95	21	60.0

TABLE 11-1
Landfill Gas Extraction Wells
Chesapeake Terrace Rubble Landfill
Anne Arundel County, Maryland

Well ID	Elevation for Top of Closure Cap (ft MSL)	Elevation for Top of Leachate Collection Layer (ft MSL)	Waste Thickness (feet)	Top of Screen (ft MSL)	Elevation for Bottom of Screen (ft MSL)	Length of Screen (feet)	Screen Length to Waste Depth (%)
EW-77	152	89	59	142	97	45	76.3
EW-78	126	80	42	116	88	28	66.7
EW-79	159	93	62	149	101	48	77.4
EW-80	132	91	37	122	99	23	62.2
EW-81	162	102	56	152	110	42	75.0
EW-82	168	92	72	158	100	58	80.6
EW-83	181	101	76	171	109	62	81.6
EW-84	155	99	52	145	107	38	73.1
EW-85	140	90	46	130	98	32	69.6
EW-86	132	92	36	122	100	22	61.1
EW-87	170	92	74	160	100	60	81.1
EW-88	170	98	68	160	106	54	79.4
EW-89	125	86	35	115	94	21	60.0
EW-90	174	93	77	164	101	63	81.8
EW-91	122	81	37	112	89	23	62.2
EW-92	121	88	29	111	96	15	51.7
EW-93	179	99	76	169	107	62	81.6
EW-94	132	90	38	122	98	24	63.2
EW-95	174	92	78	164	100	64	82.1
EW-96	130	88	38	120	96	24	63.2
EW-97	124	90	30	114	98	16	53.3
EW-98	124	86	34	114	94	20	58.8
EW-99	167	96	67	157	104	53	79.1

Notes:

1) Elevations for the top of the final cover and the top of the leachate collection layer were taken from Drawings 32 & 33 and 17 & 18.
2) The final cover system thickness is assumed to be 4 feet.
3) The waste thickness is based upon the difference between the top of final cover and the top of the leachate collection layer minus another 4-feet for the final cover thickness.
4) The wells where the ratio of the screen length compared to the waste thickness is less than sixty percent are shaded yellow. These wells have a ratio less than 60% because these wells are located in areas along the edge of the cells, where achieving the ratio is difficult while also maintaining a minimum distance from the cell floor to protect the liner system and a distance from the top of the final cover to prevent air intrusion into the well.

ATTACHMENT 11A

USEPA LandGEM Model Results

ADVANCED GeoServices a Montrose Environmental Group company	Subject: LandGEM Model		
	Job No. 2018-3854	Made by: TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEP	Sheet 1 of 2

Revised by PGS 08/29/2021

Objective:

To provide the input parameters for the LandGEM Model for the design of the landfill gas extraction system and calculate the maximum landfill gas production rate at the Chesapeake Terrace Rubble Fill.

References:

1. Landfill Gas Emission Model, V. 3.02, USEPA, May 2005.

Calculation:

Model Parameters:

The methane generation rates (k), potential methane generation capacity (L_o), nonmethane organic compounds concentration (C_{NMOC}), and methane constant were assumed to be the AP-42 default values provided in the LandGEM model.

$k = 0.04$ year^{-1}
$L_o = 100$ m^3/Mg
$C_{NMOC} = 600$ ppmv as hexane
Methane Content = 40%

Waste Type	% by Weight
Textiles, rubber, leather, sludge	6
Plastics	2
Glass	3
Cardboard Green Wastes	20
Wood	30
Poorly degradable (soil, concrete, brick)	39
	100

Paper and green waste appear to be the drivers in the methane output. Therefore, AP-42 values appear to be satisfactory.

Waste Design Capacity:

For this site, the model was ran with the following input data:

Operable life: 12 years
Tonnage Rate: ~~2,686~~ 1602 tons per day

ADVANCED GeoServices a Montrose Environmental Group company	Subject: LandGEM Model		
	Job No. 2018-3854	Made by: TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEF	Sheet 2 of 2

Revised by PGS 08/29/2021

Assuming 286 working days (5.5 days/week) per year, the following in-place tonnage is calculated

$$\frac{\text{1602}\ \cancel{2{,}686}\ tons}{day}\left(\frac{\text{260}\ \cancel{286}\ day}{year}\right)(12\ year) = \text{4,998,000}\ \cancel{9{,}200{,}000}\ tons$$

Landfill open year = 2024
Landfill closed year = 2036

$$\text{Yearly rate} = \frac{\text{4,998,000}\ \cancel{9{,}200{,}000}\ tons}{12\ yr} = \text{416,500}\ \cancel{767{,}000}\ \frac{tons}{yr}$$

Note: The resulting values were rounded to the nearest whole number.

Conclusion:

Based on the inputs described herein, the maximum total landfill gas production occurs in year 2036 and is ~~4,472~~ 2,430 scfm. This can be found on page "Report 7" in the attached model results.



Summary Report

Landfill Name or Identifier: Chesapeake Terrace Rubble Fill

Date: Monday, August 30, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)
i = 1-year time increment
n = (year of the calculation) - (initial year of waste acceptance)
j = 0.1-year time increment
k = methane generation rate ($year^{-1}$)
L_o = potential methane generation capacity (m^3/Mg)
M_i = mass of waste accepted in the i^{th} year (Mg)
t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2024**	
Landfill Closure Year (with 80-year limit)	**2036**	
Actual Closure Year (without limit)	***2036***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**5,000,000**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**40**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2024	378,655	416,520	0	0
2025	378,655	416,520	378,655	416,520
2026	378,655	416,520	757,309	833,040
2027	378,655	416,520	1,135,964	1,249,560
2028	378,655	416,520	1,514,618	1,666,080
2029	378,655	416,520	1,893,273	2,082,600
2030	378,655	416,520	2,271,927	2,499,120
2031	378,655	416,520	2,650,582	2,915,640
2032	378,655	416,520	3,029,236	3,332,160
2033	378,655	416,520	3,407,891	3,748,680
2034	378,655	416,520	3,786,545	4,165,200
2035	378,655	416,520	4,165,200	4,581,720
2036	1,600	1,760	4,543,855	4,998,240
2037	0	0	4,545,455	5,000,000
2038	0	0	4,545,455	5,000,000
2039	0	0	4,545,455	5,000,000
2040	0	0	4,545,455	5,000,000
2041	0	0	4,545,455	5,000,000
2042	0	0	4,545,455	5,000,000
2043	0	0	4,545,455	5,000,000
2044	0	0	4,545,455	5,000,000
2045	0	0	4,545,455	5,000,000
2046	0	0	4,545,455	5,000,000
2047	0	0	4,545,455	5,000,000
2048	0	0	4,545,455	5,000,000
2049	0	0	4,545,455	5,000,000
2050	0	0	4,545,455	5,000,000
2051	0	0	4,545,455	5,000,000
2052	0	0	4,545,455	5,000,000
2053	0	0	4,545,455	5,000,000
2054	0	0	4,545,455	5,000,000
2055	0	0	4,545,455	5,000,000
2056	0	0	4,545,455	5,000,000
2057	0	0	4,545,455	5,000,000
2058	0	0	4,545,455	5,000,000
2059	0	0	4,545,455	5,000,000
2060	0	0	4,545,455	5,000,000
2061	0	0	4,545,455	5,000,000
2062	0	0	4,545,455	5,000,000
2063	0	0	4,545,455	5,000,000

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2064	0	0	4,545,455	5,000,000
2065	0	0	4,545,455	5,000,000
2066	0	0	4,545,455	5,000,000
2067	0	0	4,545,455	5,000,000
2068	0	0	4,545,455	5,000,000
2069	0	0	4,545,455	5,000,000
2070	0	0	4,545,455	5,000,000
2071	0	0	4,545,455	5,000,000
2072	0	0	4,545,455	5,000,000
2073	0	0	4,545,455	5,000,000
2074	0	0	4,545,455	5,000,000
2075	0	0	4,545,455	5,000,000
2076	0	0	4,545,455	5,000,000
2077	0	0	4,545,455	5,000,000
2078	0	0	4,545,455	5,000,000
2079	0	0	4,545,455	5,000,000
2080	0	0	4,545,455	5,000,000
2081	0	0	4,545,455	5,000,000
2082	0	0	4,545,455	5,000,000
2083	0	0	4,545,455	5,000,000
2084	0	0	4,545,455	5,000,000
2085	0	0	4,545,455	5,000,000
2086	0	0	4,545,455	5,000,000
2087	0	0	4,545,455	5,000,000
2088	0	0	4,545,455	5,000,000
2089	0	0	4,545,455	5,000,000
2090	0	0	4,545,455	5,000,000
2091	0	0	4,545,455	5,000,000
2092	0	0	4,545,455	5,000,000
2093	0	0	4,545,455	5,000,000
2094	0	0	4,545,455	5,000,000
2095	0	0	4,545,455	5,000,000
2096	0	0	4,545,455	5,000,000
2097	0	0	4,545,455	5,000,000
2098	0	0	4,545,455	5,000,000
2099	0	0	4,545,455	5,000,000
2100	0	0	4,545,455	5,000,000
2101	0	0	4,545,455	5,000,000
2102	0	0	4,545,455	5,000,000
2103	0	0	4,545,455	5,000,000

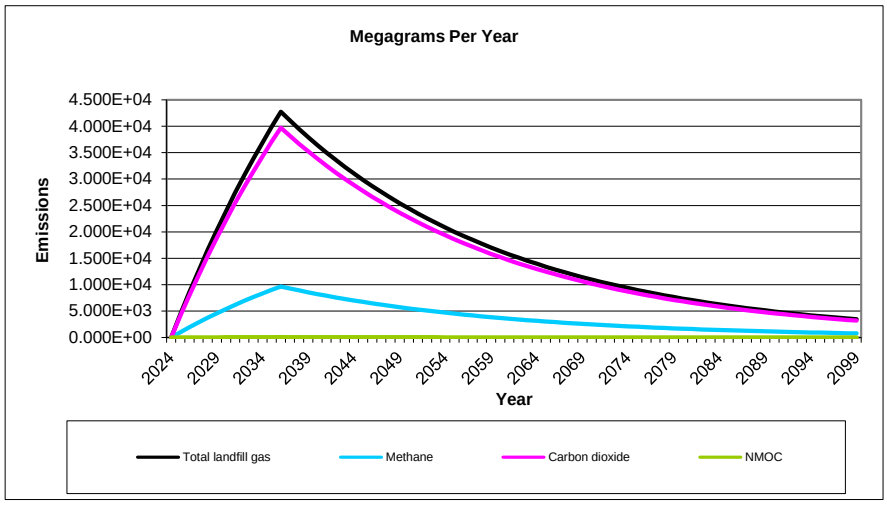
Pollutant Parameters

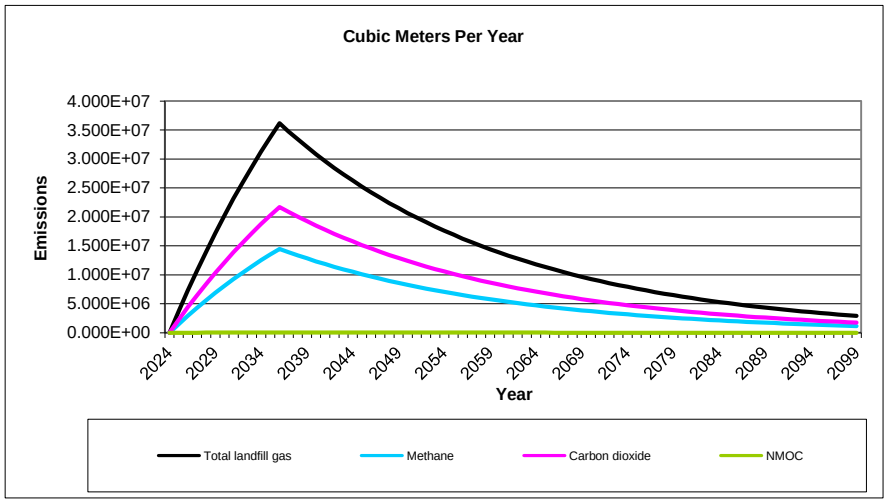
		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

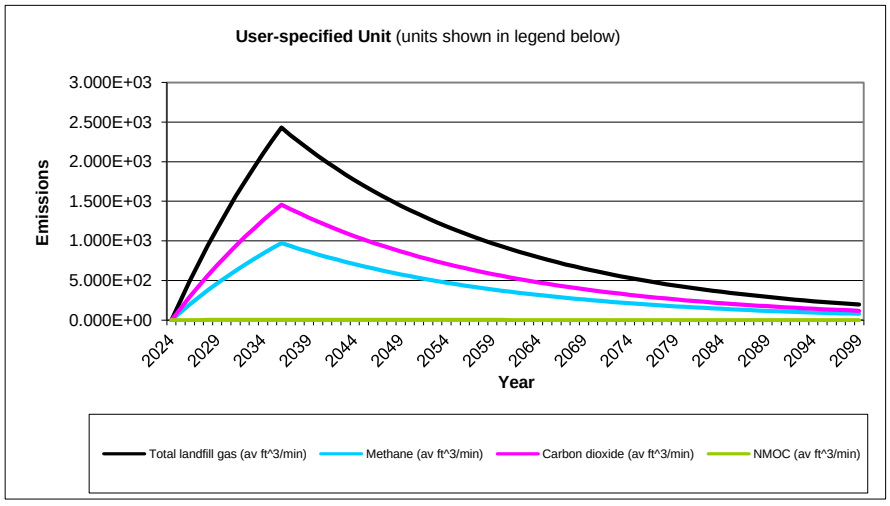
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
4.500E+04
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
4.000E+07
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
3.000E+03
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2024	0	0	0	0	0	0
2025	4.397E+03	3.719E+06	2.499E+02	9.925E+02	1.488E+06	9.996E+01
2026	8.621E+03	7.293E+06	4.900E+02	1.946E+03	2.917E+06	1.960E+02
2027	1.268E+04	1.073E+07	7.207E+02	2.862E+03	4.290E+06	2.883E+02
2028	1.658E+04	1.402E+07	9.423E+02	3.743E+03	5.610E+06	3.769E+02
2029	2.033E+04	1.719E+07	1.155E+03	4.588E+03	6.878E+06	4.621E+02
2030	2.392E+04	2.024E+07	1.360E+03	5.401E+03	8.096E+06	5.439E+02
2031	2.738E+04	2.316E+07	1.556E+03	6.182E+03	9.266E+06	6.226E+02
2032	3.071E+04	2.598E+07	1.745E+03	6.932E+03	1.039E+07	6.981E+02
2033	3.390E+04	2.868E+07	1.927E+03	7.653E+03	1.147E+07	7.707E+02
2034	3.697E+04	3.127E+07	2.101E+03	8.345E+03	1.251E+07	8.404E+02
2035	3.991E+04	3.376E+07	2.269E+03	9.010E+03	1.351E+07	9.074E+02
2036	4.274E+04	3.616E+07	2.430E+03	9.650E+03	1.446E+07	9.718E+02
2037	4.109E+04	3.476E+07	2.335E+03	9.275E+03	1.390E+07	9.341E+02
2038	3.948E+04	3.339E+07	2.244E+03	8.912E+03	1.336E+07	8.975E+02
2039	3.793E+04	3.209E+07	2.156E+03	8.562E+03	1.283E+07	8.623E+02
2040	3.644E+04	3.083E+07	2.071E+03	8.226E+03	1.233E+07	8.285E+02
2041	3.501E+04	2.962E+07	1.990E+03	7.904E+03	1.185E+07	7.960E+02
2042	3.364E+04	2.846E+07	1.912E+03	7.594E+03	1.138E+07	7.648E+02
2043	3.232E+04	2.734E+07	1.837E+03	7.296E+03	1.094E+07	7.348E+02
2044	3.105E+04	2.627E+07	1.765E+03	7.010E+03	1.051E+07	7.060E+02
2045	2.984E+04	2.524E+07	1.696E+03	6.735E+03	1.010E+07	6.783E+02
2046	2.867E+04	2.425E+07	1.629E+03	6.471E+03	9.700E+06	6.517E+02
2047	2.754E+04	2.330E+07	1.565E+03	6.217E+03	9.319E+06	6.262E+02
2048	2.646E+04	2.239E+07	1.504E+03	5.974E+03	8.954E+06	6.016E+02
2049	2.542E+04	2.151E+07	1.445E+03	5.739E+03	8.603E+06	5.780E+02
2050	2.443E+04	2.066E+07	1.388E+03	5.514E+03	8.266E+06	5.554E+02
2051	2.347E+04	1.985E+07	1.334E+03	5.298E+03	7.942E+06	5.336E+02
2052	2.255E+04	1.908E+07	1.282E+03	5.090E+03	7.630E+06	5.127E+02
2053	2.166E+04	1.833E+07	1.231E+03	4.891E+03	7.331E+06	4.926E+02
2054	2.082E+04	1.761E+07	1.183E+03	4.699E+03	7.043E+06	4.733E+02
2055	2.000E+04	1.692E+07	1.137E+03	4.515E+03	6.767E+06	4.547E+02
2056	1.922E+04	1.625E+07	1.092E+03	4.338E+03	6.502E+06	4.369E+02
2057	1.846E+04	1.562E+07	1.049E+03	4.168E+03	6.247E+06	4.197E+02
2058	1.774E+04	1.501E+07	1.008E+03	4.004E+03	6.002E+06	4.033E+02
2059	1.704E+04	1.442E+07	9.687E+02	3.847E+03	5.767E+06	3.875E+02
2060	1.637E+04	1.385E+07	9.307E+02	3.696E+03	5.541E+06	3.723E+02
2061	1.573E+04	1.331E+07	8.942E+02	3.551E+03	5.323E+06	3.577E+02
2062	1.512E+04	1.279E+07	8.591E+02	3.412E+03	5.115E+06	3.437E+02
2063	1.452E+04	1.229E+07	8.254E+02	3.278E+03	4.914E+06	3.302E+02
2064	1.395E+04	1.180E+07	7.931E+02	3.150E+03	4.721E+06	3.172E+02
2065	1.341E+04	1.134E+07	7.620E+02	3.026E+03	4.536E+06	3.048E+02
2066	1.288E+04	1.090E+07	7.321E+02	2.908E+03	4.358E+06	2.928E+02
2067	1.238E+04	1.047E+07	7.034E+02	2.794E+03	4.187E+06	2.814E+02
2068	1.189E+04	1.006E+07	6.758E+02	2.684E+03	4.023E+06	2.703E+02
2069	1.142E+04	9.664E+06	6.493E+02	2.579E+03	3.866E+06	2.597E+02
2070	1.098E+04	9.285E+06	6.239E+02	2.478E+03	3.714E+06	2.495E+02
2071	1.055E+04	8.921E+06	5.994E+02	2.381E+03	3.568E+06	2.398E+02
2072	1.013E+04	8.571E+06	5.759E+02	2.287E+03	3.428E+06	2.304E+02
2073	9.735E+03	8.235E+06	5.533E+02	2.198E+03	3.294E+06	2.213E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	9.353E+03	7.912E+06	5.316E+02	2.111E+03	3.165E+06	2.126E+02
2075	8.986E+03	7.602E+06	5.108E+02	2.029E+03	3.041E+06	2.043E+02
2076	8.634E+03	7.304E+06	4.907E+02	1.949E+03	2.922E+06	1.963E+02
2077	8.295E+03	7.017E+06	4.715E+02	1.873E+03	2.807E+06	1.886E+02
2078	7.970E+03	6.742E+06	4.530E+02	1.799E+03	2.697E+06	1.812E+02
2079	7.658E+03	6.478E+06	4.352E+02	1.729E+03	2.591E+06	1.741E+02
2080	7.357E+03	6.224E+06	4.182E+02	1.661E+03	2.490E+06	1.673E+02
2081	7.069E+03	5.980E+06	4.018E+02	1.596E+03	2.392E+06	1.607E+02
2082	6.792E+03	5.745E+06	3.860E+02	1.533E+03	2.298E+06	1.544E+02
2083	6.525E+03	5.520E+06	3.709E+02	1.473E+03	2.208E+06	1.484E+02
2084	6.269E+03	5.304E+06	3.564E+02	1.415E+03	2.121E+06	1.425E+02
2085	6.024E+03	5.096E+06	3.424E+02	1.360E+03	2.038E+06	1.370E+02
2086	5.787E+03	4.896E+06	3.290E+02	1.307E+03	1.958E+06	1.316E+02
2087	5.561E+03	4.704E+06	3.161E+02	1.255E+03	1.882E+06	1.264E+02
2088	5.343E+03	4.519E+06	3.037E+02	1.206E+03	1.808E+06	1.215E+02
2089	5.133E+03	4.342E+06	2.918E+02	1.159E+03	1.737E+06	1.167E+02
2090	4.932E+03	4.172E+06	2.803E+02	1.113E+03	1.669E+06	1.121E+02
2091	4.738E+03	4.008E+06	2.693E+02	1.070E+03	1.603E+06	1.077E+02
2092	4.553E+03	3.851E+06	2.588E+02	1.028E+03	1.540E+06	1.035E+02
2093	4.374E+03	3.700E+06	2.486E+02	9.874E+02	1.480E+06	9.945E+01
2094	4.203E+03	3.555E+06	2.389E+02	9.487E+02	1.422E+06	9.555E+01
2095	4.038E+03	3.416E+06	2.295E+02	9.115E+02	1.366E+06	9.180E+01
2096	3.879E+03	3.282E+06	2.205E+02	8.758E+02	1.313E+06	8.820E+01
2097	3.727E+03	3.153E+06	2.119E+02	8.414E+02	1.261E+06	8.474E+01
2098	3.581E+03	3.029E+06	2.036E+02	8.084E+02	1.212E+06	8.142E+01
2099	3.441E+03	2.911E+06	1.956E+02	7.767E+02	1.164E+06	7.823E+01
2100	3.306E+03	2.797E+06	1.879E+02	7.463E+02	1.119E+06	7.516E+01
2101	3.176E+03	2.687E+06	1.805E+02	7.170E+02	1.075E+06	7.221E+01
2102	3.052E+03	2.582E+06	1.735E+02	6.889E+02	1.033E+06	6.938E+01
2103	2.932E+03	2.480E+06	1.667E+02	6.619E+02	9.921E+05	6.666E+01
2104	2.817E+03	2.383E+06	1.601E+02	6.359E+02	9.532E+05	6.405E+01
2105	2.707E+03	2.290E+06	1.538E+02	6.110E+02	9.159E+05	6.154E+01
2106	2.600E+03	2.200E+06	1.478E+02	5.871E+02	8.799E+05	5.912E+01
2107	2.499E+03	2.114E+06	1.420E+02	5.640E+02	8.454E+05	5.681E+01
2108	2.401E+03	2.031E+06	1.364E+02	5.419E+02	8.123E+05	5.458E+01
2109	2.306E+03	1.951E+06	1.311E+02	5.207E+02	7.804E+05	5.244E+01
2110	2.216E+03	1.875E+06	1.260E+02	5.003E+02	7.498E+05	5.038E+01
2111	2.129E+03	1.801E+06	1.210E+02	4.806E+02	7.204E+05	4.841E+01
2112	2.046E+03	1.730E+06	1.163E+02	4.618E+02	6.922E+05	4.651E+01
2113	1.965E+03	1.663E+06	1.117E+02	4.437E+02	6.650E+05	4.468E+01
2114	1.888E+03	1.597E+06	1.073E+02	4.263E+02	6.390E+05	4.293E+01
2115	1.814E+03	1.535E+06	1.031E+02	4.096E+02	6.139E+05	4.125E+01
2116	1.743E+03	1.475E+06	9.908E+01	3.935E+02	5.898E+05	3.963E+01
2117	1.675E+03	1.417E+06	9.519E+01	3.781E+02	5.667E+05	3.808E+01
2118	1.609E+03	1.361E+06	9.146E+01	3.633E+02	5.445E+05	3.658E+01
2119	1.546E+03	1.308E+06	8.788E+01	3.490E+02	5.231E+05	3.515E+01
2120	1.485E+03	1.257E+06	8.443E+01	3.353E+02	5.026E+05	3.377E+01
2121	1.427E+03	1.207E+06	8.112E+01	3.222E+02	4.829E+05	3.245E+01
2122	1.371E+03	1.160E+06	7.794E+01	3.095E+02	4.640E+05	3.118E+01
2123	1.317E+03	1.114E+06	7.488E+01	2.974E+02	4.458E+05	2.995E+01
2124	1.266E+03	1.071E+06	7.195E+01	2.857E+02	4.283E+05	2.878E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2125	1.216E+03	1.029E+06	6.913E+01	2.745E+02	4.115E+05	2.765E+01
2126	1.168E+03	9.885E+05	6.641E+01	2.638E+02	3.954E+05	2.657E+01
2127	1.123E+03	9.497E+05	6.381E+01	2.534E+02	3.799E+05	2.552E+01
2128	1.079E+03	9.125E+05	6.131E+01	2.435E+02	3.650E+05	2.452E+01
2129	1.036E+03	8.767E+05	5.890E+01	2.340E+02	3.507E+05	2.356E+01
2130	9.957E+02	8.423E+05	5.659E+01	2.248E+02	3.369E+05	2.264E+01
2131	9.567E+02	8.093E+05	5.438E+01	2.160E+02	3.237E+05	2.175E+01
2132	9.191E+02	7.776E+05	5.224E+01	2.075E+02	3.110E+05	2.090E+01
2133	8.831E+02	7.471E+05	5.020E+01	1.994E+02	2.988E+05	2.008E+01
2134	8.485E+02	7.178E+05	4.823E+01	1.915E+02	2.871E+05	1.929E+01
2135	8.152E+02	6.896E+05	4.634E+01	1.840E+02	2.759E+05	1.853E+01
2136	7.832E+02	6.626E+05	4.452E+01	1.768E+02	2.650E+05	1.781E+01
2137	7.525E+02	6.366E+05	4.277E+01	1.699E+02	2.546E+05	1.711E+01
2138	7.230E+02	6.116E+05	4.110E+01	1.632E+02	2.447E+05	1.644E+01
2139	6.947E+02	5.877E+05	3.948E+01	1.568E+02	2.351E+05	1.579E+01
2140	6.674E+02	5.646E+05	3.794E+01	1.507E+02	2.258E+05	1.517E+01
2141	6.413E+02	5.425E+05	3.645E+01	1.448E+02	2.170E+05	1.458E+01
2142	6.161E+02	5.212E+05	3.502E+01	1.391E+02	2.085E+05	1.401E+01
2143	5.920E+02	5.008E+05	3.365E+01	1.336E+02	2.003E+05	1.346E+01
2144	5.688E+02	4.811E+05	3.233E+01	1.284E+02	1.925E+05	1.293E+01
2145	5.465E+02	4.623E+05	3.106E+01	1.234E+02	1.849E+05	1.242E+01
2146	5.250E+02	4.441E+05	2.984E+01	1.185E+02	1.777E+05	1.194E+01
2147	5.044E+02	4.267E+05	2.867E+01	1.139E+02	1.707E+05	1.147E+01
2148	4.847E+02	4.100E+05	2.755E+01	1.094E+02	1.640E+05	1.102E+01
2149	4.657E+02	3.939E+05	2.647E+01	1.051E+02	1.576E+05	1.059E+01
2150	4.474E+02	3.785E+05	2.543E+01	1.010E+02	1.514E+05	1.017E+01
2151	4.299E+02	3.636E+05	2.443E+01	9.704E+01	1.455E+05	9.773E+00
2152	4.130E+02	3.494E+05	2.347E+01	9.323E+01	1.398E+05	9.390E+00
2153	3.968E+02	3.357E+05	2.255E+01	8.958E+01	1.343E+05	9.022E+00
2154	3.812E+02	3.225E+05	2.167E+01	8.607E+01	1.290E+05	8.668E+00
2155	3.663E+02	3.099E+05	2.082E+01	8.269E+01	1.239E+05	8.328E+00
2156	3.519E+02	2.977E+05	2.000E+01	7.945E+01	1.191E+05	8.001E+00
2157	3.381E+02	2.860E+05	1.922E+01	7.633E+01	1.144E+05	7.688E+00
2158	3.249E+02	2.748E+05	1.847E+01	7.334E+01	1.099E+05	7.386E+00
2159	3.121E+02	2.641E+05	1.774E+01	7.046E+01	1.056E+05	7.097E+00
2160	2.999E+02	2.537E+05	1.705E+01	6.770E+01	1.015E+05	6.818E+00
2161	2.881E+02	2.438E+05	1.638E+01	6.505E+01	9.750E+04	6.551E+00
2162	2.768E+02	2.342E+05	1.574E+01	6.250E+01	9.368E+04	6.294E+00
2163	2.660E+02	2.250E+05	1.512E+01	6.005E+01	9.000E+04	6.047E+00
2164	2.556E+02	2.162E+05	1.453E+01	5.769E+01	8.648E+04	5.810E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2024	0	0	0	0	0	0
2025	4.085E+03	2.232E+06	1.499E+02	7.999E+00	2.232E+03	1.499E-01
2026	8.010E+03	4.376E+06	2.940E+02	1.568E+01	4.376E+03	2.940E-01
2027	1.178E+04	6.436E+06	4.324E+02	2.307E+01	6.436E+03	4.324E-01
2028	1.540E+04	8.415E+06	5.654E+02	3.016E+01	8.415E+03	5.654E-01
2029	1.888E+04	1.032E+07	6.932E+02	3.698E+01	1.032E+04	6.932E-01
2030	2.223E+04	1.214E+07	8.159E+02	4.353E+01	1.214E+04	8.159E-01
2031	2.544E+04	1.390E+07	9.339E+02	4.982E+01	1.390E+04	9.339E-01
2032	2.853E+04	1.559E+07	1.047E+03	5.587E+01	1.559E+04	1.047E+00
2033	3.150E+04	1.721E+07	1.156E+03	6.167E+01	1.721E+04	1.156E+00
2034	3.435E+04	1.876E+07	1.261E+03	6.725E+01	1.876E+04	1.261E+00
2035	3.708E+04	2.026E+07	1.361E+03	7.262E+01	2.026E+04	1.361E+00
2036	3.971E+04	2.170E+07	1.458E+03	7.777E+01	2.170E+04	1.458E+00
2037	3.817E+04	2.085E+07	1.401E+03	7.475E+01	2.085E+04	1.401E+00
2038	3.668E+04	2.004E+07	1.346E+03	7.182E+01	2.004E+04	1.346E+00
2039	3.524E+04	1.925E+07	1.293E+03	6.900E+01	1.925E+04	1.293E+00
2040	3.386E+04	1.850E+07	1.243E+03	6.630E+01	1.850E+04	1.243E+00
2041	3.253E+04	1.777E+07	1.194E+03	6.370E+01	1.777E+04	1.194E+00
2042	3.125E+04	1.707E+07	1.147E+03	6.120E+01	1.707E+04	1.147E+00
2043	3.003E+04	1.640E+07	1.102E+03	5.880E+01	1.640E+04	1.102E+00
2044	2.885E+04	1.576E+07	1.059E+03	5.650E+01	1.576E+04	1.059E+00
2045	2.772E+04	1.514E+07	1.017E+03	5.428E+01	1.514E+04	1.017E+00
2046	2.663E+04	1.455E+07	9.776E+02	5.215E+01	1.455E+04	9.776E-01
2047	2.559E+04	1.398E+07	9.393E+02	5.011E+01	1.398E+04	9.393E-01
2048	2.459E+04	1.343E+07	9.024E+02	4.814E+01	1.343E+04	9.024E-01
2049	2.362E+04	1.290E+07	8.670E+02	4.626E+01	1.290E+04	8.670E-01
2050	2.270E+04	1.240E+07	8.330E+02	4.444E+01	1.240E+04	8.330E-01
2051	2.181E+04	1.191E+07	8.004E+02	4.270E+01	1.191E+04	8.004E-01
2052	2.095E+04	1.145E+07	7.690E+02	4.102E+01	1.145E+04	7.690E-01
2053	2.013E+04	1.100E+07	7.388E+02	3.942E+01	1.100E+04	7.388E-01
2054	1.934E+04	1.057E+07	7.099E+02	3.787E+01	1.057E+04	7.099E-01
2055	1.858E+04	1.015E+07	6.820E+02	3.639E+01	1.015E+04	6.820E-01
2056	1.785E+04	9.753E+06	6.553E+02	3.496E+01	9.753E+03	6.553E-01
2057	1.715E+04	9.371E+06	6.296E+02	3.359E+01	9.371E+03	6.296E-01
2058	1.648E+04	9.003E+06	6.049E+02	3.227E+01	9.003E+03	6.049E-01
2059	1.583E+04	8.650E+06	5.812E+02	3.101E+01	8.650E+03	5.812E-01
2060	1.521E+04	8.311E+06	5.584E+02	2.979E+01	8.311E+03	5.584E-01
2061	1.462E+04	7.985E+06	5.365E+02	2.862E+01	7.985E+03	5.365E-01
2062	1.404E+04	7.672E+06	5.155E+02	2.750E+01	7.672E+03	5.155E-01
2063	1.349E+04	7.371E+06	4.953E+02	2.642E+01	7.371E+03	4.953E-01
2064	1.296E+04	7.082E+06	4.758E+02	2.539E+01	7.082E+03	4.758E-01
2065	1.246E+04	6.804E+06	4.572E+02	2.439E+01	6.804E+03	4.572E-01
2066	1.197E+04	6.538E+06	4.393E+02	2.343E+01	6.538E+03	4.393E-01
2067	1.150E+04	6.281E+06	4.220E+02	2.251E+01	6.281E+03	4.220E-01
2068	1.105E+04	6.035E+06	4.055E+02	2.163E+01	6.035E+03	4.055E-01
2069	1.061E+04	5.798E+06	3.896E+02	2.078E+01	5.798E+03	3.896E-01
2070	1.020E+04	5.571E+06	3.743E+02	1.997E+01	5.571E+03	3.743E-01
2071	9.798E+03	5.353E+06	3.596E+02	1.919E+01	5.353E+03	3.596E-01
2072	9.414E+03	5.143E+06	3.455E+02	1.843E+01	5.143E+03	3.455E-01
2073	9.045E+03	4.941E+06	3.320E+02	1.771E+01	4.941E+03	3.320E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	8.690E+03	4.747E+06	3.190E+02	1.702E+01	4.747E+03	3.190E-01
2075	8.349E+03	4.561E+06	3.065E+02	1.635E+01	4.561E+03	3.065E-01
2076	8.022E+03	4.382E+06	2.944E+02	1.571E+01	4.382E+03	2.944E-01
2077	7.707E+03	4.210E+06	2.829E+02	1.509E+01	4.210E+03	2.829E-01
2078	7.405E+03	4.045E+06	2.718E+02	1.450E+01	4.045E+03	2.718E-01
2079	7.115E+03	3.887E+06	2.611E+02	1.393E+01	3.887E+03	2.611E-01
2080	6.836E+03	3.734E+06	2.509E+02	1.339E+01	3.734E+03	2.509E-01
2081	6.568E+03	3.588E+06	2.411E+02	1.286E+01	3.588E+03	2.411E-01
2082	6.310E+03	3.447E+06	2.316E+02	1.236E+01	3.447E+03	2.316E-01
2083	6.063E+03	3.312E+06	2.225E+02	1.187E+01	3.312E+03	2.225E-01
2084	5.825E+03	3.182E+06	2.138E+02	1.141E+01	3.182E+03	2.138E-01
2085	5.597E+03	3.057E+06	2.054E+02	1.096E+01	3.057E+03	2.054E-01
2086	5.377E+03	2.938E+06	1.974E+02	1.053E+01	2.938E+03	1.974E-01
2087	5.166E+03	2.822E+06	1.896E+02	1.012E+01	2.822E+03	1.896E-01
2088	4.964E+03	2.712E+06	1.822E+02	9.720E+00	2.712E+03	1.822E-01
2089	4.769E+03	2.605E+06	1.751E+02	9.339E+00	2.605E+03	1.751E-01
2090	4.582E+03	2.503E+06	1.682E+02	8.973E+00	2.503E+03	1.682E-01
2091	4.402E+03	2.405E+06	1.616E+02	8.621E+00	2.405E+03	1.616E-01
2092	4.230E+03	2.311E+06	1.553E+02	8.283E+00	2.311E+03	1.553E-01
2093	4.064E+03	2.220E+06	1.492E+02	7.958E+00	2.220E+03	1.492E-01
2094	3.905E+03	2.133E+06	1.433E+02	7.646E+00	2.133E+03	1.433E-01
2095	3.752E+03	2.049E+06	1.377E+02	7.346E+00	2.049E+03	1.377E-01
2096	3.604E+03	1.969E+06	1.323E+02	7.058E+00	1.969E+03	1.323E-01
2097	3.463E+03	1.892E+06	1.271E+02	6.781E+00	1.892E+03	1.271E-01
2098	3.327E+03	1.818E+06	1.221E+02	6.515E+00	1.818E+03	1.221E-01
2099	3.197E+03	1.746E+06	1.173E+02	6.260E+00	1.746E+03	1.173E-01
2100	3.071E+03	1.678E+06	1.127E+02	6.015E+00	1.678E+03	1.127E-01
2101	2.951E+03	1.612E+06	1.083E+02	5.779E+00	1.612E+03	1.083E-01
2102	2.835E+03	1.549E+06	1.041E+02	5.552E+00	1.549E+03	1.041E-01
2103	2.724E+03	1.488E+06	9.999E+01	5.334E+00	1.488E+03	9.999E-02
2104	2.617E+03	1.430E+06	9.607E+01	5.125E+00	1.430E+03	9.607E-02
2105	2.515E+03	1.374E+06	9.230E+01	4.924E+00	1.374E+03	9.230E-02
2106	2.416E+03	1.320E+06	8.869E+01	4.731E+00	1.320E+03	8.869E-02
2107	2.321E+03	1.268E+06	8.521E+01	4.546E+00	1.268E+03	8.521E-02
2108	2.230E+03	1.218E+06	8.187E+01	4.367E+00	1.218E+03	8.187E-02
2109	2.143E+03	1.171E+06	7.866E+01	4.196E+00	1.171E+03	7.866E-02
2110	2.059E+03	1.125E+06	7.557E+01	4.032E+00	1.125E+03	7.557E-02
2111	1.978E+03	1.081E+06	7.261E+01	3.874E+00	1.081E+03	7.261E-02
2112	1.901E+03	1.038E+06	6.976E+01	3.722E+00	1.038E+03	6.976E-02
2113	1.826E+03	9.976E+05	6.703E+01	3.576E+00	9.976E+02	6.703E-02
2114	1.754E+03	9.585E+05	6.440E+01	3.436E+00	9.585E+02	6.440E-02
2115	1.686E+03	9.209E+05	6.187E+01	3.301E+00	9.209E+02	6.187E-02
2116	1.620E+03	8.848E+05	5.945E+01	3.171E+00	8.848E+02	5.945E-02
2117	1.556E+03	8.501E+05	5.712E+01	3.047E+00	8.501E+02	5.712E-02
2118	1.495E+03	8.167E+05	5.488E+01	2.928E+00	8.167E+02	5.488E-02
2119	1.436E+03	7.847E+05	5.273E+01	2.813E+00	7.847E+02	5.273E-02
2120	1.380E+03	7.539E+05	5.066E+01	2.703E+00	7.539E+02	5.066E-02
2121	1.326E+03	7.244E+05	4.867E+01	2.597E+00	7.244E+02	4.867E-02
2122	1.274E+03	6.960E+05	4.676E+01	2.495E+00	6.960E+02	4.676E-02
2123	1.224E+03	6.687E+05	4.493E+01	2.397E+00	6.687E+02	4.493E-02
2124	1.176E+03	6.425E+05	4.317E+01	2.303E+00	6.425E+02	4.317E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2125	1.130E+03	6.173E+05	4.148E+01	2.213E+00	6.173E+02	4.148E-02
2126	1.086E+03	5.931E+05	3.985E+01	2.126E+00	5.931E+02	3.985E-02
2127	1.043E+03	5.698E+05	3.829E+01	2.043E+00	5.698E+02	3.829E-02
2128	1.002E+03	5.475E+05	3.679E+01	1.962E+00	5.475E+02	3.679E-02
2129	9.629E+02	5.260E+05	3.534E+01	1.885E+00	5.260E+02	3.534E-02
2130	9.251E+02	5.054E+05	3.396E+01	1.812E+00	5.054E+02	3.396E-02
2131	8.888E+02	4.856E+05	3.263E+01	1.741E+00	4.856E+02	3.263E-02
2132	8.540E+02	4.665E+05	3.135E+01	1.672E+00	4.665E+02	3.135E-02
2133	8.205E+02	4.482E+05	3.012E+01	1.607E+00	4.482E+02	3.012E-02
2134	7.883E+02	4.307E+05	2.894E+01	1.544E+00	4.307E+02	2.894E-02
2135	7.574E+02	4.138E+05	2.780E+01	1.483E+00	4.138E+02	2.780E-02
2136	7.277E+02	3.976E+05	2.671E+01	1.425E+00	3.976E+02	2.671E-02
2137	6.992E+02	3.820E+05	2.566E+01	1.369E+00	3.820E+02	2.566E-02
2138	6.718E+02	3.670E+05	2.466E+01	1.315E+00	3.670E+02	2.466E-02
2139	6.454E+02	3.526E+05	2.369E+01	1.264E+00	3.526E+02	2.369E-02
2140	6.201E+02	3.388E+05	2.276E+01	1.214E+00	3.388E+02	2.276E-02
2141	5.958E+02	3.255E+05	2.187E+01	1.167E+00	3.255E+02	2.187E-02
2142	5.724E+02	3.127E+05	2.101E+01	1.121E+00	3.127E+02	2.101E-02
2143	5.500E+02	3.005E+05	2.019E+01	1.077E+00	3.005E+02	2.019E-02
2144	5.284E+02	2.887E+05	1.940E+01	1.035E+00	2.887E+02	1.940E-02
2145	5.077E+02	2.774E+05	1.864E+01	9.942E-01	2.774E+02	1.864E-02
2146	4.878E+02	2.665E+05	1.791E+01	9.552E-01	2.665E+02	1.791E-02
2147	4.687E+02	2.560E+05	1.720E+01	9.178E-01	2.560E+02	1.720E-02
2148	4.503E+02	2.460E+05	1.653E+01	8.818E-01	2.460E+02	1.653E-02
2149	4.326E+02	2.364E+05	1.588E+01	8.472E-01	2.364E+02	1.588E-02
2150	4.157E+02	2.271E+05	1.526E+01	8.140E-01	2.271E+02	1.526E-02
2151	3.994E+02	2.182E+05	1.466E+01	7.821E-01	2.182E+02	1.466E-02
2152	3.837E+02	2.096E+05	1.408E+01	7.514E-01	2.096E+02	1.408E-02
2153	3.687E+02	2.014E+05	1.353E+01	7.219E-01	2.014E+02	1.353E-02
2154	3.542E+02	1.935E+05	1.300E+01	6.936E-01	1.935E+02	1.300E-02
2155	3.403E+02	1.859E+05	1.249E+01	6.664E-01	1.859E+02	1.249E-02
2156	3.270E+02	1.786E+05	1.200E+01	6.403E-01	1.786E+02	1.200E-02
2157	3.142E+02	1.716E+05	1.153E+01	6.152E-01	1.716E+02	1.153E-02
2158	3.018E+02	1.649E+05	1.108E+01	5.911E-01	1.649E+02	1.108E-02
2159	2.900E+02	1.584E+05	1.065E+01	5.679E-01	1.584E+02	1.065E-02
2160	2.786E+02	1.522E+05	1.023E+01	5.456E-01	1.522E+02	1.023E-02
2161	2.677E+02	1.463E+05	9.827E+00	5.242E-01	1.463E+02	9.827E-03
2162	2.572E+02	1.405E+05	9.441E+00	5.037E-01	1.405E+02	9.441E-03
2163	2.471E+02	1.350E+05	9.071E+00	4.839E-01	1.350E+02	9.071E-03
2164	2.374E+02	1.297E+05	8.715E+00	4.650E-01	1.297E+02	8.715E-03



Summary Report

Landfill Name or Identifier:

Date: Tuesday, August 31, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)

i = 1-year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1-year time increment

k = methane generation rate ($year^{-1}$)

L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the i^{th} year (Mg)

t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2024**	
Landfill Closure Year (with 80-year limit)	**2026**	
Actual Closure Year (without limit)	***2026***	
Have Model Calculate Closure Year?	**No**	
Waste Design Capacity	**1,226,610**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**40**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2024	378,655	416,520	0	0
2025	378,655	416,520	378,655	416,520
2026	378,655	416,520	757,309	833,040
2027	0	0	1,135,964	1,249,560
2028	0	0	1,135,964	1,249,560
2029	0	0	1,135,964	1,249,560
2030	0	0	1,135,964	1,249,560
2031	0	0	1,135,964	1,249,560
2032	0	0	1,135,964	1,249,560
2033	0	0	1,135,964	1,249,560
2034	0	0	1,135,964	1,249,560
2035	0	0	1,135,964	1,249,560
2036	0	0	1,135,964	1,249,560
2037	0	0	1,135,964	1,249,560
2038	0	0	1,135,964	1,249,560
2039	0	0	1,135,964	1,249,560
2040	0	0	1,135,964	1,249,560
2041	0	0	1,135,964	1,249,560
2042	0	0	1,135,964	1,249,560
2043	0	0	1,135,964	1,249,560
2044	0	0	1,135,964	1,249,560
2045	0	0	1,135,964	1,249,560
2046	0	0	1,135,964	1,249,560
2047	0	0	1,135,964	1,249,560
2048	0	0	1,135,964	1,249,560
2049	0	0	1,135,964	1,249,560
2050	0	0	1,135,964	1,249,560
2051	0	0	1,135,964	1,249,560
2052	0	0	1,135,964	1,249,560
2053	0	0	1,135,964	1,249,560
2054	0	0	1,135,964	1,249,560
2055	0	0	1,135,964	1,249,560
2056	0	0	1,135,964	1,249,560
2057	0	0	1,135,964	1,249,560
2058	0	0	1,135,964	1,249,560
2059	0	0	1,135,964	1,249,560
2060	0	0	1,135,964	1,249,560
2061	0	0	1,135,964	1,249,560
2062	0	0	1,135,964	1,249,560
2063	0	0	1,135,964	1,249,560

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2064	0	0	1,135,964	1,249,560
2065	0	0	1,135,964	1,249,560
2066	0	0	1,135,964	1,249,560
2067	0	0	1,135,964	1,249,560
2068	0	0	1,135,964	1,249,560
2069	0	0	1,135,964	1,249,560
2070	0	0	1,135,964	1,249,560
2071	0	0	1,135,964	1,249,560
2072	0	0	1,135,964	1,249,560
2073	0	0	1,135,964	1,249,560
2074	0	0	1,135,964	1,249,560
2075	0	0	1,135,964	1,249,560
2076	0	0	1,135,964	1,249,560
2077	0	0	1,135,964	1,249,560
2078	0	0	1,135,964	1,249,560
2079	0	0	1,135,964	1,249,560
2080	0	0	1,135,964	1,249,560
2081	0	0	1,135,964	1,249,560
2082	0	0	1,135,964	1,249,560
2083	0	0	1,135,964	1,249,560
2084	0	0	1,135,964	1,249,560
2085	0	0	1,135,964	1,249,560
2086	0	0	1,135,964	1,249,560
2087	0	0	1,135,964	1,249,560
2088	0	0	1,135,964	1,249,560
2089	0	0	1,135,964	1,249,560
2090	0	0	1,135,964	1,249,560
2091	0	0	1,135,964	1,249,560
2092	0	0	1,135,964	1,249,560
2093	0	0	1,135,964	1,249,560
2094	0	0	1,135,964	1,249,560
2095	0	0	1,135,964	1,249,560
2096	0	0	1,135,964	1,249,560
2097	0	0	1,135,964	1,249,560
2098	0	0	1,135,964	1,249,560
2099	0	0	1,135,964	1,249,560
2100	0	0	1,135,964	1,249,560
2101	0	0	1,135,964	1,249,560
2102	0	0	1,135,964	1,249,560
2103	0	0	1,135,964	1,249,560

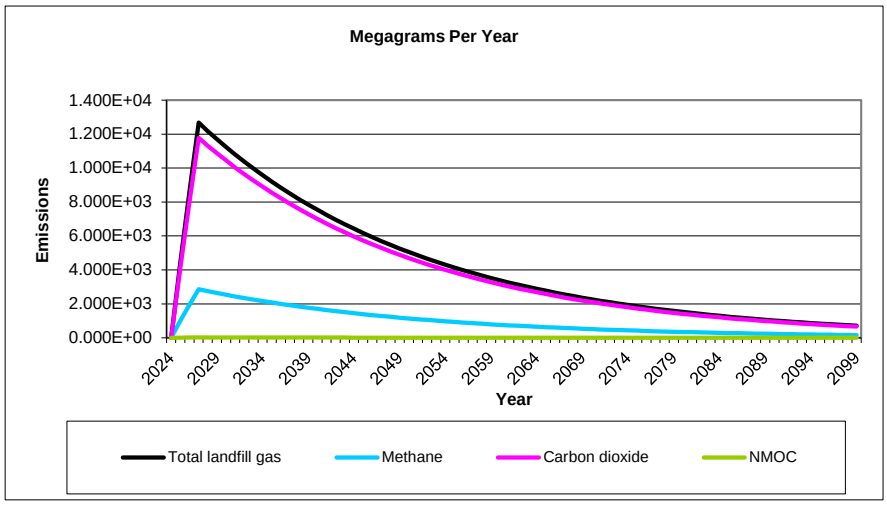
Pollutant Parameters

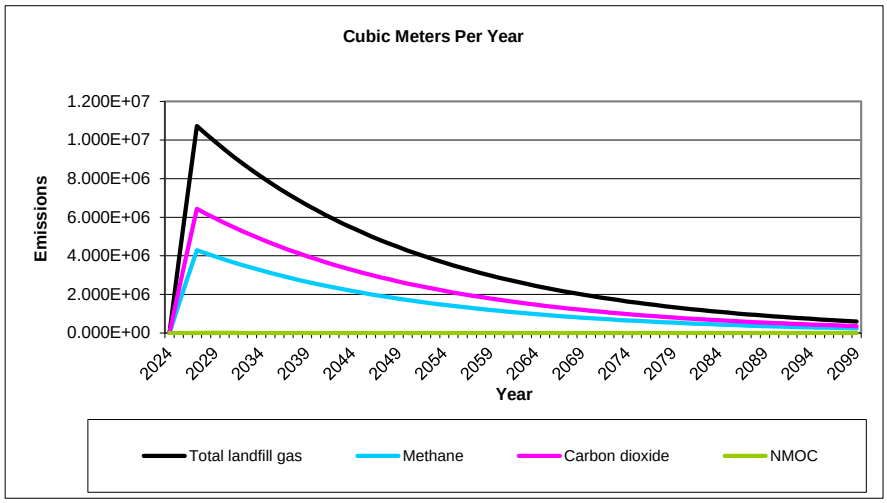
		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

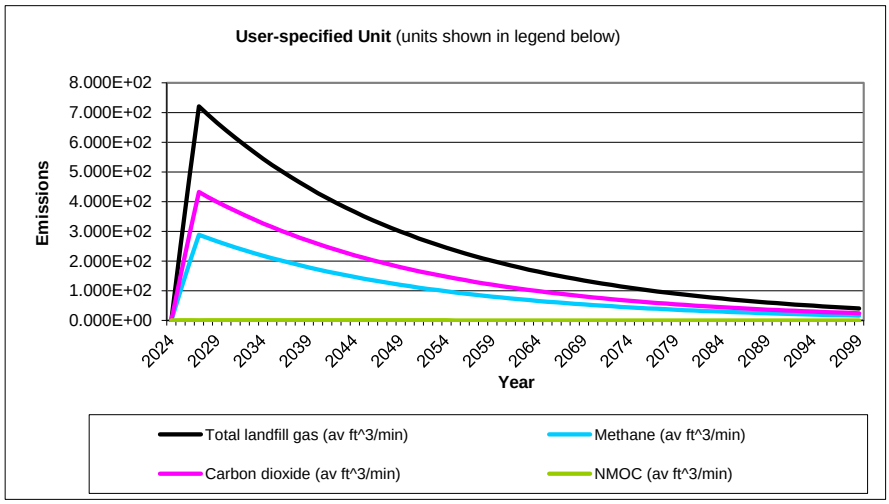
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		***User-specified Pollutant Parameters:***	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
1.400E+04
1.200E+04
1.000E+04
8.000E+03
6.000E+03
4.000E+03
2.000E+03
0.000E+00
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
1.200E+07
1.000E+07
8.000E+06
6.000E+06
4.000E+06
2.000E+06
0.000E+00
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
8.000E+02
7.000E+02
6.000E+02
5.000E+02
4.000E+02
3.000E+02
2.000E+02
1.000E+02
0.000E+00
2024
2029
2034
2039
2044
2049
2054
2059
2064
2069
2074
2079
2084
2089
2094
2099
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2024	0	0	0	0	0	0
2025	4.397E+03	3.719E+06	2.499E+02	9.925E+02	1.488E+06	9.996E+01
2026	8.621E+03	7.293E+06	4.900E+02	1.946E+03	2.917E+06	1.960E+02
2027	1.268E+04	1.073E+07	7.207E+02	2.862E+03	4.290E+06	2.883E+02
2028	1.218E+04	1.031E+07	6.924E+02	2.750E+03	4.122E+06	2.770E+02
2029	1.170E+04	9.901E+06	6.653E+02	2.642E+03	3.961E+06	2.661E+02
2030	1.125E+04	9.513E+06	6.392E+02	2.539E+03	3.805E+06	2.557E+02
2031	1.080E+04	9.140E+06	6.141E+02	2.439E+03	3.656E+06	2.456E+02
2032	1.038E+04	8.782E+06	5.900E+02	2.343E+03	3.513E+06	2.360E+02
2033	9.974E+03	8.437E+06	5.669E+02	2.252E+03	3.375E+06	2.268E+02
2034	9.583E+03	8.106E+06	5.447E+02	2.163E+03	3.243E+06	2.179E+02
2035	9.207E+03	7.789E+06	5.233E+02	2.078E+03	3.115E+06	2.093E+02
2036	8.846E+03	7.483E+06	5.028E+02	1.997E+03	2.993E+06	2.011E+02
2037	8.499E+03	7.190E+06	4.831E+02	1.919E+03	2.876E+06	1.932E+02
2038	8.166E+03	6.908E+06	4.641E+02	1.843E+03	2.763E+06	1.857E+02
2039	7.846E+03	6.637E+06	4.459E+02	1.771E+03	2.655E+06	1.784E+02
2040	7.538E+03	6.377E+06	4.285E+02	1.702E+03	2.551E+06	1.714E+02
2041	7.242E+03	6.127E+06	4.117E+02	1.635E+03	2.451E+06	1.647E+02
2042	6.959E+03	5.887E+06	3.955E+02	1.571E+03	2.355E+06	1.582E+02
2043	6.686E+03	5.656E+06	3.800E+02	1.509E+03	2.262E+06	1.520E+02
2044	6.424E+03	5.434E+06	3.651E+02	1.450E+03	2.174E+06	1.460E+02
2045	6.172E+03	5.221E+06	3.508E+02	1.393E+03	2.088E+06	1.403E+02
2046	5.930E+03	5.016E+06	3.370E+02	1.339E+03	2.006E+06	1.348E+02
2047	5.697E+03	4.819E+06	3.238E+02	1.286E+03	1.928E+06	1.295E+02
2048	5.474E+03	4.631E+06	3.111E+02	1.236E+03	1.852E+06	1.244E+02
2049	5.259E+03	4.449E+06	2.989E+02	1.187E+03	1.780E+06	1.196E+02
2050	5.053E+03	4.274E+06	2.872E+02	1.141E+03	1.710E+06	1.149E+02
2051	4.855E+03	4.107E+06	2.759E+02	1.096E+03	1.643E+06	1.104E+02
2052	4.664E+03	3.946E+06	2.651E+02	1.053E+03	1.578E+06	1.060E+02
2053	4.482E+03	3.791E+06	2.547E+02	1.012E+03	1.516E+06	1.019E+02
2054	4.306E+03	3.642E+06	2.447E+02	9.720E+02	1.457E+06	9.790E+01
2055	4.137E+03	3.500E+06	2.351E+02	9.339E+02	1.400E+06	9.406E+01
2056	3.975E+03	3.362E+06	2.259E+02	8.973E+02	1.345E+06	9.037E+01
2057	3.819E+03	3.231E+06	2.171E+02	8.621E+02	1.292E+06	8.683E+01
2058	3.669E+03	3.104E+06	2.086E+02	8.283E+02	1.242E+06	8.342E+01
2059	3.525E+03	2.982E+06	2.004E+02	7.958E+02	1.193E+06	8.015E+01
2060	3.387E+03	2.865E+06	1.925E+02	7.646E+02	1.146E+06	7.701E+01
2061	3.254E+03	2.753E+06	1.850E+02	7.346E+02	1.101E+06	7.399E+01
2062	3.127E+03	2.645E+06	1.777E+02	7.058E+02	1.058E+06	7.109E+01
2063	3.004E+03	2.541E+06	1.707E+02	6.782E+02	1.017E+06	6.830E+01
2064	2.886E+03	2.442E+06	1.641E+02	6.516E+02	9.767E+05	6.562E+01
2065	2.773E+03	2.346E+06	1.576E+02	6.260E+02	9.384E+05	6.305E+01
2066	2.664E+03	2.254E+06	1.514E+02	6.015E+02	9.016E+05	6.058E+01
2067	2.560E+03	2.166E+06	1.455E+02	5.779E+02	8.662E+05	5.820E+01
2068	2.460E+03	2.081E+06	1.398E+02	5.552E+02	8.322E+05	5.592E+01
2069	2.363E+03	1.999E+06	1.343E+02	5.335E+02	7.996E+05	5.373E+01
2070	2.270E+03	1.921E+06	1.290E+02	5.125E+02	7.683E+05	5.162E+01
2071	2.181E+03	1.845E+06	1.240E+02	4.924E+02	7.381E+05	4.960E+01
2072	2.096E+03	1.773E+06	1.191E+02	4.731E+02	7.092E+05	4.765E+01
2073	2.014E+03	1.703E+06	1.145E+02	4.546E+02	6.814E+05	4.578E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	1.935E+03	1.637E+06	1.100E+02	4.368E+02	6.547E+05	4.399E+01
2075	1.859E+03	1.572E+06	1.057E+02	4.196E+02	6.290E+05	4.226E+01
2076	1.786E+03	1.511E+06	1.015E+02	4.032E+02	6.043E+05	4.061E+01
2077	1.716E+03	1.452E+06	9.753E+01	3.874E+02	5.806E+05	3.901E+01
2078	1.649E+03	1.395E+06	9.371E+01	3.722E+02	5.579E+05	3.748E+01
2079	1.584E+03	1.340E+06	9.003E+01	3.576E+02	5.360E+05	3.601E+01
2080	1.522E+03	1.287E+06	8.650E+01	3.436E+02	5.150E+05	3.460E+01
2081	1.462E+03	1.237E+06	8.311E+01	3.301E+02	4.948E+05	3.324E+01
2082	1.405E+03	1.188E+06	7.985E+01	3.172E+02	4.754E+05	3.194E+01
2083	1.350E+03	1.142E+06	7.672E+01	3.047E+02	4.567E+05	3.069E+01
2084	1.297E+03	1.097E+06	7.371E+01	2.928E+02	4.388E+05	2.949E+01
2085	1.246E+03	1.054E+06	7.082E+01	2.813E+02	4.216E+05	2.833E+01
2086	1.197E+03	1.013E+06	6.805E+01	2.703E+02	4.051E+05	2.722E+01
2087	1.150E+03	9.730E+05	6.538E+01	2.597E+02	3.892E+05	2.615E+01
2088	1.105E+03	9.349E+05	6.281E+01	2.495E+02	3.740E+05	2.513E+01
2089	1.062E+03	8.982E+05	6.035E+01	2.397E+02	3.593E+05	2.414E+01
2090	1.020E+03	8.630E+05	5.799E+01	2.303E+02	3.452E+05	2.319E+01
2091	9.802E+02	8.292E+05	5.571E+01	2.213E+02	3.317E+05	2.228E+01
2092	9.417E+02	7.967E+05	5.353E+01	2.126E+02	3.187E+05	2.141E+01
2093	9.048E+02	7.654E+05	5.143E+01	2.043E+02	3.062E+05	2.057E+01
2094	8.693E+02	7.354E+05	4.941E+01	1.962E+02	2.942E+05	1.976E+01
2095	8.352E+02	7.066E+05	4.747E+01	1.886E+02	2.826E+05	1.899E+01
2096	8.025E+02	6.789E+05	4.561E+01	1.812E+02	2.715E+05	1.825E+01
2097	7.710E+02	6.522E+05	4.382E+01	1.741E+02	2.609E+05	1.753E+01
2098	7.408E+02	6.267E+05	4.211E+01	1.672E+02	2.507E+05	1.684E+01
2099	7.117E+02	6.021E+05	4.045E+01	1.607E+02	2.408E+05	1.618E+01
2100	6.838E+02	5.785E+05	3.887E+01	1.544E+02	2.314E+05	1.555E+01
2101	6.570E+02	5.558E+05	3.734E+01	1.483E+02	2.223E+05	1.494E+01
2102	6.313E+02	5.340E+05	3.588E+01	1.425E+02	2.136E+05	1.435E+01
2103	6.065E+02	5.131E+05	3.447E+01	1.369E+02	2.052E+05	1.379E+01
2104	5.827E+02	4.930E+05	3.312E+01	1.316E+02	1.972E+05	1.325E+01
2105	5.599E+02	4.736E+05	3.182E+01	1.264E+02	1.895E+05	1.273E+01
2106	5.379E+02	4.551E+05	3.058E+01	1.214E+02	1.820E+05	1.223E+01
2107	5.168E+02	4.372E+05	2.938E+01	1.167E+02	1.749E+05	1.175E+01
2108	4.966E+02	4.201E+05	2.822E+01	1.121E+02	1.680E+05	1.129E+01
2109	4.771E+02	4.036E+05	2.712E+01	1.077E+02	1.614E+05	1.085E+01
2110	4.584E+02	3.878E+05	2.605E+01	1.035E+02	1.551E+05	1.042E+01
2111	4.404E+02	3.726E+05	2.503E+01	9.942E+01	1.490E+05	1.001E+01
2112	4.231E+02	3.580E+05	2.405E+01	9.552E+01	1.432E+05	9.621E+00
2113	4.066E+02	3.439E+05	2.311E+01	9.178E+01	1.376E+05	9.243E+00
2114	3.906E+02	3.304E+05	2.220E+01	8.818E+01	1.322E+05	8.881E+00
2115	3.753E+02	3.175E+05	2.133E+01	8.472E+01	1.270E+05	8.533E+00
2116	3.606E+02	3.050E+05	2.050E+01	8.140E+01	1.220E+05	8.198E+00
2117	3.464E+02	2.931E+05	1.969E+01	7.821E+01	1.172E+05	7.877E+00
2118	3.329E+02	2.816E+05	1.892E+01	7.514E+01	1.126E+05	7.568E+00
2119	3.198E+02	2.705E+05	1.818E+01	7.220E+01	1.082E+05	7.271E+00
2120	3.073E+02	2.599E+05	1.746E+01	6.937E+01	1.040E+05	6.986E+00
2121	2.952E+02	2.497E+05	1.678E+01	6.665E+01	9.990E+04	6.712E+00
2122	2.836E+02	2.399E+05	1.612E+01	6.403E+01	9.598E+04	6.449E+00
2123	2.725E+02	2.305E+05	1.549E+01	6.152E+01	9.222E+04	6.196E+00
2124	2.618E+02	2.215E+05	1.488E+01	5.911E+01	8.860E+04	5.953E+00

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2125	2.516E+02	2.128E+05	1.430E+01	5.679E+01	8.513E+04	5.720E+00
2126	2.417E+02	2.045E+05	1.374E+01	5.456E+01	8.179E+04	5.495E+00
2127	2.322E+02	1.965E+05	1.320E+01	5.243E+01	7.858E+04	5.280E+00
2128	2.231E+02	1.887E+05	1.268E+01	5.037E+01	7.550E+04	5.073E+00
2129	2.144E+02	1.813E+05	1.218E+01	4.839E+01	7.254E+04	4.874E+00
2130	2.060E+02	1.742E+05	1.171E+01	4.650E+01	6.970E+04	4.683E+00
2131	1.979E+02	1.674E+05	1.125E+01	4.467E+01	6.696E+04	4.499E+00
2132	1.901E+02	1.608E+05	1.081E+01	4.292E+01	6.434E+04	4.323E+00
2133	1.827E+02	1.545E+05	1.038E+01	4.124E+01	6.181E+04	4.153E+00
2134	1.755E+02	1.485E+05	9.976E+00	3.962E+01	5.939E+04	3.990E+00
2135	1.686E+02	1.427E+05	9.585E+00	3.807E+01	5.706E+04	3.834E+00
2136	1.620E+02	1.371E+05	9.209E+00	3.658E+01	5.482E+04	3.684E+00
2137	1.557E+02	1.317E+05	8.848E+00	3.514E+01	5.267E+04	3.539E+00
2138	1.496E+02	1.265E+05	8.501E+00	3.376E+01	5.061E+04	3.400E+00
2139	1.437E+02	1.216E+05	8.168E+00	3.244E+01	4.862E+04	3.267E+00
2140	1.381E+02	1.168E+05	7.847E+00	3.117E+01	4.672E+04	3.139E+00
2141	1.327E+02	1.122E+05	7.540E+00	2.995E+01	4.489E+04	3.016E+00
2142	1.274E+02	1.078E+05	7.244E+00	2.877E+01	4.313E+04	2.898E+00
2143	1.225E+02	1.036E+05	6.960E+00	2.764E+01	4.144E+04	2.784E+00
2144	1.177E+02	9.953E+04	6.687E+00	2.656E+01	3.981E+04	2.675E+00
2145	1.130E+02	9.562E+04	6.425E+00	2.552E+01	3.825E+04	2.570E+00
2146	1.086E+02	9.187E+04	6.173E+00	2.452E+01	3.675E+04	2.469E+00
2147	1.043E+02	8.827E+04	5.931E+00	2.356E+01	3.531E+04	2.372E+00
2148	1.003E+02	8.481E+04	5.698E+00	2.263E+01	3.392E+04	2.279E+00
2149	9.632E+01	8.149E+04	5.475E+00	2.175E+01	3.259E+04	2.190E+00
2150	9.255E+01	7.829E+04	5.260E+00	2.089E+01	3.132E+04	2.104E+00
2151	8.892E+01	7.522E+04	5.054E+00	2.007E+01	3.009E+04	2.022E+00
2152	8.543E+01	7.227E+04	4.856E+00	1.929E+01	2.891E+04	1.942E+00
2153	8.208E+01	6.944E+04	4.665E+00	1.853E+01	2.777E+04	1.866E+00
2154	7.886E+01	6.671E+04	4.483E+00	1.780E+01	2.669E+04	1.793E+00
2155	7.577E+01	6.410E+04	4.307E+00	1.711E+01	2.564E+04	1.723E+00
2156	7.280E+01	6.159E+04	4.138E+00	1.643E+01	2.463E+04	1.655E+00
2157	6.995E+01	5.917E+04	3.976E+00	1.579E+01	2.367E+04	1.590E+00
2158	6.720E+01	5.685E+04	3.820E+00	1.517E+01	2.274E+04	1.528E+00
2159	6.457E+01	5.462E+04	3.670E+00	1.458E+01	2.185E+04	1.468E+00
2160	6.204E+01	5.248E+04	3.526E+00	1.400E+01	2.099E+04	1.410E+00
2161	5.960E+01	5.042E+04	3.388E+00	1.346E+01	2.017E+04	1.355E+00
2162	5.727E+01	4.844E+04	3.255E+00	1.293E+01	1.938E+04	1.302E+00
2163	5.502E+01	4.655E+04	3.127E+00	1.242E+01	1.862E+04	1.251E+00
2164	5.286E+01	4.472E+04	3.005E+00	1.193E+01	1.789E+04	1.202E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2024	0	0	0	0	0	0
2025	4.085E+03	2.232E+06	1.499E+02	7.999E+00	2.232E+03	1.499E-01
2026	8.010E+03	4.376E+06	2.940E+02	1.568E+01	4.376E+03	2.940E-01
2027	1.178E+04	6.436E+06	4.324E+02	2.307E+01	6.436E+03	4.324E-01
2028	1.132E+04	6.183E+06	4.155E+02	2.216E+01	6.183E+03	4.155E-01
2029	1.087E+04	5.941E+06	3.992E+02	2.129E+01	5.941E+03	3.992E-01
2030	1.045E+04	5.708E+06	3.835E+02	2.046E+01	5.708E+03	3.835E-01
2031	1.004E+04	5.484E+06	3.685E+02	1.966E+01	5.484E+03	3.685E-01
2032	9.645E+03	5.269E+06	3.540E+02	1.889E+01	5.269E+03	3.540E-01
2033	9.267E+03	5.062E+06	3.401E+02	1.815E+01	5.062E+03	3.401E-01
2034	8.903E+03	4.864E+06	3.268E+02	1.743E+01	4.864E+03	3.268E-01
2035	8.554E+03	4.673E+06	3.140E+02	1.675E+01	4.673E+03	3.140E-01
2036	8.219E+03	4.490E+06	3.017E+02	1.609E+01	4.490E+03	3.017E-01
2037	7.897E+03	4.314E+06	2.898E+02	1.546E+01	4.314E+03	2.898E-01
2038	7.587E+03	4.145E+06	2.785E+02	1.486E+01	4.145E+03	2.785E-01
2039	7.289E+03	3.982E+06	2.676E+02	1.427E+01	3.982E+03	2.676E-01
2040	7.004E+03	3.826E+06	2.571E+02	1.371E+01	3.826E+03	2.571E-01
2041	6.729E+03	3.676E+06	2.470E+02	1.318E+01	3.676E+03	2.470E-01
2042	6.465E+03	3.532E+06	2.373E+02	1.266E+01	3.532E+03	2.373E-01
2043	6.212E+03	3.393E+06	2.280E+02	1.216E+01	3.393E+03	2.280E-01
2044	5.968E+03	3.260E+06	2.191E+02	1.169E+01	3.260E+03	2.191E-01
2045	5.734E+03	3.133E+06	2.105E+02	1.123E+01	3.133E+03	2.105E-01
2046	5.509E+03	3.010E+06	2.022E+02	1.079E+01	3.010E+03	2.022E-01
2047	5.293E+03	2.892E+06	1.943E+02	1.037E+01	2.892E+03	1.943E-01
2048	5.086E+03	2.778E+06	1.867E+02	9.959E+00	2.778E+03	1.867E-01
2049	4.886E+03	2.669E+06	1.794E+02	9.568E+00	2.669E+03	1.794E-01
2050	4.695E+03	2.565E+06	1.723E+02	9.193E+00	2.565E+03	1.723E-01
2051	4.511E+03	2.464E+06	1.656E+02	8.833E+00	2.464E+03	1.656E-01
2052	4.334E+03	2.368E+06	1.591E+02	8.486E+00	2.368E+03	1.591E-01
2053	4.164E+03	2.275E+06	1.528E+02	8.154E+00	2.275E+03	1.528E-01
2054	4.001E+03	2.185E+06	1.468E+02	7.834E+00	2.185E+03	1.468E-01
2055	3.844E+03	2.100E+06	1.411E+02	7.527E+00	2.100E+03	1.411E-01
2056	3.693E+03	2.017E+06	1.356E+02	7.232E+00	2.017E+03	1.356E-01
2057	3.548E+03	1.938E+06	1.302E+02	6.948E+00	1.938E+03	1.302E-01
2058	3.409E+03	1.862E+06	1.251E+02	6.676E+00	1.862E+03	1.251E-01
2059	3.275E+03	1.789E+06	1.202E+02	6.414E+00	1.789E+03	1.202E-01
2060	3.147E+03	1.719E+06	1.155E+02	6.162E+00	1.719E+03	1.155E-01
2061	3.024E+03	1.652E+06	1.110E+02	5.921E+00	1.652E+03	1.110E-01
2062	2.905E+03	1.587E+06	1.066E+02	5.689E+00	1.587E+03	1.066E-01
2063	2.791E+03	1.525E+06	1.024E+02	5.465E+00	1.525E+03	1.024E-01
2064	2.682E+03	1.465E+06	9.843E+01	5.251E+00	1.465E+03	9.843E-02
2065	2.576E+03	1.408E+06	9.457E+01	5.045E+00	1.408E+03	9.457E-02
2066	2.475E+03	1.352E+06	9.086E+01	4.847E+00	1.352E+03	9.086E-02
2067	2.378E+03	1.299E+06	8.730E+01	4.657E+00	1.299E+03	8.730E-02
2068	2.285E+03	1.248E+06	8.388E+01	4.475E+00	1.248E+03	8.388E-02
2069	2.196E+03	1.199E+06	8.059E+01	4.299E+00	1.199E+03	8.059E-02
2070	2.109E+03	1.152E+06	7.743E+01	4.131E+00	1.152E+03	7.743E-02
2071	2.027E+03	1.107E+06	7.439E+01	3.969E+00	1.107E+03	7.439E-02
2072	1.947E+03	1.064E+06	7.148E+01	3.813E+00	1.064E+03	7.148E-02
2073	1.871E+03	1.022E+06	6.867E+01	3.664E+00	1.022E+03	6.867E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2074	1.798E+03	9.820E+05	6.598E+01	3.520E+00	9.820E+02	6.598E-02
2075	1.727E+03	9.435E+05	6.339E+01	3.382E+00	9.435E+02	6.339E-02
2076	1.659E+03	9.065E+05	6.091E+01	3.249E+00	9.065E+02	6.091E-02
2077	1.594E+03	8.710E+05	5.852E+01	3.122E+00	8.710E+02	5.852E-02
2078	1.532E+03	8.368E+05	5.623E+01	3.000E+00	8.368E+02	5.623E-02
2079	1.472E+03	8.040E+05	5.402E+01	2.882E+00	8.040E+02	5.402E-02
2080	1.414E+03	7.725E+05	5.190E+01	2.769E+00	7.725E+02	5.190E-02
2081	1.359E+03	7.422E+05	4.987E+01	2.660E+00	7.422E+02	4.987E-02
2082	1.305E+03	7.131E+05	4.791E+01	2.556E+00	7.131E+02	4.791E-02
2083	1.254E+03	6.851E+05	4.603E+01	2.456E+00	6.851E+02	4.603E-02
2084	1.205E+03	6.583E+05	4.423E+01	2.360E+00	6.583E+02	4.423E-02
2085	1.158E+03	6.324E+05	4.249E+01	2.267E+00	6.324E+02	4.249E-02
2086	1.112E+03	6.076E+05	4.083E+01	2.178E+00	6.076E+02	4.083E-02
2087	1.069E+03	5.838E+05	3.923E+01	2.093E+00	5.838E+02	3.923E-02
2088	1.027E+03	5.609E+05	3.769E+01	2.011E+00	5.609E+02	3.769E-02
2089	9.865E+02	5.389E+05	3.621E+01	1.932E+00	5.389E+02	3.621E-02
2090	9.478E+02	5.178E+05	3.479E+01	1.856E+00	5.178E+02	3.479E-02
2091	9.107E+02	4.975E+05	3.343E+01	1.783E+00	4.975E+02	3.343E-02
2092	8.750E+02	4.780E+05	3.212E+01	1.713E+00	4.780E+02	3.212E-02
2093	8.407E+02	4.593E+05	3.086E+01	1.646E+00	4.593E+02	3.086E-02
2094	8.077E+02	4.412E+05	2.965E+01	1.582E+00	4.412E+02	2.965E-02
2095	7.760E+02	4.239E+05	2.848E+01	1.520E+00	4.239E+02	2.848E-02
2096	7.456E+02	4.073E+05	2.737E+01	1.460E+00	4.073E+02	2.737E-02
2097	7.164E+02	3.913E+05	2.629E+01	1.403E+00	3.913E+02	2.629E-02
2098	6.883E+02	3.760E+05	2.526E+01	1.348E+00	3.760E+02	2.526E-02
2099	6.613E+02	3.613E+05	2.427E+01	1.295E+00	3.613E+02	2.427E-02
2100	6.354E+02	3.471E+05	2.332E+01	1.244E+00	3.471E+02	2.332E-02
2101	6.104E+02	3.335E+05	2.241E+01	1.195E+00	3.335E+02	2.241E-02
2102	5.865E+02	3.204E+05	2.153E+01	1.148E+00	3.204E+02	2.153E-02
2103	5.635E+02	3.078E+05	2.068E+01	1.103E+00	3.078E+02	2.068E-02
2104	5.414E+02	2.958E+05	1.987E+01	1.060E+00	2.958E+02	1.987E-02
2105	5.202E+02	2.842E+05	1.909E+01	1.019E+00	2.842E+02	1.909E-02
2106	4.998E+02	2.730E+05	1.835E+01	9.787E-01	2.730E+02	1.835E-02
2107	4.802E+02	2.623E+05	1.763E+01	9.403E-01	2.623E+02	1.763E-02
2108	4.614E+02	2.520E+05	1.693E+01	9.034E-01	2.520E+02	1.693E-02
2109	4.433E+02	2.422E+05	1.627E+01	8.680E-01	2.422E+02	1.627E-02
2110	4.259E+02	2.327E+05	1.563E+01	8.340E-01	2.327E+02	1.563E-02
2111	4.092E+02	2.235E+05	1.502E+01	8.013E-01	2.235E+02	1.502E-02
2112	3.931E+02	2.148E+05	1.443E+01	7.699E-01	2.148E+02	1.443E-02
2113	3.777E+02	2.064E+05	1.386E+01	7.397E-01	2.064E+02	1.386E-02
2114	3.629E+02	1.983E+05	1.332E+01	7.107E-01	1.983E+02	1.332E-02
2115	3.487E+02	1.905E+05	1.280E+01	6.828E-01	1.905E+02	1.280E-02
2116	3.350E+02	1.830E+05	1.230E+01	6.560E-01	1.830E+02	1.230E-02
2117	3.219E+02	1.758E+05	1.181E+01	6.303E-01	1.758E+02	1.181E-02
2118	3.093E+02	1.689E+05	1.135E+01	6.056E-01	1.689E+02	1.135E-02
2119	2.971E+02	1.623E+05	1.091E+01	5.818E-01	1.623E+02	1.091E-02
2120	2.855E+02	1.560E+05	1.048E+01	5.590E-01	1.560E+02	1.048E-02
2121	2.743E+02	1.498E+05	1.007E+01	5.371E-01	1.498E+02	1.007E-02
2122	2.635E+02	1.440E+05	9.673E+00	5.161E-01	1.440E+02	9.673E-03
2123	2.532E+02	1.383E+05	9.294E+00	4.958E-01	1.383E+02	9.294E-03
2124	2.433E+02	1.329E+05	8.930E+00	4.764E-01	1.329E+02	8.930E-03

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2125	2.337E+02	1.277E+05	8.579E+00	4.577E-01	1.277E+02	8.579E-03
2126	2.246E+02	1.227E+05	8.243E+00	4.397E-01	1.227E+02	8.243E-03
2127	2.158E+02	1.179E+05	7.920E+00	4.225E-01	1.179E+02	7.920E-03
2128	2.073E+02	1.132E+05	7.609E+00	4.059E-01	1.132E+02	7.609E-03
2129	1.992E+02	1.088E+05	7.311E+00	3.900E-01	1.088E+02	7.311E-03
2130	1.914E+02	1.045E+05	7.024E+00	3.747E-01	1.045E+02	7.024E-03
2131	1.839E+02	1.004E+05	6.749E+00	3.600E-01	1.004E+02	6.749E-03
2132	1.767E+02	9.651E+04	6.484E+00	3.459E-01	9.651E+01	6.484E-03
2133	1.697E+02	9.272E+04	6.230E+00	3.324E-01	9.272E+01	6.230E-03
2134	1.631E+02	8.909E+04	5.986E+00	3.193E-01	8.909E+01	5.986E-03
2135	1.567E+02	8.559E+04	5.751E+00	3.068E-01	8.559E+01	5.751E-03
2136	1.505E+02	8.224E+04	5.525E+00	2.948E-01	8.224E+01	5.525E-03
2137	1.446E+02	7.901E+04	5.309E+00	2.832E-01	7.901E+01	5.309E-03
2138	1.390E+02	7.591E+04	5.101E+00	2.721E-01	7.591E+01	5.101E-03
2139	1.335E+02	7.294E+04	4.901E+00	2.614E-01	7.294E+01	4.901E-03
2140	1.283E+02	7.008E+04	4.708E+00	2.512E-01	7.008E+01	4.708E-03
2141	1.232E+02	6.733E+04	4.524E+00	2.413E-01	6.733E+01	4.524E-03
2142	1.184E+02	6.469E+04	4.346E+00	2.319E-01	6.469E+01	4.346E-03
2143	1.138E+02	6.215E+04	4.176E+00	2.228E-01	6.215E+01	4.176E-03
2144	1.093E+02	5.972E+04	4.012E+00	2.140E-01	5.972E+01	4.012E-03
2145	1.050E+02	5.737E+04	3.855E+00	2.057E-01	5.737E+01	3.855E-03
2146	1.009E+02	5.512E+04	3.704E+00	1.976E-01	5.512E+01	3.704E-03
2147	9.695E+01	5.296E+04	3.559E+00	1.898E-01	5.296E+01	3.559E-03
2148	9.315E+01	5.089E+04	3.419E+00	1.824E-01	5.089E+01	3.419E-03
2149	8.950E+01	4.889E+04	3.285E+00	1.752E-01	4.889E+01	3.285E-03
2150	8.599E+01	4.697E+04	3.156E+00	1.684E-01	4.697E+01	3.156E-03
2151	8.261E+01	4.513E+04	3.032E+00	1.618E-01	4.513E+01	3.032E-03
2152	7.938E+01	4.336E+04	2.914E+00	1.554E-01	4.336E+01	2.914E-03
2153	7.626E+01	4.166E+04	2.799E+00	1.493E-01	4.166E+01	2.799E-03
2154	7.327E+01	4.003E+04	2.690E+00	1.435E-01	4.003E+01	2.690E-03
2155	7.040E+01	3.846E+04	2.584E+00	1.379E-01	3.846E+01	2.584E-03
2156	6.764E+01	3.695E+04	2.483E+00	1.324E-01	3.695E+01	2.483E-03
2157	6.499E+01	3.550E+04	2.385E+00	1.273E-01	3.550E+01	2.385E-03
2158	6.244E+01	3.411E+04	2.292E+00	1.223E-01	3.411E+01	2.292E-03
2159	5.999E+01	3.277E+04	2.202E+00	1.175E-01	3.277E+01	2.202E-03
2160	5.764E+01	3.149E+04	2.116E+00	1.129E-01	3.149E+01	2.116E-03
2161	5.538E+01	3.025E+04	2.033E+00	1.084E-01	3.025E+01	2.033E-03
2162	5.321E+01	2.907E+04	1.953E+00	1.042E-01	2.907E+01	1.953E-03
2163	5.112E+01	2.793E+04	1.876E+00	1.001E-01	2.793E+01	1.876E-03
2164	4.912E+01	2.683E+04	1.803E+00	9.618E-02	2.683E+01	1.803E-03



Summary Report

Landfill Name or Identifier:

Date: Tuesday, August 31, 2021

Description/Comments:

About LandGEM:

First-Order Decomposition Rate Equation:

$$Q_{CH_4} = \sum_{i=1}^{n} \sum_{j=0.1}^{1} kL_o \left(\frac{M_i}{10} \right) e^{-kt_{ij}}$$

Where,

Q_{CH4} = annual methane generation in the year of the calculation ($m^3/year$)

i = 1-year time increment

n = (year of the calculation) - (initial year of waste acceptance)

j = 0.1-year time increment

k = methane generation rate ($year^{-1}$)

L_o = potential methane generation capacity (m^3/Mg)

M_i = mass of waste accepted in the i^{th} year (Mg)

t_{ij} = age of the j^{th} section of waste mass M_i accepted in the i^{th} year (*decimal years*, e.g., 3.2 years)

LandGEM is based on a first-order decomposition rate equation for quantifying emissions from the decomposition of landfilled waste in municipal solid waste (MSW) landfills. The software provides a relatively simple approach to estimating landfill gas emissions. Model defaults are based on empirical data from U.S. landfills. Field test data can also be used in place of model defaults when available. Further guidance on EPA test methods, Clean Air Act (CAA) regulations, and other guidance regarding landfill gas emissions and control technology requirements can be found at http://www.epa.gov/ttnatw01/landfill/landflpg.html.

LandGEM is considered a screening tool — the better the input data, the better the estimates. Often, there are limitations with the available data regarding waste quantity and composition, variation in design and operating practices over time, and changes occurring over time that impact the emissions potential. Changes to landfill operation, such as operating under wet conditions through leachate recirculation or other liquid additions, will result in generating more gas at a faster rate. Defaults for estimating emissions for this type of operation are being developed to include in LandGEM along with defaults for convential landfills (no leachate or liquid additions) for developing emission inventories and determining CAA applicability. Refer to the Web site identified above for future updates.

Input Review

LANDFILL CHARACTERISTICS

Landfill Open Year	**2026**	
Landfill Closure Year (with 80-year limit)	**2036**	
Actual Closure Year (without limit)	***2036***	
Have Model Calculate Closure Year?	**Yes**	
Waste Design Capacity	**4,304,718**	*short tons*

MODEL PARAMETERS

Methane Generation Rate, k	**0.040**	*year $^{-1}$*
Potential Methane Generation Capacity, L_o	**100**	*m^3/Mg*
NMOC Concentration	**600**	*ppmv as hexane*
Methane Content	**40**	*% by volume*

GASES / POLLUTANTS SELECTED

Gas / Pollutant #1:	**Total landfill gas**
Gas / Pollutant #2:	**Methane**
Gas / Pollutant #3:	**Carbon dioxide**
Gas / Pollutant #4:	**NMOC**

WASTE ACCEPTANCE RATES

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2026	378,655	416,520	0	0
2027	378,655	416,520	378,655	416,520
2028	378,655	416,520	757,309	833,040
2029	378,655	416,520	1,135,964	1,249,560
2030	378,655	416,520	1,514,618	1,666,080
2031	378,655	416,520	1,893,273	2,082,600
2032	378,655	416,520	2,271,927	2,499,120
2033	378,655	416,520	2,650,582	2,915,640
2034	378,655	416,520	3,029,236	3,332,160
2035	378,655	416,520	3,407,891	3,748,680
2036	126,835	139,518	3,786,545	4,165,200
2037	0	0	3,913,380	4,304,718
2038	0	0	3,913,380	4,304,718
2039	0	0	3,913,380	4,304,718
2040	0	0	3,913,380	4,304,718
2041	0	0	3,913,380	4,304,718
2042	0	0	3,913,380	4,304,718
2043	0	0	3,913,380	4,304,718
2044	0	0	3,913,380	4,304,718
2045	0	0	3,913,380	4,304,718
2046	0	0	3,913,380	4,304,718
2047	0	0	3,913,380	4,304,718
2048	0	0	3,913,380	4,304,718
2049	0	0	3,913,380	4,304,718
2050	0	0	3,913,380	4,304,718
2051	0	0	3,913,380	4,304,718
2052	0	0	3,913,380	4,304,718
2053	0	0	3,913,380	4,304,718
2054	0	0	3,913,380	4,304,718
2055	0	0	3,913,380	4,304,718
2056	0	0	3,913,380	4,304,718
2057	0	0	3,913,380	4,304,718
2058	0	0	3,913,380	4,304,718
2059	0	0	3,913,380	4,304,718
2060	0	0	3,913,380	4,304,718
2061	0	0	3,913,380	4,304,718
2062	0	0	3,913,380	4,304,718
2063	0	0	3,913,380	4,304,718
2064	0	0	3,913,380	4,304,718
2065	0	0	3,913,380	4,304,718

WASTE ACCEPTANCE RATES (Continued)

Year	Waste Accepted		Waste-In-Place	
	(Mg/year)	*(short tons/year)*	*(Mg)*	*(short tons)*
2066	0	0	3,913,380	4,304,718
2067	0	0	3,913,380	4,304,718
2068	0	0	3,913,380	4,304,718
2069	0	0	3,913,380	4,304,718
2070	0	0	3,913,380	4,304,718
2071	0	0	3,913,380	4,304,718
2072	0	0	3,913,380	4,304,718
2073	0	0	3,913,380	4,304,718
2074	0	0	3,913,380	4,304,718
2075	0	0	3,913,380	4,304,718
2076	0	0	3,913,380	4,304,718
2077	0	0	3,913,380	4,304,718
2078	0	0	3,913,380	4,304,718
2079	0	0	3,913,380	4,304,718
2080	0	0	3,913,380	4,304,718
2081	0	0	3,913,380	4,304,718
2082	0	0	3,913,380	4,304,718
2083	0	0	3,913,380	4,304,718
2084	0	0	3,913,380	4,304,718
2085	0	0	3,913,380	4,304,718
2086	0	0	3,913,380	4,304,718
2087	0	0	3,913,380	4,304,718
2088	0	0	3,913,380	4,304,718
2089	0	0	3,913,380	4,304,718
2090	0	0	3,913,380	4,304,718
2091	0	0	3,913,380	4,304,718
2092	0	0	3,913,380	4,304,718
2093	0	0	3,913,380	4,304,718
2094	0	0	3,913,380	4,304,718
2095	0	0	3,913,380	4,304,718
2096	0	0	3,913,380	4,304,718
2097	0	0	3,913,380	4,304,718
2098	0	0	3,913,380	4,304,718
2099	0	0	3,913,380	4,304,718
2100	0	0	3,913,380	4,304,718
2101	0	0	3,913,380	4,304,718
2102	0	0	3,913,380	4,304,718
2103	0	0	3,913,380	4,304,718
2104	0	0	3,913,380	4,304,718
2105	0	0	3,913,380	4,304,718

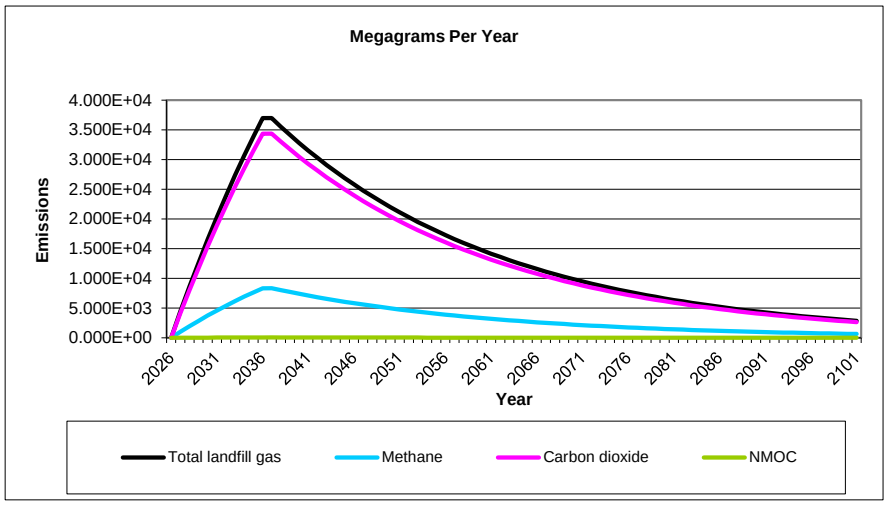
Pollutant Parameters

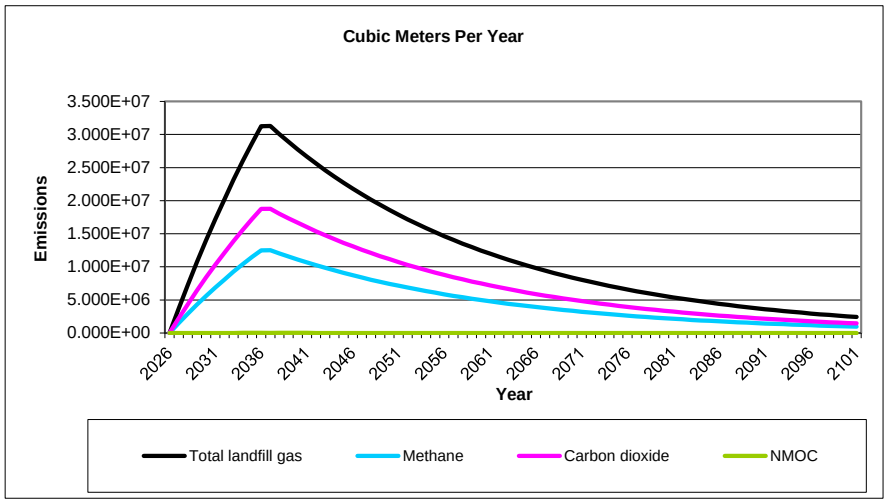
		Gas / Pollutant Default Parameters:		*User-specified Pollutant Parameters:*	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Gases	Total landfill gas		0.00		
	Methane		16.04		
	Carbon dioxide		44.01		
	NMOC	4,000	86.18		
Pollutants	1,1,1-Trichloroethane (methyl chloroform) - HAP	0.48	133.41		
	1,1,2,2-Tetrachloroethane - HAP/VOC	1.1	167.85		
	1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.4	98.97		
	1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	0.20	96.94		
	1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	0.41	98.96		
	1,2-Dichloropropane (propylene dichloride) - HAP/VOC	0.18	112.99		
	2-Propanol (isopropyl alcohol) - VOC	50	60.11		
	Acetone	7.0	58.08		
	Acrylonitrile - HAP/VOC	6.3	53.06		
	Benzene - No or Unknown Co-disposal - HAP/VOC	1.9	78.11		
	Benzene - Co-disposal - HAP/VOC	11	78.11		
	Bromodichloromethane - VOC	3.1	163.83		
	Butane - VOC	5.0	58.12		
	Carbon disulfide - HAP/VOC	0.58	76.13		
	Carbon monoxide	140	28.01		
	Carbon tetrachloride - HAP/VOC	4.0E-03	153.84		
	Carbonyl sulfide - HAP/VOC	0.49	60.07		
	Chlorobenzene - HAP/VOC	0.25	112.56		
	Chlorodifluoromethane	1.3	86.47		
	Chloroethane (ethyl chloride) - HAP/VOC	1.3	64.52		
	Chloroform - HAP/VOC	0.03	119.39		
	Chloromethane - VOC	1.2	50.49		
	Dichlorobenzene - (HAP for para isomer/VOC)	0.21	147		
	Dichlorodifluoromethane	16	120.91		
	Dichlorofluoromethane - VOC	2.6	102.92		
	Dichloromethane (methylene chloride) - HAP	14	84.94		
	Dimethyl sulfide (methyl sulfide) - VOC	7.8	62.13		
	Ethane	890	30.07		
	Ethanol - VOC	27	46.08		

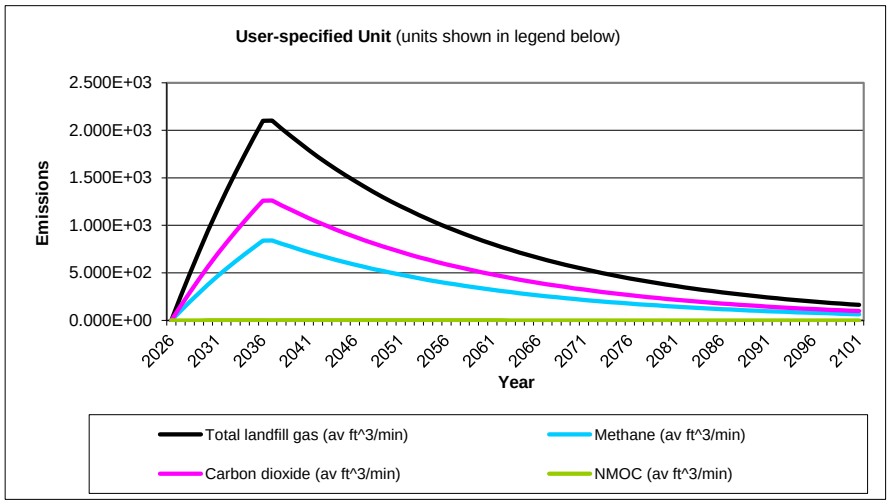
Pollutant Parameters (Continued)

		Gas / Pollutant Default Parameters:		***User-specified Pollutant Parameters:***	
	Compound	Concentration (*ppmv*)	Molecular Weight	Concentration (*ppmv*)	Molecular Weight
Pollutants	Ethyl mercaptan (ethanethiol) - VOC	2.3	62.13		
	Ethylbenzene - HAP/VOC	4.6	106.16		
	Ethylene dibromide - HAP/VOC	1.0E-03	187.88		
	Fluorotrichloromethane - VOC	0.76	137.38		
	Hexane - HAP/VOC	6.6	86.18		
	Hydrogen sulfide	36	34.08		
	Mercury (total) - HAP	2.9E-04	200.61		
	Methyl ethyl ketone - HAP/VOC	7.1	72.11		
	Methyl isobutyl ketone - HAP/VOC	1.9	100.16		
	Methyl mercaptan - VOC	2.5	48.11		
	Pentane - VOC	3.3	72.15		
	Perchloroethylene (tetrachloroethylene) - HAP	3.7	165.83		
	Propane - VOC	11	44.09		
	t-1,2-Dichloroethene - VOC	2.8	96.94		
	Toluene - No or Unknown Co-disposal - HAP/VOC	39	92.13		
	Toluene - Co-disposal - HAP/VOC	170	92.13		
	Trichloroethylene (trichloroethene) - HAP/VOC	2.8	131.40		
	Vinyl chloride - HAP/VOC	7.3	62.50		
	Xylenes - HAP/VOC	12	106.16		

Graphs


Megagrams Per Year
Emissions
4.000E+04
3.500E+04
3.000E+04
2.500E+04
2.000E+04
1.500E+04
1.000E+04
5.000E+03
0.000E+00
2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081 2086 2091 2096 2101
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


Cubic Meters Per Year
Emissions
3.500E+07
3.000E+07
2.500E+07
2.000E+07
1.500E+07
1.000E+07
5.000E+06
0.000E+00
2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081 2086 2091 2096 2101
Year
Total landfill gas
Methane
Carbon dioxide
NMOC


User-specified Unit (units shown in legend below)
Emissions
2.500E+03
2.000E+03
1.500E+03
1.000E+03
5.000E+02
0.000E+00
2026 2031 2036 2041 2046 2051 2056 2061 2066 2071 2076 2081 2086 2091 2096 2101
Year
Total landfill gas (av ft^3/min)
Methane (av ft^3/min)
Carbon dioxide (av ft^3/min)
NMOC (av ft^3/min)

Results

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2026	0	0	0	0	0	0
2027	4.397E+03	3.719E+06	2.499E+02	9.925E+02	1.488E+06	9.996E+01
2028	8.621E+03	7.293E+06	4.900E+02	1.946E+03	2.917E+06	1.960E+02
2029	1.268E+04	1.073E+07	7.207E+02	2.862E+03	4.290E+06	2.883E+02
2030	1.658E+04	1.402E+07	9.423E+02	3.743E+03	5.610E+06	3.769E+02
2031	2.033E+04	1.719E+07	1.155E+03	4.588E+03	6.878E+06	4.621E+02
2032	2.392E+04	2.024E+07	1.360E+03	5.401E+03	8.096E+06	5.439E+02
2033	2.738E+04	2.316E+07	1.556E+03	6.182E+03	9.266E+06	6.226E+02
2034	3.071E+04	2.598E+07	1.745E+03	6.932E+03	1.039E+07	6.981E+02
2035	3.390E+04	2.868E+07	1.927E+03	7.653E+03	1.147E+07	7.707E+02
2036	3.697E+04	3.127E+07	2.101E+03	8.345E+03	1.251E+07	8.404E+02
2037	3.699E+04	3.129E+07	2.102E+03	8.350E+03	1.252E+07	8.410E+02
2038	3.554E+04	3.006E+07	2.020E+03	8.023E+03	1.203E+07	8.080E+02
2039	3.415E+04	2.889E+07	1.941E+03	7.708E+03	1.155E+07	7.763E+02
2040	3.281E+04	2.775E+07	1.865E+03	7.406E+03	1.110E+07	7.459E+02
2041	3.152E+04	2.666E+07	1.792E+03	7.116E+03	1.067E+07	7.166E+02
2042	3.028E+04	2.562E+07	1.721E+03	6.837E+03	1.025E+07	6.885E+02
2043	2.910E+04	2.461E+07	1.654E+03	6.569E+03	9.846E+06	6.615E+02
2044	2.796E+04	2.365E+07	1.589E+03	6.311E+03	9.460E+06	6.356E+02
2045	2.686E+04	2.272E+07	1.527E+03	6.064E+03	9.089E+06	6.107E+02
2046	2.581E+04	2.183E+07	1.467E+03	5.826E+03	8.732E+06	5.867E+02
2047	2.479E+04	2.097E+07	1.409E+03	5.597E+03	8.390E+06	5.637E+02
2048	2.382E+04	2.015E+07	1.354E+03	5.378E+03	8.061E+06	5.416E+02
2049	2.289E+04	1.936E+07	1.301E+03	5.167E+03	7.745E+06	5.204E+02
2050	2.199E+04	1.860E+07	1.250E+03	4.964E+03	7.441E+06	5.000E+02
2051	2.113E+04	1.787E+07	1.201E+03	4.770E+03	7.149E+06	4.804E+02
2052	2.030E+04	1.717E+07	1.154E+03	4.583E+03	6.869E+06	4.615E+02
2053	1.950E+04	1.650E+07	1.109E+03	4.403E+03	6.600E+06	4.434E+02
2054	1.874E+04	1.585E+07	1.065E+03	4.230E+03	6.341E+06	4.260E+02
2055	1.800E+04	1.523E+07	1.023E+03	4.065E+03	6.092E+06	4.093E+02
2056	1.730E+04	1.463E+07	9.832E+02	3.905E+03	5.853E+06	3.933E+02
2057	1.662E+04	1.406E+07	9.447E+02	3.752E+03	5.624E+06	3.779E+02
2058	1.597E+04	1.351E+07	9.076E+02	3.605E+03	5.403E+06	3.631E+02
2059	1.534E+04	1.298E+07	8.721E+02	3.464E+03	5.192E+06	3.488E+02
2060	1.474E+04	1.247E+07	8.379E+02	3.328E+03	4.988E+06	3.351E+02
2061	1.416E+04	1.198E+07	8.050E+02	3.197E+03	4.792E+06	3.220E+02
2062	1.361E+04	1.151E+07	7.734E+02	3.072E+03	4.604E+06	3.094E+02
2063	1.307E+04	1.106E+07	7.431E+02	2.951E+03	4.424E+06	2.972E+02
2064	1.256E+04	1.063E+07	7.140E+02	2.836E+03	4.250E+06	2.856E+02
2065	1.207E+04	1.021E+07	6.860E+02	2.725E+03	4.084E+06	2.744E+02
2066	1.160E+04	9.809E+06	6.591E+02	2.618E+03	3.924E+06	2.636E+02
2067	1.114E+04	9.425E+06	6.332E+02	2.515E+03	3.770E+06	2.533E+02
2068	1.070E+04	9.055E+06	6.084E+02	2.416E+03	3.622E+06	2.434E+02
2069	1.028E+04	8.700E+06	5.846E+02	2.322E+03	3.480E+06	2.338E+02
2070	9.881E+03	8.359E+06	5.616E+02	2.231E+03	3.344E+06	2.247E+02
2071	9.494E+03	8.031E+06	5.396E+02	2.143E+03	3.212E+06	2.158E+02
2072	9.121E+03	7.716E+06	5.185E+02	2.059E+03	3.086E+06	2.074E+02
2073	8.764E+03	7.414E+06	4.981E+02	1.978E+03	2.965E+06	1.992E+02
2074	8.420E+03	7.123E+06	4.786E+02	1.901E+03	2.849E+06	1.914E+02
2075	8.090E+03	6.844E+06	4.598E+02	1.826E+03	2.737E+06	1.839E+02

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2076	7.773E+03	6.575E+06	4.418E+02	1.755E+03	2.630E+06	1.767E+02
2077	7.468E+03	6.318E+06	4.245E+02	1.686E+03	2.527E+06	1.698E+02
2078	7.175E+03	6.070E+06	4.078E+02	1.620E+03	2.428E+06	1.631E+02
2079	6.894E+03	5.832E+06	3.918E+02	1.556E+03	2.333E+06	1.567E+02
2080	6.624E+03	5.603E+06	3.765E+02	1.495E+03	2.241E+06	1.506E+02
2081	6.364E+03	5.383E+06	3.617E+02	1.437E+03	2.153E+06	1.447E+02
2082	6.114E+03	5.172E+06	3.475E+02	1.380E+03	2.069E+06	1.390E+02
2083	5.875E+03	4.970E+06	3.339E+02	1.326E+03	1.988E+06	1.336E+02
2084	5.644E+03	4.775E+06	3.208E+02	1.274E+03	1.910E+06	1.283E+02
2085	5.423E+03	4.587E+06	3.082E+02	1.224E+03	1.835E+06	1.233E+02
2086	5.210E+03	4.408E+06	2.961E+02	1.176E+03	1.763E+06	1.185E+02
2087	5.006E+03	4.235E+06	2.845E+02	1.130E+03	1.694E+06	1.138E+02
2088	4.810E+03	4.069E+06	2.734E+02	1.086E+03	1.627E+06	1.094E+02
2089	4.621E+03	3.909E+06	2.627E+02	1.043E+03	1.564E+06	1.051E+02
2090	4.440E+03	3.756E+06	2.524E+02	1.002E+03	1.502E+06	1.009E+02
2091	4.266E+03	3.609E+06	2.425E+02	9.630E+02	1.443E+06	9.698E+01
2092	4.099E+03	3.467E+06	2.330E+02	9.252E+02	1.387E+06	9.318E+01
2093	3.938E+03	3.331E+06	2.238E+02	8.890E+02	1.332E+06	8.953E+01
2094	3.783E+03	3.201E+06	2.150E+02	8.541E+02	1.280E+06	8.602E+01
2095	3.635E+03	3.075E+06	2.066E+02	8.206E+02	1.230E+06	8.265E+01
2096	3.493E+03	2.954E+06	1.985E+02	7.884E+02	1.182E+06	7.940E+01
2097	3.356E+03	2.839E+06	1.907E+02	7.575E+02	1.135E+06	7.629E+01
2098	3.224E+03	2.727E+06	1.832E+02	7.278E+02	1.091E+06	7.330E+01
2099	3.098E+03	2.620E+06	1.761E+02	6.993E+02	1.048E+06	7.043E+01
2100	2.976E+03	2.518E+06	1.692E+02	6.719E+02	1.007E+06	6.766E+01
2101	2.859E+03	2.419E+06	1.625E+02	6.455E+02	9.676E+05	6.501E+01
2102	2.747E+03	2.324E+06	1.562E+02	6.202E+02	9.296E+05	6.246E+01
2103	2.640E+03	2.233E+06	1.500E+02	5.959E+02	8.932E+05	6.001E+01
2104	2.536E+03	2.145E+06	1.441E+02	5.725E+02	8.582E+05	5.766E+01
2105	2.437E+03	2.061E+06	1.385E+02	5.501E+02	8.245E+05	5.540E+01
2106	2.341E+03	1.980E+06	1.331E+02	5.285E+02	7.922E+05	5.323E+01
2107	2.249E+03	1.903E+06	1.278E+02	5.078E+02	7.611E+05	5.114E+01
2108	2.161E+03	1.828E+06	1.228E+02	4.879E+02	7.313E+05	4.913E+01
2109	2.076E+03	1.757E+06	1.180E+02	4.687E+02	7.026E+05	4.721E+01
2110	1.995E+03	1.688E+06	1.134E+02	4.504E+02	6.751E+05	4.536E+01
2111	1.917E+03	1.621E+06	1.089E+02	4.327E+02	6.486E+05	4.358E+01
2112	1.842E+03	1.558E+06	1.047E+02	4.157E+02	6.232E+05	4.187E+01
2113	1.769E+03	1.497E+06	1.006E+02	3.994E+02	5.987E+05	4.023E+01
2114	1.700E+03	1.438E+06	9.663E+01	3.838E+02	5.752E+05	3.865E+01
2115	1.633E+03	1.382E+06	9.284E+01	3.687E+02	5.527E+05	3.713E+01
2116	1.569E+03	1.328E+06	8.920E+01	3.543E+02	5.310E+05	3.568E+01
2117	1.508E+03	1.275E+06	8.570E+01	3.404E+02	5.102E+05	3.428E+01
2118	1.449E+03	1.225E+06	8.234E+01	3.270E+02	4.902E+05	3.294E+01
2119	1.392E+03	1.177E+06	7.911E+01	3.142E+02	4.710E+05	3.164E+01
2120	1.337E+03	1.131E+06	7.601E+01	3.019E+02	4.525E+05	3.040E+01
2121	1.285E+03	1.087E+06	7.303E+01	2.900E+02	4.348E+05	2.921E+01
2122	1.234E+03	1.044E+06	7.016E+01	2.787E+02	4.177E+05	2.807E+01
2123	1.186E+03	1.003E+06	6.741E+01	2.677E+02	4.013E+05	2.697E+01
2124	1.140E+03	9.640E+05	6.477E+01	2.572E+02	3.856E+05	2.591E+01
2125	1.095E+03	9.262E+05	6.223E+01	2.472E+02	3.705E+05	2.489E+01
2126	1.052E+03	8.899E+05	5.979E+01	2.375E+02	3.559E+05	2.392E+01

Results (Continued)

Year	Total landfill gas			Methane		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2127	1.011E+03	8.550E+05	5.745E+01	2.282E+02	3.420E+05	2.298E+01
2128	9.711E+02	8.215E+05	5.519E+01	2.192E+02	3.286E+05	2.208E+01
2129	9.330E+02	7.892E+05	5.303E+01	2.106E+02	3.157E+05	2.121E+01
2130	8.964E+02	7.583E+05	5.095E+01	2.024E+02	3.033E+05	2.038E+01
2131	8.612E+02	7.286E+05	4.895E+01	1.944E+02	2.914E+05	1.958E+01
2132	8.275E+02	7.000E+05	4.703E+01	1.868E+02	2.800E+05	1.881E+01
2133	7.950E+02	6.726E+05	4.519E+01	1.795E+02	2.690E+05	1.808E+01
2134	7.639E+02	6.462E+05	4.342E+01	1.724E+02	2.585E+05	1.737E+01
2135	7.339E+02	6.208E+05	4.171E+01	1.657E+02	2.483E+05	1.669E+01
2136	7.051E+02	5.965E+05	4.008E+01	1.592E+02	2.386E+05	1.603E+01
2137	6.775E+02	5.731E+05	3.851E+01	1.529E+02	2.292E+05	1.540E+01
2138	6.509E+02	5.506E+05	3.700E+01	1.469E+02	2.203E+05	1.480E+01
2139	6.254E+02	5.290E+05	3.555E+01	1.412E+02	2.116E+05	1.422E+01
2140	6.009E+02	5.083E+05	3.415E+01	1.356E+02	2.033E+05	1.366E+01
2141	5.773E+02	4.884E+05	3.281E+01	1.303E+02	1.953E+05	1.313E+01
2142	5.547E+02	4.692E+05	3.153E+01	1.252E+02	1.877E+05	1.261E+01
2143	5.329E+02	4.508E+05	3.029E+01	1.203E+02	1.803E+05	1.212E+01
2144	5.120E+02	4.331E+05	2.910E+01	1.156E+02	1.733E+05	1.164E+01
2145	4.920E+02	4.162E+05	2.796E+01	1.111E+02	1.665E+05	1.118E+01
2146	4.727E+02	3.998E+05	2.687E+01	1.067E+02	1.599E+05	1.075E+01
2147	4.541E+02	3.842E+05	2.581E+01	1.025E+02	1.537E+05	1.032E+01
2148	4.363E+02	3.691E+05	2.480E+01	9.850E+01	1.476E+05	9.920E+00
2149	4.192E+02	3.546E+05	2.383E+01	9.464E+01	1.419E+05	9.531E+00
2150	4.028E+02	3.407E+05	2.289E+01	9.093E+01	1.363E+05	9.157E+00
2151	3.870E+02	3.274E+05	2.200E+01	8.736E+01	1.309E+05	8.798E+00
2152	3.718E+02	3.145E+05	2.113E+01	8.394E+01	1.258E+05	8.453E+00
2153	3.572E+02	3.022E+05	2.030E+01	8.064E+01	1.209E+05	8.122E+00
2154	3.432E+02	2.903E+05	1.951E+01	7.748E+01	1.161E+05	7.803E+00
2155	3.298E+02	2.790E+05	1.874E+01	7.444E+01	1.116E+05	7.497E+00
2156	3.168E+02	2.680E+05	1.801E+01	7.152E+01	1.072E+05	7.203E+00
2157	3.044E+02	2.575E+05	1.730E+01	6.872E+01	1.030E+05	6.921E+00
2158	2.925E+02	2.474E+05	1.662E+01	6.603E+01	9.897E+04	6.650E+00
2159	2.810E+02	2.377E+05	1.597E+01	6.344E+01	9.509E+04	6.389E+00
2160	2.700E+02	2.284E+05	1.535E+01	6.095E+01	9.136E+04	6.138E+00
2161	2.594E+02	2.194E+05	1.474E+01	5.856E+01	8.778E+04	5.898E+00
2162	2.492E+02	2.108E+05	1.417E+01	5.626E+01	8.433E+04	5.666E+00
2163	2.395E+02	2.026E+05	1.361E+01	5.406E+01	8.103E+04	5.444E+00
2164	2.301E+02	1.946E+05	1.308E+01	5.194E+01	7.785E+04	5.231E+00
2165	2.210E+02	1.870E+05	1.256E+01	4.990E+01	7.480E+04	5.026E+00
2166	2.124E+02	1.797E+05	1.207E+01	4.794E+01	7.186E+04	4.829E+00

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2026	0	0	0	0	0	0
2027	4.085E+03	2.232E+06	1.499E+02	7.999E+00	2.232E+03	1.499E-01
2028	8.010E+03	4.376E+06	2.940E+02	1.568E+01	4.376E+03	2.940E-01
2029	1.178E+04	6.436E+06	4.324E+02	2.307E+01	6.436E+03	4.324E-01
2030	1.540E+04	8.415E+06	5.654E+02	3.016E+01	8.415E+03	5.654E-01
2031	1.888E+04	1.032E+07	6.932E+02	3.698E+01	1.032E+04	6.932E-01
2032	2.223E+04	1.214E+07	8.159E+02	4.353E+01	1.214E+04	8.159E-01
2033	2.544E+04	1.390E+07	9.339E+02	4.982E+01	1.390E+04	9.339E-01
2034	2.853E+04	1.559E+07	1.047E+03	5.587E+01	1.559E+04	1.047E+00
2035	3.150E+04	1.721E+07	1.156E+03	6.167E+01	1.721E+04	1.156E+00
2036	3.435E+04	1.876E+07	1.261E+03	6.725E+01	1.876E+04	1.261E+00
2037	3.437E+04	1.877E+07	1.261E+03	6.730E+01	1.877E+04	1.261E+00
2038	3.302E+04	1.804E+07	1.212E+03	6.466E+01	1.804E+04	1.212E+00
2039	3.172E+04	1.733E+07	1.164E+03	6.212E+01	1.733E+04	1.164E+00
2040	3.048E+04	1.665E+07	1.119E+03	5.969E+01	1.665E+04	1.119E+00
2041	2.929E+04	1.600E+07	1.075E+03	5.735E+01	1.600E+04	1.075E+00
2042	2.814E+04	1.537E+07	1.033E+03	5.510E+01	1.537E+04	1.033E+00
2043	2.703E+04	1.477E+07	9.923E+02	5.294E+01	1.477E+04	9.923E-01
2044	2.597E+04	1.419E+07	9.534E+02	5.086E+01	1.419E+04	9.534E-01
2045	2.496E+04	1.363E+07	9.160E+02	4.887E+01	1.363E+04	9.160E-01
2046	2.398E+04	1.310E+07	8.801E+02	4.695E+01	1.310E+04	8.801E-01
2047	2.304E+04	1.258E+07	8.456E+02	4.511E+01	1.258E+04	8.456E-01
2048	2.213E+04	1.209E+07	8.124E+02	4.334E+01	1.209E+04	8.124E-01
2049	2.127E+04	1.162E+07	7.806E+02	4.164E+01	1.162E+04	7.806E-01
2050	2.043E+04	1.116E+07	7.500E+02	4.001E+01	1.116E+04	7.500E-01
2051	1.963E+04	1.072E+07	7.206E+02	3.844E+01	1.072E+04	7.206E-01
2052	1.886E+04	1.030E+07	6.923E+02	3.693E+01	1.030E+04	6.923E-01
2053	1.812E+04	9.900E+06	6.652E+02	3.548E+01	9.900E+03	6.652E-01
2054	1.741E+04	9.511E+06	6.391E+02	3.409E+01	9.511E+03	6.391E-01
2055	1.673E+04	9.139E+06	6.140E+02	3.276E+01	9.139E+03	6.140E-01
2056	1.607E+04	8.780E+06	5.899E+02	3.147E+01	8.780E+03	5.899E-01
2057	1.544E+04	8.436E+06	5.668E+02	3.024E+01	8.436E+03	5.668E-01
2058	1.484E+04	8.105E+06	5.446E+02	2.905E+01	8.105E+03	5.446E-01
2059	1.425E+04	7.787E+06	5.232E+02	2.791E+01	7.787E+03	5.232E-01
2060	1.370E+04	7.482E+06	5.027E+02	2.682E+01	7.482E+03	5.027E-01
2061	1.316E+04	7.189E+06	4.830E+02	2.577E+01	7.189E+03	4.830E-01
2062	1.264E+04	6.907E+06	4.641E+02	2.476E+01	6.907E+03	4.641E-01
2063	1.215E+04	6.636E+06	4.459E+02	2.379E+01	6.636E+03	4.459E-01
2064	1.167E+04	6.376E+06	4.284E+02	2.285E+01	6.376E+03	4.284E-01
2065	1.121E+04	6.126E+06	4.116E+02	2.196E+01	6.126E+03	4.116E-01
2066	1.077E+04	5.886E+06	3.954E+02	2.110E+01	5.886E+03	3.954E-01
2067	1.035E+04	5.655E+06	3.799E+02	2.027E+01	5.655E+03	3.799E-01
2068	9.945E+03	5.433E+06	3.650E+02	1.947E+01	5.433E+03	3.650E-01
2069	9.555E+03	5.220E+06	3.507E+02	1.871E+01	5.220E+03	3.507E-01
2070	9.181E+03	5.015E+06	3.370E+02	1.798E+01	5.015E+03	3.370E-01
2071	8.821E+03	4.819E+06	3.238E+02	1.727E+01	4.819E+03	3.238E-01
2072	8.475E+03	4.630E+06	3.111E+02	1.660E+01	4.630E+03	3.111E-01
2073	8.142E+03	4.448E+06	2.989E+02	1.594E+01	4.448E+03	2.989E-01
2074	7.823E+03	4.274E+06	2.872E+02	1.532E+01	4.274E+03	2.872E-01
2075	7.516E+03	4.106E+06	2.759E+02	1.472E+01	4.106E+03	2.759E-01

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2076	7.222E+03	3.945E+06	2.651E+02	1.414E+01	3.945E+03	2.651E-01
2077	6.939E+03	3.791E+06	2.547E+02	1.359E+01	3.791E+03	2.547E-01
2078	6.666E+03	3.642E+06	2.447E+02	1.305E+01	3.642E+03	2.447E-01
2079	6.405E+03	3.499E+06	2.351E+02	1.254E+01	3.499E+03	2.351E-01
2080	6.154E+03	3.362E+06	2.259E+02	1.205E+01	3.362E+03	2.259E-01
2081	5.913E+03	3.230E+06	2.170E+02	1.158E+01	3.230E+03	2.170E-01
2082	5.681E+03	3.103E+06	2.085E+02	1.112E+01	3.103E+03	2.085E-01
2083	5.458E+03	2.982E+06	2.003E+02	1.069E+01	2.982E+03	2.003E-01
2084	5.244E+03	2.865E+06	1.925E+02	1.027E+01	2.865E+03	1.925E-01
2085	5.038E+03	2.752E+06	1.849E+02	9.866E+00	2.752E+03	1.849E-01
2086	4.841E+03	2.645E+06	1.777E+02	9.479E+00	2.645E+03	1.777E-01
2087	4.651E+03	2.541E+06	1.707E+02	9.108E+00	2.541E+03	1.707E-01
2088	4.469E+03	2.441E+06	1.640E+02	8.750E+00	2.441E+03	1.640E-01
2089	4.293E+03	2.346E+06	1.576E+02	8.407E+00	2.346E+03	1.576E-01
2090	4.125E+03	2.254E+06	1.514E+02	8.078E+00	2.254E+03	1.514E-01
2091	3.963E+03	2.165E+06	1.455E+02	7.761E+00	2.165E+03	1.455E-01
2092	3.808E+03	2.080E+06	1.398E+02	7.457E+00	2.080E+03	1.398E-01
2093	3.659E+03	1.999E+06	1.343E+02	7.164E+00	1.999E+03	1.343E-01
2094	3.515E+03	1.920E+06	1.290E+02	6.883E+00	1.920E+03	1.290E-01
2095	3.377E+03	1.845E+06	1.240E+02	6.613E+00	1.845E+03	1.240E-01
2096	3.245E+03	1.773E+06	1.191E+02	6.354E+00	1.773E+03	1.191E-01
2097	3.118E+03	1.703E+06	1.144E+02	6.105E+00	1.703E+03	1.144E-01
2098	2.995E+03	1.636E+06	1.099E+02	5.866E+00	1.636E+03	1.099E-01
2099	2.878E+03	1.572E+06	1.056E+02	5.636E+00	1.572E+03	1.056E-01
2100	2.765E+03	1.511E+06	1.015E+02	5.415E+00	1.511E+03	1.015E-01
2101	2.657E+03	1.451E+06	9.752E+01	5.202E+00	1.451E+03	9.752E-02
2102	2.553E+03	1.394E+06	9.369E+01	4.998E+00	1.394E+03	9.369E-02
2103	2.452E+03	1.340E+06	9.002E+01	4.802E+00	1.340E+03	9.002E-02
2104	2.356E+03	1.287E+06	8.649E+01	4.614E+00	1.287E+03	8.649E-02
2105	2.264E+03	1.237E+06	8.310E+01	4.433E+00	1.237E+03	8.310E-02
2106	2.175E+03	1.188E+06	7.984E+01	4.259E+00	1.188E+03	7.984E-02
2107	2.090E+03	1.142E+06	7.671E+01	4.092E+00	1.142E+03	7.671E-02
2108	2.008E+03	1.097E+06	7.370E+01	3.932E+00	1.097E+03	7.370E-02
2109	1.929E+03	1.054E+06	7.081E+01	3.778E+00	1.054E+03	7.081E-02
2110	1.854E+03	1.013E+06	6.803E+01	3.630E+00	1.013E+03	6.803E-02
2111	1.781E+03	9.729E+05	6.537E+01	3.487E+00	9.729E+02	6.537E-02
2112	1.711E+03	9.347E+05	6.280E+01	3.350E+00	9.347E+02	6.280E-02
2113	1.644E+03	8.981E+05	6.034E+01	3.219E+00	8.981E+02	6.034E-02
2114	1.579E+03	8.629E+05	5.798E+01	3.093E+00	8.629E+02	5.798E-02
2115	1.518E+03	8.290E+05	5.570E+01	2.972E+00	8.290E+02	5.570E-02
2116	1.458E+03	7.965E+05	5.352E+01	2.855E+00	7.965E+02	5.352E-02
2117	1.401E+03	7.653E+05	5.142E+01	2.743E+00	7.653E+02	5.142E-02
2118	1.346E+03	7.353E+05	4.940E+01	2.636E+00	7.353E+02	4.940E-02
2119	1.293E+03	7.065E+05	4.747E+01	2.532E+00	7.065E+02	4.747E-02
2120	1.242E+03	6.788E+05	4.561E+01	2.433E+00	6.788E+02	4.561E-02
2121	1.194E+03	6.521E+05	4.382E+01	2.338E+00	6.521E+02	4.382E-02
2122	1.147E+03	6.266E+05	4.210E+01	2.246E+00	6.266E+02	4.210E-02
2123	1.102E+03	6.020E+05	4.045E+01	2.158E+00	6.020E+02	4.045E-02
2124	1.059E+03	5.784E+05	3.886E+01	2.073E+00	5.784E+02	3.886E-02
2125	1.017E+03	5.557E+05	3.734E+01	1.992E+00	5.557E+02	3.734E-02
2126	9.773E+02	5.339E+05	3.587E+01	1.914E+00	5.339E+02	3.587E-02

Results (Continued)

Year	Carbon dioxide			NMOC		
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(Mg/year)*	*(m^3/year)*	*(av ft^3/min)*
2127	9.390E+02	5.130E+05	3.447E+01	1.839E+00	5.130E+02	3.447E-02
2128	9.022E+02	4.929E+05	3.312E+01	1.767E+00	4.929E+02	3.312E-02
2129	8.668E+02	4.735E+05	3.182E+01	1.697E+00	4.735E+02	3.182E-02
2130	8.328E+02	4.550E+05	3.057E+01	1.631E+00	4.550E+02	3.057E-02
2131	8.002E+02	4.371E+05	2.937E+01	1.567E+00	4.371E+02	2.937E-02
2132	7.688E+02	4.200E+05	2.822E+01	1.505E+00	4.200E+02	2.822E-02
2133	7.387E+02	4.035E+05	2.711E+01	1.446E+00	4.035E+02	2.711E-02
2134	7.097E+02	3.877E+05	2.605E+01	1.390E+00	3.877E+02	2.605E-02
2135	6.819E+02	3.725E+05	2.503E+01	1.335E+00	3.725E+02	2.503E-02
2136	6.551E+02	3.579E+05	2.405E+01	1.283E+00	3.579E+02	2.405E-02
2137	6.294E+02	3.439E+05	2.310E+01	1.233E+00	3.439E+02	2.310E-02
2138	6.048E+02	3.304E+05	2.220E+01	1.184E+00	3.304E+02	2.220E-02
2139	5.811E+02	3.174E+05	2.133E+01	1.138E+00	3.174E+02	2.133E-02
2140	5.583E+02	3.050E+05	2.049E+01	1.093E+00	3.050E+02	2.049E-02
2141	5.364E+02	2.930E+05	1.969E+01	1.050E+00	2.930E+02	1.969E-02
2142	5.153E+02	2.815E+05	1.892E+01	1.009E+00	2.815E+02	1.892E-02
2143	4.951E+02	2.705E+05	1.817E+01	9.696E-01	2.705E+02	1.817E-02
2144	4.757E+02	2.599E+05	1.746E+01	9.316E-01	2.599E+02	1.746E-02
2145	4.571E+02	2.497E+05	1.678E+01	8.950E-01	2.497E+02	1.678E-02
2146	4.392E+02	2.399E+05	1.612E+01	8.599E-01	2.399E+02	1.612E-02
2147	4.219E+02	2.305E+05	1.549E+01	8.262E-01	2.305E+02	1.549E-02
2148	4.054E+02	2.215E+05	1.488E+01	7.938E-01	2.215E+02	1.488E-02
2149	3.895E+02	2.128E+05	1.430E+01	7.627E-01	2.128E+02	1.430E-02
2150	3.742E+02	2.044E+05	1.374E+01	7.328E-01	2.044E+02	1.374E-02
2151	3.595E+02	1.964E+05	1.320E+01	7.041E-01	1.964E+02	1.320E-02
2152	3.454E+02	1.887E+05	1.268E+01	6.765E-01	1.887E+02	1.268E-02
2153	3.319E+02	1.813E+05	1.218E+01	6.499E-01	1.813E+02	1.218E-02
2154	3.189E+02	1.742E+05	1.171E+01	6.244E-01	1.742E+02	1.171E-02
2155	3.064E+02	1.674E+05	1.125E+01	6.000E-01	1.674E+02	1.125E-02
2156	2.944E+02	1.608E+05	1.081E+01	5.764E-01	1.608E+02	1.081E-02
2157	2.828E+02	1.545E+05	1.038E+01	5.538E-01	1.545E+02	1.038E-02
2158	2.717E+02	1.485E+05	9.974E+00	5.321E-01	1.485E+02	9.974E-03
2159	2.611E+02	1.426E+05	9.583E+00	5.113E-01	1.426E+02	9.583E-03
2160	2.508E+02	1.370E+05	9.208E+00	4.912E-01	1.370E+02	9.208E-03
2161	2.410E+02	1.317E+05	8.846E+00	4.719E-01	1.317E+02	8.846E-03
2162	2.316E+02	1.265E+05	8.500E+00	4.534E-01	1.265E+02	8.500E-03
2163	2.225E+02	1.215E+05	8.166E+00	4.357E-01	1.215E+02	8.166E-03
2164	2.138E+02	1.168E+05	7.846E+00	4.186E-01	1.168E+02	7.846E-03
2165	2.054E+02	1.122E+05	7.538E+00	4.022E-01	1.122E+02	7.538E-03
2166	1.973E+02	1.078E+05	7.243E+00	3.864E-01	1.078E+02	7.243E-03

ADVANCED GeoServices

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ATTACHMENT 11B

Radius of Influence

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Radius of Influence		
	Job No. 2018-3854	Made by: TD TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEF VEF	Sheet 1 of 2

Revised by PGS 08/30/2021

Objective:

To calculate the radius of influence to be used for the design of the landfill gas well field.

References:

1. LandGEM Model calculation by Montrose Environmental, Project No. 20183854, dated 7/08/20.
2. Landfill Off-Gas Collection and Treatment Systems, Department of the Army, US Army Corps of Engineers, May 2008.

Attachments:

Appendix A – Radius of Influence, Microsoft Excel spreadsheet by Montrose Environmental, Project No. 20183854.

Appendix B – Well Flows & Per Foot of Well Screen Gas Production Rate, Microsoft Excel spreadsheet by Montrose Environmental, Project No. 20183854.

Calculation:

The following equation is used to calculate the radius of influence, ROI (ft.)

$$R = \sqrt{\frac{Q}{\pi * t * G * D}} \ (Ref. 2)$$

Where R is a function of:

- Methane flow rate, Q (CFM)
- Waste thickness, t (ft)
- Methane production rate, G =

$$\text{2,430 } \cancel{\text{4,472}}\ scfm \left(\frac{1440\ min}{day}\right) \cancel{(9{,}200{,}000\ tons)^{-1}} \text{ 5,000,000} = \cancel{0.700} \text{ 0.700}\ \frac{ft^3}{ton \cdot day}\ \text{(Ref. 1)}$$

- Waste density, D (γ_{waste}) = 0.66 $\frac{ton}{yd^3}$ = 0.0244 $\frac{ton}{ft^3}$

The peak landfill gas production occurs at $\cancel{4{,}472}$ 2,430 scfm (Ref. 1) for 99 wells with a combined screen length of $\cancel{6{,}844}$ 4,363 LF, which yields a collection rate of $\cancel{0.65}$ 0.56 scfm/ft of well screen. A spreadsheet was prepared for various flows and depths and is attached. The following sample calculation is for a flow of 39 scfm and 60 feet of waste depth.

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Radius of Influence		
	Job No. 2018-3854	Made by: TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEF	Sheet 2 of 2

$$R = \sqrt{\frac{39\,\frac{ft^3}{min}}{\left[\pi\,(60\,ft)\left(0.700\,\frac{ft^3}{ton\cdot day}\right)\left(0.0244\,\frac{ton}{ft^3}\right)\left(\frac{day}{1440\,min}\right)\right]}}$$

$$= \sqrt{\frac{39\,\frac{ft^3}{min}}{0.00224\,\frac{ft}{min}}} = 132.1\ ft$$

It is assumed that for the rubble fill, 0.65 (0.56) ft^3 gas will be collected per foot of well screen, this data is found in Appendix B. We chose to use ~~125~~ (130) ft. ~~for conservation~~, in addition to the waste being heterogeneous.

Conclusion:

A design ROI of 130 feet will be used to design the Chesapeake Terrace Rubble Fill well field.

$$R = \sqrt{\frac{Q}{\pi * t * G * D}}$$

Where the radius of influence, ft, is a function of:

- Methane flow rate, Q (CFM)
- Waste thickness, t (ft)
- Methane production rate, G = $0.700 \frac{ft^3}{ton \cdot day}$
- Waste density, D (γ_{waste}) = $0.0244 \frac{ton}{ft^3}$

Calculated R Values, feet

	Depth, ft										
Flow (CFM)	40	50	60	70	80	90	100	120	130	140	150
150	317	284	259	240	224	211	201	183	176	170	164
140	306	274	250	232	217	204	194	177	170	164	158
130	295	264	241	223	209	197	187	171	164	158	153
120	284	254	232	214	201	189	179	164	157	152	147
110	272	243	222	205	192	181	172	157	151	145	140
100	259	232	211	196	183	173	164	150	144	138	134
90	246	220	201	186	174	164	155	142	136	131	127
80	232	207	189	175	164	154	147	134	129	124	120
75	224	201	183	170	159	150	142	130	124	120	116
60	201	179	164	152	142	134	127	116	111	107	104
50	183	164	150	138	130	122	116	106	102	98	95
40	164	147	134	124	116	109	104	95	91	88	85
30	142	127	116	107	100	95	90	82	79	76	73
25	130	116	106	98	92	86	82	75	72	69	67
10	82	73	67	62	58	55	52	47	45	44	42

Appendix B Revised Sept 2021

West Section					
Well ID	Final Cover Proposed Elevation (ft.)	Top of Leachate System Elevation (ft.)	Elevation Difference (ft.)	Length of Well Screen System (ft.)	Q (SCFM)
EW-01	161	116	45	27	15.0
EW-02	160	109	51	33	18.4
EW-03	156	101	55	37	20.6
EW-04	190	118	72	54	30.1
EW-05	188	115	73	55	30.6
EW-06	150	96	54	36	20.1
EW-07	184	105	79	61	34.0
EW-08	140	101	39	21	11.7
EW-09	135	107	28	10	5.6
EW-10	130	106	24	6	3.3
EW-11	137	110	27	9	5.0
EW-12	144	113	31	13	7.2
EW-13	181	109	72	54	30.1
EW-14	168	112	56	38	21.2
EW-15	158	112	46	28	15.6
EW-16	192	114	78	60	33.4
EW-17	190	117	73	55	30.6
EW-18	180	119	61	43	23.9
EW-19	150	119	31	13	7.2
EW-20	197	128	69	51	28.4
EW-21	185	127	58	40	22.3
EW-22	151	122	29	11	6.1
EW-23	187	138	49	31	17.3
EW-24	154	126	28	10	5.6
EW-25	155	130	25	7	3.9
EW-26	196	127	69	51	28.4
EW-27	189	140	49	31	17.3
EW-28	158	128	30	12	6.7
EW-29	190	143	47	29	16.2
EW-30	163	129	34	16	8.9
EW-31	197	135	62	44	24.5
EW-32	165	137	28	10	5.6
EW-33	203	133	70	52	29.0
EW-34	170	126	44	26	14.5
EW-35	212	138	74	56	31.2
EW-36	175	127	48	30	16.7
EW-37	215	131	84	66	36.8
EW-38	178	128	50	32	17.8
EW-39	217	126	91	73	40.7
EW-40	180	126	54	36	20.1
EW-41	217	130	87	69	38.4
EW-42	184	123	61	43	23.9

Footnote: The Length of Well Screen took into consideration the height of the cap and liner system.

West Section					
Well ID	Final Cover Proposed Elevation (ft.)	Top of Leachate System Elevation (ft.)	Elevation Difference (ft.)	Length of Well Screen System (ft.)	Q (SCFM)
EW-43	194	120	74	56	31.2
EW-44	205	121	84	66	36.8
EW-45	222	124	98	80	44.6
EW-46	224	125	99	81	45.1
EW-47	210	132	78	60	33.4
EW-48	224	119	105	87	48.5
EW-49	218	117	101	83	46.2
EW-50	212	129	83	65	36.2
EW-51	220	114	106	88	49.0
EW-52	187	114	73	55	30.6
EW-53	202	131	71	53	29.5
EW-54	192	110	82	64	35.6
EW-55	188	120	68	50	27.8
EW-56	217	124	93	75	41.8
EW-57	223	134	89	71	39.5
EW-58	182	126	56	38	21.2
EW-59	217	132	85	67	37.3
EW-60	182	119	63	45	25.1
EW-61	211	123	88	70	39.0
EW-62	210	139	71	53	29.5
EW-63	181	123	58	40	22.3
EW-64	206	133	73	55	30.6
EW-65	201	124	77	59	32.9
EW-66	206	130	76	58	32.3
EW-67	175	112	63	45	25.1
EW-68	192	115	77	59	32.9
EW-69	198	123	75	57	31.7
EW-70	198	131	67	49	27.3
EW-71	166	119	47	29	16.2
EW-72	189	123	66	48	26.7
EW-73	195	124	71	53	29.5
EW-74	197	129	68	50	27.8
EW-75	196	121	75	57	31.7
			Total Length (ft.)	3445	

East Section					
Well ID	Final Cover Proposed Elevation (ft.)	Top of Leachate System Elevation (ft.)	Elevation Difference (ft.)	Length of Well Screen System (ft.)	Q (SCFM)
EW-76	126	87	39	21	11.7
EW-77	152	89	63	45	25.1
EW-78	126	80	46	28	15.6
EW-79	159	93	66	48	26.7
EW-80	132	91	41	23	12.8
EW-81	162	102	60	42	23.4
EW-82	168	92	76	58	32.3
EW-83	181	101	80	62	34.5
EW-84	155	99	56	38	21.2
EW-85	140	90	50	32	17.8
EW-86	132	92	40	22	12.3
EW-87	170	92	78	60	33.4
EW-88	170	98	72	54	30.1
EW-89	125	86	39	21	11.7
EW-90	174	93	81	63	35.1
EW-91	122	81	41	23	12.8
EW-92	121	88	33	15	8.4
EW-93	179	99	80	62	34.5
EW-94	132	90	42	24	13.4
EW-95	174	92	82	64	35.6
EW-96	130	88	42	24	13.4
EW-97	124	90	34	16	8.9
EW-98	124	86	38	20	11.1
EW-99	167	96	71	53	29.5
			Total Length (ft.)	918	

Total landfill gas (av ft^3/min)
2430

*LandGEM Model Calculation Ref.

Landfill Section	
West	3445
East	918
Total Length (ft.)	4363

Per foot of well screen gas produciton rate (ft^3/min)
0.56

ADVANCED GeoServices

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ATTACHMENT 11C

Piping Network Analysis

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Gas Friction Loss Calculation		
	Job No. 2018-3854	Made by: TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by:	Sheet 1 of 5

Revised by PGS 08/30/2021

Purpose:

The objective of this analysis is to perform friction loss calculation in the landfill pipeline using the Microsoft Excel spreadsheet. EPANET, a computerized simulation program, was used only to model the conceptual landfill gas extraction system design layout. The output from the spreadsheet provides data on flow rate, friction head loss, friction factor, and velocity. The following demonstrates the manual calculation used in the spreadsheet to show the friction loss through the landfill gas pipe.

Problem:

The example calculation will focus on the East Section of the landfill system. There are a total of 24 gas extraction wells producing their respective flow rates of Landfill Gas (for a total of 514 SCFM). They each have their own lateral that eventually runs to a common junction. The vacuum at the blower is set at -50 inches of water. A manual calculation is performed that will find the head loss that occurs due to friction of the landfill gas traveling through the pipe. This is done using the Darcy-Weisbach Equation:

$$h_f = f \cdot \frac{L}{D} \cdot \frac{V^2}{2g}$$

Where h_f is the head loss (in.), L is the pipe length, D is the pipe diameter, V is the velocity, g is acceleration of gravity, and f is the friction coefficient.

References:

1. EPANET Model, V. 2.0, USEPA, Sep. 2000.
2. Bhave, P.R. 1991. Analysis of Flow in Water Distribution Networks. (PA): Technomic Publishing.
3. Landfill Off-Gas Collection and Treatment Systems, Department of the Army, US Army Corps of Engineers, May 2008.

Attachments:

Appendix A – EPANET System Layout Map

Appendix B – Landfill System Friction Factor Loss Calculation Microsoft Excel spreadsheet by Montrose Environmental, Project No. 20183854.

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Gas Friction Loss Calculation		
	Job No. 2018-3854	Made by: TD	Date 07-13-20
	Ref. Chesapeake Terrace Rubble Fill	Checked by: VEK	Sheet 2 of 5

Revised by PGS 08/30/2021

Known Properties:

Landfill System Known Properties		
Operating Temp. (°F)	87	
Use 12" header Area (ft^2)	~~1.7671~~ 0.785	
ρ_{AIR} @ 87 °F, 12.89 psia (lb/ft^3)	0.07647	
Specific Gravity, SG_{CH4} (ρ_{CH4}/ρ_{AIR})	0.55	
ρ_{CH4} @ 87 °F, 12.89 psia (lb/ft^3)	0.035	
ε_{PVC} (millifeet)	0.1	
Absolute Viscosity, μ_{CH4} ($lbf\,s/ft^2$)	2.33E-07	
ρ_{CH4} @ 60°F, 14.696 psia (lb/ft^3)	0.04	
ρ_{H2O} @ 60°F (lb/ft^3)	62.1459	
g (ft/s^2) = 9.81 m/s^2	32.174	
1 lbf = 32.174 pdl =	32.174	lb ft/s^2
P_{ATM} =	14.696	psia
$P_{B\ (Blower)}$ = -50" H_2O =	12.89	psia

The area is based on the diameter of the main header pipe, the pipe running from the blower to the common junction (node HP19, Appendix A).

Volumetric Flow Rate and Velocity – Compressible VS. Incompressible

For incompressible flow, the velocity (V) may be calculated by using the following equation:

$$V_1 = \frac{Q_1}{A} = \frac{\text{~~801~~ 514}\ ft^3}{min} \cdot \frac{min}{60\ s} \cdot \frac{1}{\text{~~1.7671~~ 0.785}\ ft^2} = \text{~~7.55~~ 10.91}\ ft/s$$

Where the velocity, V, is a function of:

- Flow, Q (ft^3/sec)
- Cross-sectional area of the pipe (ft^2)

For landfill gas pipelines, however, the compressibility of gasses is to be considered. Under a vacuum, gasses expand, and this will lead to a higher value for velocity and volumetric flow rate. In the Darcy-Weisbach Equation, the term of velocity is a squared term, and has significiant impact on the

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calculation of pressure loss. To calculate the actual flow rate, the volumetric flow must be converted to mass based flow.

$$\frac{1lb}{s} \cdot \frac{ft^3{}_{AIR}}{0.07647lb_{AIR}} \cdot \frac{60\ s}{min} = 784.6\ ft^3{}_{AIR}/min$$

$$V_c = \frac{Q_c}{A} \cdot \frac{514\ \sout{801}\ ft^3{}_{AIR}}{min} \cdot \frac{\frac{lb_{AIR}}{s}}{784.6\ ft^3{}_{AIR}/min} \cdot \frac{0.55lb_{CH4}}{1lb_{AIR}} \cdot \frac{ft^3}{0.035lb_{CH4}} \cdot \frac{1}{\sout{1.7671}\ 0.785\ ft^2} = \sout{9.08}\ 13.1\ \frac{ft}{s} = \sout{2.7681}\ 4.0\ m/s$$

In the following example, the pipe-in-question is the pipe directly connected to the blower, so P_{GAS} is assumed to be equal to P_B 12.89 psi. This yields a density of 0.035lb/ft^3 for methane. The corrected values for velocity and volumetric flow are V_c = 9.08 ft/s (2.7681 m/s) and

$$A \cdot V = \sout{1.7671}\ 0.785\ ft^2 \cdot \frac{\sout{9.08}\ 13.1\ ft}{s} \cdot \frac{60\ s}{min} = Q_c = \sout{962.72}\ 617\ SCFM$$

The Friction Coefficient:

The coefficient of friction was found using the Swamee – Jain equation:

$$f = \frac{0.25}{\left[\log_{10}\left(\frac{\epsilon}{3.7d} + \frac{5.74}{Re^{0.9}}\right)\right]^2} \qquad \text{Swamee – Jain equation}$$

where the friciton factor, *f*, is a function of:

- Surface roughness height, ϵ (ft)
- Pipe Diameter, *D* (ft)
- Reynolds number, *Re* (unitless)

For transition and rough turbulent flow (Re ≥ 4,000)

For laminar flow where Reynolds number is less than 2000, the Hagen-Poiseuille equation: $f_l = 64/Re$ was used to solve for the friction factor. For Reynolds number between 2000 (laminar, f_l) and 4000 (turbulent, f_2) the friction factor was interpolated using the following equation:

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$$f = \left(f_1 \cdot \frac{(Re - 2000)}{2000}\right) + \left(f_2 \cdot \frac{(4000 - Re)}{2000}\right)$$

The following was done in three steps,

1. $$\frac{\varepsilon}{D} = \frac{0.0001\,ft}{1.5\,ft} = 0.000067$$ 1.0

2. Reynolds Number:

   Where v is kinematic viscosity found by:

$$v = \frac{\mu}{\rho} = \frac{2.33e-07 lbf \cdot s}{ft^2} \cdot \frac{ft^3}{0.04 lb_{CH4(abs)}} \cdot \frac{32.174 pdl}{lbf} \cdot \frac{lb \cdot ft/s^2}{pdl} \cdot \frac{0.0929 m^2}{ft^2} = 1.7411e-05 m^2/s$$

$$Re = \frac{V \cdot D}{v} = \frac{2.7681\,m/s \cdot 0.45720m}{1.7411e-05 m^2/s} = 72{,}688$$ 4.0 0.3048 70,025

3. Using these two numbers the friction coefficient can be found using the Swamee – Jain equation:

$$f = \frac{0.25}{\left[\log_{10}\left(\frac{0.001\,ft}{3.7 \cdot 1.5\,ft} + \frac{5.74}{72{,}688^{0.9}}\right)\right]^2} = 0.019$$ 0.020 1.0 70,025

Head Loss:

Using the solutions above, the Darcy-Weisbach equation is now satisfied:

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Gas Friction Loss Calculation		
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$$h_f = f \cdot \frac{L}{D} \cdot \frac{V^2}{2g} = \text{0.019} \cdot \frac{400\ ft}{\text{1.5}\ ft} \cdot \frac{(\text{9.08}\ ft/s)^2}{2 \cdot 32.174\ ft/s^2} = \text{6.49}\ ft_{GAS}$$

0.020 13.1 21.34 1.0

Units converted to inches of water column

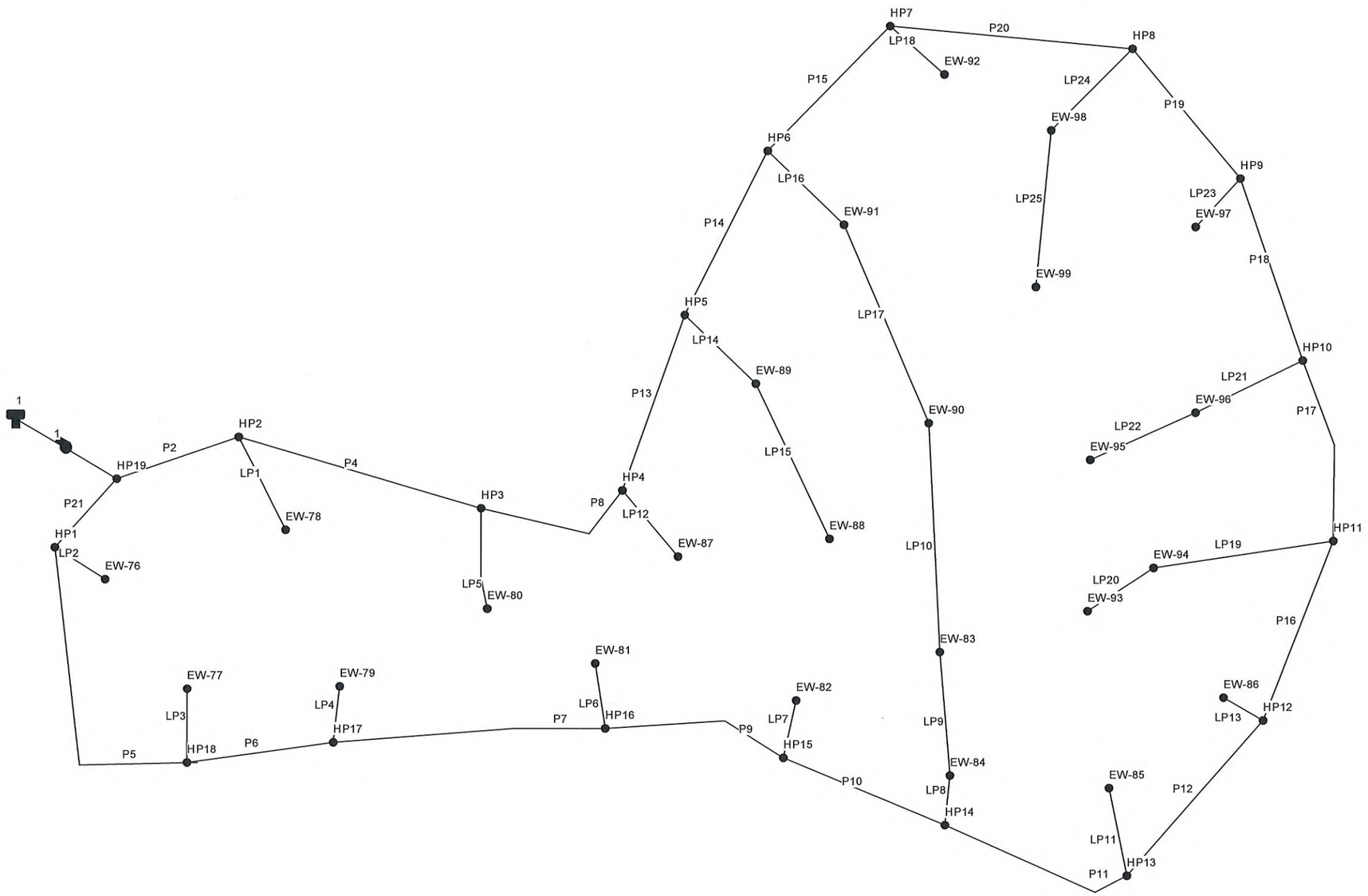
$$\text{1403}\ ft_{GAS} \cdot \frac{0.035\ lb_{GAS}}{ft^3} \cdot \frac{1\ lb_{H2O}}{1\ lb_{GAS}} \cdot \frac{ft^3}{62.1459\ lb_{H20}} \cdot \frac{12\ in}{1\ ft} = \text{0.04}\ inches\ of\ water$$

21.34 0.14

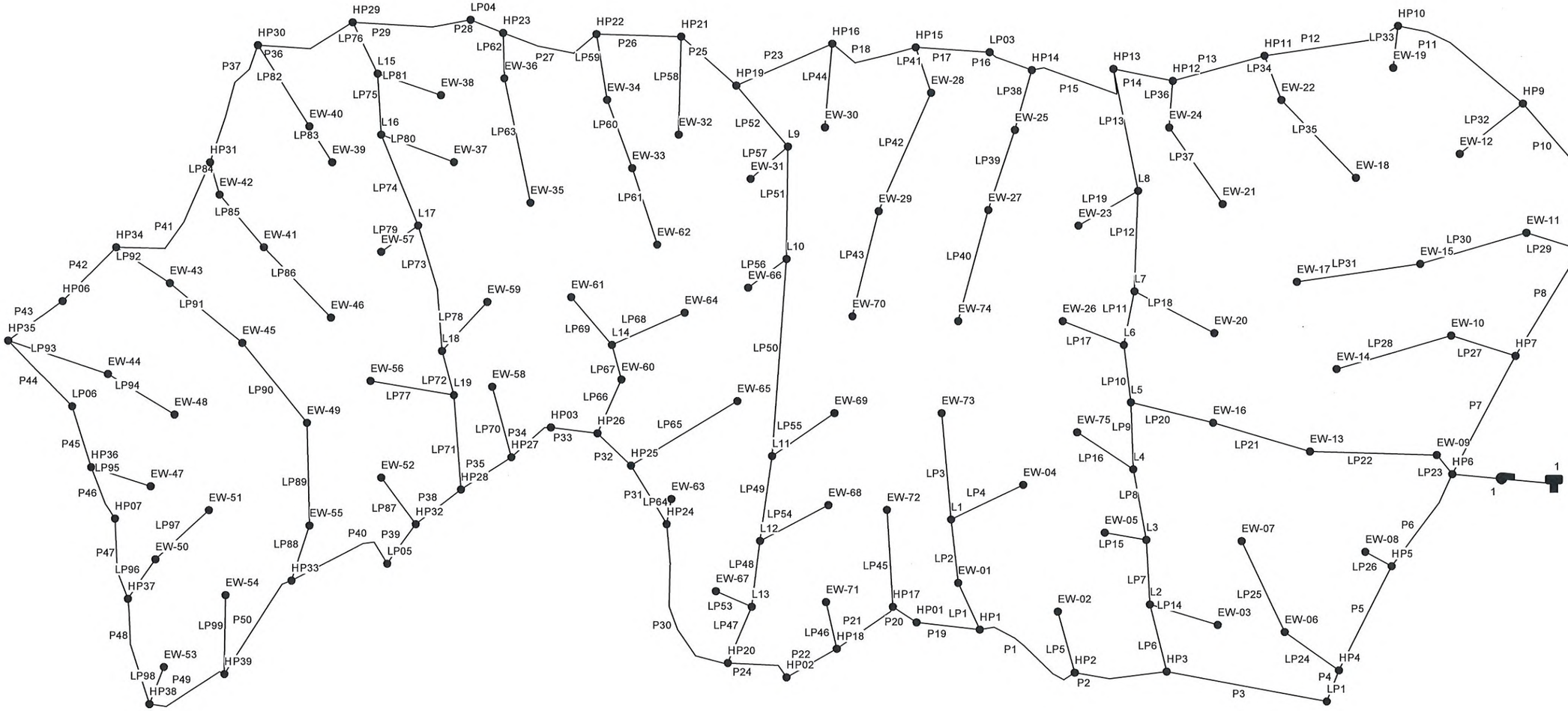
Results and Conclusion

The result of the manual calculation is ~~0.47~~ 0.14 inches of water loss.

East Section Chesapeake Terrace Rubble Landfill



West Section Chesapeake Terrace Rubble Landfill



ADVANCED GeoServices

a Montrose Environmental Group company

WEST SECTION

Landfill System Known Properties		
Operating Temp. (°F)	87	
Area (ft^2)	1.7671	
ρ_{AIR} @ 87 °F, 12.89 psia (lb/ft^3)	0.07647	
Specific Gravity, SG_{CH4} (ρ_{CH4}/ρ_{AIR})	0.55	
ρ_{CH4} @ 87 °F, 12.89 psia (lb/ft^3)	0.035	
ε_{PVC} (millifeet)	0.1	
Absolute Viscosity, μ_{CH4} (lbf s/ft^2)	2.33E-07	
ρ_{CH4} @ 60°F, 14.696 psia (lb/ft^3)	0.04	
ρ_{H2O} @ 60°F (lb/ft^3)	62.1459	
g (ft/s^2)	32.174	
1 lbf = 32.174 pdl =	32.174	lb ft/s^2
P_{ATM} =	14.696	psia
$P_{B\ (Blower)}$ = -50" H_2O =	12.89	psia

West Section Known Parameters														
Well ID	**Proposed Elevation (ft.)**	**Demand, Q (SCFM)**	**Lateral Intersection ID**	**Proposed Elevation (ft.)**	**Lateral Pipe ID**	**Length (ft.)**	**Diameter (in.)**	**Lateral Pipe ID (cont.)**	**Length (ft.)**	**Diameter (in.)**	**Header Intersection ID**	**Proposed Elevation (ft.)**	**Pipe ID**	**Length (ft.)**	**Diameter (in.)**
EW-01	161	15.0	L1	188	LP1	15	6	LP82	60	6	HP1	160	P1	240	12
EW-02	160	18.4	L2	155	LP2	150	6	LP83	210	6	HP2	148	P2	195	12
EW-03	156	20.6	L3	187	LP3	195	6	LP84	3	6	HP3	137	P3	345	12
EW-04	190	30.1	L4	195	LP4	135	6	LP85	165	12	HP4	125	P4	60	12
EW-05	188	30.6	L5	195	LP5	67	6	LP86	210	12	HP5	132	P5	210	12
EW-06	150	20.1	L6	196	LP6	70	12	LP87	75	6	HP6	128	P6	246	12
EW-07	184	34.0	L7	195	LP7	180	12	LP88	90	6	HP7	122	P7	225	12
EW-08	140	11.7	L8	184	LP8	210	12	LP89	210	12	HP8	129	P8	210	12
EW-09	135	5.6	L9	193	LP9	60	12	LP90	225	6	HP9	140	P9	135	12
EW-10	130	3.3	L10	202	LP10	180	12	LP91	240	6	HP10	150	P10	210	12
EW-11	137	5.0	L11	198	LP11	15	12	LP92	3	6	HP11	140	P11	270	12
EW-12	144	7.2	L12	192	LP12	240	12	LP93	90	6	HP12	143	P12	255	12
EW-13	181	30.1	L13	170	LP13	160	12	LP94	240	6	HP13	138	P13	210	12
EW-14	168	21.2	L14	199	LP14	40	6	LP95	45	6	HP14	147	P14	45	12
EW-15	158	15.6	L15	176	LP15	45	6	LP96	45	6	HP15	142	P15	210	12
EW-16	192	33.4	L16	214	LP16	67	6	LP97	225	6	HP16	152	P16	135	12
EW-17	190	30.6	L17	222	LP17	120	6	LP98	75	6	HP17	157	P17	45	12
EW-18	180	23.9	L18	217	LP18	97	6	LP99	90	6	HP18	150	P18	230	12
EW-19	150	7.2	L19	210	LP19	105	6				HP19	155	P19	45	12
EW-20	197	28.4			LP20	160	6				HP20	147	P20	45	12
EW-21	185	22.3			LP21	195	6				HP21	160	P21	150	12
EW-22	151	6.1			LP22	225	6				HP22	155	P22	120	12
EW-23	187	17.3			LP23	60	6				HP23	155	P23	60	12
EW-24	154	5.6			LP24	105	6				HP24	162	P24	75	12
EW-25	155	3.9			LP25	225	6				HP25	174	P25	165	12
EW-26	196	28.4			LP26	45	6				HP26	178	P26	240	12
EW-27	189	17.3			LP27	30	6				HP27	174	P27	240	12
EW-28	158	6.7			LP28	225	12				HP28	172	P28	80	12
EW-29	190	16.2			LP29	3	6				HP29	161	P29	233	12
EW-30	163	8.9			LP30	195	6				HP30	172	P30	465	12
EW-31	197	24.5			LP31	240	6				HP31	184	P31	120	12
EW-32	165	5.6			LP32	6	6				HP32	166	P32	105	12

Known Parameters (Continued)

West Section Known Parameters															
Well ID	**Proposed Elevation (ft.)**	**Demand, Q (SCFM)**	**Lateral Intersection ID**	**Proposed Elevation (ft.)**	**Lateral Pipe ID**	**Length (ft.)**	**Diameter (in.)**	**Lateral Pipe ID (cont.)**	**Length (ft.)**	**Diameter (in.)**	**Header Intersection ID**	**Proposed Elevation (ft.)**	**Pipe ID**	**Length (ft.)**	**Diameter (in.)**
EW-33	203	29.0			LP33	1.5	6				HP33	167	P33	75	12
EW-34	170	14.5			LP34	18	6				HP34	189	P34	120	12
EW-35	212	31.2			LP35	210	6				HP35	193	P35	130	12
EW-36	175	16.7			LP36	30	6				HP36	203	P36	225	12
EW-37	215	36.8			LP37	210	6				HP37	204	P37	315	12
EW-38	178	17.8			LP38	45	6				HP38	192	P38	150	12
EW-39	217	40.7			LP39	225	6				HP39	176	P39	90	12
EW-40	180	20.1			LP40	225	6						P40	90	12
EW-41	217	38.4			LP41	60	6						P41	240	12
EW-42	184	23.9			LP42	240	6						P42	135	12
EW-43	194	31.2			LP43	210	6						P43	135	12
EW-44	205	36.8			LP44	53	12						P44	15	12
EW-45	222	44.6			LP45	195	6						P45	255	12
EW-46	224	45.1			LP46	75	6						P46	125	12
EW-47	210	33.4			LP47	120	6						P47	120	12
EW-48	224	48.5			LP48	174	6						P48	285	12
EW-49	218	46.2			LP49	45	6						P49	300	12
EW-50	212	36.2			LP50	450	6						P50	240	12
EW-51	220	49.0			LP51	180	6								
EW-52	187	30.6			LP52	195	6								
EW-53	202	29.5			LP53	75	6								
EW-54	192	35.6			LP54	30	6								
EW-55	188	27.8			LP55	210	6								
EW-56	217	41.8			LP56	90	6								
EW-57	223	39.5			LP57	60	12								
EW-58	182	21.2			LP58	30	6								
EW-59	217	37.3			LP59	45	8								
EW-60	182	25.1			LP60	180	6								
EW-61	211	39.0			LP61	165	6								
EW-62	210	29.5			LP62	90	6								
EW-63	181	22.3			LP63	270	6								
EW-64	206	30.6			LP64	60	6								
EW-65	201	32.9			LP65	270	6								
EW-66	206	32.3			LP66	15	6								
EW-67	175	25.1			LP67	120	6								
EW-68	192	32.9			LP68	120	6								
EW-69	198	31.7			LP69	135	6								
EW-70	198	27.3			LP70	40	6								
EW-71	166	16.2			LP71	165	6								
EW-72	189	26.7			LP72	30	6								
EW-73	195	29.5			LP73	255	6								
EW-74	197	27.8			LP74	165	6								
EW-75	196	31.7			LP75	210	6								
Blower		1918.7			LP76	60	6								
					LP77	90	6								
					LP78	165	6								
					LP79	75	6								
					LP80	45	6								
					LP81	60	6								

Pipe Network Input Data				
Pipe	**Start**	**End**	**Length**	**Diameter**
ID	**Node**	**Node**	**(ft.)**	**(in.)**
Blower	HP6	1	400	18
P1	HP1	HP2	15	12
P2	HP2	HP3	195	12
P3	HP3	LP1	345	12
P4	LP1	HP4	60	12
P5	HP4	HP5	210	12
P6	HP5	HP6	246	12
P7	HP7	HP6	225	12
P8	HP8	HP7	210	12
P9	LP02	HP8	135	12
P10	HP9	LP02	210	12
P11	HP10	HP9	270	12
P12	HP11	HP10	255	12
P13	HP12	HP11	210	12
P14	HP13	HP12	45	12
P15	HP14	HP13	210	12
P16	LP03	HP14	135	12
P17	HP15	LP03	45	12
P18	HP16	HP15	230	12
P19	HP01	HP1	45	12
P20	HP17	HP01	45	12
P21	HP18	HP17	150	12
P22	HP02	HP18	120	12
P23	HP19	HP16	60	12
P24	HP20	HP02	75	12
P25	HP21	HP19	165	12
P26	HP22	HP21	240	12
P27	HP23	HP22	240	12
P28	LP04	HP23	80	12
P29	HP29	LP04	233	12
P30	HP24	HP20	465	12
P31	HP25	HP24	120	12
P32	HP26	HP25	105	12
P33	HP03	HP26	75	12
P34	HP27	HP03	120	12
P35	HP28	HP27	130	12
P36	HP30	HP29	225	12
P37	HP30	HP31	315	12
P38	HP30	HP31	150	12
P39	LP05	HP32	90	12
P40	HP33	LP05	90	12
P41	HP31	HP34	240	12
P42	HP34	HP06	135	12
P43	HP06	HP35	135	12
P44	HP35	LP06	15	12
P45	LP06	HP36	255	12
P46	HP36	HP07	125	12
P47	HP07	HP37	120	12
P48	HP37	HP38	285	12

Pipe Network Output Data Results									
Pipe	**Start**	**End**	**Flow**	**Head loss**	**Velocity, V_c**	**Demand, Q_c**	**Friction**	**Re**	**ε_{PVC}/D**
ID	**Node**	**Node**	**(SCFM)**	**(in.-water)**	**(ft/s)**	**(SCFM)**	**Factor**		
Blower	HP6	1	1918.7	0.002	1.36	144.1	0.030	10878	0.0000667
P1	HP1	HP2	-768.93	0.000	1.23	129.9	0.035	6539	0.0001000
P2	HP2	HP3	-787.31	0.001	1.25	133.0	0.035	6695	0.0001000
P3	HP3	LP1	-1150.86	0.004	1.83	194.5	0.031	9787	0.0001000
P4	LP1	HP4	-1150.86	0.001	1.83	194.5	0.031	9787	0.0001000
P5	HP4	HP5	-1204.89	0.003	1.92	203.6	0.031	10246	0.0001000
P6	HP5	HP6	-1216.58	0.003	1.94	205.6	0.031	10346	0.0001000
P7	HP6	HP7	-1000.08	0.002	1.59	169.0	0.033	8505	0.0001000
P8	HP7	HP8	-975.57	0.002	1.55	164.9	0.033	8296	0.0001000
P9	HP8	LP2	-924.33	0.001	1.47	156.2	0.033	7860	0.0001000
P10	LP2	HP9	-924.33	0.002	1.47	156.2	0.033	7860	0.0001000
P11	HP9	HP10	-917.09	0.002	1.46	155.0	0.033	7799	0.0001000
P12	HP10	HP11	-909.85	0.002	1.45	153.8	0.033	7737	0.0001000
P13	HP11	HP12	-879.77	0.001	1.40	148.7	0.034	7481	0.0001000
P14	HP12	HP13	-851.93	0.000	1.36	144.0	0.034	7245	0.0001000
P15	HP13	HP14	-884.09	0.001	1.41	149.4	0.034	7518	0.0001000
P16	HP14	LP3	-835.08	0.001	1.33	141.1	0.034	7101	0.0001000
P17	LP3	HP15	-835.08	0.000	1.33	141.1	0.034	7101	0.0001000
P18	HP15	HP16	-784.95	0.001	1.25	132.6	0.035	6675	0.0001000
P19	HP1	HP01	-694.30	0.000	1.11	117.3	0.036	5904	0.0001000
P20	HP01	HP17	-694.30	0.000	1.11	117.3	0.036	5904	0.0001000
P21	HP17	HP18	-667.57	0.001	1.06	112.8	0.037	5677	0.0001000
P22	HP18	HP02	-651.42	0.001	1.04	110.1	0.037	5540	0.0001000
P23	HP16	HP19	-776.04	0.000	1.24	131.1	0.035	6599	0.0001000
P24	HP02	HP20	-651.42	0.000	1.04	110.1	0.037	5540	0.0001000
P25	HP19	HP21	-710.51	0.001	1.13	120.1	0.036	6042	0.0001000
P26	HP21	HP22	-704.94	0.001	1.12	119.1	0.036	5995	0.0001000
P27	HP22	HP23	-631.98	0.001	1.01	106.8	0.037	5374	0.0001000
P28	HP23	LP04	-584.08	0.000	0.93	98.7	0.001	4967	0.0001000
P29	LP04	HP29	-584.08	0.000	0.93	98.7	0.001	4967	0.0001000
P30	HP20	HP24	-570.47	0.002	0.91	96.4	0.038	4851	0.0001000
P31	HP24	HP25	-548.19	0.000	0.87	92.6	0.039	4662	0.0001000
P32	HP25	HP26	-515.33	0.000	0.82	87.1	0.040	4382	0.0001000
P33	P26	HP03	-420.65	0.000	0.67	71.1	0.023	3577	0.0001000
P34	HP03	HP27	-420.65	0.000	0.67	71.1	0.023	3577	0.0001000
P35	HP27	HP28	-399.48	0.000	0.64	67.5	0.026	3397	0.0001000
P36	HP29	HP30	-499.05	0.000	0.80	84.3	0.012	4244	0.0001000
P37	HP30	HP31	406.25	0.000	0.65	68.7	0.025	3455	0.0001000
P38	HP28	HP32	-311.30	0.000	0.50	52.6	0.039	2647	0.0001000
P39	HP32	LP05	-280.67	0.000	0.45	47.4	0.044	2387	0.0001000
P40	LP05	HP33	-280.67	0.000	0.45	47.4	0.044	2387	0.0001000
P41	HP31	HP34	298.76	0.000	0.48	50.5	0.025	2541	0.0001000
P42	HP34	HP06	-67.32	0.000	0.11	11.4	0.112	572	0.0001000
P43	HP06	HP35	-67.32	0.000	0.11	11.4	0.112	572	0.0001000
P44	HP35	LP06	-17.90	0.000	0.03	3.0	0.421	152	0.0001000
P45	LP06	HP36	-17.90	0.000	0.03	3.0	0.421	152	0.0001000
P46	HP36	HP07	-51.31	0.000	0.08	8.7	0.147	436	0.0001000
P47	HP07	HP37	-51.31	0.000	0.08	8.7	0.147	436	0.0001000
P48	HP37	HP38	-136.53	0.000	0.22	23.1	0.055	1161	0.0001000

Pipe Network Input Data (Continued)

Pipe Network Input Data				
Pipe ID	Start Node	End Node	Length (ft.)	Diameter (in.)
P49	HP38	HP39	240	12
P50	HP39	HP33	240	12
LP1	EW-01	HP1	15	6
LP2	L1	EW-01	150	6
LP3	EW-73	L1	195	6
LP4	EW-04	L1	135	6
LP5	EW-02	HP2	67	6
LP6	L2	HP3	70	12
LP7	L3	L2	180	12
LP8	L3	L4	210	12
LP9	L4	L5	60	12
LP10	L6	L5	180	12
LP11	L7	L6	15	12
LP12	L8	L7	240	12
LP13	L8	HP13	160	12
LP14	EW-03	L2	40	6
LP15	EW-05	L3	45	6
LP16	EW-75	L4	67	6
LP17	EW-26	L6	120	6
LP18	EW-20	LP18	97	6
LP19	EW-23	L8	105	6
LP20	L5	EW-16	160	6
LP21	EW-16	EW-13	195	6
LP22	EW-13	EW-09	225	6
LP23	EW-09	HP6	60	6
LP24	EW-06	HP4	105	6
LP25	EW-07	EW-06	225	6
LP26	EW-08	HP5	45	6
LP27	EW-10	HP7	30	6
LP28	EW-14	EW-10	225	12
LP29	EW-11	HP8	3	6
LP30	EW-15	EW-11	195	6
LP31	EW-17	EW-15	240	6
LP32	EW-12	HP9	6	6
LP33	EW-19	HP10	1.5	6
LP34	EW-22	HP11	18	6
LP35	EW-18	EW-22	210	6
LP36	EW-24	HP12	30	6
LP37	EW-21	EW-24	210	6
LP38	EW-25	HP14	45	6
LP39	EW-27	EW-25	225	6
LP40	EW-74	EW-27	225	6
LP41	EW-28	HP15	60	6
LP42	EW-29	EW-28	240	6
LP43	EW-70	EW-29	210	6
LP44	EW-30	HP16	53	12
LP45	EW-72	HP17	195	6
LP46	EW-71	HP18	75	6
LP47	L13	HP20	120	6
LP48	L12	L13	174	6
LP49	L11	L12	45	6

Pipe Network Output Data Results (Continued)

Pipe Network Output Data Results									
Pipe ID	Start Node	End Node	Flow (SCFM)	Head loss (in.-water)	Velocity, V_c (ft/s)	Demand, Q_c (SCFM)	Friction Factor	Re	ε_{PVC}/D
P49	HP38	HP39	-166.05	0.000	0.26	28.06	0.0453	1412	0.000100
P50	HP39	HP33	-201.69	0.000	0.32	34.08	0.037	1715	0.000100
LP1	EW-01	HP1	-74.63	0.000	0.48	50.45	0.064	1269	0.000200
LP2	L1	EW-01	-59.59	0.000	0.38	40.28	0.068	1014	0.000200
LP3	EW-73	L1	-29.5	0.000	0.19	19.95	0.127	502	0.000200
LP4	EW-04	L1	-30.1	0.000	0.19	20.33	0.125	512	0.000200
LP5	EW-02	HP2	-18.4	0.000	0.12	12.42	0.205	313	0.000200
LP6	L2	HP3	-363.55	0.000	0.58	61.43	0.031	3092	0.000100
LP7	L3	L2	-342.94	0.000	0.55	57.95	0.034	2916	0.000100
LP8	L3	L4	283.44	0.000	0.45	47.90	0.048	2410	0.000100
LP9	L4	L5	251.69	0.000	0.40	42.53	0.030	2140	0.000100
LP10	L6	L5	-157.53	0.000	0.25	26.62	0.048	1340	0.000100
LP11	L7	L6	-129.1	0.000	0.21	21.82	0.058	1098	0.000100
LP12	L8	L7	49.43	0.000	0.08	8.35	0.152	420	0.000100
LP13	L8	HP13	32.16	0.000	0.05	5.44	0.234	274	0.000100
LP14	EW-03	L2	-20.6	0.000	0.13	13.93	0.183	350	0.000200
LP15	EW-05	L3	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP16	EW-75	L4	-31.7	0.000	0.20	21.46	0.119	540	0.000200
LP17	EW-26	L6	-28.4	0.000	0.18	19.20	0.132	483	0.000200
LP18	EW-20	LP18	-28.4	0.000	0.18	19.20	0.132	483	0.000200
LP19	EW-23	L8	-17.3	0.000	0.11	11.67	0.218	294	0.000200
LP20	L5	EW-16	94.16	0.000	-0.60	-63.65	-0.040	-1601	0.000200
LP21	EW-16	EW-13	60.74	0.000	-0.39	-41.06	-0.062	-1033	0.000200
LP22	EW-13	EW-09	30.67	0.000	-0.20	-20.73	-0.123	-522	0.000200
LP23	EW-09	HP6	25.10	0.000	-0.16	-16.96	-0.150	-427	0.000200
LP24	EW-06	HP4	-54.0	0.000	0.34	36.52	0.070	919	0.000200
LP25	EW-07	EW-06	-34.0	0.000	0.22	22.96	0.111	578	0.000200
LP26	EW-08	HP5	-11.7	0.000	0.07	7.91	0.322	199	0.000200
LP27	EW-10	HP7	-24.51	0.000	0.16	16.56	0.154	417	0.000200
LP28	EW-14	EW-10	-21.2	0.000	0.03	3.58	0.356	180	0.000100
LP29	EW-11	HP8	-51.24	0.000	0.33	34.64	0.073	871	0.000200
LP30	EW-15	EW-11	-46.23	0.000	0.29	31.25	0.081	786	0.000200
LP31	EW-17	EW-15	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP32	EW-12	HP9	-7.2	0.000	0.05	4.89	0.520	123	0.000200
LP33	EW-19	HP10	-7.2	0.000	0.05	4.89	0.520	123	0.000200
LP34	EW-22	HP11	-30.1	0.000	0.19	20.33	0.125	512	0.000200
LP35	EW-18	EW-22	-23.9	0.000	0.15	16.19	0.157	407	0.000200
LP36	EW-24	HP12	-27.8	0.000	0.18	18.82	0.135	474	0.000200
LP37	EW-21	EW-24	-22.3	0.000	0.14	15.06	0.169	379	0.000200
LP38	EW-25	HP14	-49	0.000	0.31	33.13	0.069	834	0.000200
LP39	EW-27	EW-25	-45	0.000	0.29	30.49	0.083	767	0.000200
LP40	EW-74	EW-27	-27.8	0.000	0.18	18.82	0.135	474	0.000200
LP41	EW-28	HP15	-50	0.000	0.32	33.88	0.069	853	0.000200
LP42	EW-29	EW-28	-43	0.000	0.28	29.36	0.068	739	0.000200
LP43	EW-70	EW-29	-27.3	0.000	0.17	18.45	0.138	464	0.000200
LP44	EW-30	HP16	8.9	0.000	0.01	1.51	0.845	76	0.000100
LP45	EW-72	HP17	-26.7	0.000	0.17	18.07	0.141	455	0.000200
LP46	EW-71	HP18	-16.2	0.000	0.10	10.92	0.233	275	0.000200
LP47	L13	HP20	-80.95	0.000	0.52	54.72	0.063	1377	0.000200
LP48	L12	L13	-55.88	0.000	0.36	37.77	0.068	950	0.000200
LP49	L11	L12	-23.02	0.000	0.15	15.56	0.163	392	0.000200

Pipe Network Input Data (Continued)

Pipe Network Input Data				
Pipe ID	Start Node	End Node	Length (ft.)	Diameter (in.)
LP50	L10	L11	45	6
LP51	L10	L9	180	6
LP52	L9	HP19	195	6
LP53	EW-67	L13	75	6
LP54	EW-68	L12	30	6
LP55	EW-69	L11	210	6
LP56	EW-66	L10	90	6
LP57	EW-31	L9	60	12
LP58	EW-32	HP21	30	6
LP59	EW-34	HP22	45	8
LP60	EW-33	EW-34	180	6
LP61	EW-62	EW-33	165	6
LP62	EW-36	HP23	90	6
LP63	EW-35	EW-36	270	6
LP64	EW-63	HP24	60	6
LP65	EW-65	HP25	270	6
LP66	EW-60	HP26	15	6
LP67	L14	EW-60	120	6
LP68	EW-64	L14	120	6
LP69	EW-61	L14	135	6
LP70	EW-58	HP27	40	6
LP71	L19	HP28	165	6
LP72	L18	L19	30	6
LP73	L17	L18	255	6
LP74	L17	L16	165	6
LP75	L16	L15	210	6
LP76	L15	HP29	60	6
LP77	EW-56	L19	90	6
LP78	EW-59	L18	165	6
LP79	EW-57	L17	75	6
LP80	EW-37	L16	45	6
LP81	EW-38	L15	60	6
LP82	EW-40	HP30	60	6
LP83	EW-39	EW-40	210	6
LP84	EW-42	HP31	3	6
LP85	EW-41	EW-42	165	12
LP86	EW-46	EW-41	210	12
LP87	EW-52	HP32	75	6
LP88	EW-55	HP33	90	6
LP89	EW-49	EW-55	210	12
LP90	EW-45	EW-49	225	6
LP91	EW-45	EW-43	240	6
LP92	EW-43	HP34	3	6
LP93	EW-44	HP35	90	6
LP94	EW-48	EW-44	240	6
LP95	EW-47	HP36	45	6
LP96	EW-50	HP37	45	6
LP97	EW-51	EW-50	225	6
LP98	EW-53	HP38	75	6
LP99	EW-54	HP39	90	6

Pipe Network Output Data Results (Continued)

Pipe Network Output Data Results									
Pipe ID	Start Node	End Node	Flow (SCFM)	Head loss (in.-water)	Velocity, V_c (ft/s)	Demand, Q_c (SCFM)	Friction Factor	Re	ε_{PVC}/D
LP50	L10	L11	8.7	0.000	0.06	5.90	0.431	148	0.000200
LP51	L10	L9	-41.0	0.000	0.26	27.73	0.092	698	0.000200
LP52	L9	HP19	-65.53	0.000	0.42	44.30	0.066	1115	0.000200
LP53	EW-67	L13	-25.1	0.000	0.16	16.94	0.150	426	0.000200
LP54	EW-68	L12	-32.9	0.000	0.21	22.21	0.115	559	0.000200
LP55	EW-69	L11	-31.7	0.000	0.20	21.46	0.119	540	0.000200
LP56	EW-66	L10	-32.3	0.000	0.21	21.84	0.116	549	0.000200
LP57	EW-31	L9	-24.5	0.000	0.04	4.14	0.307	208	0.000100
LP58	EW-32	HP21	-5.6	0.000	0.04	3.76	0.676	95	0.000200
LP59	EW-34	HP22	-72.96	0.000	0.26	27.74	0.069	931	0.000150
LP60	EW-33	EW-34	-58	0.000	0.37	39.53	0.068	995	0.000200
LP61	EW-62	EW-33	-29.5	0.000	0.19	19.95	0.127	502	0.000200
LP62	EW-36	HP23	-47.9	0.000	0.31	32.38	0.079	815	0.000200
LP63	EW-35	EW-36	-31.2	0.000	0.20	21.08	0.121	530	0.000200
LP64	EW-63	HP24	-22.3	0.000	0.14	15.06	0.169	379	0.000200
LP65	EW-65	HP25	-32.9	0.000	0.21	22.21	0.115	559	0.000200
LP66	EW-60	HP26	-95	0.000	0.60	64.00	0.058	1610	0.000200
LP67	L14	EW-60	-70	0.000	0.44	47.06	0.066	1184	0.000200
LP68	EW-64	L14	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP69	EW-61	L14	-39.0	0.000	0.25	26.35	0.097	663	0.000200
LP70	EW-58	HP27	-21.2	0.000	0.13	14.31	0.178	360	0.000200
LP71	L19	HP28	-88.18	0.001	0.56	59.61	0.060	1500	0.000200
LP72	L18	L19	-46.4	0.000	0.30	31.37	0.081	789	0.000200
LP73	L17	L18	9.1	0.000	0.06	6.15	0.414	155	0.000200
LP74	L17	L16	-30.4	0.000	0.19	20.58	0.124	518	0.000200
LP75	L16	L15	-67.2	0.000	0.43	45.43	0.056	1143	0.000200
LP76	L15	HP29	-85.0	0.000	0.54	57.48	0.061	1446	0.000200
LP77	EW-56	L19	-41.8	0.000	0.27	28.24	0.090	710	0.000200
LP78	EW-59	L18	-37.3	0.000	0.24	25.22	0.101	635	0.000200
LP79	EW-57	L17	-39.5	0.000	0.25	26.73	0.095	673	0.000200
LP80	EW-37	L16	-36.8	0.000	0.23	24.85	0.102	625	0.000200
LP81	EW-38	L15	-17.8	0.000	0.11	12.05	0.211	303	0.000200
LP82	EW-40	HP30	-60.7	0.000	0.39	41.04	0.062	1033	0.000200
LP83	EW-39	EW-40	-40.7	0.000	0.26	27.48	0.093	691	0.000200
LP84	EW-42	HP31	-107	0.000	0.69	72.66	0.054	1828	0.000200
LP85	EW-41	EW-42	-84	0.000	0.13	14.12	0.090	710	0.000100
LP86	EW-46	EW-41	-45.1	0.000	0.07	7.62	0.167	384	0.000100
LP87	EW-52	HP32	-30.6	0.000	0.20	20.71	0.123	521	0.000200
LP88	EW-55	HP33	-79	0.000	0.50	53.38	0.063	1343	0.000200
LP89	EW-49	EW-55	-51.1	0.000	0.08	8.64	0.147	435	0.000100
LP90	EW-45	EW-49	-4.90	0.000	0.03	3.31	0.768	83	0.000200
LP91	EW-45	EW-43	-39.7	0.000	0.25	26.80	0.095	674	0.000200
LP92	EW-43	HP34	-70.84	0.000	0.45	47.89	0.065	1205	0.000200
LP93	EW-44	HP35	-85.2	0.000	0.54	57.60	0.061	1449	0.000200
LP94	EW-48	EW-44	-48.5	0.000	0.31	32.75	0.078	824	0.000200
LP95	EW-47	HP36	-33.4	0.000	0.21	22.59	0.113	568	0.000200
LP96	EW-50	HP37	-85	0.000	0.54	57.60	0.061	1449	0.000200
LP97	EW-51	EW-50	-49.0	0.000	0.31	33.13	0.077	834	0.000200
LP98	EW-53	HP38	-29.5	0.000	0.19	19.95	0.127	502	0.000200
LP99	EW-54	HP39	-35.6	0.000	0.23	24.09	0.106	606	0.000200

ADVANCED GeoServices
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EAST SECTION

Landfill System Known Properties		
Operating Temp. (°F)	87	
Area (ft^2)	1.7671	
ρ_{AIR} @ 87 °F, 12.89 psia (lb/ft^3)	0.07647	
Specific Gravity, SG_{CH4} (ρ_{CH4}/ρ_{AIR})	0.55	
ρ_{CH4} @ 87 °F, 12.89 psia (lb/ft^3)	0.035	
ε_{PVC} (millifeet)	0.1	
Absolute Viscosity, μ_{CH4} ($lbf\ s/ft^2$)	2.33E-07	
ρ_{CH4} @ 60°F, 14.696 psia (lb/ft^3)	0.04	
ρ_{H2O} @ 60°F (lb/ft^3)	62.1459	
g (ft/s^2) = 9.81 m/s^2	32.174	
1 lbf = 32.174 pdl =	32.174	lb ft/s^2
P_{ATM} =	14.696	psia
$P_{B\ (Blower)}$ = -50" H_2O =	12.89	psia

East Section Known Values

Well ID	Proposed Elevation (ft.)	Demand, Q (SCFM)	Lateral Pipe ID	Length (ft.)	Diameter (in)	Header Intersection ID	Proposed Elevation (ft.)	Pipe ID	Length (ft.)	Diameter (in)
EW-76	126	11.7	LP1	110	6	HP1	114	P2	150	12
EW-77	159	25.1	LP2	80	6	HP2	104	P4	240	12
EW-78	132	15.6	LP3	90	6	HP3	112	P5	530	12
EW-79	162	26.7	LP4	108	6	HP4	116	P6	210	12
EW-80	168	12.8	LP5	80	6	HP5	107	P7	320	12
EW-81	181	23.4	LP6	45	6	HP6	114	P8	190	12
EW-82	155	32.3	LP7	60	6	HP7	110	P9	260	12
EW-83	140	34.5	LP8	60	6	HP8	103	P10	220	12
EW-84	132	21.2	LP9	190	6	HP9	110	P11	290	12
EW-85	170	17.8	LP10	320	6	HP10	116	P12	280	12
EW-86	170	12.3	LP11	80	6	HP11	116	P13	210	12
EW-87	125	33.4	LP12	70	6	HP12	129	P14	240	12
EW-88	174	30.1	LP13	30	6	HP13	124	P15	280	12
EW-89	122	11.7	LP14	70	6	HP14	141	P16	250	12
EW-90	121	35.1	LP15	240	6	HP15	154	P17	240	12
EW-91	179	12.8	LP16	100	6	HP16	167	P18	270	12
EW-92	132	8.4	LP17	310	6	HP17	146	P19	280	12
EW-93	174	34.5	LP18	50	6	HP18	139	P20	230	12
EW-94	130	13.4	LP19	70	6	HP19	114	P21	150	12
EW-95	124	35.6	LP20	220	6					
EW-96	124	13.4	LP21	70	6					
EW-97	167	8.9	LP22	210	6					
EW-98	136	11.1	LP23	80	6					
EW-99	196	29.5	LP24	100	6					
Blower		-511	LP25	210	6					

Pipe Network Input Data

Pipe ID	Start Node	End Node	Length (Ft.)	Diam. (in.)
Blower	HP19	Blower	400	18
P2	HP2	HP19	150	12
P4	HP3	HP2	240	12
P5	HP18	HP1	530	12
P6	HP17	HP18	210	12
P7	HP16	HP17	320	12
P8	HP4	HP3	190	12
P9	HP15	HP16	260	12
P10	HP14	HP15	220	12
P11	HP13	HP14	290	12
P12	HP12	HP13	280	12
P13	HP5	HP4	210	12
P14	HP6	H5	240	12
P15	HP7	HP6	280	12
P16	HP11	HP12	250	12
P17	HP10	HP11	240	12
P18	HP10	HP9	270	12
P19	HP9	HP8	280	12
P20	HP8	HP7	230	12
P21	HP1	HP19	150	12
LP1	EW-78	HP2	110	6
LP2	EW-76	HP1	80	6
LP3	EW-77	HP18	90	6
LP4	EW-79	HP17	108	6
LP5	EW-80	HP3	80	6
LP6	EW-81	HP16	45	6
LP7	EW-82	HP15	60	6
LP8	EW-84	HP14	60	6
LP9	EW-83	EW-84	190	6
LP10	EW-90	EW-83	320	6
LP11	EW-85	HP13	80	6
LP12	EW-87	HP4	70	6
LP13	EW-86	HP12	30	6
LP14	EW-89	HP5	70	6
LP15	EW-88	EW-89	80	6
LP16	EW-91	HP6	100	6
LP17	EW-90	EW-91	310	6
LP18	EW-92	HP7	50	6
LP19	EW-94	HP11	70	6
LP20	EW-93	EW-94	220	6
LP21	EW-96	HP10	70	6
LP22	EW-95	EW-96	210	6
LP23	EW-97	HP9	80	6
LP24	EW-98	HP8	100	6
LP25	EW-99	EW-98	210	6

Pipe Network Output Data Results									
Pipe	**Start**	**End**	**Flow**	**Headloss**	**Velocity, V_c**	**Demand, Q_c**	**Friction**	**Re**	**ε_{PVC}/D**
ID	**Node**	**Node**	**(SCFM)**	**(in.-water)**	**(ft/s)**	**(SCFM)**	**Factor**		
Blower	HP19	Blower	511.29	0.02	5.79	614.40	0.021	46380	0.000067
P2	HP2	HP19	-271.33	0.02	6.92	733.60	0.023	36919	0.000100
P4	HP3	HP2	-255.73	0.02	6.52	691.44	0.023	34797	0.000100
P5	HP18	HP1	-228.26	0.04	5.82	617.17	0.023	31059	0.000100
P6	HP17	HP18	-203.20	0.01	5.18	549.40	0.024	27649	0.000100
P7	HP16	HP17	-176.47	0.02	4.50	477.12	0.025	24012	0.000100
P8	HP4	HP3	-242.92	0.02	6.19	656.80	0.023	33054	0.000100
P9	HP15	HP16	-153.07	0.01	3.90	413.88	0.026	20829	0.000100
P10	HP14	HP15	-120.77	0.01	3.08	326.53	0.027	16433	0.000100
P11	HP13	HP14	-72.09	0.00	1.84	194.92	0.031	9810	0.000100
P12	HP12	HP13	-54.27	0.00	1.38	146.73	0.034	7384	0.000100
P13	HP5	HP4	-209.50	0.02	5.34	566.45	0.024	28507	0.000100
P14	HP6	HP5	-167.73	0.01	4.28	453.51	0.025	22823	0.000100
P15	HP7	HP6	-112.8	0.01	2.88	305.03	0.028	15351	0.000100
P16	HP11	HP12	-42.02	0.00	1.07	113.60	0.036	5717	0.000100
P17	HP10	HP11	5.88	0.00	0.15	15.90	0.080	800	0.000100
P18	HP10	HP9	-54.9	0.00	1.40	148.42	0.034	7469	0.000100
P19	HP9	HP8	-63.8	0.00	1.63	172.51	0.032	8682	0.000100
P20	HP8	HP7	-104.5	0.00	2.66	282.44	0.028	14214	0.000100
P21	HP1	HP19	-239.96	0.01	6.12	648.79	0.023	32651	0.000100
LP1	EW-78	HP2	-15.6	0.00	1.59	168.66	0.040	4244	0.000200
LP2	EW-76	HP1	-11.7	0.00	1.19	126.49	0.044	3183	0.000200
LP3	EW-77	HP18	-25.1	0.00	2.56	271.06	0.035	6821	0.000200
LP4	EW-79	HP17	-26.7	0.01	2.73	289.13	0.034	7275	0.000200
LP5	EW-80	HP3	-12.8	0.00	1.31	138.54	0.043	3486	0.000200
LP6	EW-81	HP16	-23.4	0.00	2.39	252.99	0.035	6366	0.000200
LP7	EW-82	HP15	-32.3	0.00	3.29	349.36	0.032	8791	0.000200
LP8	EW-84	HP14	-48.7	0.01	4.97	526.45	0.029	13247	0.000200
LP9	EW-83	EW-84	-27.5	0.01	2.81	297.56	0.034	7487	0.000200
LP10	EW-90	EW-83	7.02	0.00	0.72	75.90	0.034	1910	0.000200
LP11	EW-85	HP13	-17.8	0.00	1.82	192.75	0.038	4850	0.000200
LP12	EW-87	HP4	-33.4	0.01	3.41	361.41	0.032	9094	0.000200
LP13	EW-86	HP12	-12.3	0.00	1.25	132.52	0.043	3335	0.000200
LP14	EW-89	HP5	-41.8	0.01	4.26	451.76	0.030	11368	0.000200
LP15	EW-88	EW-89	-30.1	0.01	3.07	325.27	0.033	8185	0.000200
LP16	EW-91	HP6	-54.9	0.02	5.60	593.92	0.028	14945	0.000200
LP17	EW-90	EW-91	-42.1	0.04	4.29	455.38	0.030	11459	0.000200
LP18	EW-92	HP7	-8.4	0.00	0.85	90.35	0.049	2274	0.000200
LP19	EW-94	HP11	-47.9	0.01	4.89	518.02	0.029	13035	0.000200
LP20	EW-93	EW-94	-34.5	0.02	3.52	373.46	0.032	9397	0.000200
LP21	EW-96	HP10	-49.0	0.01	5.00	530.07	0.029	13338	0.000200
LP22	EW-95	EW-96	-35.6	0.02	3.64	385.50	0.032	9700	0.000200
LP23	EW-97	HP9	-8.9	0.00	0.91	96.38	0.048	2425	0.000200
LP24	EW-98	HP8	-40.7	0.01	4.15	439.72	0.030	11065	0.000200
LP25	EW-99	EW-98	-29.5	0.01	3.01	319.25	0.033	8033	0.000200

ATTACHMENT 11D

Example Landfill Gas Probe Monitoring Log

LANDFILL GAS PROBE MONITORING LOG

Technician: _____ **Temperature:_____**
Date: _____Time:_____ **Barometric Press.:_____**
Project No. _____ **Weather Conditions:_____**
Site:_____ **Wind:_____**
Monitoring Equipment & Serial No.:_____

Probe Number or Facility Structure	% Methane (CH_4)	% Carbon Dioxide (CO_2)	% Oxygen (O_2)	% Balance Gas	Static Pressure (inches of water)	Comments

SECTION 12

OPERATIONS PLAN

SECTION 12.0
OPERATIONS PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

PREPARED FOR:

National Waste Managers, Inc.
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PREPARED BY:

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PROJECT NO. 2018-3854
JULY 2020
(Revised September 3, 2021)

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LIST OF ATTACHMENTS

Attachments

12A - Equipment and Personnel Requirements
12B - Asbestos Waste Management
12C - Safety Plan
12D - Emergency Response Plan
12E - Alternative Daily Cover Fabric – Manufacturer's Information

12.0 OPERATIONS MANUAL

12.1 General

The purpose of this Operation Manual is to serve as a guide for the daily operations, the training of landfill personnel, emergency procedures and the construction of future disposal areas for the National Waste Manager's, Inc. (NWM), Chesapeake Terrace Rubble Landfill.

This Operation Manual was prepared using the Maryland Department of the Environment (MDE) Code of Maryland Regulations (COMAR) Regulations 26.04.07.16 and 26.04.07.18. Sound engineering judgment and accepted solid waste landfilling techniques are the basis for the procedures outlined in this manual.

NWM is the Operator of this facility. For the purpose of this document, the term "Operator" refers to the person, persons, or entity responsible for daily operations at the facility. NWM is the owner of the facility and permits associated with the facility are maintained in the owner's name.

12.2 Purpose of the Manual

This Manual is designed to be the reference book for the personnel who operate or supervise the Chesapeake Terrace Rubble Landfill. It addresses rubble waste placement in the landfill.

The sections that follow present project operating instructions and include:

- Design criteria;
- Project facilities description;
- Normal operating procedures;
- Waste placement procedures;
- Leachate management;
- Safety and security programs;
- Monitoring requirements;
- Maintenance programs; and,
- Procedures for responding to emergencies that may arise in conjunction with landfill operations.

In addition, the NWM has developed guidelines, procedures, forms, and plans that support the operation of the facility and are included as Appendices A through D as follows:

Attachment 12A	Equipment and Personnel Requirements
Attachment 12B	Asbestos Waste Management
Attachment 12C	Safety Plan
Attachment 12D	Emergency Response Plan
Attachment 12E	Alternative Daily Cover Fabric

12.3 Service Information

The Chesapeake Terrace Rubble Landfill is located in Anne Arundel County Maryland. The rubble landfill will accept the types of rubble waste listed in the COMAR 26.04.07.13 summarized in Section 12.7.

The Chesapeake Terrace Rubble Landfill has a total design capacity of approximately 9.3 million cubic yards (MCY) (8.4 MCY compacted rubble, 0.9 MCY cover material). The average daily rubble intake used for calculating the life of the Landfill is 1,602 tons per day. At the average daily rubble intake rate and 5-day per week operation, the life of the Chesapeake Terrace Rubble Landfill facility is 12 years. The average daily rubble intake is used for estimating purposes and the actual rubble intake rate may lead to a different facility life span. The landfill will be operated until the design capacity has been reached, or the life allowed under the special exception has expired..

At that time, the landfill will be closed, maintained, and monitored according to the COMAR regulations and the facility's Closure and Post Closure Plan.

12.4 Personnel

12.4.1 Manpower

The manpower present at the landfill will vary according to the rate rubble waste is being accepted. The landfill operational staff shall consist of a minimum of a landfill manager, a scale operator, and two (2) equipment operators. The landfill manager and scale house operator will be in charge of the day-to-day operations including inspecting, monitoring, and recording incoming loads and directing traffic to the working face. Ultimate responsibility for accepting/rejecting waste shall rest with the landfill manager. The manpower presented in Attachment 12A is for several filling rate ranges of 500 to 7,500 tons of rubble waste per day. If filling rates increase or decrease, equipment and manpower will be altered accordingly.

12.4.2 Training

All employees will be trained for the jobs that they will be expected to perform at the landfill. The facility will have an Operator certified as a Manager of Landfill Operations (MOLO) through the Solid Waste Association of North America (SWANA). In addition, on-the-job training will be provided by NWM for all employees. The training will emphasize the safe and environmentally sound operation of the landfill.

All employees will be given safety training covering the equipment and systems that they will be expected to operate on a daily basis. The dangers associated with heavy equipment operation, truck traffic, waste unloading, use of personal protective equipment, methane gas and leachate handling, and the handling and precautions associated with special wastes such as asbestos will also be included in the safety training. Documentation of the employee's participation in the safety training will be maintained in the employee's personnel file and/or on-site files.

A training program for the more specific tasks, e.g., scale operator, will be documented with written records of meetings and types of instruction. This instruction will include identification of special wastes and unacceptable wastes; emergency procedures in case of fire, spill or injury; confined space entry; respirator use and fit testing; and other issues that could potentially arise from time to time. Documentation will also be kept on file at the main personnel office and reviewed annually for any necessary updates.

12.5 Site preparation

12.5.1 Specifications

Various aspects of the construction of the landfill disposal areas will be performed by the landfill personnel. Construction will have to be in compliance with the approved MDE permit and supporting construction documents. A copy of the Phase I, Phase II, and Phase III Permit Applications and final state permit that includes the design report and engineering drawings shall be kept at the landfill site as reference documents to assist in construction activities and for daily operational questions. The Phase III Permit Application includes technical specifications, quality assurance/quality control plan, and other essential information describing construction activities.

Phase III Permit Application Technical Specifications

SECTION	TITLE
02100	Site Preparation
02110	Site Clearing and Grubbing
02125	Erosion and Sedimentation Control
02130	Monitoring Well Abandonment
02140	Construction Dewatering
02150	Shoring and Bracing
02220	Excavation
02223	Structural/General Fill
02224	Intermediate Cover
02225	Prepared Subbase Soil
02227	Articulating Concrete Mats
02231	Subsurface Drainage System
02232	Leachate Collection Layer
02233	Coarse Aggregate
02234	Protective Cover
02235	Vegetative Support Layer
02271	Stone Riprap
02402	Liquids Handling and Disposal
02418	Geocomposite Drainage Layer
02530	Geosynthetic Clay Liner
02595	Geotextile
02597	High Density Polyethylene (HDPE) Geomembrane
02598	Linear Low Density Polyethylene (LLDPE) Geomembrane
02607	Air Release and Check Valve Vaults
02612	Reinforced Concrete Pipe
02614	PE Drainage Pipe
02615	HDPE Pipe
02650	Leachate Collection & Removal System (LCRS)
02652	Leachate Side Slope Pumps
02653	Leachate Storage Facilities
02831	Chain Link Fence and Gates
02936	Seeding
03100	Concrete Formwork
03200	Concrete Reinforcement
03300	Cast-In-Place Concrete
13211	Bolted Steel Waste Water Tanks

13214	Leachate Pumping and Storage Controls System
13215	Pumps and Controls
15250	Leachate Pump House
15251	Pipe Insulation and Heat Tracing
16050	Basic Electrical Requirements

12.5.2 Quality Assurance and Control

Parameters used for quality control for the landfill disposal cells are included in the Phase III Report, the Construction Quality Assurance Plan, and the Technical Specifications. Refer to these documents for the quality control requirements. Reference is made to the facility's Closure and Post-Closure Plan for the quality assurance program and Technical Specifications specific to closure activities.

12.5.3 Timetables

Construction of the Chesapeake Terrace Rubble Landfill includes the development of 21 individual cells as shown on the Subgrade Grading Plans of the drawings (Drawings 10 and 11). Operation of the Chesapeake Terrace Rubble Landfill is expected to begin upon completion of Cell 11 construction and will last 12 years at an average rubble intake rate of 1,602 tons per day. Filling will begin in the East Section in Cell 11 and proceed as described on Drawing 63. When rubble reaches grades in an approximate 5 to 10 acre area, Closure Cap installation within that area will commence.

12.6 Operational Conditions

12.6.1 Operational Facilities and Services

As shown on the Drawings, operational support facilities include a scale house for vehicle weighing, a maintenance building for equipment storage and office facilities, and access roads. Support services include communication systems, water supply, and sanitary sewerage systems.

Potable Water	A well will be developed for drinking water and washroom facilities at the scale house.
Sanitary Facilities	Toilet facilities will be provided in the scale house building, and a septic system will be installed to provide on-site wastewater disposal.
Telephone	Telephone service will be provided in the scale house building – emergency telephone numbers and contact persons for fires, medical emergencies, spills of hazardous materials or other emergency situations shall be listed at this location at all times.
Communications	Landfill personnel will utilize portable 2-way radios (or other proven technology) to communicate between the scale house and the working face, or other on-site remote locations. Internet access will be available at the Scalehouse.
Other Facilities	Buildings will be provided near the scale house to serve as vehicle/equipment maintenance and equipment storage facilities. The landfill offices are located inside the maintenance building. Potable water supply and restroom facilities for landfill personnel shall be provided in accordance

	with applicable Anne Arundel County and State of Maryland regulations.

12.6.2 Site Access

12.6.2.1 Hours of Operation

In accordance with the Permit granted by Anne Arundel County, the landfill can be operated during the following times:

Monday through Friday	7:00 AM to 5:00 PM
Saturday and Sunday	No Operation

These hours may be amended as agreed by MDE and Anne Arundel County. The hours of operation will be posted at the entrance(s) to the facility.

Some non-operational type activities, such as leachate removal/transport, equipment maintenance, cell construction grading and capping, and general site maintenance and upkeep may be performed on weekends, however; no waste acceptance or disposal activities may occur on Saturdays or Sundays.

If demand for disposal of rubble waste increases, NWM maypursue a change in the hours of operation with MDE and Anne Arundel County.

12.6.2.2 Site Access Control

Site access will be controlled by surveillance using rubble landfill personnel. Persons on-site without the Owner's permission or legitimate business will be asked to leave the premises or risk arrest for trespassing. Access to the site will be limited to:

- Rubble fill and other Owner personnel.
- Customers depositing waste.
- State and local authorities.
- Persons with legitimate on-site business.
- Others as permitted by the Owner.

There is no public access to the site. As part of the construction, a new site security fence will be constructed around the entire proposed limits of disturbance.

With this security fence in-place, access to the site by the public will be limited to those times when authorized personnel are on duty at the facility. A locking gate will be provided across the entrance road(s) to prevent after-hours site access. At all times, the site will be fenced as required to prevent illegal dumping. Unauthorized persons are not permitted to enter the site at any time. Domestic animals will be excluded from the site.

12.6.2.3 Optional North and South Entrances

Over the life of the facility, the site will be accessed by up to three asphalt-paved entrance roads; one originating from Patuxent Road and two from Conway Road as shown on Drawing 2. The assumed East Entrance is the entrance approved by Anne Arundel County. In the event that the

East Entrance is not constructed, the Optional North Entrance or Optional South Entrance may be constructed.

An emergency vehicle lane for the assumed East Entrance and allowance for emergency vehicle movement through the Operational North or South Entrance is also provided, whichever is approved at the time of construction. The site will be fenced with a locking gate across the access road(s) that will prevent after-hours access and illegal dumping. After entering the site, the vehicles will proceed to the scale area, where they will be weighed. The vehicles will then proceed to the appropriate unloading area. Vehicles without a documented tare weight, will be weighed as they leave the site, after dumping their load at the working face. Inspection of incoming waste will be performed at the unloading area.

It is anticipated that the facility will accept rubble waste at the rate of approximately 1,602 tons per day delivered to the site by semi-trailers. Under the assumption that each semi-trailer delivers 20 tons of waste to the site, 80 semi-trailers per day would be required to meet 1,602 tons per day throughput. It is expected to require approximately two minutes processing per vehicle to move a vehicle from the truck scale onto the landfill perimeter access road. During an 8-hour day with 1,602tons per day, the average arrival rate of semi-trailers at the site would be approximately 6 minutes. In addition to waste disposal traffic, vehicles transporting recycled or reclaimed material from the site is expected. The number of loads per day will be a function of the amount of material recycled and reclaimed. If the proportion of such materials can achieve a level of 30% the number of additional vehicles would be 24 (assuming none of the trucks delivering waste are used for transport from the site, and all loads are made with 20 ton semi-trailers). In addition, the facility is expected to generate up to an average of 15 tanker truck loads of leachate per day that will be removed from the site.

In addition to queue lane provision (per Sections 3.4 of the Phase III Report), to accommodate any peak flow traffic events for any site entrance, inbound and outbound traffic will be controlled and given direction verbally, with signage, or other appropriate method. One outbound traffic lane will remain open for outbound trucks.

All vehicles traveling to the working face will drive down the access road to a landfill perimeter road and subsequently on an internal road to an active cell working face. These internal cell roads will be temporary and will move as the working face moves. Empty vehicles will exit the cell through internal roads to the perimeter road then exit the landfill via the entrance road. The entrance road is surfaced with asphalt pavement and crushed stone, as required by the Anne Arundel County Special Exception Permit for this landfill construction.

During wet weather when mud could be a problem on vehicle tires, all vehicles will be required to pass through the wheel wash. This wheel wash together with the paved access road are intended to eliminate tracking mud from the landfill perimeter access roads to off-site. Every effort shall be made to keep the entrance roads free of mud and dust.

In dry periods, water or other dust-inhibiting agents will be applied to the roads to keep dust to a minimum. When needed, additional gravel or other appropriate road materials will be applied to keep roads passable under all conditions. All roads will be constructed with a cross slope to ensure drainage from the roadway surface.

All visitors will report to the gate attendant or administrative staff on duty, sign in, and park in the designated area indicated by the attendant. No unauthorized visitors will be allowed on the site for

any reason. Visitor parking spaces near the gate attendant are provided. A designated employee parking area is also provided near the landfill entrance.

12.6.3 Inclement Weather

In the event of inclement weather conditions, landfill design considerations will permit the continued operation of the landfill. Daily cover material will be stockpiled adjacent to the working face. The access roads will be kept passable at all times. In wet conditions, additional road base will be available to stabilize soft spots in the landfill's internal roads. During cold weather, salt and/or sand shall be applied to icy spots or access roads to ensure adequate traction. During windy weather, portable litter fences will be utilized at the working face to control blowing litter (See section 12.7.2 for additional detail).

12.7 Waste handling

12.7.1 Types of Waste

The landfill will accept only those wastes permitted in a rubble landfill as described by COMAR 26.04.07.13. Those materials area as follows:

- Land Clearing Debris, includes the following:
  - Earth material such as clays, sands, gravels, and silts;
  - Topsoil;
  - Tree Stumps;
  - Root Mats;
  - Brush and Limbs;
  - Logs;
  - Vegetation; and,
  - Rock.
- Demolition Debris, includes the following:
  - Acceptable demolition debris associated with the razing of buildings, roads, bridges, and other structures includes structural steel, concrete, bricks (excluding refractory type), lumber, plaster and plasterboard, insulation material, cement, shingles and roofing material, floor and wall tile, asphalt, pipes and wires, and other items physically attached to the structure, including appliances if they have been or will be compacted to their smallest practical volume.
- Unacceptable demolition debris includes industrial waste or byproducts, any waste materials contained within a structure or on the grounds of the structure being demolished that are not physically part of the structure, or which are comprised of or contain materials that pose an undue risk to public health or the environment.
- Construction Debris, includes the following:
  - Acceptable construction debris is structural building materials, including cement, concrete, bricks (excluding refractory type), lumber, plaster and

plasterboard, insulation, shingles, floor, wall and ceiling tile, pipes, glass, wires, carpet, wallpaper, roofing, felt, or other structural fabrics.

- o Paper or cardboard packaging, spacing, or building materials, provided that they do not exceed 10 percent by volume of the waste, may be accepted at the rubble landfill.
- o Paint containers, caulk containers, or glaze containers are acceptable, provided that they are empty and any residual material that is dried before acceptance at the rubble fill, and further provided that this waste category does not exceed 1 percent by volume of the waste accepted at the rubble landfill.
- o Unacceptable construction debris includes commercial, domestic, or industrial wastes or byproducts, paint, tar or tar containers, caulking compounds, glazing compounds, paint thinner or other solvents or their containers, creosote or other preservatives or their containers, tile, paneling, or carpet cement or other adhesives, and other solid waste which may contain an unacceptable waste or substance as may be determined by the approving authority to be unacceptable.

- Tires. Scrap tires may be accepted at the facility and managed in accordance with the requirements of a scrap tire collection facility license issued under COMAR 26.04.08. Disposal of tires in a landfill is prohibited.
- Asbestos Waste. Asbestos waste is acceptable provided that the material that is received is packaged and labeled as specified in COMAR 26.11.15.04, and is managed in the following manner:
  - o Prior notification to the landfill manager is required;
  - o The waste asbestos is unloaded carefully to prevent emission of fibers into the air;
  - o The area used for burial of asbestos shall be restricted to the working face of the landfill, or a separate cell dedicated solely to asbestos disposal;
  - o The waste shall be completely covered with earth, other rubble, or alternate daily cover materials, and may not be compacted or driven over until sufficient cover has been applied to prevent the release of asbestos fibers to the atmosphere during compaction or application of other cover material; and,
  - o Operators at the landfill shall be appropriately trained and wear respiratory protection approved by the National Institute for Occupational Safety and Health for protection against asbestos fibers, and protective clothing when considered necessary.
- Household Appliances and White Goods. Household appliances and white goods are acceptable provided that any refrigerant is removed from the appliances before burial in the landfill and is managed in accordance with §608 of the Federal Clean Air Act (42 U.S.C. §7671g).
- Processed Debris. Processed debris is acceptable because the facility is a rubble landfill having a liner and leachate collection system constructed to the standards as specified in MDE COMAR Regulations 26.04.07.16.

- Other Waste Materials. Waste materials not specifically listed in this section may not be disposed of in a rubble landfill before receiving written approval of the Approving Authority.

The proposed facility will not receive or dispose of hazardous waste.

12.7.2 Litter Control

Every effort shall be made to prevent litter from being blown off the landfill site. All vehicles shall be covered while on site to prevent loose waste from being blown out of the vehicles. Litter control fencing will be placed downwind from the working face to prevent litter from being blown away if blowing material becomes a persistent problem. All rubble waste will be covered as quickly as possible on windy days to prevent blowing wastes from leaving the working area. Daily cover will be applied at the minimum of the close of every third operating day to further control litter. Fences and site perimeters will be policed daily and collected litter will be deposited in the cell area being worked. Work areas and access roads will be kept clean by use of a street sweeper, tank truck and litter patrol.

12.7.3 Noise, Dust, Odor, and Vector Control

Noise

Noise levels are regulated by the State of Maryland. It is expected that the surrounding woodland vegetation and topographic conditions will limit the exposure of the neighbors to landfill operations. All vehicles associated with the landfill operation will meet OSHA standards for noise levels. Operation of site equipment that contributes to excessive noise shall the limited to operating only during approved hours for landfill operation and during landfill cell or cap construction efforts or noise mufflers will be added to the equipment.

If landfill personnel observe that mufflers fitted to equipment are damaged, personnel shall report the need to repair the equipment to the Landfill Manager who will schedule the required repairs, as soon as possible. If this damaged muffler results in the noise exceeding regulated levels, the affected equipment will be removed from service until repairs have been completed.

If noise levels recorded at the site boundary are determined to be above State of Maryland limits, the Landfill Manager (or his designee) will work with equipment manufacturers to further muffle equipment noise or upgrade equipment. The Landfill Manager may also choose to adjust his landfill operations to assure that noise levels do not exceed state limits.

Dust

Dust and airborne particulate matter are regulated by the State of Maryland. Levels of such matter will be in compliance with Maryland and local regulations, if applicable. Dust is created by excavating operations, hauling cover from stockpiles and covering/filling operations. Vehicular traffic along the aggregate portion of the access roads may raise dust during dry periods and in the summer. Dust will be controlled by sprinkling working areas with water. Stockpiles and excavation areas will be sprinkled periodically while being worked. During dry periods and in the summer, a water truck equipped with pump and hose will be available to add moisture when dust conditions arise. All paved roads will be swept or washed when dirt and mud have accumulated on them.

Outgoing trucks will be routed through the wheel wash to limit the amount of mud tracked out of the landfill property during wet conditions.

Odor

Odors are generally not a problem at rubble landfills, due to the nature of the waste materials accepted. All waste will be covered at 3-day maximum intervals or daily as required to control odor. The proposed design includes an active gas extraction system to mitigate decomposition gases (primarily methane) that can create odor issues.

Vector Control

Vector prevention can be accomplished by limiting the size of the working area, keeping waste confined and compacted, and providing the specified depth of cover. Special attention must be given to eliminating voids associated with bulky wastes. Excess cover will be added to fill up voids created by bulky waste and sufficient cover will be added to obtain compaction over this waste. If vector activity becomes a problem, a vector control program will be implemented through the County Health Department or through a licensed pest control/exterminator contractor.

Mosquitoes breed during spring and fall in this area. Eggs are laid in water or places that flood. In warm weather, the eggs of most species hatch in two to three days; eggs of other species require a drying period, and may remain dormant for months and hatch within minutes after being flooded by a spring or summer rain. Larvae (wigglers) that hatch from the eggs feed mainly on bits of organic matter in the water. Standing water and depressions will be eliminated by maintaining positive grading to prevent ponding, which will reduce the areas where mosquitoes may breed.

Flies and other insects are usually associated with municipal solid waste rather than rubble waste due to the non-organic nature of the rubble waste. Various species of bees, wasps and ants are present on the site and will be in close proximity during the entire operation. These insects cannot be entirely controlled because their habitat exists on the site and in close proximity to the site. Control of these insects at rubble landfills is possible at or near the operational area by keeping the area clean of vegetation and accumulation of organic debris outside the working face.

12.7.4 Open Burning

Open burning will not be permitted at the landfill. Burning of rubble waste is not allowed except as permitted by MDE and the local Health Department.

12.7.5 Placements of Waste in State Waters

No wastes of any kind are to be deposited in any state waters.

12.7.6 Salvaging

Salvaging of recyclable materials is to be permitted at the landfill site only by authorized personnel. No lead batteries or waste oil are to be deposited in the landfill cells. Waste tires and other unacceptable items will be separated from approved waste, segregated/staged in a designated area and then disposed off-site at appropriately licensed disposal or recycling facilities.

12.7.7 Filling Operation

Waste filling will be by the area method. Wastes shall be deposited in lifts in order to achieve the maximum practical density. Wastes will generally be deposited at the bottom of the lift in layers that are approximately 8 feet thick. For safety reasons, vehicles entering the waste deposition area will

be segregated between small vehicles (pickup trucks and single axel dump trucks) and large transport vehicles, with small vehicles unloading at one end of the working face and large vehicles unloading at the other, or one type of vehicle going to one active cell area and the other going to another active cell area. (The procedures for unloading will be the same for both types of vehicles with material being deposited at the bottom of the working face and then spread/compacted by the landfill equipment.) The waste will then be spread in subsequent, uncompacted layers of 8 to 10 feet thick and compacted by at least 3 to 5 passes (dependent on waste type) with a landfill compactor that provides the compactive effort of a Caterpillar 836, or other equipment that provides a greater compactive effort. The compacted lift shall have a maximum thickness of 8 feet.

The liner system includes a 48-inch thick layer of Select Waste over the 24-inch thick leachate collection layer. NWM shall notify MDE prior to placement of the Select Waste The Select Waste shall contain no long pipes, boards, or other objects judged by the operator to be detrimental to the underlying liner system or leachate collection system. The protective layer may be spread in layers as thin as 24-inch thick for the initial lift and 12 inches for subsequent lifts (to facilitate inspection and removal of objects detrimental to the leachate collection system or liner), but the protective layer shall not be compacted until it has achieved a thickness of 48-inches.

If detrimental objects are found and removed, the operator will ensure that the object has not punctured the filter layer. Any detected punctures or penetrations will be repaired. The working face is to be kept as small as possible to ensure adequate compaction and to limit the amount of exposed waste. The maximum truck unloading area width is not expected to exceed 250 feet. This will allow adequate room for the anticipated peak traffic loading. A smaller working face may be technically possible, but this width is preferred by NWM for the safety of its employees and clients.

Due to occasional operational situations, NWM may rotate operations between three filling areas, each with an approximate area of 1-acre. During the rotation of operations among multiple filling areas, the total area will not exceed the 3-acres, and NWM will operate with the required number of equipment at each filling area to support the activities being performed, as specified in Attachment 12A. The operational situations that may necessitate multiple filling areas include, but are not limited to, rubble placement on side-slopes, placement of rubble to final grades, operation in a new cell, waste placement for an access road inside the landfill, or rubble placement during inclement weather.

NWM anticipates that the working face will rotate among these filling areas based upon the nature of the material being disposed. Due to the potentially diverse nature of material being disposed, NWM anticipates that no more than two filling areas will be designated as active working face on any given day. NWM envisions reserving the third filling area for placing select rubble fill or steep side slopes, building an internal access road in the landfill footprint, or other temporary condition.

At the end of each third operational day not less than six inches of compacted soil (“periodic cover material”) or approved cover material shall be deposited on any exposed waste in the area of the working face, including the area of other dumping or push platforms. If a fabric-type alternate daily cover is used, the cover shall be deployed over the deposited solid waste in the working face at the end of each day by pulling the cover into position by the available heavy equipment and anchoring by placing soil over the corners of the fabric.

The fabric type cover(s) are not expected to exceed 150 feet by 150 feet in size and can be easily placed by the available personnel and equipment. Prior to depositing waste the next working day, the cover will be pulled from the waste with the available heavy equipment and stored in accordance

with the manufacturer's recommendation. Refer to Section 12.7.8 for a discussion of alternate daily cover material (ADCM).

Intermediate cover of 12-inches (an additional six inches to the periodic cover material placed every third day) of compacted soil shall be applied on areas that will not have additional wastes deposited for 30 days or more. Twelve inches of compacted soil cover will be utilized as intermediate cover in areas that have used approved alternate daily cover materials. The intermediate cover shall be graded to minimize infiltration and erosion, while not exceeding the maximum permitted final cover slope or 25%, whichever is less. Additional cover shall be applied or reworked on a weekly basis to any waste filled areas over which the cover is cracked, eroded or uneven.

Previously placed cover materials may not be reused.

As part of the operations when moving into a new cell, NWM will strip intermediate cover prior to placing waste along the interface between the two cells. The removed intermediate cover will be blended and spread within the waste lift. The removed intermediate cover may not be reused as cover materials. The maximum area that will be stripped at one time will be equal to the maximum working face specified in Attachment 12A and any exposed waste will be covered by six inches of compacted periodic cover at a minimum frequency of every 3 days. After the intermediate soil is stripped, the surface will be scarified to mix any remaining soil with the waste and to promote bonding between the new rubble and the existing rubble. Scarifying will be accomplished by "ripping", back-dragging, tilling, disking, harrowing, or other methods to sufficiently scarify the surface.

12.7.8 Alternate Periodic Cover Material

Alternative Periodic Cover Materials (APCM) may be in use at site, with prior approval of MDE. For this project, the APCM being considered are as follows:

- Fabric-type alternate daily covers

The following table provides a summary of how fabric type covers meet the requirements outlined in COMAR 26.04.07.18.

APCM		Fabric-type Alternative Periodic Covers
May not contain free liquids, putrescibles, or toxic materials		The nature of this material prevents it from absorbing free liquids.
May not create a dust or odor problem		A fabric material will not contribute to dust generation nor will it emit odors.
May not attract or harbor vectors		By nature of this material (it does not contain putrescibles); it does not attract or support vectors.

May not impede compaction with standard compaction equipment		This material can be placed, then removed and reused. This material will minimize the amount of airspace lost to daily cover, thereby extending the life of the landfill.

Manufacturer's information for fabric-type alternate daily covers is included in Attachment 12E to this Manual.

12.7.9 Handling of Special Waste

In the daily operation of the landfill, there will be waste types that require special handling. Examples of these wastes are bulky items, tires, and asbestos containing materials. The Chesapeake Terrace Rubble Landfill may accept these wastes when handled and/or treated as specified in the following paragraphs. No hazardous wastes are to be accepted at this landfill.

12.7.9.1 Bulky Wastes

Bulky wastes such as furniture or appliances need special handling to ensure proper compaction and placement in the working face. Bulky waste should be crushed on solid ground before placement in the working area, if possible. If not, the items should be deposited near the working face and run over with the compaction equipment until it is of suitable size. The item should then be buried in the toe of the working face and covered with waste. If any depressions are formed, they also should be backfilled with waste.

12.7.9.2 Asbestos Containing Material

Asbestos waste is acceptable provided that the material that is received is packaged and labeled as specified in COMAR 26.11.15.04, and is managed in the following manner:

- Prior notification to the landfill manager is required;
- The waste asbestos is unloaded carefully to prevent emission of fibers into the air;
- The area used for burial of asbestos shall be restricted to the working face of the landfill, or a separate cell dedicated solely to asbestos disposal;
- The waste shall be completely covered daily with earth or other rubble and may not be compacted or driven over until sufficient cover has been applied to prevent the release of asbestos fibers to the atmosphere during compaction or application of other cover material; and,
- Operators at the landfill shall wear respiratory protection approved by the National Institute for Occupational Safety and Health for protection against asbestos fibers, and protective clothing when considered necessary.

12.7.9.3 Tires

Scrap tires may be accepted at the facility and managed in accordance with the requirements of a scrap tire collection facility license issued under COMAR 26.04.08. Disposal of tires in a landfill is

prohibited. The technical and operational standards as described in COMAR 26.04.08.17 include the following:

- Designation of Scrap Tire Storage Areas. For those scrap tire facilities that will store scrap tires, a scrap tire storage area shall be used. Only scrap tires, including processed portions and raw material, may be stored in the designated scrap tire storage area. This area shall be maintained free of excessive vegetation or other flammable materials.
- Scrap tires shall be stored indoors or outdoors under the specifications described in the "Standard for Storage of Rubber Tires", NFPA 230 (2003 Edition), National Fire Protection Association (NFPA), Batterymarch Park, Quincy, Massachusetts, which is incorporated by reference. A copy of this publication shall be maintained at the facility.
- NFPA Standards are superseded if they conflict with or are less stringent than:
  - Applicable State or local fire and zoning regulations or statutes; or
  - Provisions of these regulations.
- The Department may impose additional requirements on a scrap tire facility that stores scrap tires, including adequate on-site fire control equipment, based on the unique characteristics of a site that may affect the facility's potential to endanger the public health and safety, or the environment.
- A scrap tire facility that stores scrap tires shall be operated and maintained in a manner that controls mosquitoes and other insects or vermin to prevent public nuisances or health hazards.
- The site shall be engineered and constructed to keep any liquid runoff from entering waters of the State in the event of a tire fire.
- For those scrap tire facilities that store scrap tires, an up-to-date emergency preparedness manual shall be maintained at the facility at all times. This manual shall be submitted to the MDE for approval at the time the facility applies for a license or otherwise seeks authorization. Once accepted, the manual becomes part of the authorization. This manual shall be updated if a change in the operations of the scrap tire facility occurs, or if the Department requests an update. This emergency preparedness manual shall, at a minimum, contain:
  - A list of names and telephone numbers of persons to contact in the event of a fire, flood, or other emergency involving the facility;
  - A list of emergency response equipment present at the facility or available for use at the facility, the location of the equipment, and how it should be used in the event of a fire or other emergency;
  - The procedures to be followed by facility personnel from discovery of an emergency until the situation is corrected, including the measures that shall be taken to minimize the occurrence, recurrence, or spread of fires, explosions, and releases;
  - The location of known water supplies, fire hydrants, dry chemical extinguishers, or other materials that may be used for fire fighting purposes;

- Provision for reporting emergency situations to the Department without delay; and,
- Provision for familiarizing all employees with the requirements of the emergency preparedness manual.

- An emergency preparedness manual may not be approved by the MDE unless the applicant demonstrates that police and fire protection services are available for the facility.

12.7.9.4 Hazardous Waste

No hazardous wastes are to be accepted at this landfill. If they are identified at the time of delivery they shall remain on the truck and the truck and NWM shall reject the load, nofy the transporter or generator of the reason for rejection.

If hazardous waste is identified in an accepted load, NWM shall separate and handle the waste material in accordance with COMAR 26.13.02 Disposal of Controlled Hazardous Substances; notify MDE via phone within 2 hours of discovery. Within 5 days, the facility shall prepare and submit a written report containing the following information:

- Name of the source (if known)
- Name of the transporter (if known)
- Circumstances of discovery
- Description of efforts to secure and control the waste and any releases of pollutants from the waste.
- The current location.
- Final disposition of the waste (if known)

12.8 Equipment and Equipment Maintenance

The landfill is to be equipped with several pieces of heavy equipment and various pieces of support equipment. The heavy equipment is used for compaction of the rubble waste and excavation of cover materials. There are various pieces of support equipment used for mowing, maintenance work and other related tasks. Appendix A lists the equipment that should be available for landfill use. The actual equipment used will vary as new and improved equipment becomes available or the waste stream quantity and composition changes. Equipment breakdown will not be an operational problem providing backup is available. In the event of equipment breakdown, NWM will make every effort to obtain rental equipment or a replacement if necessary for normal operations within 24 hours.

The guardhouse, leachate storage controls and equipment, and leachate collection and conveyance system shall be equipped with sufficient standby backup power to operate those systems during a power outage. The capacity and configuration of the backup power supply shall be detailed in the electrical Building Permit application submitted to the County. The facility shall also maintain at least one towable generator power lighting tower at the site for emergency use.

12.9 Compaction and Cover

12.9.1 Compaction

After the rubble waste is deposited at the base of the working face, the waste shall be spread out in approximate 8-foot thick layers and run over by the compactor with at least 3 to 5 passes depending on waste type. This operation of placement and compaction shall continue until the desired lift height has been reached.

12.9.2 Lifts

The height of the compacted lifts shall be limited to 8 feet. This will ensure that the waste is properly compacted. The maximum 8-foot compacted lift is dictated by COMAR Sec. 26.04.07.18(E)**.** Based on the anticipated waste generation rates and the approximately 250 foot width of the working face, the amount of cover material needed will also be minimized. The surface of the lifts shall be sloped and compacted to prevent runoff to completed fill areas (i.e. areas protected by Final Cover or Closure Cap), or to areas beyond the limits of the liner system. The periodic and intermediate cover layers should be graded and compacted to minimize infiltration and erosion prevent standing water a the working face. The limit of the liner system during stages of construction shall be defined by the completed anchor trench in the perimeter berm or the inter-cell berm (Drawing 14). The runoff from within the active filling areas is intended to enter the leachate collection system and flow to the cell sump, where it will be removed by the submersible pump and conveyed through the double containment piping system to the leachate tanks. The inter-cell berm also functions to prevent the inflow of clean runoff from the adjacent undeveloped or unfilled areas. Water from outside the waste disposal area is not allowed to flow into the waste disposal area. Once waste placement begins within a cell, all runoff occurring in the cell must be handled and disposed as leachate.

12.9.3 Periodic Cover

By the end of the third day's operation, or more frequently if required, the working face and any other exposed wastes will be covered by a minimum of six inches of uniform compacted clean soil. The cover soil will be graded to minimize infiltration and erosion, and prevent ponding of water at the working face. compacted by a bulldozer or compactor. This will help reduce litter, odor, fire hazard, and vectors. Cover for asbestos waste in the specially designated asbestos waste disposal area is discussed in the Asbestos Management and Disposal Plan (Appendix B).

Cover soil will not:

- Contain free liquids, decaying or toxic materials. Moisture present in the cover material solely as a result of precipitation is not free liquid.
- Create a dust or odor problem.
- Attract or harbor animals or insects.
- Impede compaction with standard landfill equipment

If a fabric-type alternate periodic cover is approved by MDE, the cover shall be deployed over the deposited rubble waste (including exposed waste at the tipping area and other dumping or push platforms) by pulling the cover into position by the available heavy equipment and anchoring by placing soil over the corners of the fabric. The fabric type cover(s) are not expected to exceed 150 feet by 150 feet in size and can be easily placed by the available personnel and equipment. Prior to

depositing solid waste the next working day, the cover will be pulled from the waste with the available heavy equipment and stored in accordance with the manufacturer's recommendation.

12.9.4 Intermediate Cover

Weather permitting, intermediate cover of compacted soil will be provided over the waste disposal areas not to be used for a period of 30 days or more. Intermediate cover will be compacted by a bulldozer. The intermediate cover shall be graded to minimize infiltration and erosion, while not exceeding the maximum permitted final cover slope or 25%, whichever is less. The intermediate cover layer shall have a minimum thickness of twelve (12) inches. The intermediate cover shall be graded to prevent ponding and promote positive drainage away from the waste cell and working areas.

A 12-inch layer of intermediate cover is also required after each 8-foot lift is placed.

12.9.5 Final Cover

Not later than ninety (90) days following the completion of filling operations as indicated on the Final Grading Plan drawings, Final Cover layer must be applied. Final Cover will consist of a uniform compacted layer of earthen material not less than 2-feet thick. The Final Cover layer supports the 40-mil LLDPE, a geocomposite drainage layer components of the Closure Cap.. No slopes shall be more than 25% or less than 4%. Cross slopes across the surface of the Cover Soil layer beneath terraces and cap access roads shall be 7%. All depressions and low spots shall be filled and the cover graded to promote drainage away from the cell to the proper drainage controls.

12.9.6 Closure Cap

The Closure Cap is installed over the Final Cover Layer. Closure Cap installation must be started within 24 months after reaching top of waste elevations, and be completed within 36 months of reaching top of waste elevations. The Closure Cap consists of a 40 mil geomembrane (textured on both sides), geocomposite drainage layer, 18-inches of Protective Cover Soil and 6-inch thick Vegetative Cover Layer.

12.9.6.1 Closure Cap Geosynthetics

The Closure Cap geosynthetics consist of a geocomposite drainage layer, with a triplanar drainage net and 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; and a 40-mil textured on both sides, linear low density polyethylene (LLDPE) geomembrane with a permeability less than or equal to 1 x 10-10 cm/sec.

12.9.6.2 Protective Cover Layer

The protective cover layer component of the Closure Cap consists of the following components:

12.9.6.3 Vegetative Cover

After the final cover has been applied, a vegetative cover must be established on the cell to prevent erosion. The final grading and landscaping shall be as designated in the final Closure and Post-Closure Plan and drawings. Lime and fertilizer will be applied as necessary to ensure that the vegetative cover is well established. Specifications for seeding of the final cover are attached to the Closure and Post-Closure Plan. Specifications for seeding in other disturbed areas are contained in the Phase III Permit Application.

The final vegetative support layer shall be planted with grass after installation. Ground cover must be maintained by cutting and repairing damaged or eroded areas. Slopes must be maintained by grading and filling to eliminate ponding and to correct for settlement. All seed and mulch, topsoil, fertilizer, lime, sod and all other landscaping items shall conform to and be installed in accordance with the Anne Arundel County Soil Conservation District Specifications. For problem erosion areas, use of a synthetic soil stabilizer is recommended. As part of the closure cap construction, installation of stormwater management terraces and downchutes will be constructed as shown on the Drawings 32 and 33.

12.9.6.4 Protective Cover Soil

The Closure Cap includes a 24-inch thick layer of soil placed on top of the geosynthetic cap components. The uppermost 6-inch thick layer of protective cover soil is the vegetative support layer. Approved materials are defined in the Specification (Section 14.0) and included topsoil reserved from the landfill cell construction, imported topsoil materials, or other material capable of supporting vegetation. The 18-inches of protective cover soils underlying the topsoil and setting directly on the cap geosynthetics shall have a permeability not exceeding 1x10-5 cm/sec and meet the other requirements described in Specification Section 02234.

Cracks or fissures, caused by dry soil, may occur in intermediate cover, Final Cover and Protective Cover layers. This condition, which allows water to enter the fill, shall be corrected by regrading and revegetating the cover.

12.9.7 Stockpiles

Soil shall be stockpiled to ensure there is enough material for approximately nine days worth of cover soil. The stockpiles shall be as designated on the Design Plans or in other suitable areas. Proper erosion control devices shall be implemented for all stockpile areas.

12.9.8 Alternate Periodic Cover

- Fabric: Section 12.7.8 describes the use of a fabric-type periodic cover.

12.10 Safety

Attachment 12C contains the Safety Plan that describes safety procedures to follow for work at the Chesapeake Terrace Rubble Landfill. Attachment 12D contains the Emergency Response Plan developed to assist the personnel at the Chesapeake Terrace Rubble Landfill in the event of an emergency. The safety plans are in compliance with state and local ordinances as well as requirements of the Occupational Safety and Health Act of 1970 (OSHA). Records are to be maintained to verify attendance of safety and training meetings.

12.11 Inspection Plan

An inspection plan shall be implemented to ensure that all of the major aspects of the facility are in compliance with the COMAR regulations for rubble landfills. The major areas requiring inspection are incoming rubble waste, leachate collection, conveyance and storage system, storm water conveyance system, erosion and sedimentation controls, roads and facility structures, equipment used in operations, landfill gas management system, and groundwater monitoring system. Records are to be kept of the inspections and made part of the facility operating record.

The Inspection Checklist included in the Closure and Post-Closure Plan may serve as a guide for inspecting and monitoring on-site systems during active landfill activities as well.

12.11.1 Incoming Rubble Waste Inspection Plan

The incoming rubble waste to the landfill shall be visually inspected by the landfill manager or scale operator to ensure that it does not contain any undesirable waste. The landfill manager or scale operator will keep records of all incoming materials and ascertain whether the material will be accepted or rejected. Operational personnel will be trained to recognize and identify prohibited and hazardous waste. Vehicles shall be inspected at the scale house and by the operators who will be coordinating the placement of waste and visually inspecting all incoming waste as it is unloaded. If undesirable waste is encountered, the load should be isolated and the driver and waste generator's driver's license number recorded. Unless a safety concern exists, the driver shall remain with the vehicle on the site until the landfill manager or his designee can examine the load and determine the proper course of action. If the waste is determined to be regulated, the MDE and the owner of the facility are to be notified immediately (See Section 12.7.9).

12.11.2 Leachate Collection System Inspection Plan

The leachate collection system consists of many different parts, including the piping, sideslope risers, leachate sumps, the force-main, various pumps, manholes, and storage facilities. All of the portions of the leachate collection system that are to remain under the rubble waste shall be checked before any rubble waste is placed in a cell to be sure that the pumps are operating properly and that there are no blockages of the piping.

After the initial startup and inspection, a yearly visual inspection and cleaning of the line (if necessary) should be performed by the landfill manager. All pumps are to be pulled yearly and serviced/inspected. All the manufacturers' recommended periodic maintenance shall be performed at this time. This shall include replacement of the pumps, if necessary. The force-main shall have the same maintenance as the leachate piping and pumps. The storage facilities shall be inspected on a regular basis to check for leakage or other defects.

When inspecting the leachate collection system, be especially careful as methane can be trapped in manholes or other places and could cause explosions. Leachate is of unknown content, so caution should be taken in handling leachate. Protective clothing should be worn whenever working with the leachate collection system, and confined space entry procedures shall be used when appropriate.

If leachate seeps are observed during the leachate collection system inspection, the following steps will be taken to correct the seep:

- Excavate the area around seep down to source if possible;
- If source cannot be found, excavation shall be deep enough to direct leachate down towards leachate collection system;
- Backfill excavation with excavated waste and daily cover material; and,
- Repair intermediate cover layer, as necessary.

The landfill manager shall inspect the repaired area after the repair to ensure that the seep has been eliminated.

12.11.3 Stormwater Conveyance System Inspection Plan

The stormwater conveyance system consists of sediment basins, pipe, and ditches. Quarterly inspections should be performed by the landfill manager to ensure that pipes and ditches are free of

obstructions and that there is no visible damage to the system. In addition, the storm water conveyance system will be inspected immediately after major storm events, defined as 0.5-inches, or more, of rainfall in a 24-hour period. If culverts have been used, check to see that the ends are still open and, if they have been crushed, repair or replace them. Periodically regrade the roadside ditches to prevent standing water and ensure adequate capacity. If sediment has accumulated in stormwater conveyance structures to a depth greater than one foot, they should be cleaned out in an appropriate manner. The sediment basin should be cleaned out when sediment has accumulated to the clean out level.

Sediment control and stormwater management devices in-place at the beginning of construction shall be operational throughout the life of the landfill or as detailed on the final sediment control plans, and therefore must be repaired or replaced as required. Particular attention shall be directed to earth dikes and diversion ditches, to prevent surface water from entering the fill. Basins shall be cleaned of sediment when cleanout elevations are reached.

Generally, all exposed earth surfaces that show signs of erosion must be restored and protected with seed and mulch, mulch only, riprap or a synthetic stabilizer, depending on the location and severity.

12.11.4 Erosion and Sedimentation Control Inspection Plan

The erosion and sedimentation control devices will be inspected concurrently with the stormwater conveyance system inspection. If any of the control devices are found to be damaged, they are to be repaired or replaced or upgraded with a more robust control device, as soon as possible. Whenever sediment accumulation in a sediment basin exceeds one-half of the ponds storage capacity, the operator shall remove the accumulated sediment to restore the pond to its design storage capacity.

12.11.5 Roadways and Facility Structure Inspection Plan

Roadways are to be kept clear of mud and dust, and kept in passable condition at all times. Roadways shall be inspected monthly by the landfill manager. New surface gravel/stone will be applied to gravel/stone roads to keep them in passable condition. Potholes and ruts should be filled as soon as they occur. Roads shall be periodically regraded to maintain a cross slope and to keep water from ponding on the roadway surface.

Access to the working face will be provided by temporary cell access roadways, which will be a minimum of 12-inch thick compacted dense graded aggregate, with a minimum width of 24 feet. The temporary access roadways within the cells shall be designed with turning radii adequate for the hauler trucks; vertical grades shall not exceed 15%. All aggregate roads shall be maintained to continuously provide a compacted surface suitable for truck traffic. An aggregate stockpile shall be placed on the site to provide replacement material, as necessary.

All facility structures shall be inspected on a routine basis as determined by the landfill manager. Repairs will be performed whenever necessary to preserve the integrity of the facility.

12.11.6 Equipment Inspection Plan

The equipment used at the landfill shall be inspected each day of operation by the respective operators for any visible signs of deterioration or malfunction. Any daily required maintenance shall be performed as required and the fluid levels checked. This shall include any attachments or accessories that will be used with the equipment. Equipment is to be serviced routinely as

suggested in the service manual for each piece of equipment. During routine maintenance, equipment shall be steam- or high-pressure water cleaned, at designated areas (like the wheel wash building) to facilitate inspection of the equipment for signs of wear or deterioration that is not easily visible to the operator. Proper records of all maintenance are also required for each piece of equipment.

12.11.7 Areas Subject to Spills Inspection Plan

A Stormwater Pollution Prevention Plan (SWPPP) is in the process of being prepared and will be submitted to MDE under separate cover. The SWPPP will contain requirements for conducting site operations in a manner to limit impacts to stormwater runoff and prevent spills and releases. The fuel storage area, equipment maintenance area, generators, leachate transmission lines and flare paddock are all facilities subject to spillage that could have significant adverse consequences. Details related to routine inspection, record keeping and responses to releases related to spill prevention will also be provided in the SWPPP.

The fuel storage area will consist of an aboveground tank, waste oil tank and possible used battery storage. These facilities will be surrounded by an earthen containment of adequate capacity to hold the entire contents of the tanks should a spill occur. If a leak occurs, it will be observed during the daily usage of the fuel tank. If this happens, the spilled fuel in the containment will be pumped into a tanker truck, and the tank will be emptied and repaired.

The leachate force main be contained in double-wall pipe where it is outside the landfill liner system. This double-wall pipe will be checked at the cleanout vaults for leakage between the inner and outer liner on a monthly basis.

12.11.8 Gas Management System Inspection Plan

The gas management system will be inspected as described in the Landfill Gas Management Plan (LFGMP) (Section 11.0 of the Phase III Permit Application). The landfill gas extraction (LFGE) system will be monitored monthly and the gas monitoring system will be monitored quarterly by qualified personnel. Refer to the Landfill Gas Management Plan for more details.

12.11.9 Groundwater Monitoring System Inspection Plan

Groundwater monitoring wells are used to measure groundwater levels and as sampling stations to test groundwater quality. A detailed groundwater monitoring plan is provided in Section 17.0 of the Phase III Permit Application. Certain elements of the groundwater monitoring system will require periodic inspections. The inspection of the groundwater monitoring system will be performed concurrently with the collection of samples and the results provided in the respective groundwater monitoring report. All wells are to be inspected as follows:

- Well casings are to be checked for signs of damage;
- The cover of the wells will be examined for signs of cracks or other deterioration that would prevent a weather tight seal;
- The lock should be checked for proper operation and replaced if necessary;
- The concrete base around the well should be examined for cracks and to ensure that it repels water from around the base of the well. Look for signs of erosion that could undermine the base;

- All components of the well should be checked for signs of deterioration and replaced or repaired if necessary;
- Examine the inside of the well for signs of plugging or other foreign objects; and,
- Check the immediate area of the well for visual signs of possible contaminants.

Any portions of the groundwater monitoring system that are found to be deficient shall be repaired or replaced as soon after detection as possible.

The perimeter monitoring probes will remain in-place indefinitely but some monitoring wells will be removed prior to placing waste in the area occupied by the device. Removal of monitoring wells must be performed by a well driller licensed in the State of Maryland in accordance with the provisions of COMAR 26.04.04. Monitoring wells remaining in place must be protected and maintained throughout the landfill operation and beyond.

12.11.10 Safety Equipment Inspection Plan

Various pieces of safety equipment will be specifically available for use by personnel. Other pieces of equipment will be standard on certain pieces of machinery and in designated buildings. Inspections shall be performed monthly and in accordance with manufacturer's specific instructions and frequencies. Below is a list of some of the equipment requiring periodic inspection.

12.11.10.1 Fire Extinguisher

Check periodically to ensure they are in the designated locations. Check the individual extinguisher for proper charge and to ensure they have no visual defects. Fire extinguishers on landfill operations equipment shall be checked daily prior to operating the landfill equipment or whenever the equipment is used. A check of the fire extinguisher on each piece of landfill equipment is included on the mechanic's/operator's daily inspection checklist. Be sure to follow the manufacturer's maintenance schedule.

12.11.10.2 First Aid Kits

Check to ensure they are in the required locations. Inspect each kit on a monthly frequency to ensure that all items are properly supplied and that no items have passed their expiration date. Re-supply as needed.

12.11.10.3 Personal Protective Clothing

Check for signs of deterioration and tears. Check to see that there is ample supply for all personnel and that appropriate sizes are available. For eye wear, check lens for scratches or cracks and replace as needed. These checks shall be performed monthly and whenever the item is used.

12.11.10.4 Respirators

Perform inspections per the manufacturer's specifications before each use. If using a cartridge-type respirator, be sure that any cartridges being used are of the correct type for the anticipated environment.

12.11.10.5 Detection Devices

On a monthly basis, inspect visually for signs of worn or broken pieces. If the device must be calibrated by the manufacturer, check to see that the calibration certification has not expired.

12.11.10.6 Emergency Lighting

On a monthly basis, check to see that the lights are operational and are in good repair. Any safety equipment found to be deficient shall be repaired or replaced immediately. A Site Safety Plan is provided in Attachment 12C.

12.12 Control and Monitoring of Liquids and Gas

12.12.1 Leachate Management

12.12.1.1 Handling of Leachate

Care must be exercised when handling leachate. All personnel that will be engaged in the handling of leachate will be specifically trained in the use and operation of the leachate management system, including pumps, pipes, valves, storage tanks, personnel protective equipment, loading and unloading of leachate, and spill prevention techniques.

12.12.1.2 Collection

Leachate from the Chesapeake Terrace Rubble Landfill is collected via the leachate collection layer and subsequently flows to the leachate collection sumps. The leachate collection system is designed to operate automatically to remove leachate present in the sump so that it does not exceed one foot of head over the liner system. Pumps in the leachate collection sumps will automatically pump the leachate to the leachate Force Mains. Once in the Force Main, the leachate will be routed to one of two leachate storage facilities described in Section 12.12.1.2.2 of this Plan.

12.12.1.2.1 Leachate Pumps

The submersible pumps and accessories for each landfill sump will be manufactured by EPG Companies or engineer-approved equivalent. Existing electrical power supply for pump operation is located near the site in Patuxent Road and Conway Road rights-of-way.

Prior to beginning the landfill operation in each new cell, the operator will ensure that a spare pump for emergency use is stored in the site's maintenance building. The specific spare pump to be used will be dependent upon operational conditions during the life of the landfill operation, as shown on Intermediate Construction Stage Drawings included in Section 7 of the Phase III Permit Application, and Sequence and General Notes for Construction on Drawing 63.

A level sensor for each submersible pump is included in all cell sumps. The leachate levels are monitored at the pump control panel, mounted on the Pump House wall (see Drawing 26). The level sensor pump-off position will be set at 6-inches above the sump floor. The pump-on position will be 12-inches above the sump floor, and pump high- level alarm will be set at 16-inches above top of sump. Drawing 19 includes the materials that are included in the cell sumps.

To ensure that the pump alarm will not be activated in cell sumps containing two pumps, a lead/lag system will be provided. This system includes a pump focused control panel at each cell pumphouse and a master control panel at each Leachate Storage Facility Pump House (see Drawing 10 leachate storage facility control building locations) with duplicate controls for the pumps discharging to that location.

The cell pump control panel is designed to operate one pump. The cell sump sideslope riser pipes are designed to allow the addition of a second pump in the second sideslope riser pipe and be

connected to the master control panel, so the two pumps can operate in a lead/lag arrangement, if the cell is actively filling during a particularly wet year or the operator wishes to install the “spare” pump to reduce wear and tear on the primary single, pump.

In the lead/lag, the lead pump starts at the pump start level set point and continues to run until the liquid level decreases to the pump stop level set point as programmed in the level control meter. The lag pump will start after the lead pump starts if the liquid level continues to rise above the pump start level set point and both pumps will continue to run until the liquid level decreases to the pump stop level set point as sensed by the pressure transmitter. If the liquid level rises to the high level alarm set point, a high level alarm will be annunciated. If a motor trips while running due to an overload condition, the other pump will start automatically.-

The control panel will monitor and record leachate levels in the landfill cells. In the event of high level alarm occurrence, a light at the Pump Control Panel will be activated. During landfill operating hours, the alarm signal will be electronically transmitted to the Scale House. During all landfill non-operation hours, the Landfill Manager and Superintendent will receive a high level alarm signal, via electronic telemetry from the Pump Control Panel.

12.12.1.2.1.1 Pump Access and Maintenance

Access to pumps within 24-inch HDPE sideslope riser pipes is provided by means of stainless steel pulling cables as shown on Drawing 19. The Landfill Perimeter Berm and Pump House, shown on Drawing 23, are designed to provide equipment access, as necessary to install and remove pumps. An aluminum roll-up door, or wide swing doors, allows access to both pump sideslope riser pipes and the Landfill Perimeter Berm top width is designed to allow access for Pump Installation and Removal Equipment (i.e., equipment mounted with boom and winch, with steel cable for attachment to the pumps stainless steel pulling cable).

12.12.1.2.1.2 Force Main Access and Maintenance

Force Mains and Laterals are readily accessible for construction equipment trenching excavation, during the life of the landfill operation. The location of the leachate force mains are shown on Drawings 17 and 18, and the force main profiles are shown on Drawings 24 and 25. A majority of Leachate Force Mains are buried at minimum 3.5 feet depth in the Landfill Perimeter Access Road as shown on Drawings 22 and 23. Leachate Force Mains exceed minimum depth burial as required for crossings at Storm Drains and Landfill Perimeter Channel. Construction equipment access across Landfill Perimeter Channels will be provided by placement of permanent pre-cast concrete spans to provide ready and immediate access to the pump houses.

Force Main cleanouts are provided at minimum 400 feet intervals as noted on Drawings 17, 18, 24 and 25. Flow in the Force Main will be check at each cleanout at a minimum of once per year. The Force Main will be cleaned out at the appropriate cleanouts if flow is observed to be restricted.

Check Valve Vaults and Air Release Valve Vaults (per Details on Drawing 22) are 6 feet minimum from bottom of precast concrete top slab to concrete base slab floor. Steps beneath manhole covers, centered on 2’-0” top slab openings are provided. The vaults will be inspected at least once per year. Any damage to the vault, access, ladder, or brackets shall be repaired at that time. Check valves and Air release valves will be inspected as suggested by the manufacturer or at least once per year, whichever is more frequent. Maintenance, repair, or replacement of the valves as required in the manufacturer’s recommendations will be performed at that time.

12.12.1.2.2 Leachate Storage

Leachate from the entire landfill is conveyed to two storage areas, each with two 45-foot diameter, glass coated bolted steel Aquastore Tanks with a storage capacity of 500,000 gallons. The storage tanks are located inside a concrete secondary containment area designed for 500,000 gallons containment capacity, with 1-foot freeboard to top of berm.

The Master Control Panel at each Leachate Storage Facility will monitor and record leachate levels in the storage tanks to prevent storage tank overflow. In the event that the storage tanks become tank filled to near capacity, an alarm is activated and all leachate pumps are automatically shut down.

Each secondary containment structure is equipped with a sump from which uncontaminated rainwater can be pumped. The containment structure is also equipped with a load-out pad where leachate can be transferred from the storage tanks to tank trucks for transport to the wastewater treatment facility. The load-out pad is equipped to drain into the secondary containment in the event of spillage and rainwater that falls on the load-out pad.

Transport and disposal of leachate will be performed on a daily or near-daily basis, while the landfill is in operation. The average daily generation rate for the landfill is projected to be on the order of 75,000 gallons, at its highest production rates. This will equate to an average of 15 truckloads every day. NWM shall maintain normal tank levels below 25% capacity (i.e. at least 750,000 gallons of available capacity), to help ensure that adequate capacity is available to manage spikes in flow associated with heavy rain events.

12.12.1.2.2.1 Leachate Storage Tank Access and Maintenance

Access to the leachate storage facilities is provided via leachate storage facility access roads, as shown in the Drawings 10 and 11.

12.12.1.3 Leachate Disposal

From the leachate storage tanks, the leachate be hauled off-site for disposal. We have received a favorable response from Environmental Recovery Corporation (ERC) of Maryland, located in Baltimore that they do receive rubble landfill leachate and they have provided a preliminary quote for disposal of the leachate, up to 75,000 gallons per day from our site.

Depending on the nature of the waste disposed, the levels of contaminants in the leachate, and the volume of leachate produced (which is directly linked to the amount of rainfall), the owner may choose, in the future to develop an on-site wastewater treatment plant to treat leachate and obtain a NPDES discharge permit.

12.12.2 Leachate Record Keeping

Records will be kept on the amount of leachate being generated in each sump and the amount of leachate being loaded onto tanker trucks for off-site disposal at the storage tank locations. The generation rate of leachate from the collection sumps will be recorded by means of a flow meter incorporated into the discharge line for the collection sump leachate pumps. Quantities of leachate load out on tanker trucks will be measured by the number and capacity of tanker loads transported off-site.

12.12.3 Gas Migration Monitoring

Pursuant to 26.04.07.21(5) of the COMAR, solid waste disposal facilities are required to maintain a gas monitoring network capable of detecting the presence of decomposition gas in the vadose zone at the facility property boundary. Methane gas monitoring probes will be located on approximate 500-foot centers near the property line surrounding the facility. Gas probes will be monitored quarterly to ensure that the concentration of landfill gas at the property boundary does not exceed 100 percent of the lower explosive limit, and does not exceed 25 percent of the lower explosive limit in facility structures. In addition, assessment of monitoring data will help determine the effectiveness of the gas system. The Gas Monitoring Plan is provided in Section 11.0 of the Phase III Permit Application.

12.12.3.1 Landfill Gas Collection System

An active landfill gas collection system will be installed at the landfill, if required based on the results of landfill gas monitoring. During construction associated with installation of the landfill gas collection system, there is a potential for the generation of odors. The following preventative measures will be taken as necessary in order to minimize the potential for these odors:

- Drilling and trenching activities will be suspended during adverse weather conditions (i.e., rain conditions);
- Suitable odor control products may be applied directly to and in the general vicinity of all work where the intermediate cover soil layer is breached and the underlying waste is exposed (i.e., well drilling and lateral trenching) to minimize and control any odors associated with the exposed waste;
- At the completion of well installation activities, the well will either be capped or connected to a utility flare (temporary) or to the landfill gas extraction system (permanent). A permanent connection to the landfill gas extraction system will be made as soon as possible; and,
- Trenching may be limited to only that amount which can be completed by the contractor within a day (or less in sensitive areas). All transmission pipelines will be temporarily sealed at the end of the workday.

12.12.3.2 Operation Modifications

The following equipment and working face procedures will be employed to minimize odor migration:

- The amount of exposed waste on the working face will be minimized by applying daily cover to finished areas during the course of the working day;
- Waste vehicles waiting to unload waste and untarp will be queued away from areas adjacent to public roads;
- The facility may use a water truck equipped with water cannons to spray odor control products directly onto the working face during waste disposal, if necessary;
- Vaporization equipment may be used to reduce water consumption as compared to atomization
- A portable / mobile boom trailer using a proprietary natural, carbon-material odor control product may be available to be placed where needed; and,

- A supply of granular odor control products may be maintained on site to provide odor control in localized areas.

12.12.3.3 Response Actions

Upon the identification of an odor outside the property line of the landfill as a result of an inspection or odor complaint, the General Manager or designee, shall take the following actions:

- Landfill staff will attempt to identify the source of the odor that has been detected off-site;
- Upon identifying that the landfill is the odor source, the Staff shall take appropriate action to minimize and control the odor as follows:
  - If the source of the odor is landfill gas, as the situation dictates, the Staff can increase the vacuum to the gas collection system, add additional cover material, repair any leaks to wells or exposed piping, or apply an odor control product; and,
  - If the source is the working face, the Staff can deploy any of the odor control product dispensing equipment that is not in use or increase the concentration of the products already in use. If the source of the odor is identified as a particular waste stream, the Staff can direct the working face operators to bury the waste as quickly as possible. In the latter case, the Staff should contact the generator of the offending waste to coordinate future disposal.

12.12.4 Groundwater Protection and Monitoring

12.12.4.1 Groundwater Protection

Protection of groundwater at the disposal facility is accomplished by the construction of a composite liner system for the Chesapeake Terrace Landfill cells that incorporates a leachate collection system. The liner system consists of, from top to bottom:

- Four feet of Select Waste;
- 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator if breached;
- Two feet of leachate collection layer, comprised of locally mined sandy soils;
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides;
- 60-mil high density polyethylene geomembrane with a permeability less than or equal to 1×10^{-10} cm/sec; and,
- 24-inch thick prepared subbase soil layer with permeability $<1 \times 10^{-5}$ cm/sec.

The Chesapeake Terrace Landfill design maintains a minimum three-foot buffer between the bottom of the prepare subbase and the highest predicted/observed groundwater level.

A comprehensive groundwater monitoring program has been developed for the facility. The monitoring program involves collecting and analyzing samples of groundwater semi-annually from wells strategically placed at the site, and the monitoring of the groundwater gradient to document the direction of hydraulic movement.

12.12.4.2 Groundwater Monitoring

Groundwater monitoring wells are used to measure groundwater levels and as sampling stations to test groundwater quality. A detailed groundwater monitoring plan is provided in Section 17.0 of the Phase III Permit Application. This plan includes installation of monitoring wells, sampling and testing procedures, and the evaluation program. Monitoring wells remaining in place must be protected and maintained throughout the landfill operation and beyond.

12.13 Records and Measurements

Records shall be kept on a daily basis of the weight of all rubble waste brought to the landfill. These records will be used to monitor the amount of waste being deposited in each cell. They will also be used to project future waste generation rates for projecting the life of future cells.

A record of the nature and quantity of asbestos waste and its source shall be maintained.

Records shall also be kept for the amount of leachate being generated. Copies all groundwater monitoring and landfill gas monitoring results shall be retained. A complete discussion of groundwater monitoring is included in the groundwater monitoring plan section of this application. Copies of all records shall be retained in the main office and at the scale house. Appropriate copies shall be sent to the required state agencies.

The rubble waste will be measured in place by field and/or aerial survey as required to prepare as-built documents, in compliance with MDE regulations. Each day each delivery of waste will be categorized and measured by the scale house operator. The waste will be weighed at the scale house and will be classified based upon the source of the material. At the end of each day, the scale house operator will summarize the day's deliveries, by category of waste type (based upon source) and the received tonnage of each waste type. This information will be used to provide annual reports and to estimate remaining cell life. The annual report will include the following:

- Quantity of solid waste received each month (c.y.) during the calendar year of the report;
- Percentage of the projected total rubble landfill capacity used annually, and to date;
- Projected rubble landfill completion date, and a description of the basis for this projection; and,
- Type and quantity of materials received each month.

12.14 Closure and Post-Closure Care

For a detailed description of the closure procedure and post-closure care, refer to the Chesapeake Terrace Landfill Closure and Post-Closure Plan.

ATTACHMENT 12A

Equipment and Personnel Requirements

TABLE 12A-1
PERSONNEL LIST
CHESAPEAKE TERRACE RUBBLE LANDFILL, ANNE ARUNDEL COUNTY, MARYLAND

POSITION/TITLE	PERSONNEL	CONTACT INFORMATION
Landfill Supervisor	*TBD (see Note 1)	*TBD (see Note 1)
Landfill Foreman	*TBD (see Note 1)	*TBD (see Note 1)
Scalehouse Operator	*TBD (see Note 1)	*TBD (see Note 1)
Equipment Operators	*TBD (see Note 1)	*TBD (see Note 1)
Truck Drivers	*TBD (see Note 1)	*TBD (see Note 1)

NOTES:

1) Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, names and phone numbers for personnel listed above will be provided to Maryland Department of the Environment (MDE). Any personnel changes during the life of the cell cosntruction and operation will be provided in writing to MDE.

Table 12A-2
MAJOR LANDFILL EQUIPMENT, PERSONNEL, WORKING FACE SIZE, AND DAILY COVER SOIL BY DAILY TONNAGE

Daily Tonnage Range (tons/day)	Equipment Type and Use	Minimum Operating units Recommended	Personnel Type	Minimum Personnel Recommended	Max. Uncovered Area (Working Face Size) (square feet)	Max. Daily Cover Soil Required (cy)
500-2,500	Water Dispersion Equipment	1	Landfill Supervisor	1	109,000	2,936
	Dozer (spread refuse and cover, compact waste, berm construction)	1	Scale Operator	1		
	Compactor (compaction of waste and cover material)	1	Equipment Operator	3		
	Off-Road Truck or Scraper (haul and discharging cover material)	1	Maintenance Worker	1		
	Excavator (soil excavation loading)	1	Laborer/Truck Driver	1		
2,500 - 5,000	Water Dispersion Equipment	1	Landfill Supervisor	1	118,000	3,168
	Dozer (spread refuse and cover, compact waste, berm construction)	2	Scale Operator	1		
	Compactor (compaction of waste and cover material)	1	Equipment Operator	5		
	Off-Road Truck or Scraper (haul and discharging cover material)	2	Maintenance Worker	1		
	Excavator (soil excavation loading)	1	Laborer/Truck Driver	2		
	Water truck for dust control	1	Laborer/Truck Driver	1		
5,000 - 7,500	Water Dispersion Equipment	1	Landfill Supervisor	1	127,000	3,400
	Dozer (spread refuse and cover, compact waste, berm construction)	3	Scale Operator	1		
	Compactor (compaction of waste and cover material)	1	Equipment Operator	6		
	Off-Road Truck or Scraper (haul and discharging cover material)	2	Maintenance Worker	1		
	Water truck for dust control	1	Laboroer/Truck Driver	1		
	Excavator (soil excavation loading)	1	Laborer/Truck Driver	2		

Notes:

1. Dozer, Compactor, Truck, Excavator (or Loader), and Water Dispersion Equipment sizes will vary to match operating needs.
   Minimum Operating Units calculations based on smallest make and model of each given class of equipment except for the compactor.
   Each piece of equipment is matched with one or more operators to meet personnel needs over the daily operating period.

2. Larger and/or equivalent equipment may be used in place of those units listed above.

3. Other non-major landfill equipment such as a Motor Grader, Utility Pickup Truck, Utility Tractor with Attachments, Tire Splitter, and portable pumps may be used on site for various non-working face activities.

4. Daily Covering of wastes is accomplished with a variety of Alternative Daily Covers approved for use at the site. If soil cover is needed, it is readily available from on-site stockpiles. Soil cover will be transported to the working face by Off-Road Truck or Scraper.

ADVANCED GeoServices

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ATTACHMENT 12B

Asbestos Waste Management

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ASBESTOS WASTE MANAGEMENT

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1.0 DEFINITIONS

"Asbestos" means the asbestiform varieties of serpentinate (chrysotile), riebeckite (crocidolite), cummingtonite-grunerite, anthophyllite, and actinolite-tremolite.

"Asbestos-containing waste materials (ACM)" means mill tailings or any waste that contains commercial asbestos. This term includes filters from control devices, friable asbestos waste material, and bags or other similar packaging contaminated with commercial asbestos. As applied to demolition and renovations operations, this term also includes regulated asbestos-containing waste material and materials contaminated with asbestos including disposable equipment and clothing.

"Asbestos waste generator" means any owner or operator of a source covered by the Code of Federal Regulations (CFR), Title 40, Part 61 (40 CFR 61), *National Emission Standards for Hazardous Air Pollutants (NESHAP),* Subpart M, *National Emission Standard for Asbestos* whose act or process produces asbestos-containing waste material.

"Category I nonfriable asbestos containing material (ACM)" means asbestos-containing packings, gaskets, resilient floor covering, and asphalt roofing products containing more than 1 percent asbestos as determined using the polarized light microscopy method specified in 40 CFR 763, Subpart E, Appendix E.

"Category II nonfriable asbestos-containing material (ACM)" means any material, excluding Category I nonfriable ACM, containing more than 1 percent asbestos as determined using the polarized light microscopy methods specified in 40 CFR 763, Subpart E, Appendix E, that when dry, cannot be crumbled, pulverized, or reduced to powder by hand pressure.

"Commercial asbestos" means any material containing asbestos that is extracted from ore and has value because of its asbestos content.

"Friable asbestos" means any material containing more than one percent asbestos as determined using the polarized light microscopy methods specified in 40 CFR 763, Subpart E, Appendix E, which is capable of being crumbled, pulverized or reduced to powder by hand pressure.

"Leak-tight" means that solids or liquids cannot escape or spill out. It also means dust-tight.

"Natural barrier" means a natural object that effectively precludes or deters access. Natural barriers include physical obstacles such as cliffs, lakes or other large bodies of water, deep and wide ravines, and mountains. Remoteness by itself is not a natural barrier.

"Regulated asbestos containing material (RACM)" means:

- Friable asbestos material;
- Category I nonfriable ACM that has become friable;
- Category I nonfriable ACM that will be or has been subjected to sanding, grinding, cutting, or abrading; and,
- Category II nonfriable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of demolition or renovation operations.

For the purposes of this definition **"renovation"** means altering an installation, structure or building or any part of such installation, structure or building in any way, including the stripping

or removal of RACM. Operations in which load-supporting structural members are wrecked or taken out are **"demolitions."**

"Resilient floor covering" means asbestos-containing floor tile, including asphalt and vinyl floor tile, and sheet vinyl floor covering containing more that 1 percent asbestos as determined using polarized light microscopy according to the method specified in 40 CFR 763, Subpart E, Appendix E.

"Waste shipment record" means the shipping manifest, required to be originated and signed by the asbestos waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

2.0 APPLICABLE ASBESTOS WASTE GENERATION PROCESSES

The standards contained herein apply to the management of all asbestos-containing materials (ACM) generated by asbestos mills, by manufacturing, fabricating, and spraying operations, and ACM generated in the course of demolition and renovation of installations, structures or buildings, or other waste generating activities.

3.0 PRE-ACCEPTANCE PROCEDURES

In order for ACM to be accepted for disposal site at the Chesapeake Terrace Rubble Landfill site, the asbestos waste generator shall follow the pre-acceptance procedures described in this section.

3.1 PACKAGING

The generator shall conform to all packaging requirements contained in 40 CFR 61.149 and 40 CFR 61.150.

All ACM generated in a manufacturing, fabrication, or spraying operation and all regulated ACM generated in a demolition or renovation operation shall be placed in leak-tight containers while wet. Materials that will not fit into containers without additional breaking shall be put into leak-tight wrapping, consisting of 6-mil double “bladder” for bulky wastes, taped shut. The containers shall meet federal DOT standards 49 CFR 173.216. Materials placed in double, 6-mil thick plastic bags and sealed will conform to the above requirements when transported in motor vehicles that are loaded by and for the exclusive use of the consignor and unloaded by the consignee. To ensure that the personnel at the disposal facility can verify that the material has been placed in double bags, the outer bag should be transparent.

The containers or wrapped materials specified in 9 VAC 20-80-640, Section C.1.a shall be labeled using warning labels specified by Occupational Safety and Health Administration (OSHA) under 29 CFR 1910.1001(j)(3) or 1926.1101(k)(7). The labels shall be printed in letters of sufficient size and contrast so as to be readily visible and legible and shall contain the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD

For materials transported off-site, label containers or wrap materials with a name of the waste generator and the location at which the waste was generated.

Category I nonfriable ACM and Category II nonfriable ACM generated in a demolition or renovation operation that do not meet the definition of regulated ACM need not meet the requirements of 9 VAC 20-80-640, sections C.1.a, b, and c.

3.2 MARKING

Conform to all marking requirements contained in COMAR 26.11.15.04 for vehicles used to transport ACM during loading and unloading of wastes.

3.3 IDENTIFICATION

As part of identification of ACM transported to the disposal facility, the generator shall submit to National Waste Managers, Inc. (NWM) the appropriate Waste Characterization Data Forms and a copy of the waste manifest shipment record described above at the same time the ACM is delivered to the disposal site. The Waste Characterization Data Forms shall contain the following information:

- The name, address, and telephone number of waste generator;
- The name and address of the state NESHAP office; Maryland Department of the Environment, Air & Radiation Management Administration; Division of Asbestos Licensing & Enforcement; 1800 Washington Blvd., Suite 725 Baltimore MD 21230-1720
- The approximate quantity in cubic meters (cubic yards);
- The name and telephone number of the disposal site operator;
- The date transported;
- The name, address, and the telephone number of the transporters; and,
- A certification that the contents of the consignment are fully and accurately described by proper shipping name and classified, packed, marked, and labeled, and in all respects in proper condition for transport by highway according to applicable international and government regulations.

4.0 TRANSPORTATION OF ASBESTOS RELATED MATERIAL

NWM requires the transporter of asbestos related material to conform to the requirements set forth in COMAR 26.11.15.04. All asbestos-containing materials shall be properly packed for transportation in accordance with these requirements. Asbestos-containing waste materials shall be accompanied by the waste shipment manifest record.

5.0 DISPOSAL OF ASBESTOS-CONTAINING MATERIALS

NWM shall comply with the requirements of this section at the Chesapeake Terrace Rubble Landfill site. All asbestos-containing materials generated in a manufacturing, fabrication, or spraying operation and all regulated ACM generated in a demolition or renovation operation shall be disposed in a designated area of the Chesapeake Terrace Rubble Landfill. When Category I and Category II nonfriable ACM is disposed in the landfill advanced notice shall be required and other pertinent requirements of this part shall be met.

5.1 UNLOADING OF ACM

Upon arrival at the Chesapeake Terrace facility, the vehicles used to transport ACM shall be marked during the unloading process so that the signs are visible. The markings shall:

- Be displayed in such a manner and location that a person can easily read the legend;
- Conform to the requirements for 20 inches by 14 inches upright format caution signs specified in 29 CFR 1910.145(d)(4);
- Display the following legend with letter sizes and styles of a visibility at least equal to those specified in the following table. Spacing between any two lines shall be at least equal to the height of the upper two lines.

Legend	Notation
DANGER	1-inch Sans Serif, Gothic or Block A
ASBESTOS DUST HAZARD	1-inch Sans Serif, Gothic or Block A
CANCER AND LUNG DISEASE HAZARD	3/4-inch Sans Serif, Gothic or Block A
Authorized Personnel Only	14-point Gothic

5.2 PLACEMENT OF ACM

Asbestos-containing waste materials shall be segregated in designated areas and not disposed of on the active work face with other solid wastes. An initial lift of 10 feet of rubble waste will be placed in the designated asbestos disposal area. The boundaries of the asbestos area will then be clearly marked and signs posted in the appropriate manner. Prior to receipt of asbestos containing waste shipment, an excavator will dig a trench in the solid waste that will be able to contain all the asbestos waste scheduled for that day plus the one-foot of soil cover. The depth of the trench will be approximately six feet but no greater than 8 feet. Once the first lift in the designated asbestos area is completely full and the 1 foot of soil cover applied, an additional 10 feet of solid waste will be placed over the designated disposal area for the future placement of asbestos waste. This process will continue until the maximum height of the landfill is achieved. Asbestos containing waste will not be placed within 15 feet of the intermediate cover or of the cell's final elevation.

The waste shall either be hand placed in the excavated trench or deposited by means of slowly unloading the asbestos containing wastes. Either placement method will ensure that the integrity of bags, wrapping or containers are not punctured or damaged.

The waste shall not be compacted until a sealing layer of soil has been placed over the waste and great care is taken to prevent the breaking of bags or wrapping. All accidentally broken materials shall be covered with 12 inches or more of soil immediately. A cell that has been completely covered with soil, at least one foot thick may be compacted.

All waste shall be covered with at least one foot of soil at the end of each day of operation. A final cover of 3 feet of soil shall be placed over all areas that have not been in use or will not be used for more than 30 days. Areas that will not or have not been used for one year, in addition to final soil cover, shall be graded for erosion prevention and revegetated.

5.3 ACCESS CONTROL

The entire landfill will have access control and site security. As such an internal fence is not required. The entrance and asbestos waste boundary line shall be clearly marked. Permanent

warning signs shall be provided at all entrances and at intervals of 330 feet or closer around the waste boundary line. The warning signs shall:

- Be posted in such manner and location that a person can easily read the legend;
- Conform to the requirements for 20 inches by 14 inches upright format caution signs specified in 29 CFR 1910.145.d.4;
- Display the following legend with letter sizes and styles of a visibility at least equal to those specified in the following table. Spacing between any two lines shall be at least equal to the height of the upper two lines.

Legend	Notation
ASBESTOS WASTE DISPOSAL AREA	1-inch Sans Serif, Gothic or Block
DO NOT CREATE DUST	3/4-inch Sans Serif, Gothic or Block
Breathing Asbestos is Hazardous to Your Health	14-point Gothic

The asbestos area within this secure sanitary landfill will not be located closer than 50 feet to the property boundary or occupied building or structure.

5.4 RECORDKEEPING AND REPORTING

5.4.1 Waste Shipment Records

For all ACM received, NWM shall follow the following requirements regarding waste shipment records:

- Complete each waste shipment record submitted by the asbestos waste generators for each shipment received by the Chesapeake Terrace facility by noting shipment discrepancies and dating and signing the waste shipment record. The discrepancies will include:
  - The presence of improperly enclosed or uncovered waste, or any ACM not sealed in leak-tight containers or wrappings; and,
  - A discrepancy between the quantity of waste designated on the waste shipment record and the quantity actually received.
- Send a copy of the signed waste shipment record to the waste generator as soon as possible and no longer than 30 days after receipt of the waste;
- Upon discovering the discrepancy in the shipment quantity, attempt to reconcile such discrepancy with the generator. If the discrepancy is not resolved within 15 days after receiving the waste, immediately report it in writing to the Maryland Department of the Environment, Air & Radiation Management Administration; Division of Asbestos Licensing & Enforcement; 1800 Washington Blvd., Suite 725 Baltimore MD 21230-1720 at the above address. Describe the discrepancy and the attempts to reconcile it, and submit a copy of the waste shipment record along with the report; and

- Retain a copy of all records and reports required at least two years.

5.4.2 Disposal records

NWM shall follow the following requirements regarding disposal records:

- Initiate and maintain, until closure, records of the location, depth and area, and quantity in cubic yards of ACM within the Chesapeake Terrace site on a map or diagram of the disposal area;
- Submit to the Director of the MDE, upon closure of the facility, a copy of records of asbestos waste disposal locations and quantities; and,
- Furnish upon request by the director of the MDE, and make available during normal business hours for inspection, all records required by the regulations.

5.4.3 Safety and Health Program

NWM shall institute an occupational safety and health program required under 29 CFR 1910.1001 or 29 CFR 1910.1101, as applicable.

5.4.4 Closure and Post-Closure Care

In addition to the closure and post-closure care requirements for the facility, NWM shall follow the following requirements if the facility receives ACM materials:

- Within 60 days of the closure of the Chesapeake Terrace site, record with the Anne Arundel County Clerk's office a notation on the deed to the facility property or any other document that would normally be examined during a title search that will in perpetuity notify any purchaser of the property that:
    - The property has been used for the disposal of ACM; and,
    - The copy of the survey plat and the record of location and quantity of ACM disposed are attached to the notation.

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ATTACHMENT 12C

Safety Plan

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SAFETY PLAN

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1.0 EMERGENCY PROCEDURES

A. Posting of Procedures -- All emergency procedures must be updated as appropriate and after each emergency. All emergency procedures should be posted in the landfill site office, in conspicuous places at the site, and at the gate house.

B. Emergency Contact Information -- The name, location, and telephone number of the nearest police, fire department, doctors, medical treatment facilities, and ambulance service should be posted in the scale house and maintenance buildings.

C. Instructions of Procedures -- All new personnel should be instructed on the emergency procedures used at the landfill. All employees should be informed of any changes in emergency procedures.

D. Responsibility of Employee -- It is the responsibility of every employee to know and remember his role in each emergency procedure at the site.

2.0 GENERAL SAFETY PROCEDURES

A. Access to the site should be limited only to those authorized to use the site

B. Knowledge of Procedures -- All employees at the landfill will know the proper procedures for reporting accidents, injuries, and fires.

C. Posting of Information -- Landfill rules, roadway limits and speed limits on each road will be clearly posted. Direction of travel and location of curves will be posted. The location of disposal areas should be clearly indicated.

D. Dumping -- For safe operations, the dumping area will be only slightly sloped at all times and equipment maintained in good repair.

E. Safety Devices -- Proper safety devices, such as rollover protective cabs will be installed on all equipment and kept in good repair.

F. Fire Extinguishers -- Fire extinguishers will be provided in the scale house, maintenance building and on all heavy equipment. Each extinguisher will be appropriate for the types of fires likely and they will be checked or serviced as appropriate. Discharged fire extinguishers will be removed and replaced with fully charged units.

G. Employee Alertness -- All employees will be alert for hazards at the landfill. Potential hazards will be reported to the supervisor.

H. Safety Meetings -- Safety meetings will be regularly scheduled. Situations that can cause accidents and ways to prevent them will be discussed. Also, the effectiveness of corrective action will be discussed. Records will be maintained including attendance of the safety meetings and the subjects discussed.

I. **NO SMOKING** near flammable materials, methane extraction facilities, or other designated areas.

J. Inspect incoming waste. This inspection should determine the nature of the waste to ensure that materials detrimental to health and safety are not allowed. Only waste specifically specified by the owner, this manual and the MDE Permit requirements is allowed.

K. Arrange for response agreements with local emergency personnel, such as police, firefighters and hospital staff.

L. An adequate stock of first aid supplies should be maintained on site, and at least one person with first aid training should be on duty during the operational hours.
M. Establish a communication system using two-way radios (hand held) or cell phones that are capable of summoning outside emergency assistance.
N. Train personnel to respond to emergencies and familiarize them with emergency procedures, emergency equipment and emergency systems.
O. Operational personnel shall, on a periodic basis, receive instructions in the principles of first aid and operational safety.
P. Operational personnel will be trained to recognize and identify prohibited and hazardous waste.
Q. The Owner should conduct a periodic review and evaluation of safety procedures and provide modifications as needed.

2.0 SAFETY PROCEDURES FOR HANDLING ASBESTOS WASTE

A. All asbestos containing waste shall be disposed in the specially-designated asbestos waste daily disposal area.
B. Asbestos is a known human carcinogen for which no level of exposure is known to be without risk. Single exposures may even present a health risk to some individuals.
C. As discussed in the Asbestos Management and Disposal Plan (Appendix C in Section 12 of the Phase III Report), asbestos waste materials require special handling, bagging and sealing requirements. In the event that asbestos containers are broken or damaged such that asbestos fibers may come in contact with operating personnel, the precautions listed below regarding protective equipment and clothing shall be utilized.
D. The maximum feasible level of respiratory protection shall be used by workers engaged in work with or in close proximity to asbestos-containing material, when such workers are, or could reasonably be expected to be, occupationally exposed to airborne asbestos. "Occupationally exposed" means exposed to any detectable level of airborne asbestos at or above the lowest limit of reliable quantification as determined by the Transmission Electron Microscopy Method (Code of Federal Regulations Title 40, Part 763, Subpart E, Appendix A).
E. An air purifying type respirator approved for use with asbestos shall be worn by all employees involved in the handling of asbestos waste.
F. An effective respirator program shall be established to include:
    1. Written standard operating procedures governing the selection and use of respirator.
    2. Medical examination of workers to determine whether or not they may be assigned an activity where respiratory protection is required.
    3. User training in the proper use and limitations of respirators (as well as a way to evaluate the skill and knowledge obtained by the worker through training).
    4. Respirator fit testing.
    5. Regular cleaning and disinfecting of respirators.

6. Routine inspection of respirators during cleaning, and at least once a month and after each use for those respirators designated for emergency use.
7. Storage of respirators in convenient, clean, and sanitary locations.
8. Surveillance of work area conditions and degree of employee exposure.
9. Regular inspection and evaluation of the continued effectiveness of the program.
10. Recognition and resolution of special problems as they affect respirator use (e.g., facial hair, eye glasses, etc.)
11. Proper respirator use (procedures for donning and doffing respirators when entering and exiting the disposal area).

3.0 SAFETY PRECAUTIONS FOR EQUIPMENT OPERATORS

A. Check Equipment -- Check equipment for defects before operating. This can best be done by completing check-out lists prior to starting equipment in the morning. Do not start or operate defective equipment.

B. Use Stepping Points -- To prevent slipping, use stepping points and hand holds when mounting and dismounting equipment.

C. Keep Debris from Cab -- Keep operator's compartment, stepping points, and handholds free from oil, grease, mud, loose objects, and solid waste.

D. Look All Ways Before Moving -- Protect personnel and other equipment in the area by looking to the front, rear, and sides before moving equipment. If unsure of the surrounding conditions, dismount and inspect area.

E. Control Equipment Properly -- The operator should control his equipment only from the driver's seat. Always have equipment under control.

F. Wear Safety Belts and Hard Hats -- Always wear seat belts while operating equipment to provide support and security in the operator's compartment. A hard hat will reduce the potential for head injuries and should be worn while outside of any equipment.

G. Do Not Mount Moving Equipment -- Never mount or dismount from moving equipment. Wait until equipment has come to a complete stop and the brake is set before mounting or dismounting.

H. Carry Only Authorized Passengers -- Persons other than the operator should not normally be allowed on landfill equipment. If it is necessary to carry a passenger, he should sit in a safe location. The passenger should be performing official duties only.

I. Carry blades and attachments low when equipment is traveling.

J. Check Blind Areas -- Never push waste until sure that no person or equipment is in the blind area ahead of the machine, the blade, or the solid waste. If the operator is not sure of the surrounding conditions, he should get off the equipment and personally inspect the area. When operating in reverse, turn around to look in the direction of travel.

K. Maintain Adequate Clearance -- When pushing waste, maintain adequate clearance from other vehicles or obstructions to assure that any falling objects will not strike other equipment or persons. Equipment should be kept clear of solid waste vehicles.

L. Operate Up and Down Slope -- Avoid side-hill travel to reduce the chance of rolling over.

M. Avoid Excessive Speed -- Operating conditions generally determine the speed of heavy equipment. Under no circumstances should heavy equipment be driven at excessive speed or operated recklessly.

N. Move Cautiously Over Bulky Objects -- When compacting or traversing bulky items the operator should proceed with extreme caution to avoid tipping or sudden lurching movements.

O. Constantly Check Work Area -- The operator should constantly check the work area for the location of other persons or equipment.

P. Define and establish vehicular routes.

Q. Use traffic control signs to direct traffic.

R. Keep speed limits low. Speed limits along entrance roads should not exceed 10 mph. In landfill cells, speed limits should be reduced to 5 mph.

S. Do not mix heavy traffic with light trucks.

5.0 SAFETY EQUIPMENT

Certain Safety equipment is specified for equipment operator protection. It is the responsibility of each employee to be sure his safety equipment is in good repair. Each employee must use his equipment at appropriate times. The proper safety equipment for equipment operators is listed below.

OPERATOR PROTECTIVE EQUIPMENT

Equipment: Each piece of heavy equipment should be provided with:
Rollover bars
Backup warning system
Fire Extinguisher

Personal: Equipment operators should have available personal protective clothing:
Earmuffs or earplugs
Face shields or goggles
Dust mask
Rubber or leather (steel toe) boots
Work gloves
Hard hats

6.0 FIRE PREVENTION AND CONTROL PLAN

A fire prevention plan will be prepared for review by local fire prevention officials and periodic inspection visits will be scheduled with the local fire company. Additionally, recommended fire prevention equipment will be available on-site.

Supervisors and key personnel will be trained in fire prevention and fire fighting techniques. Training must be recognized by the Anne Arundel County Fire Department, and personnel will maintain and update their skills on an annual basis.

Operators will carefully screen incoming waste for fires, hot ashes and volatile liquids to reduce the risk of starting fires. Fuels will not be stored or placed near the landfill operation and refueling of equipment shall take place away from the placing zone.

Inspection and preparedness are the best protection against fires. By inspecting incoming waste, and waste as it is placed, the potential for fires can be greatly reduced. Being prepared to fight fires eliminates any response delay between detection and proper action.

Each piece of landfill operating equipment assigned to placing and covering rubble waste shall be equipped with a fire extinguisher of the type recommended by the manufacturer.

Equipment operators will carefully operate their equipment to avoid suspicious containers and aerosol containers. Compaction will not begin until the rubble to be compacted has been inspected and cleared of containers that may contain volatile substances.

6.1 WHEN FIRE OCCURS

Surface fires are usually detectable at the working face where they start or are brought in. Small fires are usually extinguished with portable extinguishers or by simply covering with soil. Another method of extinguishing small fires on the working face is to take out the burning or smoldering mass from the working face and cover it until the fire is out.

At least two (2) fire extinguishers will be available to landfill personnel at the working face for use in dousing small fires that start or appear in the rubble. One of the extinguishers will be suitable for extinguishing fires from petroleum and solvent products and the other extinguisher will be suitable for use on wood, paper and brush. Additionally, a stockpile of cover material will always be available for fire fighting and a water truck will be on-call as a back-up for fighting fires.

Underground fires are difficult to detect and control. Subsurface fires are usually indicated by unusual or rapid settlement, venting of smoke and elevated subsurface temperatures. The presence of carbon monoxide can also indicate the existence of a fire below the surface. Settlement resulting from subsurface combustion is rapid and usually followed by collapsing of upper waste layers into a void space created by the combustion. Settlement may not be apparent when fires are deep within the fill. Smoke will confirm the existence of subsurface fire but not the location. Cracks and fissures are usually present in a fire zone as the fires draw air through these openings.

Subsurface fires may require a drilling program to locate the combustion area. Drilling is, however, dangerous due to the potential presence of high temperature gas and burning waste. Placement of borings should begin away from the fire where normal temperatures prevail. Usually a series of borings in a grid pattern will be required to determine temperature gradients which can be used to locate the fire.

Fires 30 feet or less in depth should be extinguished by excavation and the application of water. Excavation must proceed with caution and personnel must be protected from toxic and explosive gases. Fires below a reasonable level of excavation can be saturated with water by

injecting water in a well system (installed with steel pipe) that encircles the fire zone. As deep fires are usually fed by convection, all surface cracks and openings should be sealed. Additionally, a layer of compacted cover material should be added over the fire zone and adjacent areas.

A. Extinguish small fires with fire extinguisher or smother with soil. Do not remain near large fires or explosive materials.
B. Determine location, extent, type and if possible cause of fire or explosion.
C. Notify on-site personnel and implement safety and fire control procedures.
D. Notify facility emergency coordinator if the fire cannot be immediately controlled.
E. Notify fire department if necessary. Clearly state:
    1. Location of landfill.
    2. Location of fire or explosion in landfill.
    3. Extent of fire or explosion.
    4. Type of fire or explosion.
    5. Actions now being taken.
    6. Injuries.
F. Notify Rescue Squad, if necessary.
G. Notify health care facility, if necessary.
H. Notify Police Department if necessary.

6.2 "HOT LOAD" PROCEDURES

A "hot load" is a load of burning solid waste in an incoming truck. It may be actively burning, but more likely will be just smoldering. When a "hot load" is discovered in a vehicle, the driver should be directed to dump the material in an area located away from the actual fill face and cleared of vegetation and debris. After the "hot load" is dumped, the equipment operator should spread the material, and then cover it with soil to smother the fire.

After the fire has been extinguished, the material should remain in the cleared area until no evidence of fire remains. At the end of that day, check to make sure no fire or smoldering remains, and then place it into the fill.

6.3 FIRE EXTINGUISHERS

Fire extinguishers should be installed in the following locations:

A. Scale House
B. Maintenance Building
C. Selected on-site Vehicles and Equipment

7.0 INCLEMENT WEATHER

Site personnel shall be ever vigilante regarding the weather forecast for their day's work. Site personnel shall cease all operations in the event of the following inclement weather:

- High winds, associated with low-pressure events;
- Intense Rain;
- Lightening; and,

- Snow/Ice.

The following paragraphs describe the precautions to be taken for each form of inclement weather.

7.1 HIGH WINDS

High winds may be associated with localized, low pressure cells (e.g., tornadoes) or regional low pressure events. The choice to continue work activities will be based upon the safety of the personnel and the ability to effectively operate the landfill, as determined by the Landfill Manager.

7.2 INTENSE RAIN

In the event of intense rain, the choice to continue to operate the landfill will be dependent upon the following:

- Visibility;
- Stability of the equipment in the operating face; and,
- Ability of the equipment to maneuver on the site access road between the scale house and the operating face.

If any of these items is in question, as determined by the Landfill Manager, landfill operation activities will cease, unless the operation can be altered to accommodate these issues. Means of altering the operation may include but are not limited to:

- Temporarily relocating the working face to a better protected or more stable location;
- Placing stone or other natural material to stabilize the access roads; and/or,
- Allowing the delivery of material to the working face, but restricting activities on the working face until the area is better stabilized.

In the event of reduced visibility, equipment shall cease mobile activities until conditions improve and visibility is restored.

7.3 LIGHTNING

At the first strike of lightening within sight of the landfill, equipment shall shutdown. All personnel outside shall seek immediate shelter in the site buildings and, where immediate shelter of buildings is precluded (e.g., personnel in heavy equipment during lightening), these personnel shall remain in their equipment until the storm has cleared the area. Landfilling activities may continue 15 minutes after the last strike of lightening or rumble of thunder has passed.

7.4 SNOW/ICE

In circumstances where snow or ice is present at the site, having occurred overnight or during the course of the day, landfill operations will cease if the equipment cannot safety maneuver the

access roads or the working face, as determined by the Landfill Manager. The Landfill Manager may direct site personnel to implement safety measures to address snow or ice accumulation on site roads by plowing and/or spreading salt/sand.

8.0 COMMUNICATIONS SYSTEM

Telephone communications will be available at the scale house and administration building. Radio, cellular, and/or other types of communication will be available between the scale house, administration building, landfill manager, operations manager, lead mechanic, lead operator(s) and other key personnel. A CB radio will also be available to communicate with truck drivers.

9.0 CONFINED SPACE

A confined space is defined as any space not currently used for human occupancy, having a limited means of exit, which is subject to the accumulation of toxic contaminants, a flammable or oxygen deficient atmosphere, or other hazards such as engulfment or electrical or mechanical hazards should equipment be activated while a employee is in the space. Confined spaces include but are not limited to storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, air pollution control devices, smoke stacks, underground utility vaults, sewers, septic tanks, landfill pump houses and open top spaces more than four feet deep such as pits, trenches or vats.

Confined space entry requires special training. At no time is a NWM employee to enter into a confined space or a trench without first receiving explicit training and authorization from the Landfill Manager. When entering a confined space the personnel shall follow all requirements prescribed under OSHA regulations for confined space entry (29 CFR 1910.146) as applicable.

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ATTACHMENT 12D

Emergency Response Plan

EMERGENCY RESPONSE PLAN

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This written plan has been developed to assist the Chesapeake Terrace Rubble Landfill in the management of emergencies that might reasonably be expected to occur at the landfill site located at (*insert landfill street address here*). This plan is written and designed to place the Chesapeake Terrace Rubble Landfill in compliance with OSHA 1910.38.

1.0 EMERGENCY RESPONSE PROCEDURES

A. Evacuation routes are posted throughout the facility and all personnel are advised during safety meetings as to the shortest route to take from their particular work area. In the event of an emergency that requires the immediate evacuation of the entire building, the decision to evacuate will be made by the Safety Manager and/or the Landfill Manager. In their absence, the decision will be made by the Operations Manager on site who is best able to evaluate the situation. Decision to evacuate should be made with considerations of the following factors:
   1. Is there immediate danger to life?
   2. Can the emergency be safely managed without a complete evacuation?
   3. Is there enough time to evaluate the emergency without allowing the situation to become life threatening?

B. Fire Response
   1. A minor fire that can be extinguished with one fire extinguisher in one minute.
   2. Attempt to fight the fire only if you are not endangering yourself.
   3. If in an enclosed area and fire is creating heavy smoke, evacuate the area immediately.
   4. A major fire is any fire that requires more than one minute or more than one fire extinguisher to extinguish.
   5. Contact 911 immediately.
   6. Evacuate the immediate area of the fire.
   7. If in an enclosed area and fire is creating heavy smoke, evacuate the area immediately, proceed to the employee parking lot and stay there.

C. Toxic Agent Release
   1. In the event of a toxic agent release, the Safety Manager or Landfill Manager will order the immediate total evacuation of the facility, and should immediately ensure that all personnel move to a point upwind from the site, and begin personnel accountability procedures as soon as practicable.
   2. The Safety Manager will ensure that the proper emergency authorities are notified of the situation immediately and are aware that there has been a toxic agent release.
   3. Since there are no chemicals or agents used or stored at the landfill that pose such a great threat, the primary avenue by which such agent could be released would most likely be one of the following:
      i. Transport into the facility in a located solid waste vehicle as a result of improper disposal of water from a pick-up point.
      ii. Transport into the facility in a non-NWM vehicle, such as a delivery truck or other vendor vehicle.

2.0 SPECIAL PROCEDURES

A. Critical operations requiring shutdown:
   1. The main power to the facility will be shut off by the Operations Manager.

B. Removal of Equipment
   1. Equipment that can be moved quickly and safely out of the hazard area will be moved to safe locations around the site.
   2. The responsibility of making the determination of whether or not to move equipment is assigned to the Landfill Manager or Operations Manager.
   3. Decisions to move vehicles should be made with personnel safety as the top priority. No truck or piece of equipment is worth an injury or death, but we should make an effort to remove our equipment to safety only when it is practical.
   4.

3.0 MUSTER LOCATIONS

After evacuation of the building is determined to be necessary, all employees must gather in a safe location. This will be the employee parking lot.

4.0 PERSONNEL ACCOUNTABILITY

The following system will be used to ensure that employees are accounted for after an evacuation:

A. Once safely at the gathering point in the parking lot, all employees should group themselves together. A head count will be taken by the Safety Manager or Landfill Supervisor.

B. Once a head count has been taken, the zone leader will report to the Safety Manager with all information pertinent to their assigned zone (i.e., missing, injured, etc.).

5.0 MEDICAL/FIRST AID

A. In case of life-threatening injuries, call 911 for ambulance service immediately.

B. Serious or minor injuries that are not life threatening must be taken to the nearest emergency medical care facility.

C. First aid may be rendered by any employee that has been certified in Standard First Aid by the National Safety Council and/or the American Red Cross.

6.0 NOTIFICATION OF AUTHORITIES

A. It is the responsibility of the Safety Manager to ensure that all emergency authorities are notified. This notification will be done in the form of a phone call placed from the District Office or cellular phone if available.

B. **Call 911** in an emergency.

C. Emergency phone numbers are posted throughout the Landfill.

7.0 CONTACT LIST

A. Key Personnel

Landfill Supervisor _____*[1]_____

Safety Manager _____*_____

Environmental Manager _____*_____

8.0 EMERGENCY PHONE LIST

Ambulance, Fire and Rescue	911
Poison Control Center	1-800-222-1222
Nearest Hospital Emergency Room	Baltimore Washington Medical Center South Gate, MD 410-787-4000
	Anne Arundel Medical Center Parole, MD 443-481-1000
	Clifton T. Perkins Hospital Center Jessup, MD 410-724-3000

Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, phone numbers for the above will be inserted and provided to Maryland Department of the Environment.

9.0 CRITIQUE OF RESPONSE

After each incident involving the application of an Emergency Procedure, the Safety Manager will review the response to ascertain efficient application and inform the Landfill Supervisor of the effectiveness of the response.

[1] Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, more phone numbers for the above will be inserted and provided to Maryland Department of the Environment.

10.0 EMERGENCY RESPONSE PHONE NUMBER/CHECKLIST

In case of emergency, all employees are responsible for immediately contacting the appropriate individuals and/or authority listed below. Additionally, following notification, each employee should attempt to record the following information for any accident or emergency:		
We need to know who (driver, employee, other parties): What (system type & equipment involved): When (time of accident): Where (exact location): Complete the AIG accident form if possible and call the AIG # Notify the following as appropriate:		
EMERGENCY AMBULANCE	911	
POLICE DEPARTMENT	911	(NON-EMER.)
FIRE DEPARTMENT	911	(NON-EMER.)
STATE POLICE	Insert Number	Insert Number
TELEPHONE COMPANY	Insert Number	Insert Number
UTILITY COMPANY	Insert Number	
OIL SPILL, TOXIC CHEMICAL RELEASE POLLUTION	Insert Number	
Maryland MDE	Insert Number	Dept. of the Environment
KEY CONTACTS		
POSITION	**NAME**	**PHONE NUMBER**
INSURANCE CARRIER	Insert Name	Insert Number
LANDFILL SUPERVISOR	Insert Name	Insert Number
SAFETY MANAGER	Insert Name	Insert Number

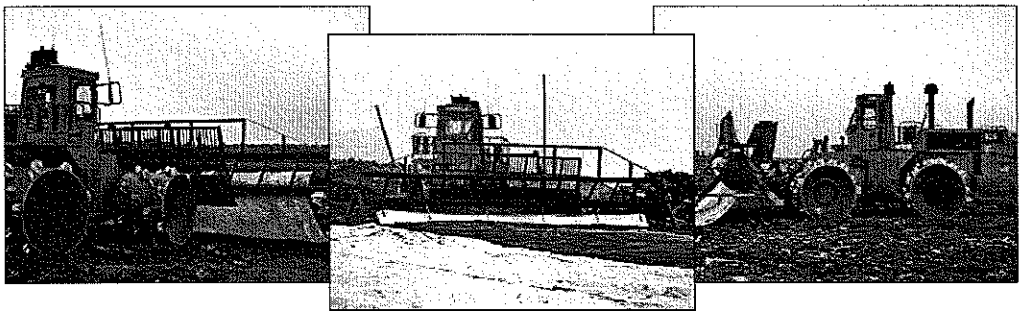
Following refuse disposal permit issuance for the facility and prior to beginning rubble waste acceptance, phone numbers for the above will be inserted and provided to Maryland Department of the Environment.

ATTACHMENT 12E

Alternative Daily Cover Fabric – Manufacturer's Information

1-888-222-0124

Our Clients



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- Jeff McGown and Sherwood McKenney, Crossroads Landfill in Norridgewock Maine
- Greg Hannah, Botetourt Country Landfill in Troutville, Virginia

The following is a partial list of our customers throughout the United States and Canada. For more information, please contact our sales team at 1-888-222-0124.

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- Florida
- Georgia
- Hawaii
- Illinois
- Iowa
- Maine
- Maryland
- Massachusetts
- Michigan
- Mississippi
- New Hampshire
- New York
- Ohio
- Pennsylvania
- South Carolina
- Tennessee
- Virginia
- Washington

Alabama

City of Scottsboro
Solid Waste Department
27150 John T. Reed Parkway
Scottsboro, AL 35768

Canada

Municipality District of Guysborough
Guysborough Waste Management Facility
151 Waste Management Road
P.O. Box 85 Boylston, Nova Scotia
BOH 1G0

City of Ottowa
Trail Road Landfill Facility
4309 Trail Road
Ottowa, Ontario Canada K0A 2Z0

Florida

Hernando County
Northwest Solid Waste Facility
14450 Landfill Road
Brooksville, FL 34614

Brevard County Solid Waste
Central Disposal Facility
2250 Adamson Road
Cocoa, FL 32926

Charlotte County
Municipal Solid Waste Mgmt. Div.
Dept of Environmental Services
29751 Zemel Road
Punta Gorda, FL 33955

Georgia

Pine Grove Landfill
7160 Sacerdote Lane
Columbus, GA 31907

Telfair County Landfill
98 Landfill Lane
McRae, GA 31055

Hawaii

County of Kauai
Public Works - Solid Waste Division
Kekaha Landfill
6900-A Kaumualii Highway
Kekaha, HI 96766

Illinois

Land & Lakes Company
Solid Waste Department
2100 South Central Ave.
Matteson, ILL 60443

Iowa

City of Muscatine
Muscatine County Landfill
1000S Houser Street
Muscatine, IA 52761

Maine

Crossroads Landfill
Waste Management
P.O. Box 629
327 Mercer Rd.
Norridgewock, ME 04957

City of Bath, Public Works
450 Oak Grove Ave
Bath, Maine 04630

Maryland

Carroll County
Northern Landfill
1400 Baltimore Blvd.
Westminster, MD 21157

Solid Waste Frederick County Landfill
9031 Reich's Ford Road
Frederick, MD 21701

Solid Waste - Forty West Landfill
12630 Earth Care Road

Hagerstown, Maryland 21740

Massachusetts

Northampton Landfill
170 Glendale Road
Northampton, MA 01060

Waste Management Middleboro Landfill
207 Plympton Street
Middleboro, MA 02346

Michigan

Environmental Services Department
6779 Smiths Creek Road
Smiths Creek, Michigan 48074

Mississippi

Allied Waste Services
Big River Landfill
1035 Old Brandon Road
Jackson, MS 39232

New Hampshire

City of Lebanon Landfill
370 Plainfield Road
Lebanon, NH 03766

New York

DANC - Development Authority of North County
Solid Waste Management Facility
23400 NYC Rt. 177
Rodman, N.Y. 13682

Oneida-Herkimer Solid Waste Management Authority
Oneida Herkimer Regional Landfill
7044 State Route 294
Boonville, NY 13309

Ohio

Erie County Landfill
10102 Hoover Road
Milan, Ohio 44846

Central Waste Inc.
12003 Oyster Road
Alliance, Ohio 44601

Pennsylvania

SECCRA – Southeastern Chester County Refuse Authority
219 Street Road
West Grove, PA 19390

South Carolina

Georgetown Public Works Dept.
Georgetown County Landfill
2242 Browns Ferry Road
Georgetown, SC 29440

Tennessee

Hardeman County Landfill
75 Landfill Way
Bolivar, TN 38008

Allied Waste Services
550 Aaron Long Road
Jackson, TN 38301

Virginia

Botetourt County Landfill
259 Landfill Road
Troutville, VA 24175

Rockingham County Landfill
2400 Grassy Creek Road
Harrisonburg, VA 22803

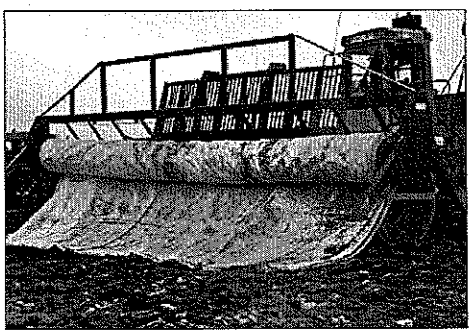
Washington

Engineered Compost Systems
4211 24th Avenue West
Seattle, Washingion

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1-888-222-0124

Tarp Deployment System for Landfills



Mercer Motor Works, LLC currently manufactures two Tarp Deployment Systems for use in landfills, the TDS-30 and the TDS-30 HC. You can learn more about these systems by reading the product information presented on this page. In addition, you can download our product information in PDF format using the following links:

- TDS-30 Spec Sheet
- TDS-30 HC Spec Sheet

TDS-30 Automatic Tarping System

Frame:

The frame is made of heavy-duty gauge steel and able to support at least (3) 30ft. wide by 100ft. long ballasted 6.5 oz. coated polypropylene tarps, with 5/16" chain sewn in pockets. Frame legs have shoes welded on to support the TDS-30 in soft or muddy ground conditions.

Weight:

The TDS-30 weighs around 3,000 lbs. and can easily be used in landfills with high sludge content.

Engine and Hydraulics System:

The engine (5 1/2hp Honda gas powered) and hydraulic system is of adequate size to operate the TDS-30 spool that supports the specified tarps and capable to operate in all weather conditions.

The TDS-30 comes with a manual control and a heavy-duty remote control unit for retracting and extending controls for rolling and unrolling the tarp covering system.

Tarp:

The size of the tarp on the TDS-30 is 30ft. wide and can hold up to (3) ballasted tarps up to 100ft. in length. There is 5/16" chain in pockets around perimeter and webbing reinforced edges and corners. However, tarp size can be of custom order to a shorter width depending on the working face. Also, the tarps can be ordered unballasted if working face is not subjected to high winds and the operator prefers to use a couple of tires to weigh down the tarp.

Quick Attaching To Existing Landfill Equipment:

The TDS-30 is manufactured so no fixtures or brackets need to be added to your equipment. The brackets are manufactured right on the TDS-30. The blade of your equipment hooks under the bracket on the TDS-30 unit and you are then simply ready to deploy or retrieve for your daily operation. It's attaching simplicity enables the operator to place the TDS unit anywhere on site and also out of the way so he can continue using his landfill equipment elsewhere.

Existing Landfill Equipment:

The TDS-30 can be moved and operated from D4 to D8 class bulldozers or CAT 826 to CAT 836

class compactors.

Remote Control Unit:

The remote control unit has a maximum operating distance of 150 feet from the tarp machine. The TDS-30 is easily operated by the operator inside his cab.

Warranty:

12 months on TDS-30 only. Tarps cannot be warranted. However, the tarps we use have a very high UV resistance and are of 21-mil thickness that make them very durable and should last with proper operator observation while deploying and retrieving over the working face.

TDS-30 HC Automatic Tarping System

Frame:

The frame is made of heavy-duty gauge steel and able to support (4) 30ft. wide x 100ft. long ballasted 6.5 oz. coated polypropylene tarps, with 5/16" chain sewn in pockets. Frame legs are adjustable and have shoes welded on to support the TDS-30 HC in soft or muddy ground conditions.

Weight:

The TDS-30 HC weighs around 4,000 lbs. and can easily be used in landfills with high sludge content.

Engine and Hydraulics System:

The engine (5 1/2hp Honda gas powered) and hydraulic system is of adequate size to operate the TDS-30 HC spool that supports the specified tarps and capable to operate in all weather conditions.

The TDS-30 HC comes with a manual control and a heavy-duty remote control unit for retracting and extending controls for rolling and unrolling the tarp covering system.

Tarp:

The size of the tarp on the TDS-30 HC is 30ft. wide and can hold up to (4) ballasted tarps up to 100ft. in length. There is 5/16" chain in pockets around perimeter and webbing reinforced edges and corners. However, tarp size can be of custom order to a shorter width depending on the working face. Also, the tarps can be ordered unballasted if working face is not subjected to high winds and the operator prefers to use a couple of tires to weigh down the tarp.

Quick Attaching To Existing Landfill Equipment:

The TDS-30 HC is manufactured so no fixtures or brackets need to be added to your equipment. The brackets are manufactured right on the TDS-30 HC. The blade of your equipment hooks under the bracket on the TDS-30 HC and you are then simply ready to deploy or retrieve for your daily operation. It's attaching simplicity enables the operator to place the TDS-30 HC anywhere on site and also out of the way so he can continue using his landfill equipment elsewhere.

Existing Landfill Equipment:

The TDS-30 HC can be moved and operated from D5 to D8 class bulldozers or CAT 826 to CAT 836 class compactors.

Remote Control Unit:

The remote control unit has a maximum operating distance of 150 feet from the tarp machine. The TDS-30 HC is easily operated by the operator inside his cab.

Warranty:

12 months on TDS-30 HC only. Tarps cannot be warranted. However, the tarps we use have a very

high UV resistance and are of 21-mil thickness that make them very durable and should last with proper operator observation while deploying and retrieving over the working face.

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SECTION 13

CONSTRUCTION QUALITY ASSURANCE (CQA) PLAN

CONSTRUCTION QUALITY ASSURANCE PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

PREPARED FOR:

National Waste Managers, Inc.
2900 Linden Lane
Silver Spring, MD 20910

PREPARED BY:

1055 Andrew Dr, Suite a
West Chester PA 19380

PROJECT NO. 2018-3854
July 2020
Revised September 3, 2021

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13.0 CONSTRUCTION QUALITY ASSURANCE PLAN

13.1 Introduction

13.1.1 Purpose and Scope

This Construction Quality Assurance Plan (CQA Plan) describes the procedures associated with the implementation of the construction quality assurance (CQA) monitoring of activities associated with the construction of soil and geosynthetic components of the containment and final cover closure systems for the Chesapeake Terrace Rubble Landfill (Site) in Anne Arundel County, Maryland. This CQA Plan is the implementation document for CQA monitoring personnel. The plan does not address design guidelines, construction specifications, or the contractor's construction means and methods.

13.1.2 References

This CQA Plan references test procedures of the American Society for Testing and Materials (ASTM) and the American Association of State Highway and Transportation Officials (AASHTO). Preparation of this CQA Plan also referenced the following documents:

EPA/600/R-93-182, Technical Guidance Document, "Quality Assurance and Quality Control for Waste Containment Facilities", September 1993;

- EPA/600/2-88/052, "Lining of Waste Containment and Other Impoundments";
- Chesapeake Terrace Rubble Landfill Construction Specifications, prepared by AGC Montrose., dated July 2020, and revised September 3, 2021 (hereafter referred to as the "Specifications"); and,
- Chesapeake Terrace Rubble Landfill Permit Drawings prepared by AGC Montrose, dated July 2020 and revised September 3, 2021, (hereafter referred to as the "Permit Drawings").

13.1.3 Project Design

The project involves construction of a composite containment liner system, composite cover system, and related support facilities, including storm water controls, for the Chesapeake Terrace Rubble Landfill (Site) in Anne Arundel County, Maryland.

The proposed composite containment liner system consists of, from top to bottom in accordance with COMAR 26.04.07.16.C.:

- Protective layer of four feet of select waste;
- 10 ounce per square yard (oz./s.y.) nonwoven geotextile for layer separation and visual indicator, if breached;
- Two feet of leachate collection layer, comprised of locally-mined sandy soils;
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides, to work in conjunction with the leachate collection layer soils;
- 60-mil high density polyethylene geomembrane with a permeability less than or equal to 1×10^{-10} cm/sec; and,
- A two feet thick prepared soil subbase with a minimum permeability less than or equal to 1×10^{-10} cm/sec.

When landfilling activities are complete, the landfill must be closed. Following the requirements of COMAR 26.04.07.21 for rubble landfills, the proposed cap system will consist of the following, from top to bottom:

- A 24-inch thick soil layer (with 6-inch thick surface layer capable of supporting vegetation that is subsequently seeded and 18-inch thick uniform protective soil layer);
- A geocomposite drainage layer (GDL), consisting of a tri-planar drainage net with a minimum 8 oz./s.y. nonwoven geotextile heat-bonded to both sides;
- 40-mil textured Linear Low Density Polyethylene (LLDPE) Geomembrane; and,
- A 24-inch thick compacted soil Final Cover layer.

13.2 Definitions

This Section defines terms used throughout this CQA Plan.

- Construction Quality Assurance (CQA) refers to the means and actions employed by the Quality Assurance Consultant to assess whether the Contractor's or Installer's work complies with the Contract Drawings, Construction Specifications, and contractual and regulatory requirements.
- Quality Assurance Consultant (QAC) refers to an organization independent of the CONTRACTOR, contracted by the OWNER to provide on-site monitoring services and perform CQA services.
- Resident Manager (RM) refers to the on-site representative of the QAC.
- Contractor Quality Control (CQC) refers to actions taken by the Contractor, or Installer, to determine and demonstrate compliance with the requirements for materials and workmanship as stated in the Permit Drawings and Construction Specifications.
- Manufacturer Quality Control (MQC) refers to measures taken by the Manufacturer to determine and demonstrate compliance with the requirements for materials and workmanship as stated in the Permit Drawings and Construction Specifications.
- DESIGNER refers to:

  Advanced GeoServices Corp,
  A Montrose Environmental Group company
  1055 Andrew Drive, Suite A
  West Chester, PA 19380

  DESIGNER refers to the individual, partnership, firm, corporation, or any combination thereof, authorized by OWNER to represent OWNER on contract and payment issues. The DESIGNER shall also observe construction activities for compliance with the Contract Documents and shall perform specified engineering functions including, but not limited to, review of submittals, including CQC documentation and confirmatory sampling activities, as outlined in the Contract Documents. The DESIGNER may also serve the role of QAC.

  OWNER refers to:

  National Waste Managers, Inc.
  2900 Linden Lane
  Silver Spring, Maryland 20910

CONSTRUCTION SPECIFICATIONS refers to those portions of the Bidding Documents consisting of written descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto.

CONTRACT DOCUMENTS include the Bid Form, the Technical Specifications, all Addenda, the Agreement, General Conditions, Supplemental Conditions, Permits, and Drawings.

13.3 Project Participant Responsibilities and Qualifications

13.3.1 Owner

National Waste Managers, Inc. (NWM) (OWNER) is responsible for construction of the Chesapeake Terrace Rubble Landfill and for the Site. The OWNER will appoint an individual to act as the "point of contact" for all issues related to construction.

13.3.2 Designer

13.3.2.1 Responsibilities

Advanced GeoServices Corp., a Montrose Environmental Group Company (AGC Montrose) is the DESIGNER retained by the OWNER to design the landfill liner and cover systems for the Chesapeake Terrace Rubble Landfill. The DESIGNER's Project Manager is a licensed P.E. in the State of Maryland and has experience on solid waste landfill design and closure projects. During the construction phase, DESIGNER will:

- Assist the OWNER in the selection of a CONTRACTOR;

  Review design and specification change and modification requests, as necessary;

  Submit design and specifications changes or modifications to the Maryland Department of the Environment (MDE) for their review;
- Provide clarifications to the Permit Drawings and Construction Specifications; and,
- Respond to requests for information from the Contractor.

The DESIGNER, OWNER, and the MDE shall review and approve or deny all design and specification change requests. DESIGNER shall document that MDE has reviewed and approved any design and specification changes or modifications to the plan. All design changes shall be documented in the final report and the design engineer will certify that the changes did not diminish the pollution control systems or materials. DESIGNER will appoint an individual approved by the OWNER to act as the point of contact for issues related to the construction of the containment and cover systems.

13.3.3 General Contractor

13.3.3.1 Responsibilities

The General Contractor (CONTRACTOR) is responsible for the preparation of the Site, construction of the containment and cover systems, and maintenance of the quality of materials and workmanship employed by himself and all Subcontractors. The CONTRACTOR shall have the responsibility to protect completed work and materials (including deployed geosynthetics) during the project. The CONTRACTOR shall meet the qualification requirements stipulated in the

Specifications. The CONTRACTOR will assign a Project Manager as the responsible "person in charge" of all aspects of the project. The Project Manager will have a background in engineering or construction management, with significant experience in construction and contract administration.

The CONTRACTOR shall also designate a Site Superintendent (SS) who will be the full-time, on-site representative for the CONTRACTOR. The SS will oversee the daily Site operations for the CONTRACTOR, and interface with the QAC regarding status of daily and upcoming activities. The SS shall have experience with performing in this capacity for other comparable projects on behalf of the CONTRACTOR.

Finally, the CONTRACTOR will assign a Project Administrator (PA) who will be responsible for preparing the submittals for proposed materials and substitutions and providing these submittals to the DESIGNER for review. The submittals shall be of the format and completed as outlined in the Specifications. This person may be the Project Manager or SS; however, the PA shall have sufficient experience with engineering and construction to compile complete submittals, and shall have experience serving in this capacity on other comparable projects.

13.3.4 Maryland Department of Environment (MDE)

13.3.4.1 Responsibilities

The MDE staff will be responsible for evaluating compliance with the landfill permit, including the Construction Quality Assurance Plan and for reviewing proposed design changes that could affect pollution control systems or materials. The MDE staff will have the opportunity to attend the preconstruction meeting, the geosynthetics kick-off meeting, and progress meetings and will do so as agency resources allow.

13.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer (MANUFACTURER) of the geotextile, geocomposite, and geomembrane, shall meet the qualification requirements stipulated in Sections 02595, 02418, and 02597/02598, respectively, of the Specifications. The MANUFACTURER is responsible for the production and MQC testing of the geosynthetic materials used on this project. The MANUFACTURER is responsible for providing copies of the MQC Certificates of Compliance to the CONTRACTOR in a timely manner. It is possible that the CONTRACTOR will propose different manufacturers for each component. The reference to MANUFACTURER includes the manufacturers for the geosynthetic components for the project.

13.3.6 Geosynthetics Installer

13.3.6.1 Responsibilities

The Geosynthetics Installer (INSTALLER) is responsible for the deployment, seaming, non-destructive testing, and all other aspects of the geosynthetics installation. The INSTALLER shall provide a full-time, on-site, field supervisor who will oversee the activities of the installation crew.

13.3.6.2 Qualifications

The OWNER shall only approve a pre-qualified INSTALLER. The INSTALLER shall provide qualified personnel to meet the demands of the project. The INSTALLER shall have a minimum of five (5) years continuous experience in installation of HDPE and/or LLDPE geomembrane or experience totaling a minimum 5,000,000 sq. ft. of installed HDPE and/or LLDPE geomembrane for a minimum of five (5) completed facilities. Personnel performing seaming operations shall be qualified by experience or training. At least one seamer shall have experience seaming a minimum of 2,000,000 sq. ft. of HDPE and/or LLDPE geomembrane using the same type of seaming

apparatus in use at the site. The most experienced seamer, or Master Seamer, shall provide direct supervision, as required, over less experienced seamers. In addition, the INSTALLER shall provide a Superintendent for the project.

The Superintendent shall oversee the activities of the installation crew. The Superintendent must have a minimum documented experience of fifty (50) acres of successful landfill, or comparable, geosynthetic systems installation on a minimum of five (5) different projects. The personnel performing seaming operations for the geomembrane installation shall be qualified by experience and by successfully passing on-site trial seaming tests.

13.3.7 Quality Assurance Consultant (QAC)

13.3.7.1 Responsibilities

The Quality Assurance Consultant (QAC) is responsible for implementation of the CQA Plan, including monitoring, testing, and documentation of all aspects of the containment system construction. The team leader for the QAC shall be the Project Manager (PM), who will be a licensed Professional Engineer in Maryland, and will provide supervision of the field team. The QAC will assign a Resident Manager (RM), who will be responsible for field implementation of the CQA Plan and will remain on-site throughout construction. Additional quality assurance (QA) Monitor(s) shall assist the RM as required by the number and type of construction activities in progress. The QAC will:

- Review the Permit Drawings, Construction Specifications, and related work plans;
- Review schedule of construction activities with the CONTRACTOR;
- Coordinate CQA testing activities;
- Monitor and document CQC activities performed by the CONTRACTOR and Subcontractors;
- Monitor and document CQA activities as required by this CQA Plan and the Contract Documents;
- Review corrective measures to be employed in the event of deviation from the Contract Documents;
- Evaluate the soils and geosynthetics laboratories to be used during this project; and,
- Prepare and submit a Final Record Documentation Report as required by the Contract Documents.

13.3.7.2 Qualifications

The QAC shall be experienced with geosynthetic liner systems with an emphasis on polyethylene geomembranes. The QAC shall be experienced in the preparation of quality assurance documentation including quality assurance forms, reports, certifications, and manuals.

13.3.7.2.1 Resident Manager and Quality Assurance Monitors

The RM is the on-site representative of the QAC and is responsible for field implementation of the CQA Plan. The RM shall be thoroughly familiar with the project, Permit Drawings, and Construction Specifications. Quality Assurance Monitors (QA Monitors) shall assist the RM in performance of the CQA tasks required by this CQA Plan. The RM shall document that the project has been completed in substantial conformance with the Contract Documents. The RM responsibilities include the following:

- Act as the on-site representative of the OWNER;
- Attend and record project meeting minutes;
- Observe and document that required CQC testing has been performed in accordance with the Construction Specifications;
- Review shop drawings and other material submittals provided by the CONTRACTOR to verify that materials are in conformance with the Construction Specifications;
- Schedule and coordinate CQA activities;
- Obtain soil and geosynthetic samples for CQA laboratory conformance testing;
- Monitor, test, and document earthwork construction;
- Monitor and document the unloading and storage of geosynthetic materials;
- Monitor and document activities associated with geomembrane installation including deployment, welding, repair, destructive testing, and non-destructive testing;
- Monitor and document all activities associated with non-woven geotextile installation;
- Mark, obtain, and ship geomembrane seam destructive test samples;
- Monitor the methods used to protect completed work and materials (including deployed geosynthetics);
- Direct and oversee activities of the QA Monitor(s);
- Review CQA field data and daily reports of the QA Monitor(s);
- Prepare daily reports describing construction progress, testing performed, and results of testing;
- Coordinate requests for design/specification clarifications and modifications with the design DESIGNER and OWNER;
- Maintain on-site CQA records; and,
- Assist in the preparation of the Final Record Documentation Report.

The QA Monitor(s) will:

- Assist in performance of CQA activities as directed by the RM; and,
- Prepare written daily reports describing construction progress, sketches showing the locations of tests, testing performed, and results of testing.

Appointment of the RM and QA Monitor(s) shall be subject to the approval of the OWNER.

13.3.7.2.2 Qualifications

The Resident Manager either shall hold a B.S. or higher degree in Engineering or have performed such duties on at least five (5) other projects of similar nature and difficulty. The Resident Manager shall be specifically experienced in the installation of geosynthetic liner systems with an emphasis on polyethylene geomembrane.

The QA Monitors shall have specifically trained in the quality assurance of geosynthetic and/or soil liner systems.

13.3.7.3 Soils CQA Laboratory

The Soils CQA Laboratory shall be an experienced, accredited (ASTM, AASHTO), independent geotechnical-testing laboratory approved by the OWNER, responsible for performing tests in accordance with the applicable standards on samples of soil materials used during construction of the containment system. The Soils CQA Laboratory will be capable of providing test results to the CQA Consultant in a timely manner in accordance with Section 01410 of the Specifications.

13.3.7.4 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be an independent geosynthetics testing laboratory responsible for conducting tests in accordance with applicable standards on samples of geosynthetic materials used during construction of the containment system. The Geosynthetics CQA Laboratory will be an experienced geosynthetics-testing laboratory approved by the OWNER, will be accredited by the Geosynthetics Accreditation Institute-Laboratory Accreditation Program (GAI-LAP), (GSRI-GSI Accreditation), and will be capable of providing test results in a timely manner in accordance with the Specifications. Geomembrane destructive seam test results will be provided to the CQA Consultant within 24 hours of receipt of the sample at the laboratory throughout the project.

13.4 Documentation

13.4.1 Introduction

The purpose of this Section is to describe the CQA reports that shall be prepared during the construction of the site containment system. Documentation must be thorough and sufficiently detailed to allow individuals who are not on Site on a daily basis to make informed judgments concerning the quality of the materials and work performed.

13.4.2 Daily Reports

13.4.2.1 QA Monitors

QA Monitor(s) shall prepare daily written field monitoring reports describing the work performed, area of work, tests, and observations made, and the adequacy of the work. These reports shall be submitted to the RM no later than the beginning of the work or business, day after the work was performed.

13.4.2.2 Resident Manager

The RM shall prepare a field monitoring summary report on a daily basis. This report shall incorporate the information provided by the QA Monitor(s). The RM may incorporate his own monitoring activities and observations into this summary, and is not required to prepare a separate field monitoring report. The field-monitoring summary shall contain at a minimum:

- Project identification;

- Description of weather conditions;
- Description of work performed, including area, personnel and equipment involved;
- Description of off-site material received, including any quality control data;
- Description of CQA monitoring activities, including tests performed, and observations made;
- Description of any damage observed on installed pollution control systems and materials and corrective actions taken to repair the damage;
- Description of any problems encountered and corrective action taken;
- Summaries of meetings held and actions recommended or taken;
- Summary of the quantities of geosynthetic materials installed; and,
- Summary of the quantities and types of soil materials installed (alternately, tonnage of the material delivered if not all deployed should also be included).

13.4.3 Monitoring and Test Logs and Reports

Observations and results of field and laboratory tests shall be recorded on data sheets, in a format acceptable to the QAC PM. These data sheets shall include at a minimum:

- Project identification;
- Description or title of the monitoring activity;
- Location of monitoring activity or location from which the sample was obtained;
- Type of monitoring activity and procedure used;
- Recorded observation of test data;
- Results of monitoring activity; and,
- Personnel involved in the monitoring.

13.4.4 Issue Identification and Resolution Reports

The RM shall prepare a report describing any issue associated with materials or workmanship that fails to meet project plans or specifications and corrective actions taken to resolve it. This report shall contain at a minimum:

- Project identification;
- Location of the issue;
- Description of issue;
- Probable cause;
- How and when the issue was identified;
- Time frame of the issue (where applicable);
- Any disagreement noted by the Monitor between the Monitor and the CONTRACTOR concerning the Issue;
- Corrective measures taken to resolve the issue; and,
- Suggestions to prevent similar issues (if applicable) in the future.

13.4.5 Record Drawings

Record Drawings shall be prepared by the QAC as required by Section 01564 of the Specifications and be included in the Record Documentation Reports.

13.4.6 Record Documentation Report

At the conclusion of the construction project or phase, the QAC shall prepare a Record Documentation Report as required by the Contract Documents and MDE regulations. The Record Documentation Report shall certify that the construction of any cells or closure of any cells was

constructed in substantial compliance with the CQA Plan, construction and material specifications, and permit drawings. The Record Documentation Report shall be certified by a Professional Engineer (QAC Engineer's Certification) registered in the State of Maryland, and shall be submitted to MDE within 90 calendar days of the completion of the construction activities covered by the report.

The Record Documentation Report shall contain a narrative describing the work performed, problems encountered, and measures taken to resolve those problems, and the CQA field and laboratory activities conducted during the construction phase. The Report shall include summaries of the field and laboratory CQA data and copies of the Record Drawings. A list of responsible parties involved with the construction, including pertinent contact information, shall be provided. The report shall be submitted in a general format that simplifies the review by the MDE. This standard format includes a dated title page stating the name and location of the facility, table of contents, and numbered pages, sections, and paragraphs.

The phase or cell will not be considered closed until MDE has provided its written notification that the closure construction and the final report meet the requirements of the solid waste permit and applicable COMAR regulations.

The Record Documentation Report for the construction of new containment system (for a Cell or part of a Cell) will include the following documentation:

- A narrative of the construction activities
- The QAC Engineer's certification
- CQA documentation for any subgrade and low permeable liner preparation and testing including:
    - Subgrade Acceptances Documentation
    - Laboratory testing results
    - Field testing results
- CQA documentation for the geomembrane liner material and installation including:
    - Material inventory
    - Manufacture material certifications
    - CQA material conformance testing
    - Geomembrane installation documentation including:
        - Documentation of deployment logs
        - Documentation of trial seams
        - Documentation of field seams
        - Documentation of non-destructive testing, including liner leak testing
        - Documentation of geomembrane repairs
        - Documentation of destructive testing
- CQA documentation for the leachate collection layer installation including:
    - Leachate drainage material conformance testing
    - Documentation of the leachate drainage material installation observations
    - Documentation of leachate pipe material conformance submittals
    - Filter geotextile documentation including:
        - Material inventory
        - Manufacture material certifications
        - CQA material conformance testing

Documentation of the filter geotextile installation observations

- CQA Documentation of the Liner Leak Testing
- CQA documentation for any other ancillary construction such as the construction of leachate collection tanks and secondary containment areas, sediment basins, leachate-pumping systems, and the abandonment of any piezometers or groundwater monitoring wells required for the construction of the phase.
- Documentation of any design modifications
- Resumes for the geosynthetic installer and the QAC Certifying Engineer
- Record drawings including:
    - A site plan
    - A base record drawing
    - A geomembrane record drawing including panel locations, destructive test locations, and repair locations.
    - A leachate collection layer record drawing including the location of all leachate collection piping and sumps.
    - A thickness map illustrating the thickness of the leachate collection layer.

The Record Documentation Report for the construction of final cover system (for a Cell or part of a Cell) will include the following documentation:

- A narrative of the construction activities
- The QAC Engineer's certification
- CQA documentation for any subgrade preparation and testing including:
    - Subgrade Acceptance Documentation
    - Laboratory testing results (if required)
    - Field testing results (if required)
- CQA documentation for the geomembrane cover material and installation including:
    - Material inventory
    - Manufacture material certifications
    - CQA material conformance testing
    - Geomembrane installation documentation including

        Documentation of deployment logs
        Documentation of trial seams
        Documentation of field seams
        Documentation of non-destructive testing
        Documentation of geomembrane repairs
        Documentation of destructive testing
- CQA documentation for the geocomposite drainage layer installation including:
    - Material inventory
    - Manufacturer material certifications
    - CQA material conformance testing
    - Documentation of the geocomposite installation observations
- CQA documentation for the terrace drainage system installation

- CQA documentation protective cover soils and vegetative support layer installation including:
    - Laboratory testing results
    - Field testing results
- CQA documentation for storm water controls such a downchutes and scour holes
- Documentation of any design modifications
- Resumes for the geosynthetic installer and the QAC Certifying Engineer
- Record drawings including:
    - A site plan
    - A base record drawing
    - A geomembrane record drawing including panel locations, destructive test locations, and repair locations.
    - A record drawing of the top of the final closure surface including the location of all storm water controls.
    - A thickness map illustrating the thickness of the combination of the protective cover soil and vegetative support layer.

13.4.7 Document Storage

The RM shall maintain on Site, copies of all CQA and Manufacturers QC conformance test results, field reports, and CQA data logs. Originals of all CQA documentation shall be forwarded to the office of the DESIGNER for review and storage. Final disposition of all project related documentation shall be performed in accordance with the Contract Documents.

13.5 Soils CQA

13.5.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the soil components of the containment cell and cover systems at the Site. During construction of the containment cell and cover systems, the following different classes of soil material will be used:

- Structural Fill - to construct foundations and berms to the design lines and grades;
- General Fill - Material used to backfill anchor trenches, pipe trenches, and foundations for structures such as manholes and vaults;
- Prepared Subbase – to exhibit a permeability less than or equal to 1×10^{-5} cm/sec;
- Aggregate - to be used as the leachate collection drainage layer material;
- Coarse Aggregate - for drainage and leachate collection systems, and gravel road upgrades (coarse aggregate used in the leachate collection system sumps must include <15% carbonate content);
- Intermediate Cover – Material used to obtain final slopes and elevations for the geosynthetic capping system subgrade;
- Protective Cover – Material used over the geosynthetic capping system and shall exhibit a permeability less than or equal to 1×10^{-5} cm/sec; and,
- Vegetative Support Layer - to provide support for surface vegetation;

13.5.2 Pre-Construction

13.5.2.1 Borrow Selection and Testing

The CONTRACTOR shall identify borrow sources and supplies for the various soil materials to be used during construction of the containment and cover systems. The CONTRACTOR shall arrange for testing of the proposed borrow material by a geotechnical testing laboratory approved by the OWNER in accordance with Section 01410 of the Specifications.

All soil types shall be pre-construction tested at a minimum frequency of one (1) per source. Testing requirements for each material type are as follows:

Soil Type	Test Method
Structural/General Fill & Access Road Subgrade	Grain Size Analysis (ASTM D422) Atterberg Limits (ASTM D4318) Standard Proctor (ASTM D698)
Prepared Subbase	Grain Size Analysis (ASTM D422) USCS Classification (ASTM 2487) Standard Proctor (ASTM D698) Atterberg Limits (ASTM D4318) Specific Gravity (ASTM C128) Hydraulic Conductivity (ASTM D5084) pH
Leachate Collection Layer	USCS Classification (ASTM 2487) Grain Size Analysis (ASTM D422) Hydraulic Conductivity (ASTM D2434) Carbonate Content (ASTM D3042)
Coarse Aggregate	Grain Size Analysis (ASTM D422) Carbonate Content (ASTM D1603) Permeability (ASTM D2434) Carbonate Content (ASTM D3042)*
Protective Cover	Grain Size Analysis (ASTM D422) USCS Classification (ASTM 2487) Standard Proctor (ASTM D698) Atterberg Limits (ASTM D4318) Specific Gravity (ASTM C128) Hydraulic Conductivity (ASTM D2434)
Vegetative Layer	Grain Size Analysis (ASTM D422) Atterberg Limits (ASTM D4318) pH (ASTM D4972) Organic Content (ASTM D2974) Soil Fertility (LaMotte or Baker Test)

**Note: Coarse Aggregate carbonate testing only required for materials used in the leachate collection system sumps.*

A minimum of ten business days prior to the use of the proposed material, the CONTRACTOR shall submit to the QAC, two 5-gallon bucket samples of the material, for CQA laboratory testing. The DESIGNER shall review the test results to verify compliance with the Specifications. This documentation shall be included in the Record Documentation Report. Requirements and pre-construction testing frequencies for each material type are discussed below. If, in the opinion of

the QAC, the proposed material is unsuitable for the proposed application, the CONTRACTOR shall submit the above certification for material of another type, or from another source, for consideration by the QAC. Material samples submitted by the CONTRACTOR become the property of the OWNER. No soil shall be placed prior to approval by the QAC of the material and the underlying surface.

13.5.2.2 Material Requirements

13.5.2.2.1 General Requirements

General requirements for materials are as follows:

- Contain no frozen soil, organic materials, wood, trash, or other objectionable materials which may be compressible or which cannot be properly compacted;
- Contain no rock fragments, broken concrete, masonry rubble, or similar material; and,
- Be readily spread and compacted (structural fill and prepared subbase layer) to the specified density.

13.5.2.2.2 Structural Fill

Requirements for structural fill materials are contained in Section 02223 of the Specifications.

13.5.2.2.3 Prepared Subbase Soil

Requirements for prepared subbase soil materials are contained in Section 02225 of the Specifications.

13.5.2.2.4 Leachate Collection Layer

Requirements for leachate collection layer soil materials are contained in Section 02232 of the Specifications.

13.5.2.2.5 Coarse Aggregate

Requirements for coarse aggregate are contained in Section 02233 of the Specifications. Coarse Aggregate shall be used in three separate applications: Leachate collection system (refer to Section 02650), drainage system for the cap (refer to Section 02231), and for the road surface (refer to Section 02223).

13.5.2.2.6 Intermediate Cover

Requirements for intermediate cover materials are contained in Section 02224 of the Specifications.

13.5.2.2.7 Final Cover

Requirements for Final Cover materials are contained in Section 02229 of the Specifications.

13.5.2.2.8 Protective Cover

Requirements for protective cover materials are contained in Section 02234 of the Specifications.

13.5.2.2.8 Vegetative Support Layer

Vegetative support layer material requirements are contained in Section 02235 of the Specifications.

13.5.3 Construction

13.5.3.1 Subgrade Preparation

Prior to structural fill placement, the CONTRACTOR shall proof roll the subgrade surface to verify that the underlying soil is firm and does not contain excessively moist or soft areas. The RM shall visually inspect the condition of the subgrade. Areas determined by the RM to be unsuitable, shall be excavated and the removed material shall be replaced with structural fill, as required. No soil shall be placed on the subgrade without the approval of the RM.

13.5.3.2 Structural Fill

Structural fill shall be placed as indicated in the Permit Drawings. Structural fill shall not be placed until the subgrade or other component has been observed in place and approved by the RM.

Structural fill shall be placed in relatively horizontal uniform lifts not exceeding 12 inches in loose thickness throughout the fill area. Structural fill shall be compacted to a minimum of 95 percent of the maximum dry density as determined by the Standard Proctor Test (ASTM D 698). Hand-operated plate type vibratory, or other suitable, equipment may be used in areas not accessible to larger rollers or compactors as long as the density criteria is met. The RM, or QA Monitors, shall continuously monitor and document the placement of structural fill materials.

RM shall conduct field density/moisture testing (ASTM D2922/D3017). Refer to Section 02223 in the Construction Specifications for laboratory and field-testing. If, during placement of structural fill, the RM has reason to suspect that the material has changed from that previously tested and approved, he shall immediately notify the CONTRACTOR's on-site representative and arrange for additional laboratory testing. Material determined to be unsuitable by the RM shall be removed and replaced at the CONTRACTOR's expense. The CONTRACTOR shall also reimburse the QAC for the additional testing and monitoring of removing and replacing the unsuitable material. Grading tolerance for structural fill shall be -0.1 to + 0.2 feet for elevations, and -0.0 to +0.1 feet for thickness.

13.5.3.3 Prepared Subbase Layer

Prior to Subbase placement, the CONTRACTOR shall proof-roll the subgrade with heavy equipment to verify that the underlying soil is firm and does not contain excessively moist or soft areas. The RM shall visually inspect the condition of the subgrade. Areas determined by the RM to be unsuitable shall be excavated and the removed material replaced with prepared subbase material as required. No soil shall be placed above the subgrade without the approval of the RM.

The Subbase shall be placed in relatively horizontal uniform lifts not exceeding 9 inches in loose thickness and compacted to a maximum of 6 inches. A pad or sheep's-foot compactor shall be used to compact the Subbase with a minimum of four passes to a minimum of 95% of the maximum dry density as determined by the Standard Proctor test (ASTM D698). Hand-operated cleat-foot or other suitable equipment may be used in areas not accessible to larger rollers or compactors as long as the density criteria are met. Refer to Section 02224 in the Construction Specifications for laboratory and field testing requirements.

13.5.3.4 Leachate Collection Layer

Leachate collection layer shall be constructed in those areas specified in the Permit Drawings. The leachate collection layer shall be placed with minimum handling and in a manner that will result in minimal compaction.

Placement of the leachate collection layer shall meet the following requirements:

- Avoid damage to the underlying geosynthetics. Any damage shall be repaired in accordance with Section 02597/2598 of the Specifications at no additional cost to the OWNER;
- Minimize wrinkles to avoid creases and wrinkles in the geomembrane. Repair or walkout wrinkles as described in Section 02597/02598.

The RM shall continuously monitor and document the placement of all leachate drainage material and shall perform thickness checks at a minimum frequency of five locations per acre. Refer to Section 02232 in the Construction Specifications for laboratory and field-testing.

If, during placement of the leachate drainage layer, the RM should have any reason to suspect that the leachate collection layer material has changed from that previously tested and approved, they shall immediately notify the CONTRACTOR's on-site representative and arrange for additional testing. Material determined to be unsuitable by the RM shall be removed and replaced at no additional cost to the OWNER. Grading tolerance for the leachate drainage material shall be –0.0 to +0.3 feet for elevations.

Leachate collection layer material shall be transported within the cell over temporary haul roads constructed of the same drainage material. Haul roads constructed over geosynthetics shall have a minimum of 36-inch (3-feet) thickness between the geosynthetics and the transporting equipment. Leachate collection layer material shall be placed at the toe of the slope by transporting equipment, and pushed up slope by low ground pressure (LGP) bulldozers. A minimum of 12-inches shall be maintained between geosynthetics and LGP equipment. Transporting equipment shall, under no circumstances, be allowed on the slopes. The RM shall monitor and document the placement of leachate drainage material. Refer to Section 02232 in the Construction Specifications for laboratory and field-testing.

13.5.3.5 Coarse Aggregate

Coarse aggregate shall be used for drainage, leachate collection systems, and gravel road upgrades. Coarse aggregate material shall be clean, sound, tough, durable, subangular, subrounded, or round stone, not lumpy, and free from slag, cinders, ashes, rubbish, or other deleterious material. Coarse aggregate used in the Leachate Collection sumps shall have a maximum carbonate content of 15%. The CONTRACTOR shall maintain a uniform gradation of coarse aggregate.

Aggregate shall be stored in designated areas approved by the RM. The CONTRACTOR is responsible for maintaining the aggregate free of contamination. The DESIGNER or RM may at any time inspect the coarse aggregate in the on-site stockpile for contamination and, if necessary, reject all or portions of the coarse aggregate.

Coarse aggregate shall be placed to the lines, depths, and grades as shown on the Permit Drawings. The RM shall continuously monitor and document the placement of all coarse aggregate. No material shall be placed unless approved by RM. Refer to Section 02233 in the Construction Specifications for laboratory and field-testing.

13.5.3.6 Intermediate Cover

Intermediate cover shall be used to placed over the waste fill surface as specified in the Design documents. A minimum of 12-inches of compacted intermediate cover shall be placed for each cover layer.Refer to Section 02224 in the Construction Specifications for quality control (QC).

13.5.3.7 Final Cover

Final cover shall be used to obtain final slopes and elevations for the closure subgrade. A minimum of 24-inches of compacted Final Cover shall exist between the rubble waste and the final subgrade. Refer to Section 02229 in the Construction Specifications for quality control (QC).

13.5.3.8 Protective Cover Soil Layer

Prior to the placement of the protective cover for the closure cap system, laboratory testing shall be performed to develop an acceptable moisture-density-permeability "window," which will define the pass/fail criteria for field moisture-density tests. Refer to Section 02234 in the Construction Specifications for laboratory and field testing requirements.

Eighteen (18) inches of protective cover shall be placed in a single lift over the geosynthetic components of the closure system cap. A smooth-drum roller compactor shall be used to compact protective cover soil. The RM shall conduct field density/moisture testing (ASTM D2922/D3017). Failing areas shall be reworked by the CONTRACTOR until passing results are obtained at no additional cost to the OWNER.

Protective cover material shall be transported to the closure area over temporary haul roads constructed of material approved by the RM. Haul roads constructed over geosynthetics shall have a minimum of 36-inch (3-feet) thickness between the geosynthetics and the transporting equipment. Protective cover shall be placed at the toe of the slope by transporting equipment, and pushed up slope by low ground pressure (LGP) bulldozers. A minimum of 12-inches shall be maintained between geosynthetics and LGP equipment. Transporting equipment shall, under no circumstances, be allowed on the slopes.

On steep slopes, compaction may be obtained through tracking with the placement equipment instead of a smooth-drummed roller, as a smooth-drummed roller may not be stable, particularly under conditions of excess moisture.

The RM shall monitor and document the placement of protective cover. Refer to Section 02234 in the Construction Specifications for laboratory and field-testing.

13.5.3.9 Vegetative Support Layer

Vegetative support layer shall be used in those areas specified in the Permit Drawings. No vegetative support layer shall be placed until placement of underlying soil layer is complete and approved by the RM. Vegetative support layer shall be placed in all areas indicated on the Permit Drawings and as directed by the DESIGNER to a minimum thickness of 6 inches. The vegetative soil layer shall be tracked perpendicular to the toe of slope with a low ground pressure tracked dozer (< 5 psi) prior to seeding. Heavy equipment transporting vegetative support layer material shall, under no circumstances, be allowed on slopes. Vegetative material shall be placed at the toe of the slopes by transporting equipment and pushed up slope by LGP equipment.

The RM shall continuously monitor and document the placement of the vegetative support layer. Soil shall be graded to blend in with existing grades and to prevent surface ponding or erosion. Mixing of underlying soil with the vegetative support layer during installation shall be avoided. Mixing excessive amounts of gravel sized or larger material from the substrate into the vegetative support layer, which may restrict growth of vegetation, shall be avoided. The minimum thickness of soil is as shown on the permit drawings. The vegetative support layer thickness tolerance is 0.0 to +0.3 feet. Refer to Section 02235 in the Construction Specifications for laboratory and field-testing.

13.5.3.10 Temporary Berms

Temporary runoff containment soil berms shall be constructed in accordance with Section 02125 of the Specifications, titled, "Temporary and Permanent Erosion and Sedimentation Control", the Maryland Specifications for Soil Erosion and Sediment Control (1994, or newer version), and as required by the sequencing of the construction activities.

13.5.3.11 Excavations

The extent of excavations left open shall be kept to a minimum. Unless otherwise directed, excavations shall be backfilled as soon as possible after the Work is observed, tested as required and accepted, and permission to backfill has been given by the RM. Immediately prior to backfilling, all rubbish, debris, forms and similar materials shall be removed from the excavations.

13.6 Geotextile

13.6.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the geotextile components of the containment cell and closure system at the site. Geotextile requirements are contained in Section 02595 of the Specifications.

13.6.2 Pre-Installation

13.6.2.1 Manufacturer's QC Certification

The CONTRACTOR shall provide the QAC with copies of the Manufacturer's QC Certificates for the material supplied to the project prior to delivery of the material to site. The QAC shall review these certificates to verify that the material's properties comply with the Specifications. Material properties and Manufacturer's Quality Control testing frequencies for woven and non-woven geotextile are contained in Section 02595 of the Specifications.

13.6.2.2 Labeling

The Manufacturer shall identify each roll of geotextile with the following:

- Manufacturer' s name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and,
- Roll dimensions.

The RM shall examine rolls upon delivery and any deviation from the above requirements shall be reported to the CONTRACTOR and DESIGNER.

13.6.2.3 Inventory, Storage, and Handling

The CONTRACTOR shall be responsible for the proper storage and handling of the material. The CONTRACTOR shall designate and prepare a geosynthetics storage area prior to the arrival of the material. This area should be readily accessible, and shall provide the geotextile with adequate protection against dirt, mud, sharp objects, impact, and other possible sources of damage. Upon arrival, the CONTRACTOR shall unload the geotextile in such a manner as to minimize the risk of damage to the material, and place the rolls in the prepared storage area.

The RM shall verify that the geotextile storage area is adequate. The RM shall perform a physical inventory of all geotextile delivered to the site for use in the containment and cover systems, and

shall record the project identification, the date of arrival, the method of transport, the manufacturer's roll number, the condition of each roll on arrival, and all damage caused during unloading. The RM shall verify that the material delivered corresponds to the Manufacturer's QC Certificates.

13.6.2.4 CQA Conformance Testing

The RM shall collect and ship samples of the geotextile for CQA geosynthetics laboratory testing as soon as practicable after delivery. Samples shall be 3 feet long in the machine direction by the width of the roll, and shall not be taken from the first 3 feet of the roll. The RM shall mark each sample with the Manufacturer's roll number and an arrow indicating the machine direction. Conformance testing of geotextile shall be performed in accordance with the Construction Specifications. Material properties and Quality Assurance conformance testing frequencies for the non-woven geotextile are summarized in the tables contained in Section 02595 of the Construction Specifications.

Upon receipt of CQA test results, the RM shall verify that the material meets project specifications. Should the material fail to meet project specifications, the RM shall notify the DESIGNER. The CONTRACTOR shall remove rejected material from the site, or store it at a location separate from accepted rolls until they can be removed from site. The RM shall obtain and ship additional conformance test samples from the closest numerical rolls to the rejected material. Should either or both of these samples fail to meet project specifications, the CONTRACTOR shall continue to test the next closest numerical rolls until passing conformance tests bound the failed material. The cost of all-additional testing and replacement of all non-conforming material shall be borne exclusively by the CONTRACTOR.

13.6.3 Installation

13.6.3.1 Deployment

Prior to deployment of the geotextile, the RM shall verify that the manufacturer's QC certification and CQA Geosynthetics Laboratory conformance test results have been received, and that the material meets the project specifications.

The geotextile shall be placed in such a manner as to minimize the risk of damage to the material. It shall be laid smooth and free of tension, stress, folds, wrinkles, or creases. In the presence of wind, geotextile shall be weighted with sandbags or the equivalent. Refer to Section 02595 in the Construction specifications for specific installation procedures.

13.6.3.2 Seams and Overlaps

Filter geotextile shall be sewn. All sewing shall be done using a polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding that of the geotextile. In general, no horizontal seams shall be allowed on steep slopes (i.e., slope greater than 8%), except as part of a repair. Seams should be along, not across the line of maximum slope. The RM shall visually inspect each seam to verify continuity of stitching. The INSTALLER shall repair any sewing discontinuities at no additional expense to the OWNER.

13.6.3.3 Repair

The RM shall visually inspect the geotextile for damage. Damage shall be repaired by placing a piece of geotextile over the damaged area. The patch shall overlap the defect for a minimum of three (3) feet in each direction, and shall be continuously leistered (heat tacked) around the edges.

13.7 Geomembrane

13.7.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the geomembrane component of the Chesapeake Terrace Rubble Landfill containment cell liner system and the final closure system. The geomembrane component of the containment liner system consists of a single 60-mil High Density Polyethylene (HDPE) textured geomembrane layer, while the final closure system utilizes a 40-mil, Linear Low Polyethylene (LLDPE) textured geomembrane. The requirements for both of these geomembranes are contained in Sections 02597 and 02598, respectively, of the Specifications.

13.7.2 Pre-Installation

13.7.2.1 Manufacturer's QC Certification

The CONTRACTOR shall provide the PM and RM with copies of Quality Control Certificates for the material supplied to the project. The PM and RM shall review these certificates to verify that the material properties comply with Section 02597 and 02598 of the Specifications. Material properties and Manufacturers' Quality Control testing frequencies for geomembrane are summarized in the table included in the Construction Specification Sections 02597 and 02598.

13.7.2.2 Inventory, Storage, and Handling

The CONTRACTOR shall be responsible for the proper storage and handling of the material. The CONTRACTOR shall designate and prepare a geosynthetics storage area prior to the arrival of the material. This area should be readily accessible, and shall provide the geomembrane with adequate protection against dirt, mud, sharp objects, impact, and other possible sources of damage. On arrival, the CONTRACTOR shall unload the geomembrane in such a manner as to avoid the risk of damage to the material, and place the rolls in the prepared storage area.

The RM shall verify that the geomembrane storage area is adequate. The RM shall perform a physical inventory of all geomembrane delivered to the site for use in the containment and cover systems, and shall record the project identification, the date of arrival, the method of transport, the manufacturer's roll number, the condition of each roll on arrival, and all damage caused during unloading. The RM shall verify that the material delivered corresponds to the previously submitted Manufacturer's Quality Control Certificates.

13.7.2.3 CQA Conformance Testing

The RM shall collect and ship samples of the geomembrane for CQA Geosynthetics Laboratory testing as soon as practicable after delivery. Samples shall be three (3) feet long in the machine direction by the width of the roll, and shall not be taken from the first three (3) feet of the roll. The RM shall mark each sample with the manufacturer's roll number and an arrow indicating the machine direction. Geomembrane conformance testing shall be performed in accordance with Sections 02597 and 02598 of the Specifications. Material properties and Quality Assurance conformance testing frequencies are summarized in the tables included in the Construction Specification Sections 02597 and 02598.

Upon receipt of CQA Geosynthetics Laboratory test results, the RM shall verify that the material meets project specifications. Should the material fail to meet project specifications, the RM shall notify the DESIGNER. The CONTRACTOR shall remove rejected material from the site, or store at a location separate from accepted rolls until they can be removed from site. The RM shall obtain and ship additional conformance test samples from the closest numerical rolls bracketing the rejected material. Should either or both of these samples fail to meet project specifications, the

CONTRACTOR shall continue to test the next closest numerical rolls until passing conformance tests bound the failed material. The cost of all additional testing, and replacement of all non-conforming material shall be borne exclusively by the CONTRACTOR.

13.7.3 Installation

13.7.3.1 Deployment

Prior to deployment of a roll of geomembrane, the RM shall verify that the Manufacturer's QC certification and CQA Geosynthetics Laboratory conformance test results have been received and that the material meets the Construction Specifications.

Immediately prior to panel deployment, the INSTALLER and the RM shall confirm that the subgrade layer has a smooth surface, free of stones, sharp objects, debris, or excessive moisture that could damage the geomembrane or adversely affect seaming operations.

Any portion of the subgrade deemed unsuitable by either the INSTALLER or the RM shall be repaired or reworked by the CONTRACTOR at no additional costs to the OWNER, until it meets the specifications. During each day of geomembrane deployment, a subgrade certification will be completed and signed by the geosynthetic installation superintendent and the RM.

Geomembrane deployment shall not proceed when the ambient air temperature measured 6-inches above the geomembrane are below 32^0F or above 104^0F, unless otherwise directed by the DESIGNER. Geomembrane deployment shall not be performed during precipitation, or when winds exceed 20 mph, unless the Contractor pre-submits acceptable evidence (to be approved by the DESIGNER) that performance standards can be maintained under these conditions.

During deployment, the INSTALLER shall write the panel and manufacturers roll numbers on each panel. Unique panel numbers shall be marked, on each panel, numerically in the order they are installed. The RM, or his designee, shall maintain a log indicating the correlation between the panel number and the manufacturer's roll number. The RM shall complete a panel deployment log containing the panel number, the manufacturers roll number, the deployment date, the panel condition on deployment, the observed overlap, and the deployed length. The RM shall maintain a field sketch indicating the relative location of deployed panels.

The INSTALLER shall only deploy panels that can be welded during the same day. Panels deployed on side slopes shall be oriented along the maximum line of slope. Panels shall be deployed with the fewest possible wrinkles or fishmouths. The INSTALLER shall ensure that the deployment method avoids potential damage to the geomembrane, and that deployed panels are adequately protected against wind uplift and associated damage.

13.7.3.2 Field Seaming

For the geomembrane components of the containment and cover systems, field seams shall be of the following type:

- Fusion weld – A seam produced by melting the two intimate surfaces by running a hot metal wedge between the surfaces followed immediately by pressure to form a homogeneous bond. This seam has an integral air channel for non-destructive testing.
    - All areas to be seamed shall be free of dust, dirt, and excessive moisture.
    - In general, the geomembrane panels shall be aligned to have a nominal overlap of 6 inches.
    - No solvent or adhesive

- Extrusion weld – A seam produced by extruding molten parent HDPE resin between or at the edge of two overlapped HDPE panels. A bonded seam is completed when extruded hot resins melt adjacent sheet resins to form a homogeneous bond.
    - All areas to be seamed shall be free of dust, dirt, and excessive moisture.
    - In general, the geomembrane panels shall be aligned to have a nominal overlap of 3 inches.
    - Grinding shall be performed no more than 1 hour prior to seaming.
    - Clean dry welding rod shall be used for seaming.
    - Exposed grinding adjacent to extrusion seams shall be kept to a minimum, and shall at no point exceed ¼-inch.
    - No solvent or adhesive shall be used during seaming.

13.7.3.3 Trial Seam Testing

Prior to production welding, each Seamer shall produce a trial seam. Trial seams shall be made at the beginning of each shift, following restart of welding equipment, upon a change of seamers, and at least once each five (5) hours of seaming that day.

Fusion and extrusion trial seams shall be a minimum of five (5) feet long. Trial seams shall be welded under the same field conditions as production welding. Seamers shall produce trial seams for each machine. The Seamer shall mark each trial seam with the machine number, temperature, speed, date, and time the trial seam was produced, and the Seamer's initials or other means of identification.

The INSTALLER shall cut and test six 1-inch wide coupons from each trial seam. Three coupons shall be tested for peel adhesion and three coupons shall be tested for bonded seam strength (also known as "shear"). Both the inside and outside weld of fusion welds shall be tested for peel adhesion. Testing of coupons must meet project specifications for geomembrane seam destructive test samples as indicated in the table included in the Construction Specification Sections 02597 and 02598.

If a trial seam fails to meet project specifications, the Seamer will weld a second trial seam. If the second trial seam fails to meet project specifications, the INSTALLER shall investigate the cause of the failures and take the necessary corrective action. Once the deficiency is corrected, the Seamer must produce two consecutive passing trial seams before being permitted to begin or resume production welding. If, at any point during the day, a seamer fails three trial welds prior to acceptance for production welding, the seamer and/or the seaming apparatus shall not be used for seaming that day.

The RM shall observe trial seam testing, and maintain a log containing the project identification, the date and time the trial seam was produced, ambient temperature, machine and Seamer identification, the machine temperature and speed, and the strength and mode of failure of each coupon.

13.7.3.4 General Seaming

The Master Seamer, as defined in Sections 02597 and 02598 of the Specifications, shall be on-site at all times during production welding. Only Seamers that have produced trial welds meeting Construction Specifications shall perform production welding. Welding at night shall be avoided unless approved in writing by the DESIGNER.

Welding of geomembrane seams will not be performed during inclement weather. Emergency seams welded in unsuitable weather conditions will be removed and replaced, or capped. Welding in temperatures less than 32° F or greater than 104° F shall be permitted only with the approval of the OWNER, or DESIGNER, and after the INSTALLER has demonstrated that welding can be successfully performed in those conditions.

Seams shall be lapped to produce a "shingle" effect. Temporary rub sheets may be used as conditions warrant; however, no rub sheet shall be left below the geomembrane. At the beginning of each seam, the Seamer shall record the date, start time, machine, and Seamer identification on the geomembrane. All seams shall be welded through the anchor trench.

Fishmouths, or wrinkles at the seam overlaps, shall be cut along the ridge of the wrinkle to achieve a flat overlap. Cut wrinkles shall be overlapped a minimum of three (3) inches and seamed, or patched, and any area where the overlap is inadequate shall be patched.

Geomembrane panels shall be staggered such that cross seams between panels are not continuous throughout the geomembrane area. Panel layouts shall be such that no horizontal seams (cross Seams) are constructed on slopes steeper than eight percent (8%). No horizontal seams (cross seams) shall be within five (5) feet from the toe or crest of the slope or areas of potential stress concentrations unless approved by the RM.

The INSTALLER shall mark, on the starting end of the seam, the machine, the seamer identification, the date, and the start time. The RM shall monitor and document welding operations. The RM shall employ a method of uniquely identifying each geomembrane seam. The RM shall maintain a log for each seam noting the project identification, the machine and Seamer identification, the start time, the machine start and end points, the approximate ambient temperature, and the length of the seam.

13.7.3.5 Defects and Repairs

The RM shall observe the geomembrane panels and seams for any damage or deficiency that may adversely affect the performance of the geomembrane. The RM shall mark each defect with a unique identification code, and maintain a log noting at a minimum the defect location, and type.

Any portion of the geomembrane containing a defect or failed seam (destructive or non-destructive) shall be repaired by the INSTALLER at no additional cost to the OWNER. Available repair techniques include the following:

- Patching – used to repair all holes, intersections, tears, and contaminated areas in the geomembrane.
- Capping – used to repair a failed seam length area with either fusion or extrusion welding.
- Removal of bad seam and replacing area with new material welded into place.

Only those Seamers completing a successful trial weld with the extrusion welder shall perform repairs. All holes in the geomembrane shall be patched. Failed fusion or extrusion seam lengths shall be removed or capped. All panel "T" intersections shall be capped. Use of the "grind and weld" repair technique shall be minimized to very small defects in the geomembrane as approved by the RM. Temporary repairs (e.g. emergency patches welded in the rain) shall be marked "Temp." For each repair, the Seamer shall record the date, start time, and machine and seamer identification on the geomembrane.

General Practices for performing repairs shall be as follows:

- Surface to be repaired shall be clean and dry.
- Surface to be extruded shall be abraded (ground) no more than 1 hour prior to seaming.
- Patches shall extend a minimum of 6 inches beyond the edge of the defect on all sides with the corners of the patch rounded.

The RM shall monitor and document the repair of each defect. Repair documentation shall include at a minimum the project identification, the date, approximate time, type, and size of the repair, and identification of the welding machine and Seamer.

13.7.3.6 Non-Destructive Testing

13.7.3.6.1 Introduction

This section discusses the non-destructive testing of fusion and extrusion welds. All production welds and repairs shall be non-destructively tested over their entire length. Non-destructive testing shall be performed as soon as possible after completion of the weld. Air pressure testing shall be performed prior to the removal of seam destructive test samples. Welds failing to meet the non-destructive test specifications shall be removed and replaced or capped at no additional cost to the OWNER.

13.7.3.6.2 Pressure Testing

All dual track fusion seams shall be non-destructively tested using the air pressure test method as described in Sections 02597 and 02598 of the Construction Specifications. Both ends of the weld shall be sealed and the air channel pressurized to approximately thirty (30) psi. After stabilization, the initial pressure shall be recorded. The pressure shall be monitored for a period of five (5) minutes, and the final pressure recorded. The test is considered to be passing if the pressure drop is less than or equal to three (3) psi for HDPE and four (4) psi for LLDPE during the five (5) minute interval. If the pressure test fails to meet project specifications, the INSTALLER shall determine the cause of the failure and correct the deficiency. The affected weld may be retested, removed, or capped.

At the conclusion of the test, the air channel shall be cut at the end opposite from the point of pressurization and the air channel depressurization noted. If the air channel does not depressurize, the INSTALLER shall identify and remove the source of the blockage, and retest the affected seam.

The INSTALLER's Technician performing air pressure testing shall mark the date, the initial and final pressures, the test start and end times, and technician identification on the geomembrane.

The RM, or his designee, shall monitor and document all pressure testing. The RM shall maintain a pressure test log containing at a minimum the project identification, the date of the test, identification of the seam or portion of seam being tested, test start and end times, the initial and final test pressures, and the identification of the technician performing the test.

13.7.3.6.3 Vacuum Testing

All extrusion welds shall be non-destructively tested using the vacuum test method described in Sections 02597 and 02598 of the Construction Specifications. The weld shall be wetted with a soapy water solution and an approved vacuum testing apparatus capable of producing a minimum vacuum pressure of 5 psi. The vacuum shall be maintained for a minimum of 10 seconds. If no leaks (as indicated by a stream of bubbles) are detected, the vacuum will be released and the vacuum box advanced. A minimum overlap of 3 inches between tests shall be maintained. The

procedures described in specification sections 02597 and 02598 shall be followed where vacuum testing is not feasible.

The INSTALLER's Technician performing vacuum testing shall mark the date, technician identification, and a notation of the test result (e.g. VT OK for a passing test) on the geomembrane for all vacuum tests performed.

The RM, or his designee, shall monitor vacuum testing. The RM shall record at a minimum the project identification, the date, the repair number, the seam, or portion of seam, the technician identification and the test results for all vacuum testing.

13.7.3.6.4 Leak Testing

A geomembrane leak location survey shall be performed in the cell geosynthetic barrier layer as described in Section 02597 of the Construction Specifications.

13.7.3.7 Geomembrane Seam Destructive Testing

Destructive testing of fusion and extrusion welding shall be performed at a minimum rate of one (1) per 500 linear feet of weld for each welding machine, or as directed by the RM, to evaluate seam strength. This minimum frequency shall be determined as an average taken from the total linear footage of seaming, per machine, at the end of the geomembrane installation. Test locations shall be determined during seaming and may be prompted by the suspicion of overheating, contamination, offset welds, or any other potential cause of inadequate welding.

The RM will ensure that sufficient destructive test samples are taken for each machine to meet Specifications. The RM shall assign each destructive test sample with a unique identification number, and mark and document the location of the sample. The sample shall be approximately five (5) feet long, and will be divided into three sections. Each section shall be marked with the destructive sample identification number, the seam number, machine and Seamer identification, the machine temperature and speed, and the date.

The INSTALLER shall remove the sample in a timely manner, and repair the resulting defect. One, 1-inch wide test strip shall be cut from each end of the sample to be tested in the field as specified for peel adhesion. If the test strips pass, the installer shall cut the sample into three sections as indicated. One section will be retained as an archive by the INSTALLER, one section will be shipped to the Geosynthetics CQA Laboratory for testing, and the third will be retained as an archive by the OWNER. If one of the test strips fails, the sample shall be considered a failure and the seam should be repaired in accordance with 13.8.3.5 of the CQA Plan.

13.7.3.8 Laboratory Destructive Testing

Laboratory destructive testing shall include bonded seam strength (shear) and peel adhesion. The minimum acceptable values for these tests are shown in the table included in the Construction Specification Sections 02597 and 02598. A minimum of five coupons shall be tested for both peel adhesion and shear seam strength, with the coupons being selected alternatively by test from the sample. A passing test shall meet the minimum acceptable values and FTB (Film Tear Bond) in at least four of five coupons for each test method. Seam separation shall not extend more than 25% into the seam. Seam separation greater than 25% into the seam shall be considered failing. In the event of a destructive test failure, the Installer has two options:

- The Installer can cap or remove the failed seam between two passing destructives.
- The Installer can have the RM mark additional samples along the welding path a minimum of 10 feet from the failed test in each direction. These samples shall be

marked, removed, and tested as indicated above. If both tests pass, the failed seam between the passing destructives shall be capped or removed. If one or both of the samples fail, the process is repeated until passing tests are achieved on both sides of the original failure to establish the area of failed seam to be capped or removed.

All acceptable repaired seams must be bound by a passing laboratory destructive tests on each end. Laboratory destructive samples must come from field seaming, and shall be tracked back to previous days welding if necessary. Trial welds shall not be used for destructive samples to bind failed seaming.

13.8 Geocomposite Drainage Layer

13.8.1 Introduction

The purpose of this section is to describe the CQA monitoring, testing, and documentation requirements for the geocomposite drainage layer of the containment cell and final cover system at the Site. The geocomposite drainage layer requirements are contained in Section 02418 of the Specifications.

13.8.2 Pre-Installation

13.8.2.1 Manufacturer's QC Certification

The CONTRACTOR shall provide the PM and RM with copies of the Manufacturer's QC Certificates for the material supplied to the project. The PM and RM shall review these certificates to verify that the material properties comply with the Construction Specifications. Material properties and Manufacturers Quality Control testing frequencies for the geocomposite drainage layer are contained in Section 02418 of the Construction Specifications.

13.8.2.2 Inventory, Storage, and Handling

The CONTRACTOR shall be responsible for the proper storage and handling of the material. The CONTRACTOR shall designate and prepare a geocomposite drainage layer storage area prior to the arrival of the material. This area should be readily accessible, and shall provide the geocomposite with adequate protection against dirt, mud, sharp objects, impact, and other possible sources of damage. Upon arrival, the CONTRACTOR shall unload the geocomposite in such a manner as to minimize the risk of damage to the material, and place the rolls in the prepared storage area.

The RM shall verify that the geocomposite storage area is adequate. The RM shall perform a physical inventory of all geocomposite delivered to the site for use in the cell construction and final cover system, and shall record the project identification, the date of arrival, the method of transport, the manufacturer's roll number, the condition of each roll on arrival, and all damage caused during unloading. Each roll shall be marked or tagged with the following information: manufacturer's name; project identification; lot number; roll number; and roll dimensions. The RM shall verify that the material delivered corresponds to the Certificates. Any damaged rolls may be rejected. Rejected material is to be removed from the site or stored at a location separate from accepted rolls until they can be removed from the site. Geocomposite rolls, which do not have proper manufacturer's documentation, must also be stored at a separate location, until all documentation has been received and approved.

13.8.2.3 CQA Conformance Testing

The RM shall collect and ship samples of the geocomposite for CQA geosynthetics laboratory testing as soon as practicable after delivery. Samples shall be 3 feet long in the machine direction

by the width of the roll, and shall not be taken from the first 3 feet of the roll. The RM shall mark each sample with the Manufacturer's roll number and an arrow indicating the machine direction. Conformance testing of geocomposite shall be performed in accordance with the Construction Specifications. Material properties and Quality Assurance conformance testing frequencies for the geocomposite are located in Section 02418.

Upon receipt of CQA test results, the RM shall verify that the material meets project specifications. Should the material fail to meet project specifications, the RM shall notify the DESIGNER. The RM shall obtain and ship additional conformance test samples from the closest numerical rolls to the rejected material. Should either or both of these samples fail to meet project specifications, the CONTRACTOR shall continue to test the next closest numerical rolls until passing conformance tests bound the failed material. Failed material shall be removed, by the CONTRACTOR, from the site, or stored at a location separate from accepted rolls until they can be removed from the site. The cost of all additional testing, and replacement of all non-conforming material shall be borne exclusively by the CONTRACTOR.

13.8.3 Installation

13.8.3.1 Deployment

Prior to the installation of the geocomposite, the RM will monitor that all lines and grades have been verified by the contractor and that the geomembrane has been installed in accordance with the specifications and all associated documentation has been completed.

During the placement of the geocomposite, the RM (or his designee) shall observe deployment, record all defects and defect corrective actions (panel rejected, patch installed, etc.). The RM shall verify that corrective actions are performed in accordance with the specifications. The RM shall monitor that equipment used does no damage the geocomposite by handling, equipment transit, leakage of hydrocarbons, or other means. The crews working on the material shall not smoke, wear shoes or engage in activities that could damage the geocomposite. The geocomposite shall be securely anchored to prevent movement by the wind. Adjacent panels shall be installed in accordance with the specifications. The RM shall examine the geocomposite after installation to ensure that no potentially harmful foreign objects are present.

The RM (or his designee) shall inspect the completed work for holes, tears, small defective areas, large wrinkles, bridging, and any other defect and shall verify that repairs are made in accordance with project specifications. The repair procedures for the geocomposite include patching, used to repair large holes, tears, and small defective areas, and removal, used to replace large defective areas where patching is not appropriate.

13.9 HDPE Pipe

13.9.1 Introduction

This section describes CQA procedures for high-density polyethylene (HDPE) pipe installations. Perforated and solid HDPE pipe will be utilized to construct the leachate collection and recovery system. CQA for the HDPE pipe installations shall be performed to verify that HDPE pipe systems are installed in accordance with the design. Construction shall be conducted in accordance with the project permit drawings and specifications.

To monitor compliance, the RM will: (1) review the contractor's quality control submittals; (2) monitor construction testing; and (3) monitor installations. All construction testing shall be conducted in accordance with the project technical specifications.

13.9.1.1 Delivery

Upon delivery of the HDPE pipe, the RM Monitor will:

- Observe pipe for damage during shipping and handling. Identify damaged materials and document that damaged materials are set aside.
- Document that all manufacturing documentation required by the specifications has been received.
- Monitor that pipe out-of-roundness does not occur due to excessive stacking heights when the pipe is stored at the site.

Damaged pipe or pipe sections shall be rejected. If rejected, document that pipe is removed from the site or stored at a location, separate from accepted pipe. Pipe that does not have proper manufacturer's documentation must be stored at a separate location, until all documentation have been received, reviewed, and accepted.

13.9.1.2 Conformance Testing

No conformance testing is required for HDPE pipe. The RM shall review manufacturer's certifications.

13.9.1.3 Pipe Installation and Welding

During pipe installation and welding, the RM will:

- Monitor that the pipe is not damaged during handling operations.
- Monitor that the pipe is not damaged by sharp rocks or excessive abrasion when the pipe is pulled into place during fusion welding and installation operations.
- Before pipe fusion welding operations and installations verify that solid walled pipe, perforated pipe, fittings, and flanged couplings comply with product requirements of the technical specifications.
- Monitor that certified fusion-welding operators will be performing the welding.
- Monitor that caution is taken to prevent water from coming in contact with the pipe and heater plates during welding operations. A shelter may be required for the fusion-welding machine to allow operations to continue in adverse weather conditions.
- Monitor that inside and outside of the pipe ends are cleaned to remove dirt, water, grease, and other foreign material.
- Monitor that pipe ends are squarely faced with the facing tool of the fusion-welding machine.
- Monitor that pipe ends line up in the fusion-welding machine and that the pipe ends meet squarely and completely over the entire surface to be welded. Monitor at this point that the pipe is securely clamped into place so that the pipe does not move during the fusion welding process.
- Monitor that the heater plate is clean and maintains the appropriate temperature. Monitor that the heater plate is inserted between the aligned pipe ends and that the pipe ends are firmly brought into contact with the heater plate. NO PRESSURE shall be applied to achieve the melt pattern.

- Monitor that the pipe ends are allowed to heat and soften. As the pipe heats and softens a melt bead begins to roll back from the contact point of the heater plate and the pipe ends.
- Monitor that the heater plate is removed quickly and cleanly when the appropriate melt bead is achieved and that no melted pipe material sticks to the heater plate. If melted material sticks to the heater plate, Monitor that this joint is discontinued, the heater plate is cleaned, the pipe ends are re-faced, and that the joint is re-started.
- Monitor that the melted pipe ends are rapidly joined together and that enough pressure is applied to the joint to form a melt bead 1/8-inch to 3/16-inch in diameter around the entire circumference of the pipe. Pressure is critical to cause the heated material of each pipe end to flow together.
- Monitor that the joint is allowed to cool and solidify properly before the pipe is released from the fusion-welding machine. Cooling and solidification is completed when your finger can remain comfortably on the bead.
- Examine the joint when the pipe is released from the fusion-welding machine to verify that the weld is completely around the entire circumference of the pipe.

13.9.1.4 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the pipe Installer using the pressure test procedures given in ASTM C924 under the observation of the RM.

13.9.1.4.1 Segment Testing

Prior to the installation of the polyethylene piping, the installer will perform a pressure test using the following procedures:

- Similar sizes of polyethylene piping shall be butt welded together into testing. Segments shall be fitted with a cap on one end and testing apparatus on the other.
- The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test.
- The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes that will occur during temperature fluctuations.
- The test pressure shall be a minimum of 20 psi.
- The allowable pressure drop observed during the test shall not exceed 1 percent of the testing gauge pressure over a period of 1 hour. This pressure drop shall be corrected for temperature changes before determining pass or failure.
- The RM shall be notified before testing procedure and shall have the option of being present during the test.

The CONTRACTOR shall furnish the equipment for this testing procedure. This shall consist of a polyethylene flange adaptor with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 2l2°F (0 to 100°8C), a pressure gauge 0 to 20 psi (0 to 1 kg/cm^2), a. "tire valve" to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested.

13.9.1.4.2 Test Failure

- The following steps shall be performed when a pipe segment fails the 1 percent - 1 hour test:
  - The pipe and all fusions shall be inspected for cracks, pinholes or perforations.
  - All blocked risers and capped ends shall be inspected for leaks.
  - Leaks shall be verified by applying a soapy water solution and observing soap bubble formation.
- All pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe.
- After all leaks are repaired, a retest shall be performed in accordance with Section 13.10.1.4.

13.9.1.4.3 Test Reporting

All testing shall be reported by the CONTRACTOR to the RM and shall include the following information:

- Date
- Test time start and stop
- Testing pressures at start and stop
- Person performing test
- Test results

13.10 Surveying

Surveying of lines and grades will be conducted in accordance with the requirements of Section 01050 of the Specifications. The CONTRACTOR shall maintain at the Work Site a complete, accurate log of control and survey work as it progresses.

Upon completion of each phase of work requiring services of the Surveyor, the CONTRACTOR shall submit to the PM and RM Record Drawings and survey notes signed by the Surveyor stating that elevations and locations of site-constructed features are in conformance, or non-conformance with Contract Documents.

Upon completion of the work, all Record Drawings must be submitted to the OWNER under provisions of Project Record Documents (Section 01564) by the CONTRACTOR.

13.11 Plan Modification Procedure

Should this CQA Plan require modification, the proposed change shall be submitted in writing to the DESIGNER and the OWNER for review. A letter requesting approval of the change will be submitted to the MDE Solid Waste Program if the proposed modification is deemed appropriate. An addendum shall be attached to copies of the CQAP following receipt of approval from MDE.

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SECTION 14

TECHNICAL SPECIFICATIONS

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PART 1 - GENERAL

1.1 Description of Work

Work under this Section includes all surveying services required for accurate location of all features of construction, and for establishing proposed grades and elevations.

1.2 Quality Control

CONTRACTOR is responsible for all surveying necessary for control of its work at the Site. His Surveyor shall be a qualified and Registered Land Surveyor in the State of Maryland. This Surveyor shall also have a minimum of two (2) years experience in Construction Surveying layout, and maintenance of Record Drawings, with a record of performing horizontal and vertical control requirements as stated in the Contract.

1.3 Submittals

A. CONTRACTOR shall submit Name, address, and telephone number of Surveyor to OWNER before starting survey work.
B. CONTRACTOR shall submit to QAC, on request, documentation verifying accuracy of survey work.

1.4 Survey Requirements

A. CONTRACTOR shall utilize existing control points and establish new control points as needed to complete work under this Section.
B. CONTRACTOR shall provide field engineering services, and use recognized engineering survey practices.
C. Establish elevations, lines and levels. Locate and layout by instrumentation and similar appropriate means Site improvements including, roadways, stakes for grading and fill placement, utility locations, slopes, and invert elevations.
D. Periodically verify layouts by same means.

1.5 Survey Tolerances

Grading Tolerances shall be as defined in Division 2 of these specifications.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 Inspection

CONTRACTOR shall verify locations of Site reference and survey control points prior to starting work. QAC must be promptly notified of any discrepancies discovered.

3.2 Survey Reference Points

A. CONTRACTOR shall take measures to protect Site reference and survey control points prior to starting work, and must preserve permanent reference points during construction. Site reference points may not be relocated without prior written notice to OWNER and QAC.
B. The QAC shall be immediately notified of loss, damage or destruction of any reference point, or relocation required because of changes in grades or other reason. CONTRACTOR shall replace disturbed survey control points based on original survey control at no additional cost to the OWNER.
C. X, Y, and Z coordinates of benchmarks and survey control points shall be determined (and recorded) with a maximum permissible error of 0.10 feet (±) in any coordinate direction.
D. All X and Y coordinates are to be referred to the Project coordinate system with an accuracy of 0.10 feet (±).
E. All Z coordinates are to be referred to nearest NGVD benchmark with an accuracy of 0.10 feet (±).

3.3 Survey Requirements

A. CONTRACTOR shall reference survey and data reference points to permanent benchmarks and record locations of survey control points, with horizontal and vertical data.
B. CONTRACTOR shall reverify layouts periodically during construction by same means.

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

A. Work under this Section includes all scheduling and administration of pre-construction and progress meetings as herein specified and necessary for the proper and complete performance of this Work.

B. Scheduling and Administration by OWNER and QAC shall include the following:

1. Record minutes, including significant proceedings and decisions.
2. Distribute copies of the Minutes to participants within five (5) working days after each meeting.

C. CONTRACTOR shall make physical arrangements for meetings. Representatives of CONTRACTOR, subcontractors, and suppliers attending the meetings shall be qualified and authorized to act on behalf of the entity each represents. QAC will ascertain that Work is expedited consistent with Contract Documents and the construction schedules.

1.2 Pre-Construction Meetings

A. The OWNER shall schedule the preconstruction conference prior to the issuance of the Notice to Proceed. The geosynthetics pre-installation meeting shall be held as soon as practicable following start of the Work.

B. Representatives of the following parties are to be in attendance at the meetings:
1. OWNER.
2. DESIGNER.
3. Quality Assurance Contractor (QAC)(may be same as DESIGNER)
4. CONTRACTOR, including Superintendent.
5. Major subcontractors.
6. Representatives of governmental or regulatory agencies, when appropriate.

C. The agenda for the preconstruction meeting shall consist of the following as a minimum:
1. Distribute and discuss a list of major subcontractors/suppliers, and a tentative construction schedule.
2. Critical work sequencing.
3. Designation of responsible personnel and emergency telephone numbers.
4. Processing of field decisions and change orders.
5. Adequacy of distribution of Contract Documents.
6. Schedule and submittal of shop drawings, product data, and samples.
7. Pay request format, submittal cutoff date, pay date, and retainage.
8. Procedures for maintaining Record Documents.

9. Use of premises, including office and storage areas, and QAC and DESIGNER requirements.
10. Major equipment deliveries and priorities.
11. Safety and first aid procedures.
12. Security procedures.
13. Housekeeping procedures.
14. Work hours.
15. Site access and laydown/storage areas.

1.3 Progress Meetings

A. Schedule regular weekly meetings as directed by the OWNER.
B. Hold called meetings as the progress of the Work dictates.
C. Representatives of the following parties are to be in attendance at the meetings:
   1. OWNER;
   2. DESIGNER, if required by OWNER;
   3. CONTRACTOR and superintendent;
   4. Major subcontractors as pertinent to the agenda;
   5. QAC, as appropriate; and.
   6. Representatives of governmental or other regulatory agencies, as appropriate.

D. At a minimum, the agenda for progress meetings shall consist of the following:
   1. Review and approve Minutes of previous meetings.
   2. Review work progress since previous meeting.
   3. Note field observations, problems, and decisions.
   4. Identify problems which impede Construction Schedule.
   5. Review submittal schedule and expedite as required to maintain schedule.
   6. Maintenance of quality and work standards.
   7. Review changes proposed by CONTRACTOR or OWNER for their effect on the construction schedule and completion date.
   8. Complete other current business.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description of Work

A. Wherever submittals are required hereunder, all such submittals by the CONTRACTOR shall be submitted to the QAC.

B. Prior to mobilization onto the Site and within five (5) calendar days after date of commencement, as stated in the Notice to Proceed;

1. CONTRACTOR shall submit final cost estimates, including Schedule of Values (Section 01026).
2. CONTRACTOR shall submit a Construction Schedule using critical path analysis. This schedule shall indicate the start and completion dates of the various stages of the Work. The schedule shall follow the same format as the Schedule of Values, Section 01026.
3. A preliminary schedule of Shop Drawing, sample, and proposed substitutes or "or equal", submittals.
4. Layout data.
5. CONTRACTOR shall submit a Health and Safety Plan (Section 01564).

C. Any details deemed by the CONTRACTOR as required for construction but not indicated on the Contract Drawings shall be submitted for review by the DESIGNER at least 10 calendar days prior to construction. Responsibility for identifying such details is the responsibility of the CONTRACTOR.

1.2 Shop Drawing Submittal

A. Whenever stipulated in the Contract Documents, or where required by the OWNER, CONTRACTOR shall furnish to the QAC, OWNER and DESIGNER for review, 4, 1 and 1 copies of each shop drawing submittal, respectively. The term "Shop Drawings" as used herein shall be understood to include detailed design calculations, shop drawings, fabrication and installation drawings, erection drawings, lists, graphs, operating instructions, catalog sheets, data sheets, and similar items.

B. All Shop Drawing submittals shall be accompanied by a submittal transmittal form.

C. Except as may otherwise be provided herein, the DESIGNER will return prints of each submittal to the CONTRACTOR with its comments noted thereon, within 15 calendar days following their receipt by the DESIGNER.

D. All CONTRACTOR shop drawing submittals shall be carefully reviewed by an authorized representative of the CONTRACTOR, prior to submission to the DESIGNER. Each submittal shall be dated and signed by the CONTRACTOR, as being correct and in strict conformance with the Contract Documents. In the case of shop drawings, each sheet shall be so dated and signed. No consideration for review by the DESIGNER of any CONTRACTOR submittals will be made for any items which have not been

so certified by the CONTRACTOR. All noncertified submittals will be returned to the CONTRACTOR without action taken by the DESIGNER, and any delays caused thereby shall be the total responsibility of the CONTRACTOR.

E. The CONTRACTOR shall present Shop Drawings at least one month before work is due to start.

1.3 CONTRACTOR's Progress Schedule Submittals

A. CONTRACTOR's initial construction schedule shall be prepared and submitted to the OWNER within 10 calendar days after date of Award of Contract OWNER-CONTRACTOR Agreement.

B. CONTRACTOR shall revise schedule, as required, and resubmit with each request for payment. Payment requests will not be processed without a revised schedule.

C. CONTRACTOR shall show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

D. CONTRACTOR shall indicate estimated percentage of completion for each item of Work at each submission.

E. CONTRACTOR shall indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by OWNER and under Allowances.

1.4 Proposed Substitutes of "Or Equivalent" Items:

A. Whenever materials or equipment are specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular supplier, the naming of the item is intended to establish the type, function, and quality required. If the name is followed by the words "or equivalent" indicating that a substitution is permitted, materials or equipment of other suppliers may be accepted by the DESIGNER if sufficient information is submitted by the CONTRACTOR to allow the DESIGNER to determine that the material or equipment proposed is equivalent or equal to that named, subject to the following requirements:

1. The burden of proof as to the type, function, and quality of any such substitute material or equipment shall be upon the CONTRACTOR.
2. The DESIGNER will determine as to the type, function, and quality of any such substitute material or equipment.
3. The DESIGNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense additional data about the proposed substitute.
4. The OWNER may require the CONTRACTOR to furnish at the CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitution.

5. Acceptance by the DESIGNER of a substitute item proposed by the CONTRACTOR shall not relieve the CONTRACTOR of the responsibility for full compliance with the Contract Documents and for adequacy of the substitute item.
6. The CONTRACTOR shall be responsible for resultant changes and all additional costs which the accepted substitution requires in the CONTRACTOR's work, the work of its subcontractors and of others, and shall effect such changes without cost to the OWNER.

B. The procedure for review by the DESIGNER will include the following:

1. If the CONTRACTOR wishes to furnish or use a substitute item of material or equipment, the CONTRACTOR shall make written application to the DESIGNER.
2. The CONTRACTOR shall certify that the proposed substitute will adequately perform the functions and achieve the results called for by the general design, be similar and of equal substance to that specified, and be suited to the same use as that specified.
3. The DESIGNER will be allowed 20 calendar days within which to evaluate each proposed substitute.
4. As applicable, no Shop Drawing submittals will be made for a substitute item nor will any substitute item be ordered, installed, or utilized without the DESIGNER's prior written acceptance of the CONTRACTOR's substitution request.

C. The CONTRACTOR's application shall contain the following statements and/or information which shall be considered by the DESIGNER in evaluating the proposed substitution:

1. The evaluation and acceptance of the proposed substitute will not prejudice the CONTRACTOR's achievement of substantial completion on time.
2. Whether or not acceptance of the substitution for use in the Work will require a change in any of the Contract Documents to adapt the design to the proposed substitute.
3. Whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty.
4. All variations of the proposed substitute for that specified shall be identified.
5. Available maintenance, repair, and replacement service shall be indicated.
6. Itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including cost of redesign and claims of other contractors affected by the resulting change.

1.5 Manufacturer's Instructions

A. When specified in individual specification sections, submit manufacturer's printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, in quantities specified for Product Data.
B. If, manufacturer's instructions and contract documents conflict, the more stringent shall govern.

1.6 Manufacturer's Certificates

A. When specified in individual specification sections, submit manufacturer's certificate to QAC for review, in quantities specified for Product Data.
B. Indicate if the material or product conforms to or exceeds specified requirements. Submit supporting reference date, affidavits, and certifications as appropriate.
C. Certificates may be recent or previous test results on material or product, but must be acceptable to the QAC.

1.7 Construction Photographs

A. Photography

1. The QAC is to provide a set of mounted, dated photographs of Site and construction throughout progress of Work acceptable to the QAC, mounted in albums.
2. Take photographs on date for each Application of Payment and as follows (as is relevant to the active construction phase):

a. Site clearing;
b. Excavation and Backfilling;
c. Access Road
d. Geosynthetics (each type, including seaming/welding);
e. Soils layers in liner system (each type);
f. Sedimentation/Stormwater Management Basin;
g. Protective cover soil;
h. Vegetative layer;
i. Buried piping;
j. Tank construction and,
j. Final completion.

B. Electronic Photographs

1. Photographs shall be chronologically numbered by month/day/year - number of photograph (i.e., 08222021_Photograph No.1).
2. Digital files of photographs shall be provided via thumb drive or CD_ROM or another platform which is readily available at the time of transfer of data.

3. Four sets thumb drives (or other QAC-approved transfer mechanism) of digital photographs shall be provided..

1.8 Soil Erosion and Sedimentation Control Plan (SESCP)

Prior to performing any soil removal or material placement, the CONTRACTOR shall submit a plan for temporary and permanent erosion control in accordance with Section 02125. The erosion control measures shown on the Contract Drawings are the minimum measures. The CONTRACTOR's SESCP shall provide detailed layout information regarding erosion control measures for each phase of construction.

1.9 Daily, Weekly, and Monthly Reports

The CONTRACTOR shall prepare daily reports summarizing on-Site activities. Daily reports shall include, as a minimum, the following:

A. Weather conditions;
B. Active work area;
C. Crew description;
D. Subcontractor activity;
E. Equipment operating;
F. Hours worked;
G. Work performed;
H. Problems;
I. Corrective actions; and,
I. Health and safety issues.

The CONTRACTOR shall also submit monthly reports describing the activity of the period. Daily reports shall be submitted the day following the report day. Monthly reports shall be submitted within 14 days of the report period.

1.10 Health and Safety Plan

The CONTRACTOR shall prepare and submit a Site-Specific Health and Safety Plan to the OWNER and QAC at least 15 calendar days prior to mobilization for construction.

1.11 Layout Data

A. General - The CONTRACTOR is responsible for coordinating work of all trades on the job. He shall confer with OWNER and provide guidance and information to all trades as required for proper progress of the work.
B. Conflicts - Where the work of two (2) trades will be installed in close proximity to each other, or where there is evidence that work of one (1) trade will interfere with another trade, CONTRACTOR shall prepare composite working drawings if directed by QAC. Such drawings shall indicate how all work is to be installed before coordinating with other trades so as to cause interference with work of other trades, shall make necessary

changes in his work to correct conditions to the satisfaction of the QAC without extra charge.

C. Procedures - If requested, by QAC, CONTRACTOR shall provide detailed drawings as required to indicate construction procedures.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

*** END OF SECTION ***

PART 1 - GENERAL

1.1 Description of Work

A. Quality Assurance and the control of construction.
B. Inspection and testing laboratory services.

1.2 Quality Assurance of Installation

A, The Owner shall appoint a Quality Assurance Consultant (QAC) to monitor and report construction activities, and the CONTRACTOR shall monitor quality control over products, services, Site conditions, and workmanship, for conformance with the Contract Documents.
B. CONTRACTOR shall comply fully with manufacturers' instructions, including each step in sequence.
C. Should manufacturers' instructions conflict with Contract Documents, the more stringent shall govern.
D. CONTRACTOR shall comply with specified standards as a minimum quality for the Work, except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
E. CONTRACTOR shall perform Work by persons qualified to produce workmanship of specified quality.

1.3 References

A. Conform to the reference standard defined in each Specification Section and the Construction Quality Assurance (CQA) Plan in effect as of the date for receiving bids.
B. Obtain copies of standards when required by Contract Documents.
C. Should specified reference standards conflict with Contract Documents, request clarification from QAC before proceeding.
D. The contractual relationship of the parties to the Contract shall not be altered from the Contract Documents by either mention or inference in any reference document.

1.4 Inspection and Laboratory Testing Services

A. The CONTRACTOR is responsible for performing and documenting Quality Control tests. OWNER will appoint, employ, and pay for services of a QAC to perform quality assurance inspection and testing. The site specific CQA Plan contains minimum testing criteria in addition to the testing defined in these Specifications. Where there is a conflict between the CQA Plan and these Specifications, the more stringent requirement will be maintained.
B. The QAC will perform inspections, tests, and services as required by the CQA Plan and the Project Specifications.

C. Reports will be submitted by the QAC to the OWNER, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

D. The CONTRACTOR, when required, shall cooperate with QAC to furnish samples of materials, design mix, equipment, tools, storage, and assistance as requested.
   1. Notify QAC 24 hours prior to expected time for operations requiring services.
   2. Make arrangements with QAC and pay for additional samples and tests required for CONTRACTOR's use.

E. Retesting or reinspection required because of non-conformance to specified requirements shall be performed by the QAC on instructions by the OWNER.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description of Work

A. The OWNER will select and employ an Independent Testing Laboratory either directly or through the QAC to perform services as required by the supplementary General Conditions and the Specifications.
B. The OWNER shall pay all charges of the Independent Testing Laboratory.
C. CONTRACTOR shall contract his own lab for Quality Control testing services. Contractor's testing laboratory may not be the same and OWNER's testing laboratory. CONTRACTOR shall be responsible for paying all charges from his testing laboratory.

1.2 Laboratory Duties

A. Cooperate with OWNER, DESIGNER, and QAC, to provide qualified personnel promptly on notice. Perform specified inspections, sampling and testing of materials and methods of construction; ascertain compliance with requirements of Contract Documents.
B. Promptly notify OWNER, DESIGNER, and QAC of irregularities or deficiencies of work which are observed during performance of services. Submit two (2) copies of reports of inspections and tests to OWNER, including:

1. Date issued
2. Project title and number
3. Testing Laboratory name and address
4. Name and signature of Inspector
5. Date of inspection or sampling
6. Record of temperature and weather
7. Date of test
8. Identification of product and Specification Section
9. Location in project
10. Type of inspection or test
11. Observations regarding compliance with Contract Documents

C. Laboratory is not authorized to release, revoke, alter or enlarge on requirements of Contract Documents; to approve or accept any portion of work, or perform any duties of the CONTRACTOR.

1.3 Laboratory Reports

A. After each inspection and test, WITHIN 72 HOURS, submit two (2) copies of laboratory report to QACand to the OWNER.
B. Include:

1. Date issued
2. Project title and number

3. Name of inspector
4. Date and time of sampling or inspection
5. Identification of product and Specifications Section
6. Location in the Project
7. Type of inspection or test
8. Date of test
9. Results of tests
10. Conformance with Contract Documents

C. When requested by OWNER or QAC, provide interpretation of test results.

1.4 CONTRACTOR's Responsibility

A. Cooperate with Laboratory personnel and provide access to work.
B. Provide to Laboratory, preliminary representative samples of materials to be tested, in required quantities.
C. Furnish casual labor and facilities to provide access to work to be tested, to obtain and handle samples at the site, and to facilitate inspections and tests.
D. Notify Laboratory sufficiently in advance of operations to allow for his assignment of personnel and schedule of tests.
E. Arrange with Laboratory, and pay for, any additional samples and testing required for CONTRACTOR's convenience.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

The CONTRACTOR shall furnish temporary construction facilities as required for the use of all trades during the construction period.

1.2 Access and Parking

Provide and maintain adequate and safe access to site and work. All construction personnel must park in designated areas.

1.3 Trash Removal

Provide one (1) or more dumpsters for trash. Each CONTRACTOR, including all subcontractors, shall pick up accumulated trash and debris daily and deposit it in dumpster. CONTRACTOR to empty dumpster as often as necessary, and dispose of all trash and waste materials off Site.

1.4 Temporary Sanitary Facilities

Provide and maintain chemical type self-contained temporary toilet accommodations on the premises for use of workmen employed during the building operation. There shall be one toilet for every five (5) workers in each work zone. After completion of the project, they shall be removed. The temporary toilets shall be enclosed and weather-proof and kept in a sanitary condition at all times.

1.5 Temporary Utilities

The CONTRACTOR shall provide all temporary electric, water and lighting utilities necessary for the proper performance of the Work.

1.6 Construction Field Office

A. The CONTRACTOR shall provide a construction field office with appropriate furnishings, for use by the QAC, OWNER, and regulatory agencies, as needed.
B. The field office for the QAC and OWNER shall include electric power and suitable telephone service.
C. The CONTRACTOR shall provide appropriate ventilation/heating to provide comfortable working conditions for QAC and OWNER personnel.

1.7 Removal of Utilities, Facilities, and Controls

A. Remove temporary above-grade or buried utilities, equipment, facilities, materials, prior to Final application for Payment inspection.

B. Remove temporary underground installations outside of the limit of the landfill to a minimum depth of two (2) feet. Grade site when indicated to promote positive drainage.
C. Clean and repair damage caused by installation or use of temporary work.
D. Restore existing facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

1.8 Protection of Existing Utilities and Facilities

A. Protect and maintain in-service all existing utilities.
B. Do not allow utility and service outages.
C. Provide temporary services, where required, to provide uninterrupted utility services for on-going site operations.
D. Prevent damage to existing facilities structures and buildings - repair damage or replace immediately on direction of OWNER.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Barricades, Lights and Signals

A. The CONTRACTOR shall furnish and erect such barricades, fences, lights, and danger signals, and shall provide such other precautionary measures for the protection of persons or property and of the Work, as necessary, and to comply with Federal, State, and local regulations.

B. The CONTRACTOR will be held responsible for all damage to the Work due to failure of barricades, signs, and lights, and whenever evidence is found of such damage, the CONTRACTOR shall immediately remove the damaged portion and replace it, at CONTRACTOR's cost and expense. The CONTRACTOR's responsibility for the maintenance of barricades, signs, and lights shall not cease until the Work has been accepted by the OWNER.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

A. The CONTRACTOR shall employ construction methods and means that keep airborne particulates to the minimum, and shall provide for the application of water, or employ other appropriate preventive means or methods, to control dust, subject to the approval of the OWNER or QAC.

B. Dust control measures shall be compatible with existing on-site materials and proposed materials, and site operations.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Watering equipment shall be used to minimize airborne concentrations and shall consist of pipelines, tank trucks, or other devices approved by the OWNER or QAC, which are capable of applying a uniform spread of water over the ground surface. A suitable device for a positive shut-off and for regulating the flow rate of water shall be located so as to permit positive operator control. Calcium chloride is not allowed for dust control.

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

The intention of this plan is to minimize traffic congestion in the area around the Site. The CONTRACTOR shall comply with all Federal, State, and local laws, and regulations that apply to the Work to be performed, including, but not limited to, all traffic laws, and vehicular weight limitations. Compliance with this Plan does not relieve the CONTRACTOR from any liability associated with traffic issues, including but not limited to accidents and fines.

1.2 Site Access

All truck traffic for the operating landfill accesses the Site from Conway Road. Temporary construction access also will be via Conway Road.

PART 2 - TRAFFIC PLAN

2.1 Limits on Volume

To minimize traffic congestion in the area around the Site, the CONTRACTOR shall limit the number of trucks entering the Site and shall not disrupt Site operations.

2.2 Off-Loading

The CONTRACTOR, in conjunction with the OWNER, shall select the areas to be used for off-loading and temporary storage of materials. These areas shall be located so that trucks can exit the public roads into the area with no delay, so that there is no impact to local traffic flow. To reduce tracking of soils back on to the roads, dumping of soils should be done in a manner that minimizes wheel contact with the soils.

2.3 Covering of Materials

All trucks used for transport of soils shall be covered with a well secured tarp before transportation on public roads. The CONTRACTOR shall take such steps as necessary to prevent spillage, wind blown deposits on the roads, and damage to other vehicles. After dumping the load at the Site, the CONTRACTOR shall inspect the truck bed for residual materials and shall remove or cover residual material before the truck is allowed to leave the Site on public roads.

2.4 Street Cleaning

The CONTRACTOR is responsible for removing soils, dirt, rock, asphalt and other deposits that accumulate on the public roads, or paved areas within the limits of the landfill that are a result of the CONTRACTOR's hauling operation. This includes windblown deposits, spillage, and trackage of materials onto the roads. Inspection of the roads is to be performed at least daily during hauling operations. When the inspection determines that cleaning is required, it shall be performed immediately. The OWNER or QAC will verify compliance with this requirement. CONTRACTOR shall maintain a street sweeper (or equal) on-site.

2.5 Flagmen

Hauling, dumping, and other operations shall be performed in such a manner that public roads and traffic flow on the roads are not impacted. If the CONTRACTOR finds, in planning and scheduling of the work, that there will be a requirement to restrict traffic flow or temporarily stop traffic, a flagman will be required.

2.6 On-Site Transportation

Movements of trucks and equipment within the Site boundary are not limited in volume. However, the work is to be performed in a manner such that public streets and the business operations on-site are not adversely impacted. The CONTRACTOR shall coordinate via the OWNER with business operations on-site to stage the work such that on-site business activities are not adversely impacted. The control of traffic is the CONTRACTOR's sole responsibility and shall be performed in a safe and orderly manner. A speed limit of 12 MPH shall be enforced by the CONTRACTOR on all vehicles and equipment performing work on the Site.

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description of Work

A. The work under this Section includes, but is not necessarily limited to, the maintenance, recording, and submittal of Project Record Documents, as herein specified.

B. The CONTRACTOR shall maintain in designated locations at the Site for the OWNER one record copy of:

1. Drawings and Addenda.
2. Specifications and Addenda.
3. Change orders and other modifications to the Contract.
4. OWNER/QAC field orders or written instructions.
5. Reviewed shop drawings, product data and samples.
6. Field test records.
7. Manufacturer's certificates.
8. Daily work activity reports, including:

   a. Field test records;
   b. Photographs;
   c. Reports on emergency response actions;
   d. Records of all site work;
   e. Chain-of-custody documents;
   f. Laboratory test records;
   g. Meteorological records;
   h. Daily inspection records;
   i. Reports on all safety and accident incidents;
   j. Reports on all spill incidents;
   k. Air monitoring reports and data;
   l. Manifest documents, truck-load tickets and shipping papers;
   m. Security records;
   n. Other items that may be required by OWNER;
   o. Log of control and survey work.

C. Other Documents: Manufacturer's certifications, inspection certifications, field test records required by individual Specifications Sections.

D. The CONTRACTOR shall keep and maintain at the Site, one (1) set of progress drawings. On these, it shall mark all project conditions, locations, configurations, and any other changes or deviations from the details represented on the original Contract Drawings, including buried or concealed construction and utility features which are revealed during the course of construction. Special attention shall be given to recording the horizontal and vertical location of all buried utilities that differ from the locations indicated, or which were not indicated on the Contract Drawings. The Record Drawings shall be supplemented by any detailed sketches, as necessary or directed, to fully indicate, the Work as actually constructed. These progress drawings of the CONTRACTOR's representation of

as-built conditions, including all revisions made necessary by addenda, change orders, and the like shall be maintained up-to-date during the progress of the Work. Progress plans shall be accurate and certified by a Registered Land Surveyor and a Professional DESIGNER licensed to practice in the State of Delaware.

E. Progress drawings shall be accessible to the QAC at all times during the construction period and shall be delivered to the QAC upon completion of the Work.

F. Upon Substantial Completion of the Work and prior to final acceptance, the CONTRACTOR shall complete and deliver twelve (12) complete sets of record drawings to the QAC, conforming to the construction records of the CONTRACTOR. This set of drawings shall consist of corrected drawings showing the reported location of the Work. The information submitted by the CONTRACTOR and incorporated by the QAC into the Record Drawings will be assumed to be reliable, and the QAC will not be responsible for the accuracy of such information, nor for any errors or omissions which may appear on the Record Drawings as a result.

1.2 Maintenance of Documents and Samples

A. Storage

1. Store documents and samples in CONTRACTOR's field office apart from documents used for construction.
2. Provide files and racks for storage of documents.
3. Provide locked cabinet or secure storage space for storage of samples.

B. File documents and samples in accordance with format of these Specifications.

C. Maintenance

1. Maintain documents in a clean, dry, legible condition and in good order.
2. Do not use record documents for construction purposes.

D. Make documents and samples available at all times for inspection by OWNER, QAC, and DESIGNER.

1.3 Recording

A. Label each document "PROJECT RECORD" in neat, large printed letters.

B. Recording

1. Record information concurrently with construction progress.
2. Do not conceal any work until required information is recorded.

C. Drawings: Progress drawings shall be reproducible, shall have a title block indicating that the drawings are record drawings, the name of the company preparing the progress drawings and the date the progress drawings were prepared. The CONTRACTOR will be provided paper sepias of the Contract Drawings, at the cost of reproduction, or he may elect to provide reproducible drawings via another method. Legibly mark drawings to record actual construction:

1. Field changes of dimension and detail.
2. Changes made by Requests for Information (RFI), field order or by change order.
3. Details not on original Contract Drawings.

D. Specifications: Legibly mark each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Requests for Information (RFI), field order or by change order.

1.4 Submittal

A. At Contract closeout, deliver record documents in the form of a Final Construction Report to the OWNER.
B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date
2. Project title and number
3. CONTRACTOR's name, address, and telephone number
4. Title and number of each record document
5. Signature of CONTRACTOR's authorized representative.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

Not Used

***** END OF SECTION *****

PART 1 - GENERAL

1.01 Description of Work

A. Furnish all labor, materials, tools, equipment and appurtenances required for the cleaning and testing of piping for the landfill gas headers and laterals, compressed air lines, landfill gas condensate sump, leachate force main, and other piping systems installed by the CONTRACTOR as specified herein and in other Sections of these Specifications.

1.02 References

A. National Fire Protection Association (NFPA)

1. NFPA 54 - National Fuel Gas Code
2. American Water Works Association Standard C600-77.

1.03 Submittals

A. Submittals shall include proposed cleaning and testing procedures, including test medium and pressure, line segments and equipment included in the test, methods of isolating sections of the system, pressure monitoring techniques, and the testing certification form to be submitted to the QAC.

PART 2 - PRODUCTS

2.01 General

A. Detergents, solvents, and other cleaning or testing materials shall be compatible with the materials of fabrication of the systems in which they are used. They shall not adversely affect the materials or mechanisms in the systems, and they shall be acceptable to equipment manufacturers/vendors. Detergents, solvents, and other cleaning agents shall also be non-flammable and compatible with the process streams to be handled by the systems in which they are used and shall not contain any chlorinated solvents.

B. Materials including blinds, gaskets, bolts, flanges, caps, gauges, valves, and other equipment used in isolating segments of systems shall be compatible with the systems being cleaned or tested.

2.02 Test Mediums

A. The CONTRACTOR shall furnish all equipment, necessary piping, required labor and expenses to test piping systems. Test medium shall be as specified herein.

2.03 Test Equipment

A. The CONTRACTOR shall furnish all labor and equipment, including required pumps, vacuum pumps and compressors with regulated bypass meters, valves, blind flanges, plugs, chart recorders, and gauges, for conducting of the piping tests. Gauges and chart recorders shall be calibrated to a National Bureau of Standards traced standard. Gauges and chart recorders shall have divisions not exceeding 2 percent of the test pressure.

PART 3 - EXECUTION

3.01 Cleaning

A. The CONTRACTOR shall provide and install temporary connections, strainers, and other equipment to thoroughly clean the piping systems before start-up in accordance to the Plan submitted in Part 1.03 of this section. The QAC shall visually observe a clean piping system free of shavings and/or other debris prior to start-up. The CONTRACTOR shall collect and dispose of all shavings, debris and other materials as directed by the QAC and shall remove all temporary connections and strainers after cleaning is complete.

B. Piping shall be cleaned just prior to installation and again prior to start-up. Cleaned piping material shall be protected against contamination by sealing open ends with clear plastic sheets, metal foil, or other approved materials.

3.02 Testing

A. Upon completion of piping installation, but prior to covering concealing or burying piping, the CONTRACTOR shall test all newly installed landfill gas piping, landfill gas condensate sump, compressed air lines, landfill gas condensate piping systems, and leachate force mains.

B. The timing and sequence of testing shall be scheduled by the CONTRACTOR, subject to the favorable review by the QAC. The CONTRACTOR shall provide the QAC two (2) working days notice prior to testing.

C. Utilize vacuums, media, and test duration as specified herein.

D. Isolate equipment, which may be damaged by the specified test conditions.
E. Perform vacuum / pressure tests using calibrated pressure gauges. Select each gauge so that the specified test vacuum falls within the upper half of the gauge's range.
F. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing piping systems.
G. All piping (in a completed system) shall be vacuum / pressure tested to 1.5 times the maximum pressure / vacuum that can be applied by the blower / compressor / pumps in place, in the presence of the QAC, in accordance with the method approved in Part 1.03(A), for a period of 1 hour with less than 10 percent loss of pressure / vacuum.
H. No pipe installation will be accepted should there be evidence of exterior surface damage to the pipe that, in the option of the QAC, may compromise the integrity of the piping system, even though it may pass the testing requirements
I. All tests shall be made before piping is painted, covered, or otherwise concealed. The CONTRACTOR, at the CONTRACTOR's own expense, shall uncover and retest any piping not satisfactorily tested in the presence of the QAC. Testing shall be conducted after laying or modifying of the piping systems and prior to backfilling and then repeated after final grading.
J. The testing requirements for the respective systems shall include all those of NFPA 54, and applicable Laws and Regulations. All code-required inspection certificates shall be furnished to the QAC.
K. The CONTRACTOR shall collect and dispose liquids used for testing in accordance with Section 02402 of these Specifications.

3.03 Pipe Test Schedule

A. Upon completion of each piping system or sub-system, clean and test the lines. All piping shall be tested:
    1. After completion of a section or subsection prior to backfilling of trench
    2. After completion of entire system after installation of any heat tracing and insulation cover.
B. Repair and retest any piping system found to be leaking until results are satisfactory to the QAC.

3.04 Repairs

A. The point or points of leakage shall be sought out and remedied by the CONTRACTOR at the CONTRACTOR's expense.
B. All repairs will be observed by the QAC.
C. Repair methods must be satisfactory to the QAC.

3.05 Final Acceptance

A. No pipeline installation or hydraulic structure will be accepted until all leaks have been repaired and retested in accordance with Section 3.02 of this Specification. All repairs will be observed by the QAC.

B. The CONTRACTOR shall provide the QAC with written certification and test charts clearly identifying location of pipe being tested of equipment/system cleaning and testing in accordance with this Section. All test data and documentation shall be provided to the QAC as part of the written certification.

*****END OF SECTION*****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the work as described below. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. This Section describes materials and equipment to be utilized, and requirements for their use, in preparing the work site for construction.

C. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State or Federal authorities having jurisdiction.

D. Remove and dispose of all debris, bulky items, waste materials, etc., existing in the area to be constructed and encountered on the surface. All bulky items such as large debris, stumps, cars, old fencing, etc. are to be disposed off-site at CONTRACTOR's expense.

E. Protect and maintain benchmarks, monuments, and other reference points. Re-establish, at no cost to the OWNER, any such reference points disturbed or destroyed. The CONTRACTOR's surveyor shall conduct a survey of all monuments and property markers within proposed work areas prior to any disturbance such that they can be re-established by the CONTRACTOR after completion of the Work.

F. Remove, demolish, excavate, haul, and dispose of any on-site structures, pavement, roads, drainage pipes, utilities, etc. per Section 1.1D, above.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all materials, labor, equipment, tools and appurtenances required to complete the work as described below. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Site clearing and grubbing includes, but is not limited to, removing from within the limits of work and disposing of trees, stumps, roots, brush, structures, abandoned utilities, trash, asphalt, debris, and all other materials found on or near the surface of the ground in the construction area. Precautionary measures that prevent damage to existing features that are to remain are part of the work.

C. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

D. No clearing and grubbing will be allowed without adequate erosion and sedimentation control measures in place and to the satisfaction of the DESIGNER.

1.2 Job Conditions

Location of the Work: The area to be cleared and grubbed includes all areas designated for cell, access road, channel, and sedimentation basin construction, excavation, and required construction access areas.

PART 2 PRODUCTS

The CONTRACTOR shall furnish equipment of the type normally used in clearing and grubbing operations, including, but not limited to, dozers, shears, skidders, loaders, root rakes, chipping equipment, and stump grinders.

PART 3 EXECUTION

3.1 Scheduling of Clearing

A. The CONTRACTOR shall install all temporary elements and features required by the CONTRACTOR's Soil Erosion and Sedimentation Control Plan, as approved by the DESIGNER, prior to start of clearing operations.

B. The CONTRACTOR shall maintain all survey controls.

3.2 Clearing and Grubbing

A. Materials to be cleared, grubbed, and removed from the construction areas include, but are not limited to, trees, stumps, roots, brush, trash, organic matter, miscellaneous structures, debris, and abandoned utilities.

B. Grubbing shall consist of completely removing roots, stumps, trash, and other debris from all graded areas so that surface material is free of these materials. Surface material is to be left sufficiently clean so that further picking and raking will not be required.

C. All stumps, roots, foundations, and other debris in the ground shall be removed and disposed in a manner and at locations approved by the DESIGNER.

D. Surface rocks and boulders shall be grubbed from the soil and removed to an on-site disposal area designated by the OWNER.

E. All construction areas shall be grubbed.

F. Where tree limbs interfere with utility wires, or where the trees to be felled are in close proximity to utility wires, the tree shall be taken down in sections to eliminate the possibility of damage to the utility. The CONTRACTOR shall be responsible for damages to utilities, and shall replace/repair damaged utilities at no cost to OWNER.

G. Any work pertaining to utility poles and guy wires shall comply with the requirements of the appropriate utility.

H. Stumps and roots shall be grubbed and removed to a depth not less than 2-feet below grade. All holes or cavities extending below the subgrade surface elevation in the proposed work shall be filled with crushed rock or other suitable material and compacted to a similar density as the surrounding material.

I. The CONTRACTOR shall exercise special precautions for the protection and preservation of trees and shrubs situated adjacent to the limits of the construction area. The CONTRACTOR shall be held liable for any damage the CONTRACTOR's operations have inflicted on such property.

J. The CONTRACTOR shall be responsible for all damages to existing structures and/or improvements resulting from CONTRACTOR's operations.

3.3 Disposal of Debris

A. All wood debris (stumps, roots, branches, and leaves) resulting from the clearing and grubbing operation shall be disposed by either landfilling or processing and on-site staging, i.e., chipping to produce mulch, or by other methods, as approved by DESIGNER, in accordance with the Specifications and placed in an on-site location designate by the OWNER. No open burning is allowed unless authorized by the Maryland Department of the Environment or Anne Arundel County.

B. All large debris, pipe, large metal objects, and bulky items will be removed and hauled to an off-site disposal facility approved by the OWNER. Debris consistent with the waste materials that are approve for placement in the proposed landfill cell, may be staged at a location acceptable to the OWNER until disposal space in a lined waste disposal area becomes available.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all materials and promptly take all actions necessary to achieve effective erosion and sedimentation control in accordance with all applicable Federal, State, and local enforcing agency guidelines, and these Specifications. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The work shown on the Permit Drawings shall be considered a minimum requirement. The CONTRACTOR shall take all steps necessary to control soil erosion and sedimentation resulting from the Work.

C. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

D. CONTRACTOR shall repair any material or existing surface conditions damaged by erosion or covered with sedimentation at the CONTRACTOR's expense.

E. Erosion control measures shall be provided by the CONTRACTOR for all construction activities in the Chesapeake Terrace Rubble Landfill area, as well as other related work throughout the Site. The CONTRACTOR shall maintain on-site at least 20% overstock of erosion control materials for the active construction phase, to replace or repair installed erosion and sedimentation control features, as necessary.

F. The CONTRACTOR shall maintain installed temporary erosion control features until no longer needed, as determined by the DESIGNER, or until permanent erosion control features are completed and accepted by the OWNER.

G. It shall be the sole responsibility of the CONTRACTOR to properly schedule and coordinate all necessary labor, equipment, and materials, such that the specified work is performed in accordance with the project schedule and the Contract requirements. At the discretion of the DESIGNER, the DESIGNER may reject, or direct the CONTRACTOR to repair (at the CONTRACTOR's sole expense), those items which are detrimental to the project or not in compliance with the Contract Documents. Such direction or rejection by the DESIGNER shall not relieve the CONTRACTOR of his obligation to properly schedule and perform other specified work items in conformance with the Contract Documents.

1.2 Submittals

At the preconstruction meeting, the CONTRACTOR shall submit for the DESIGNER's approval, a Soil Erosion and Sedimentation Control Plan which will include, but is not limited to a schedule and construction drawing(s) for installation and construction of temporary and permanent erosion control work,

as are applicable for clearing and grubbing, grading, structures at watercourses, and general construction. No work shall be started until the erosion control schedules and methods of operation for each phase of construction have been accepted by the DESIGNER. This plan will be referred to as the CONTRACTOR's Soil Erosion and Sedimentation Control Plan. The CONTRACTOR's Soil Erosion and Sedimentation Control Plan shall conform to the requirements of "Maryland Erosion and Sedimentation Control Handbook".

PART 2 PRODUCTS

2.1 Silt Fence

Silt fence shall be Filter X, Mirafi 100X, Stabilinka T140N, or approved equal.

2.2 Bales

Bales shall be oat or wheat straw that are clean and seed free.

2.3 Seed

Seed type shall meet the requirements of Section 02936 "Seeding".

2.4 Temporary Erosion Control Mat

Temporary Erosion Control Mat shall be Landlok BonTerra CS2, Erosion Control Systems, Inc.'s High Impact Excelsior Mat, or approved equivalent.

2.5 Riprap

Stone riprap shall consist of hard, durable, subangular material as specified in section 02271-Stone Riprap. It shall be free from any considerable amount of flat, laminated or elongated particles; and shall be free from cracks, overburden shells, clay, organic matter, or other deleterious matter.

PART 3 EXECUTION

3.1 General

A. Conduct earthwork and excavation activities in such a manner to fit the topography, and soil type and condition.
B. Minimize the area being disturbed, and the exposure duration of features subject to erosion.
C. Stabilize disturbed areas immediately.

D. Retain sediment generated on-site. Place sediments under cover, after dewatering, during construction, and dispose of unsaturated sediments as daily cover at the landfill.

E. Prevent silt and sedimentation from entering any watercourse, if soil erosion cannot be prevented.

F. Prevent silt and sediment from migrating downstream, in the event it cannot be prevented from entering a watercourse.

G. Where provisions of pertinent rules and regulations conflict with these specifications, the more stringent provisions shall govern.

H. The DESIGNER has the authority to limit the surface area of erodible material exposed by clearing and grubbing, and to direct the CONTRACTOR to provide immediate temporary or permanent control measures to prevent sediment impact on adjacent watercourses, and off-site property.

I. Where erosion is likely to be a problem, clearing and grubbing operations should be scheduled and performed so that grading operations and permanent erosion control features can follow immediately thereafter, if the project conditions permit; otherwise, erosion control measures may be required between successive construction stages. Under no conditions shall the total aggregate erodible surface area (such as exposed soil or erodible material without vegetation or erosion protection) resulting from clearing and grubbing be exposed for more than 30 calendar days without approval by the DESIGNER.

J. The CONTRACTOR will limit the area of active operations commensurate with their ability to maintain temporary and permanent Sedimentation and erosion control measures.

K. In the event that additional temporary erosion and sedimentation control measures are required due to the CONTRACTOR's negligence, carelessness, or failure to install permanent controls as a part of the work schedule, and are ordered by the DESIGNER, such work shall be performed by the CONTRACTOR at the CONTRACTOR's expense, and no time extension shall be given.

3.2 Temporary Erosion and Sedimentation Control

A. Temporary erosion control measures shall be used to correct conditions which develop during construction that lead to soil erosion or deposition of waterborne sediments, are needed prior to installation of permanent erosion control features, or are needed temporarily to control erosion that develops during normal construction practices, but are not associated with permanent control features on the Project.

B. Temporary erosion and sedimentation control devices shall be installed and maintained prior to the initial land disturbance activity until the satisfactory completion and establishment of permanent erosion control measures. At that time, temporary devices shall be removed.

C. The CONTRACTOR shall coordinate the installation of temporary erosion and sedimentation control provisions contained herein with the permanent erosion control features, to ensure economical, effective, and continuous erosion control throughout the construction and post-construction period.

D. Temporary erosion and sedimentation control procedures should be initially directed toward preventing silt, and sediment from entering the watercourses. The preferred method is to provide an undisturbed natural buffer, extending a minimum of 5-feet from the top of the bank, to filter the run-off.

E. Silt fences, barriers, temporary sedimentation basins and other temporary measures and devices shall be installed, and shall be maintained until no longer needed, as determined by the DESIGNER. The CONTRACTOR shall remove temporary erosion and sedimentation control features, when no longer required. All temporary items and devices must be removed, with the DESIGNER's approval, prior to final demobilization from the Site.

F. Where permanent vegetation is not appropriate, and where the CONTRACTOR's temporary erosion and sedimentation control practices are inadequate, the CONTRACTOR shall provide temporary vegetative cover. The CONTRACTOR shall provide temporary vegetative cover, in compliance with Section 02936 "Seeding" of these Specifications.

G. All erosion and sedimentation control devices shall be inspected by the CONTRACTOR at least weekly, and after each rain event, and cleaned out and repaired by the CONTRACTOR, as necessary.

3.3 Temporary Erosion and Sediment Control Techniques

A. *Temporary Diversion Berms*

1. A temporary diversion berm is constructed of compacted soil, with or without a shallow ditch, at the top of fill slopes.
2. These diversion berms are used temporarily at the top of newly constructed slopes to prevent excessive erosion until permanent controls are installed or slopes stabilized.
3. A temporary diversion berm shall be constructed of compacted soil, with a minimum width of 24-inches at the top and a minimum height of 12-inches with or without a shallow ditch. Side slopes shall be three horizontal to one vertical (3H:1V) or flatter.

B. *Temporary Slope Drains*

1. A temporary slope drain may consist of stone downchutes, fiber mats, plastic sheets, half-round pipe, metal pipe, plastic pipe, sod or other material acceptable to the DESIGNER that may be used to carry water down slopes to reduce erosion prior to installation of permanent facilities or growth of adequate ground cover on slopes.

2. Fiber matting and plastic sheeting shall not be used on slopes steeper than 4H:1V, except for short distances of 20-feet or less.
3. All temporary slope drains shall be adequately anchored to the slope to prevent disruption by the force of the water flowing in the drains. The base of temporary slope drains shall be compacted and concavely formed to channel water or hold the slope drain in place. The inlet end shall be properly constructed to channel water into the temporary slope drain.
4. Energy dissipators, sediment basins, or other approved devices shall be constructed at the outlet end of the slope drains to reduce erosion downstream.

C. *Sediment Control Structures*

1. Sediment basins, ponds and traps, are prepared storage areas constructed to trap and store sediment from erodible areas in order to protect stream channels below the construction areas from excessive siltation.
2. Sediment structures shall be utilized to control sediment where slope drains outlet. All sediment structures shall be at least twice as long as they are wide.
3. When use of temporary sediment structures is to be discontinued, all sediment accumulation shall be removed and all excavation backfilled and properly compacted. The existing ground shall be restored to its natural or intended condition.

D. *Riprap*

Unless shown otherwise on the Permit Drawings, riprap shall be placed where ordered by the DESIGNER and at all points where banks of streams or drainage ditches are disturbed by excavation. Fill or backfill shall be carefully compacted and riprap placed to prevent subsequent settlement and erosion. This requirement applies equally to construction along side a streams or drainage ditches as well as crossing a stream or drainage ditch.

E. *Straw Bales*

1. Straw bales are temporary measures to control erosion and retain the suspended silt particles in the runoff water leaving disturbed areas. Bales shall contain five cubic feet or more of material.
2. Straw bales shall be embedded in the ground 4 to 6-inches to prevent water flowing under them. The bales shall also be anchored securely to the ground by wooden stakes driven through the bales into the ground. Bales shall be removed after they have served their purpose, as determined by the DESIGNER.

3. The CONTRACTOR shall keep the bales in good condition by replacing broken or damaged bales immediately after damage occurs. Normal debris clean-out will be considered routine maintenance.
4. Straw bales shall be used at the toe of fill slopes, in ditches, or other areas where siltation, erosion or water run-off is a problem.

F. *Silt Fences*

1. Silt fences are temporary measures utilizing woven wire or other approved materials attached to posts with filter cloth attached to the upstream side of the fence to retain the suspended silt particles in the runoff water.
2. Temporary silt fences shall be placed on the natural ground, at the toe of fill slopes, in ditches or other areas where siltation is a problem. Temporary silt fences shall be anchored as indicated on the Permit Drawings.
3. The CONTRACTOR shall be required to maintain the silt fence in a satisfactory condition for the duration of the Project or until its removal is requested by the DESIGNER. The silt accumulation at the fence must be removed and placed on Site, as directed by the DESIGNER.

G. *Temporary Vegetation*

1. Temporary vegetation are measures consisting of seeding, mulching, fertilizing, and matting utilized to reduce erosion. All cut and fill slopes shall be seeded when and where necessary to eliminate erosion. Disturbed or bare soil areas shall not be left without stabilization for more than 30-days.
2. Seeding, mulching and fertilizing shall be performed in accordance with Section 02936 "Seeding" of these Specifications.
3. If germination does not occur due to late autumnal weather conditions, the CONTRACTOR shall winterize disturbed areas by mulching without application of seed, as a minimum.

3.4 Permanent Erosion and Sediment Control

A. The CONTRACTOR shall incorporate all permanent erosion control features into the Work at the earliest practicable time, as outlined in the CONTRACTOR's Soil Erosion and Sediment Control Plan, accepted schedule, or as land disturbance for each segment of the Project has been completed.

B. Restore the work site to its original contours, unless shown otherwise on the Permit Drawings, or directed by the DESIGNER.

C. All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover, in accordance with Section 02936 "Seeding" of these Specifications.

D. When final grade has been established, all bare soil shall be seeded, fertilized, and mulched in an effort to restore to a protected condition, unless otherwise required by the Contract Documents. Areas that are not stabilized with seed and mulch shall be sodded, as approved or directed by the DESIGNER.

E. Specified permanent vegetation shall be established in the first appropriate season following establishment of final grading in each section of the Site.

F. Where sod is removed or damaged, such areas shall be replanted using sod of the same species of grass in the first appropriate season.

G. Permanent vegetative cover activities shall comply with local soil and water conservation guidelines.

H. Where permanent vegetative cover cannot be immediately established (due to season or other circumstances) the CONTRACTOR shall provide temporary vegetative cover.

3.5 Permanent Erosion and Sediment Control Techniques

A. *Permanent Vegetation*
All references to permanent vegetation, unless noted otherwise, shall relate to establishing permanent vegetative cover and be in accordance with Section 02936 "Seeding" of these specifications.

B. *Riprap*

1. Riprap used for permanent stabilization of channels, slopes and culvert outlets shall be installed in accordance with the Permit Drawings and Section 02271 "Stone Riprap" of these Specifications.
2. Placing of riprap at locations other than those specified on the Permit Drawings shall be done only with approval or by the direction of the DESIGNER.
3. The ground surface upon which the riprap is to be placed shall be brought in reasonably close conformity to the correct lines and grades before placement is commenced.
4. Unless otherwise shown or specified, riprap shall begin in a toe ditch constructed in original ground around the toe of the fill or the cut slope. The toe ditch shall be two (2) feet deep in original ground, and the side next to the fill or cut shall have that same slope. After the riprap is placed, the toe ditch shall be backfilled and the excess soil spread neatly within the construction area.

5. Geotextile shall be placed in all areas to receive riprap, unless otherwise required by the Contract Documents. The surface to receive geotextile shall be prepared to a relatively smooth condition free from obstructions, depressions and debris. The geotextile shall be placed with the machine (long) direction running up the slope, and shall be placed to provide a minimum number of seams. Geotextile shall be overlapped a minimum of 6-inches prior to seaming. All geotextile seams shall be continuously sewn. Spot sewing or thermal bonding are not allowed. The geotextile shall be anchored in place with securing pins of the type recommended by the geotextile manufacturer. The geotextile shall be placed loosely to provide sufficient slack to avoid stretching and tearing during placement of riprap. Riprap shall be dropped no more than three (3) feet during construction. The geotextile shall be protected at all times during construction from runon containing clay, silts, chemicals or other substances. Any geotextile damaged during installation or during placement of riprap shall be removed and replaced with undamaged geotextile at no expense to OWNER.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and performing all operations in connection with the installation of cellular concrete mattresses as shown, specified or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. The CONTRACTOR shall submit Manufacturer specification for block height, block weight, and minimum shear resistance to the DESIGNER at least 3 weeks prior to delivery of material to the Site.

B. The CONTRACTOR shall submit Shop Drawings showing proposed construction methods.

PART 2 PRODUCTS

2.1 Material

A. The cellular concrete mattress shall be Bethlehem Precast, or approved equivalent. Equivalent materials must be approved by the DESIGNER a minimum of thirty (30) days prior to delivery to the Site. Two (2) integral vertical cables per block are required, as well as one (1) integral horizontal cable. If a proposed system does not have an integral horizontal cable, all vertical cables shall be increased in size to provide additional equivalent horizontal restraint. Additionally, no partial or “half” blocks will be allowed without a horizontal cable. The final revetment system must be tied continuously throughout with cables in both directions. The OWNER or the DESIGNER reserves the right to accept or reject any proposed equal cellular concrete mattress system for reasons including, but not limited to, previous performance record, appropriate and applicable testing, and qualified technical support.

B. Aggregate shall meet the requirements of ASTM C33. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size that can be conveniently handled with available equipment.

C. Cellular concrete blocks shall be either wet cast using concrete as specified herein, or formed by a vibratory block forming machine. In the latter case, Manufacturer QC testing of the concrete shall be conducted on 2-inch cubes cut from the core of the sample block. Compressive strength testing shall be done in general accordance with ASTM C 42, with one cube tested at 7 days, and two cubes tested at 28 days. Cellular concrete blocks shall be interlocking; and

penetrations shall be included for revetment cables as necessary to bind the individual blocks into mattresses both vertically and horizontally. The blocks shall be open cell and capable of articulation when formed into mattresses.

D. The concrete blocks shall remain stable when subjected to the below noted shear stresses determined by test methodology developed by the Federal Highway Administration testing protocol, FHWA-RD-89-199, “Hydraulic Stability of Articulated Concrete Block Revetment Systems During Overtopping Flow".

Block Height	Block Weight	Open/Closed Cell	Minimum Shear Resistance
4”	65-72 lbs.	Closed	40 psf
6”	101-108 lbs.	Closed	60 psf

E. The assembled mattresses shall have a range of 18 to 23 percent open areas to be achieved by penetrations within the block for open cell applications. For closed cell applications, the amount of open area shall be 7 percent.

F. The cellular concrete blocks and cables and fittings shall be fabricated at the manufacturer’s plant, or another approved location, into mattresses with a width of up to 8-feet and a length that is capable of being transported without special permitting.

G. The concrete blocks shall be bound into mats by the use of polyester revetment cable fittings.

H. Polyester revetment cable shall be constructed of high tenacity, low elongation, and continuous filament polyester fibers. Cable shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover. The weight of the parallel core shall be between 65 to 70 percent of the total weight of the cable. Vertical cables shall be sized to provide a minimum cable strength to mat weight ratio of 5:1 for safe material lifting/handling. Additionally, all revetment cable shall have the following minimum physical characteristics:

Location	Nominal Cable Diameter	Approx. Avg. Strength lbs.	Weight/100ft (lbs.)
Vertical	5/32”	3300	2.2
Horizontal	1/8”	2100	2.2

I. Elongation Requirements: Specified below are based upon stabilized new, dry cable. Stabilization shall be accomplished in accordance with the manufacturer’s standard procedures.

J. The revetment cable shall exhibit good to excellent resistance to most concentrated acids, alkalis, and solvents. Cable shall be impervious to rot, mildew, and degradation associated with marine organisms. The materials used in the construction of the cable shall not be affected by continuous immersion in fresh or salt water.

K. Selection of cable and fittings shall be made in a manner that ensures a minimum of 5:1 design safety factor for mattresses being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Revetment cable splicing fittings shall be selected so that the resultant splice shall provide a minimum of 75% of the minimum rated cable strength. Fittings such as sleeves, stops, and washers shall be in accordance with manufacturer's recommendations unless otherwise shown on the drawings.

L. A minimum 8 oz/sy, non-woven geotextile bonded to the bottom of the articulating concrete mats is preferred. However, a separate layer of non-woven geotextile can be placed on the cap closure surface prior to the placement of the articulating concrete mats. For this case, a minimum 10 oz/sy non-woven geotextile shall be placed.

M. The CONTRACTOR shall submit to the DESIGNER for approval of a sample of each type and size of earth anchor to be used.

PART 3 EXECUTION

3.1 Installation

A. Areas on which the articulating concrete mats and geotextile are to be placed shall be constructed to the lines and grades shown on the drawings. The subgrade for the cellular concrete mats shall be free of voids, pits, or depressions shall be brought to grade by backfilling, in accordance with the applicable portions of the project Specifications.
All obstructions, such as roots and projecting stones larger than 1-inch remaining on the surface, shall be removed and all of the soft or low density pockets of material removed must be filled with selected material and compacted to a minimum of 90% of the ASTM D 698 (standard Proctor) density.

B. Immediately prior to placing the articulating concrete mattresses and geotextile, the prepared area shall be inspected by the RM. No mats or geotextile shall be placed prior to approval of subgrade materials by the RM.

C. The cellular concrete mats or blocks shall be placed on the filter fabric in such a manner as to produce a relatively planar surface. No more than 200 linear feet of filter fabric shall be laid before being covered with concrete mattresses, and any fabric installed more than 2-days shall be lifted, and the surface of the slope inspected by the RM for any defects. The DESIGNER may require any uncovered fabric to be lifted after heavy rainfall to inspect for slope damage. The CONTRACTOR shall hold the OWNER harmless from liability of any kind arising from the use of any patented or unpatented invention used in the performance of the Work.

D. Placement of prefabricated mattresses shall be done with mats attached to a spreader bar or other approved device to aid in the lifting and placing of the mats in their proper position by the use of a crane or other approved equipment. The mats shall be placed side by side and/or end to end so that the mats abut each other. The maximum space or gap between mattresses shall be 3-inches, except that local wider gaps may be accepted if the length of the gap is grouted. No overlapping of mats will be accepted and no blocks shall project vertically more than one inch beyond the adjacent blocks. All placement of mats shall be in accordance with the manufacturer's recommendations.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances to complete the work of locating, abandoning and sealing designated groundwater monitoring wells located within the limits of Work and identified in the Permit Drawings.
B. All wells shall be abandoned by a well driller (DRILLER), certified in the State of Maryland.

1.2 Submittals

The DRILLER shall provide a well abandonment report, as required by the State of Maryland, at the completion of each monitoring well abandonment. The DRILLER will submit copies of the well abandonment report to the DESIGNER and RM.

1.3 Applicable Laws

Monitoring wells shall be abandoned in accordance MDE Monitoring Well Guidelines. CONTRACTOR shall be responsible notifying appropriate agencies, as required.

PART 2 PRODUCTS

2.1 Cement

Type II Portland Cement shall be used in the grout mixture.

2.2 Bentonite

Bentonite used in the grout mixture shall be 30 mesh granular bentonite, or finer.

PART 3 EXECUTION

3.1 Installation

A. Locate all groundwater-monitoring wells using visual means.
B. If possible, pull the well casing from the well. The CONTRACTOR shall supply the appropriate equipment to remove the well casings, including overdrilling of the well casings, if they are grouted in place.

3.2 Monitoring Well to be Abandoned

In the event of abandonment of any water well, or other type of well, as indicated in the Permit Drawings, the following procedure and materials shall be used:

A. The well shall be plugged to prevent the entrance of surface water, circulation of water between or among producing zones, or any other process resulting in the contamination or pollution of groundwater resources.

B. In the event of temporary abandonment or discontinuance of the use of any well, the well shall be sealed with a watertight cap or seal.

C. All abandoned monitoring wells or piezometers shall be over drilled to a depth of one (1) foot greater than the original well depth.

D. The well shall be checked from land surface to the entire depth of the well before it is sealed, to ensure against the presence of any obstruction that will interfere with sealing operations. Silt deposit shall be removed from silted-in wells, to ensure an adequate seal.

E. The well bore shall be filled and sealed with a mixture of 95% Portland cement and 5% bentonite.

F. The grout material shall be placed through a tremie pipe extending to the bottom of the well, which shall be raised as the well is filled.

G. Any well constructed in a consolidated rock formation may be filled with fine sand in the zone or zones of consolidated rock. The top of the sand fill shall be at least 10-feet below the top of the consolidated rock and the remaining portions of the well shall be filled with any of the materials specified in subsection D, above.

Note: Impermeable grout shall be used, rather than sand, at sites with dense organic chemical contamination. Any screen or sandpack in the rock zone shall be removed.

Note: Boreholes, which intersect multiple yielding zones, shall also be grouted to preclude cross-contamination.

H. Any test well or bore shall be abandoned in such a manner that it does not become a channel for the vertical movement of water or other substance to potable groundwater resources.

Note: Older monitoring wells may require special abandonment efforts to meet this requirement, especially if they are screened/sandpacked for long vertical intervals or inadequately grouted above the screened interval (see subsection F, above).

I. Upon completion of abandonment of the well, the top of the casing or grout material shall be terminated at least 4-feet below the ground surface.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. This Section specifies the requirements for handling and management of dewatering activities.

B. The CONTRACTOR shall design, construct, and maintain all dikes, sumps, diversions, and drainage channels, as necessary, to complete the construction, and to protect the areas to be occupied by permanent work from water damage. The CONTRACTOR shall remove temporary works after they have served their purpose.

C. The CONTRACTOR shall be responsible for removing water from the construction area during construction.

D. The CONTRACTOR shall be responsible for the stability of all temporary and permanent slopes, grades, foundations, materials, and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials, and structures damaged by water, both surface and subsurface, to the lines, grades, and conditions existing prior to the damage, at no additional cost to OWNER.

E. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all Work.

F. The CONTRACTOR shall submit a description of its methods for accomplishing construction dewatering to OWNER and DESIGNER for approval.

G. CONTRACTOR shall provide measures to minimize accumulation of surface water in the work area.

H. CONTRACTOR will segregate all surface runoff, and waters from perched groundwater and seeps encountered during excavation filling operations. Perched groundwater and seeps encountered by CONTRACTOR will be collected, pumped, transferred, and hauled to an on-site discharge point as designated by DESIGNER.

PART 2 PRODUCTS

Piping, pumping equipment, and all other equipment and materials required for dewatering shall be suitable for the intended purpose. Standby pumping units shall be maintained at the Site to be used in case of failure of the primary pumping units.

PART 3 EXECUTION

3.1 Handling of Water

A. Design, furnish, install, maintain, monitor, operate, and remove necessary pumping and other equipment for dewatering the various parts of the Work, and for maintaining the work areas free from water, as required for constructing each part of Work.

B. Install all drainage ditches, sumps, and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables, and to drain impervious surfaces at final excavation elevation.

C. Dewater by means that will enable completion of the Work and preserve final lines and grades. Do not disturb or displace adjacent soil.

D. All pumping and drainage shall be done with no damage to property or structures, and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic, or the Work of other contractors, and in accordance with all Federal, State, and local laws, ordinances, and regulations.

E. Do not overload or obstruct existing drainage facilities.

F. Separate all surface runoff water, and segregate and collect all water from perched groundwater and seeps that may be encountered during excavation or site grading. Collect, hold, and dispose of water collected from perched groundwater and seeps separately from surface runoff.

G. After they have served their purpose, remove all temporary protective work at a time, and in a manner, approved by the DESIGNER. All temporary diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled, and processed in accordance with Section 02223 “Structural/General Fill of these Specifications.

H. When the temporary works will not adversely affect any item of permanent work, or the Site operations, CONTRACTOR may be permitted by the DESIGNER to leave such temporary works in place. In such instances, breaching of dikes and other temporary works may be required.

3.2 Dewatering

A. By the use of pumps, tile drains or other approved methods, CONTRACTOR shall control the flow and accumulation of water in excavated areas, to prevent excessive softening and disturbance of exposed soils in excavations, as necessary for completion of the Work.

B. The system used shall not cause settlement damage to adjacent structures. The CONTRACTOR shall carry out the Work by the use of techniques that will not endanger adjacent structures. All such Work shall be done at the CONTRACTOR’s expense.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of shoring, bracing, and sheeting or sheet piling, necessary to complete the construction, protect structures, and prevent the loss of ground or caving of embankments, excavations, or cut slopes, as shown, specified or required, and shall meet all applicable building and safety codes. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all shoring and bracing. The OWNER, DESIGNER, or QAC personnel shall not be the "Competent Person" on the Site.

B. CONTRACTOR shall be solely responsible for proper excavation procedures including, but not limited to, safe slope angles and the design and use of properly designed and installed shoring and bracing systems, in accordance with OSHA and other applicable standards and requirements. As required, shoring and bracing shall be designed by the CONTRACTOR's engineer who is a registered Professional Engineer in the State of Maryland. Remove all shoring and bracing without disturbing backfill, bedding, haunching, pipes, or structures. The presence of the QAC shall not relieve the CONTRACTOR of his responsibility to properly design, install, and maintain, shoring and bracing.

C. Pressures on sheeting and the stability of the sheeting and bottom of the excavation are dependent not only on soil conditions, but upon many procedures and options available to the CONTRACTOR, such as dewatering, staging of excavation, installation of bracing, flexibility of sheeting, construction equipment used, and duration of the Work. All such factors shall be considered and investigated, as necessary, in the design of the sheeting and bracing.

D. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. In cases where the excavation cannot be open cut to a safe working angle in accordance with applicable requirements, or where excavation may jeopardize adjacent site areas or the stability of nearby structures or facilities, the CONTRACTOR shall submit drawings, computations, and substantiating data, prepared, signed, and sealed by a Professional Engineer licensed in the State of Maryland, showing his proposed shoring and bracing design and method of construction, for the information of the DESIGNER, prior to the start of such construction.

B. Shoring and bracing systems shall be designed such that removal shall not jeopardize work already performed. Shoring and bracing systems shall not remain permanently in place without the written approval of the DESIGNER.

C. Any review or comments by the DESIGNER shall not relieve the CONTRACTOR of his responsibility for sheeting and bracing.

D. In trenches, the sheeting shall be designed so that the lowest brace is no closer than 12-inches above the base of the structure to be installed.

1.3 Quality Control

During the installation of the sheeting and bracing and as long as the excavation is open, the CONTRACTOR's "Competent Person" shall monitor the work to ensure that it is carried out in accordance with his design and procedures.

PART 2 PRODUCTS

All materials shall meet, or exceed, the minimum requirements of the applicable codes and assumptions included in the CONTRACTOR's design.

PART 3 EXECUTION

3.1 Verifying Existing Conditions

Before commencing work, the CONTRACTOR shall check and verify all governing dimensions and elevations, including field measurements of existing and adjoining work on which his work is dependent, to assure proper fit and clearance of each part of the Work to the new and existing structures.

3.2 Coordination with Other Operations

The schedule and progress of the shoring, bracing, and sheeting work shall be coordinated with the excavation and backfilling work. If, during the progress of the excavation, lateral movement of the surrounding soils, or any other evidence of instability, is discovered, further excavation or backfilling work in the excavation shall cease and corrective measures shall be taken immediately to prevent further movement.

3.3 Removal of Shoring and Bracing Materials

A. Where the CONTRACTOR is permitted by the DESIGNER to leave shoring and bracing material in place, all such material shall be removed to the extent that the top of the material shall be a minimum of 5 feet below the proposed finished grade. No shoring or bracing may remain in place within the limits of the proposed geomembrane liner placement.

B. Removal of shoring and bracing shall be carried out in a manner such that no structure shall be disturbed or damaged during or after removal. Protection of structures during the removal of shoring and bracing shall be the sole responsibility of the CONTRACTOR, and any disturbance or damage shall be rectified at no expense to the OWNER.

3.4 Safety

Installation and removal of shoring and bracing shall meet, or exceed, the minimum requirements of the applicable codes, and safety precautions as outlined in such codes, and shall be enforced by the CONTRACTOR.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of excavation, mass excavation, stripping and removal of surface soils, excavation, removal, and disposal of excess and unsuitable materials, relocation of excavated soils to designated areas, and other related and incidental work within the designated area, and as required for the construction of other work, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall locate all existing active and abandoned utilities and structures in work areas prior to commencing any excavation activities, and shall protect from damage those utilities and structures which are to remain in place.

C. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State or Federal, authorities having jurisdiction.

1.2 Definitions

A. Excavation shall mean the removal of all materials and shall include soil, facilities, structures above and below ground, rock, pavements, topsoil, boggy waste, rubbish, tree stumps, boulders, logs, ashes, cinders, organic material (such as peat, humus or organic silt), softened or disturbed soils, or other unsuitable bearing materials, as determined in the field by the QAC.

B. Mucking or mucking-out shall mean excavation, as defined herein, without prior dewatering.

1.3 Protection of People and Property

A. The CONTRACTOR shall plan and conduct his operations as to prevent damage to existing structures, safeguard people and property, minimize traffic inconvenience, and provide safe working conditions.

B. Excavations, except as specified herein, shall be adequately shored and braced. Where the installation of shoring is impractical, or might cause damage as a result of, but not limited to, vibration, settlement, or lateral movement, the CONTRACTOR shall utilize other methods, consistent with applicable standards and regulations.

C. Excavation may be made without sheeting and bracing, within the limitations and requirements of the governmental agencies having jurisdiction, provided that:
   1. Hazards, such as described herein before, do not exist in the proximity of the excavation.
   2. Work is not in streets, or other paved, landscaped, or improved areas.
   3. Work can be restricted to the land provided for the CONTRACTOR's use.
   4. Sheeting and bracing are not specifically required by the Contract Documents.

5. The CONTRACTOR shall submit a certification by a Professional Engineer, licensed in the State of Maryland, indicating the maximum slope of the sides of the excavation proposed, and that said slopes will be stable under all weather and working conditions for the period that the excavation will be open. Such certification shall be based on the CONTRACTOR's own subsurface exploration and consideration of the options available to the CONTRACTOR, such as dewatering, construction equipment, and proximity of spoil area. Any review of comments by the DESIGNER, QAC, or OWNER shall not relieve the CONTRACTOR of his responsibilities arising from the excavation.

D. In cases where excavation without shoring and bracing is not permissible, trench boxes may be used.

E. The CONTRACTOR shall not stockpile any excavated material adjacent to trench excavations, without the DESIGNER's written approval.

F. Prior to exposing subgrades for placement of cover fills and backfills, the area of the Work shall be surrounded by a soil berm, to contain surface runoff accumulating within the berm and exclude surface runon from areas surrounding the Work. The CONTRACTOR shall employ excavation methods that minimize the need to remove accumulated water from excavations. Water may be disposed of by pumping through a sedimentation filter and treating the discharge in accordance with methods approved by the DESIGNER if accumulation of water is unavoidable.

1.4 Site Conditions

Borehole logs and laboratory analyses of samples performed by others shall be provided to the CONTRACTOR upon request. Any such information developed by the CONTRACTOR shall be made available to the OWNER.

PART 2 PRODUCTS

A. All materials shall be as defined on the Permit Drawings and these Specifications.

B. Unsuitable material shall include any topsoil, soft or non-bearing soils, mulch, waste materials, debris, wood waste, organic material, peat, humus, or any other material deemed unsuitable and required to be removed by the QAC.

PART 3 EXECUTION

3.1 Limits of Excavation

A. *Excavation Classifications*: The following classifications of excavation will be made when rock or earth excavation is encountered in Work.

1. Earth excavation includes excavation of on-site soils to achieve proposed excavation grades. These soils could be sandy, silty, or clayey materials. Some of these soils will be saved for later use for liner system components or daily cover. Staging of materials retained for future use will be staged within the landfill footprint, in future cell locations.
2. Deleterious material includes pavements and other obstructions visible on ground surface, underground facilities, utilities, refuse, debris, waste, and other items indicated to be demolished and removed, together with earth and other materials encountered that are not classified as rock, or unauthorized excavation.
3. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42" wide bucket on track-mounted power excavator equivalent to Caterpiller Model 215, rated at not less than 90 HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10-feet in width, and pits in excess of 30-feet in either length or width, are classified as Open Excavation.
4. Rock excavation in open excavations includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted, heavy-duty, excavating equipment without drilling, blasting, or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power, and developing 40,000 pounds break-out force (measured in accordance with SAE J732C).
5. Typical materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.
6. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered, will be classified as earth excavation.
7. Rock excavation shall not be performed until material to be excavated has been classified by the QAC.

B. *Unauthorized excavation* consists of removal of materials below the limits specified herein and indicated subgrade elevations or dimensions shown on the Permit Drawings, without specific direction of the QAC and excavation of rock material prior to classification of material as rock by QAC.

Unauthorized excavation shall be at CONTRACTOR's expense unless otherwise approved by QAC.

C. *Additional Excavation*: When excavation has reached required subgrade elevations, notify QAC who will make a review of conditions.

1. If unsuitable bearing materials are encountered at required subgrade elevations, for select backfill within limits of cell construction, carry excavations to develop suitable bearing and replace excavated material as directed by QAC. Within the limits of cell construction, at least 6-inches of surface materials identified as unsuitable shall be stripped. Select fill as defined in Section 02223 "Structural/General Fill and Intermediate Cover" shall be used to replace unsuitable materials.
2. Further removal of unsuitable material and its replacement will be performed based on results of proofrolling, and as directed by QAC.
3. If unsuitable materials are encountered in trenches at specified subgrade elevations for crushed stone or aggregate bedding beneath pipes, or other drainage structures, they shall be removed. The new exposed subgrade shall be compacted, and the areas refilled to the specified bedding subgrade elevation with select fill as specified in Section 02223 "Structural/General Fill and Intermediate Cover". Unsuitable materials for bedding beneath pipes or other drainage structures shall include miscellaneous fill, topsoil, or soil containing organic materials, or other such materials identified in the field by the QAC.

D. *Stability of Excavations*: Slope sides of excavations shall comply with local codes and ordinances having jurisdiction. Shore and brace in accordance with Section 02150 "Shoring and Bracing" where sloping is not possible, because of space restrictions or stability of material excavated. Comply with all OSHA and other applicable safety requirements.

Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.2 Material Storage

Stockpile excavated materials satisfactory for use as common fill on-site where directed by DESIGNER, until required for backfill or fill. Stockpile shall be graded and shaped to maintain proper drainage.

A. Locate and retain soil materials away from the edge of excavations, where the weight of the material could create a surcharge on such edge, whether sheeted or not. Do not store within drip line of trees indicated to remain.
B. Dispose off-site refuse, waste, debris, or other materials that cannot be reused during construction or by OWNER at the existing operating landfill, as alloed in the facility pemit.

3.3 Excavation

A. *Excavation for Trenches:* Excavate trenches to the uniform width required for a particular item to be installed, sufficiently wide to provide ample working room, shoring, or as shown on Permit Drawings.

1. Excavated trenches with a depth greater than 4-feet shall be considered a confined space, and shall be excavated in conformance with the requirements of the CONTRACTOR's Health and Safety Plan.
2. All excavated material shall be removed from the area at time of excavation, and stockpiled on-site or disposed as determined by the QAC.
3. Open excavations shall be protected using suitable barricades and signs.
4. Excavate trenches to depth indicated or required to allow placement of specified thickness of bedding materials beneath the bottom of all barrels, bells, or couplings of all pipes installed. Carry depth of trenches for piping to establish flow lines and invert elevations indicated in the Permit Drawings.
5. Where rock is encountered, carry excavation 1-foot below required elevation and backfill with compacted structural fill, as defined in Section 02223 "Structural/General Fill and Intermediate Cover " overlain by a 6-inch thick layer of coarse aggregate prior to installation of pipe.
6. Do not backfill trenches until tests and inspections have been made, and backfilling is authorized by the QAC. The CONTRACTOR shall use care in backfilling to avoid damage or displacement of pipe or foundation systems.
7. Trench dewatering shall be in accordance with Section 02140 "Construction Dewatering", of these Specifications. If inadequate dewatering causes softening of the subgrade, CONTRACTOR shall, at its own expense, excavate softened subgrade, as determined by the QAC, and backfill with structural fill as specified in Section 02223 "Structural/General Fill and Cover Material".

B. Following excavation for swales, concrete structures, outlets, outfalls, pipes, etc., the CONTRACTOR shall regrade and add compacted fill, as needed, to achieve required surface for placement of materials, as shown in the Permit Drawings. All visible sharp, protruding objects shall be removed, or covered with a minimum of 12-inches of compacted fill.

C. CONTRACTOR shall remove all unsuitable material (and all objects greater than 6-inches) within 24-inches of a swale or channel, or as determined by QAC, and replace same with compacted fill.

D. Protect excavation bottoms against freezing. No fill or structures shall be allowed to be placed on frozen materials or subgrades softened as a result of freeze/thaw action.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of structural/general fill and intermediate cover, including fill for roads, berms, embankments, over excavated subgrade areas, backfill of anchor trenches and pipe trenches, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):
1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definition

A. *Structural Fill* – Material used to construct perimeter embankments and fill required for structural foundations, roads, fill for over-excavated subgrade areas and sedimentation ponds and the Closure Cap protective soil layer.

B. *General Fill* – Material used to backfill anchor trenches, pipe trenches, and around structures such as manholes and vaults.

PART 2 PRODUCTS

2.1 Materials

A. General Requirements

1. Fill and cover materials, unless otherwise specified, shall consist of suitable soil from selected borrow areas (located on or off site), approved by the DESIGNER.
2. No frozen earth shall be used for backfill and fill, and no backfill or fill shall be placed over frozen surfaces. All backfill and fill materials shall be free from all perishable and objectionable (as described below) materials. All fill shall be protected from freezing conditions.
3. All required fill and cover materials shall be free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Fill and cover materials shall not contain broken concrete, masonry rubble, or other similar materials that could damage geosynthetics. Fill and cover materials shall have physical properties such that it can be readily spread and compacted. Snow, ice, and frozen soil shall be removed from fill and cover material prior to placement.

B. Structural Fill

1. Material proposed to use as structural fill shall meet the following specifications:
2. Borrow materials shall have a USCS classification of GM, GW, GC, SM, SW, SC, ML, or CL in accordance with ASTM D2487. The maximum particle size shall not exceed 6 inches, unless otherwise specified. The maximum particle size for the protective soil layer component of the Closure Cap shall not exceed 2-inches. The plasticity index (PI) shall be less than, or equal to 25.
3. Structural fill materials shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).
4. Test frequencies listed in tables 1 and 2 under PART 3.

C. General Fill

1. Material proposed to use as general fill shall be approved by the QAC and meet the general requirements listed in section 2.1(A)

PART 3 INSTALLATION

3.1 Structural Fill

A. *Quality Assurance (QA) Pre-construction Testing*

The QAC shall conduct QA pre-construction sampling/testing to verify compliance with the specifications listed in section 2.1(B) at the following frequencies:

TABLE 1
QA Pre-construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	1 per source
Sieve Analysis (with hydrometer)	ASTM D422	1 per source

Atterberg Limits	ASTM D4318 (B)	1 per source
Standard Proctor	ASTM D698	1 per source
Moisture Content	ASTM D2216	1 per source

B. *Placement*

1. General Specifications
   a. Areas on which embankments, containment berms, or other fill will be constructed, shall be cleared of all vegetation. Immediately prior to filling, the subgrade shall be proof-rolled, unless otherwise specified. All unsuitable material, ponded water, and soft disturbed soils, as determined by the QAC, shall be removed prior to filling and filled with compacted structural fill.
   b. Structural fill shall be placed in an approximate loose lift thickness of 12 inches. Lift thickness may be increased to bridge over saturated areas at the discretion of the QAC.
   c. Compaction shall be accomplished using a penetrating-foot compactor (e.g.,
   d. Caterpillar 815 peg-foot compactor, or equal) subject to the approval of the QAC and/or DESIGNER.
   e. Structural fill shall be compacted to 95% of its maximum dry density determined by Standard Proctor (ASTM D698). Field-testing for dry density and compaction moisture content shall be performed using a nuclear gauge (ASTM D-2922/3017) or drive cylinder (ASTM D-2937). During the construction of each lift of structural fill, field moisture-density tests shall be performed at the frequency listed in Table 2. The frequency of testing may be increased at the discretion of the QAC when visual observations indicate a potential problem.
   f. The surface of each compacted lift shall be scarified prior to the placement of subsequent lifts to ensure homogeneous bonding.
2. Embankment Construction
   a. Structural fill placed for embankments shall be placed in accordance with general specifications listed in section 3.1(B).
3. Over-excavated Areas
   a. Structural fill placed in over-excavated areas shall be placed in accordance with Specifications listed in section 3.1(B).
4. Structural Fill for Sedimentation Ponds
   a. Structural fill for sedimentation ponds shall be placed in accordance with general specifications listed in section 3.1(B). Structural fill shall not contain any more than 15 percent, by volume, particle sizes larger than 2inches.

5. Access Road Construction
   a. In addition to the general specifications listed in section 3.1(B), the construction of the access road shall meet the following specifications:
   b. Access Road Subgrade structural fill shall have a maximum particle size of 3-inches. Borrow materials shall be free of organic matter.
   c. Any Temporary Access Roads required by the CONTRACTOR shall be at least 12-feet wide at the crest.
   d. Access Road Subgrade structural fill shall have side slopes no steeper than 2(H):1(V), maximum. The CONTRACTOR shall design and maintain the road surface and side slopes, as necessary, to maintain the original grades and conditions specified in the Contract Documents. The road shall be passable at all times with construction traffic and passenger automobiles. At the end of the work, the CONTRACTOR shall repair the road to achieve a well-maintained condition to the satisfaction of the DESIGNER.
   e. A woven geotextile followed by coarse aggregate shall be place over the final surface of the access road. The ends of the woven geotextile shall be over lapped a minimum of 2 feet. Refer to permit drawings, geotextile section 02595, and coarse aggregate section 02233 for specifications on placement and quality assurance.

C. *Quality Control (QC) Construction Testing*
The QAC shall monitor the placement of structural fill on a full time basis and conduct QC construction sampling/testing to verify compliance with the specifications at the following frequencies:

TABLE 2
QC Construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	Every 10,000 CY
Sieve Analysis (with hydrometer)	ASTM D422	Every 10,000 CY
Atterberg Limits	ASTM D4318 (B)	Every 10,000 CY
Standard Proctor	ASTM D698	Every 10,000 CY
Moisture Content	ASTM D2216	Every 10,000 CY
Field Density	ASTM D2922/2937	Every 10,000 SF, 1 per 100 LF for Access Road
Field Moisture	ASTM D3017	Every 10,000 SF, 1 per 100 LF for Access Road

3.2 General Fill

A. Quality Assurance (QA) Pre-construction Testing

1. QA pre-construction testing shall not be required for general fill. The QAC shall approve material proposed for use as general fill prior to placement.
2. Placement
   a. Backfill for Pipe Trenches and Around Structures
      i. Backfill shall not be placed until the structure, pipeline, subgrade or other construction component has been inspected in place and approved by the QAC. The extent of pipe trenches left open shall be kept to a minimum.
      ii. Unless otherwise approved by the QAC, excavations shall be backfilled as soon as possible after structures are constructed, pipes are laid and the work is inspected, tested (as required) and accepted, and permission to backfill has been given by the QAC.
      iii. Pipes shall be bedded and backfilled as shown on the Permit Drawings or as approved by the QAC.
      iv. Fill shall be brought up in essentially horizontal uniform lifts throughout the area. The loose lift thickness shall not exceed 12 inches, unless otherwise noted.
      v. The backfill shall be compacted with the compaction effort acceptable to the QAC. The method of compaction shall not damage the pipe, the structure, or the geosynthetics. A minimum of 12 inches of fill must exist over pipes prior to the use of heavy equipment for compaction.
      vi. Hand-operated plate type vibratory or other suitable equipment may be used in areas not accessible to larger rollers or compactors, and to avoid damaging pipes or structures.
   b. Backfill for Geomembrane Anchor Trenches
      i. General fill approved by the QAC shall be placed in the anchor trench and compacted with a compaction effort acceptable to the QAC. Heavy equipment equipped with rubber tires, or other suitable equipment may be used for compaction.

B. Quality Control (QC) Construction Testing

1. QC sampling for laboratory testing shall not be required for general fill during construction. Quality control shall consist of the following activities:
2. The QAC shall monitor placement of general fill on a full time basis; and,
3. Conduct density testing at the discretion of the QAC where insufficient compaction is suspected and in areas where the uniformity of the material is not maintained based on visual observation.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of intermediate cover, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A. *Intermediate Cover* – Pursuant to COMAR Sec. 26.04.07.18(G) Intermediate cover soil is a uniform compacted layer of clean earth not less than 1 foot in depth placed over each lift not later than 1 month following completion of that lift. Procedures for placement of Intermediate cover soil are provided in Section 12 of this Phase III Permit Application.

PART 2 PRODUCTS

2.1 Materials

2.1.1
Intermediate Cover

Material proposed for use as intermediate cover, unless otherwise approved by MDE, shall be a uniform compacted layer of clean earth not less than 1 foot in depth placed over each lift not later than 1 month following completion of that lift.

PART 3 INSTALLATION

3.1 Intermediate Cover

A. *Quality Assurance (QA) Pre-construction Testing*
QA pre-construction testing shall not be required for intermediate cover material. The QAC shall approve material proposed for use as intermediate cover prior to placement.

B. *Placement*
Intermediate cover shall consist of at least 12-inches of soil placed in a single lift and compacted using tracked heavy equipment or roller. .

C. *Quality Control (QC) Construction Testing*
No QC testing is required for Intermediate Cover material.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of subbase soil, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587 - Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A *Subbase Soil* – Material used as the bottom-most layer in the cell liner system to provide protection to geosynthetics from underlying natural soils.

PART 2 PRODUCTS

2.1 Materials

A. Material proposed to use as subbase soil shall meet the following specifications:

1. Subbase sol material shall have a USCS classification of ML or CL in accordance with ASTM D2487.
2. The maximum particle size shall not exceed 1-inch, unless otherwise specified. The plasticity index shall be less than, or equal to, 25.

3. Subbase soil shall not contain debris, trash, or other deleterious materials. The soil shall not be contaminated with chemicals or other substances that would inhibit the growth of vegetation.
4. The permeability shall be less than or equal to 1.0 x 10^{-5} cm/sec, as determined by ASTM D5084.
5. Subbase soil materials shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).

PART 3 INSTALLATION

3.1 Pre-Construction Laboratory Testing

A. Prior to the placement of the subbase soil, each source of materials shall be tested to determine the moisture-density-permeability "window" to meet the permeability requirements. Table 1 outlines the minimum borrow source testing requirements.

TABLE 1
Minimum Pre-Construction Borrow Source Testing Requirements

Test	Method	Testing Frequency
Moisture Content	ASTM D-2216	1 per 5,000 cy, or fraction thereof, of each material type
Liquid and Plastic Limits	ASTM D-4318	1 per 5,000 cy, or fraction thereof, of each material type
Percent Finer Than No. 200 Sieve	ASTM D-422	1 per 5,000 cy, or fraction thereof, of each material type
Moisture-Density Relationship (Standard Proctor)	ASTM D-698	1 per 5,000 cy, or fraction thereof, of each material type
Remolded Permeability	ASTM D-5084	3 per 5,000 cy, or fraction thereof, of each material type (strategically selected to define the moisture-density-permeability window)
Specific Gravity	ASTM D-854	1 per 5,000 cy, or fraction thereof, of each material type
Internal Friction Angle	ASTMD4767	1 per 100,000 square feet

B. The pre-construction laboratory testing must be completed and approved by the QAC before use.

3.2 Construction

A. No material shall be placed until the QAC has approved the installation of the underlying subgrade preparation.
B. No material shall be placed until the QAC has approved the pre-construction laboratory testing as described in Section 3.1.
C. The subbase soil shall be compacted with a smooth-drum roller to 90 percent of the maximum dry density (ASTM D698) as determined by the pre-construction

laboratory-testing program. In no case shall the compaction be less than 90 percent. Should the QAC have reason to suspect that the material delivered to the Site has changed from that previously tested and approved; the QAC shall immediately notify the CONTRACTOR's on-Site representative and arrange for additional laboratory testing.

D. Subbase soil field-testing for dry density and compaction moisture content shall be performed using a nuclear gauge (ASTM D-2922/3017) or drive cylinder (ASTM D-2937). During the construction of each lift of subbase soil, five (5) field moisture-density tests shall be performed per acre. The frequency of testing may be increased at the discretion of the QAC when visual observations indicate a potential problem (i.e., material change, zones of suspected failing moisture content, zones of failing density, etc.).

E. Subbase soil compaction moisture content shall be wet of the optimum moisture content as established by ASTM D698, and shall fall within the acceptable moisture-density-permeability window developed from the pre-construction laboratory testing.

F. All subbase soil materials shall be transported over constructed temporary haul roads or benches to the toe of the slope. Material shall be placed at the toe of the slope by transporting equipment and pushed up slope by LGP spreading equipment. Transporting equipment shall not be allowed on slopes of the capping system under any circumstances. All equipment to be used on the slope shall be low ground pressure, and be approved by the DESIGNER.

G. The CONTRACTOR shall take care to ensure that:
   1. No foreign material is mixed into the subbase soil that may damage the proposed geosynthetics.
   2. No vehicles shall drive on the uncovered geosynthetics.
   3. All grade stakes used for survey control during subbase soil placement are removed in their entirety.

3.3 Quality Control (QC) Construction Testing

A. Quality control testing shall consist of field-testing for moisture content, dry density, and percent compaction as outlined in Section 3.2.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of Final Cover, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A. *Final Cover* – Pursuant to COMAR Sec. 26.04.07.18(E)(5) Final Cover is a uniform compacted layer of earthen material not less than 2 feet in depth placed over the final lift of the filled landfill not later than 90 days following completion of that lift. Procedures for placement of the Final Cover Layer are provided in Section 12 of this Phase III Permit Application.

PART 2 PRODUCTS

2.1 Materials

2.1.1 Final Cover Layer

A. The Final Cover layer will directly underlie the cap geomembrane, unless otherwise specified, shall consist of suitable soil meeting the requirements for

Structural Fill (Specification 02223, Section 2.1(B)) (except that the maximum particle size shall be 2-inches) from selected borrow areas (located on or off site), approved by the DESIGNER.

B. The Final Cover materials shall not contain frozen earth and shall not be placed over frozen surfaces. All backfill and fill materials shall be free from all perishable and objectionable (as described below) materials. All fill shall be protected from freezing conditions.

C. The Final Cover materials shall be free from organic materials, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. The Final Cover materials shall not contain broken concrete, masonry rubble, or other similar materials that could damage geosynthetics. Fill and cover materials shall have physical properties such that it can be readily spread and compacted. Snow, ice, and frozen soil shall be removed from fill and cover material prior to placement.

D. The Final Cover material shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).

PART 3 INSTALLATION

3.1 Final Cover Layer

A. *Quality Control (QC) Construction Testing*
Soil utilized for the Final Cover sol shall comply with the specifications for structural soil fill (Section 02223) and be tested at the following frequencies:

TABLE 2
QC Construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	Every 10,000 CY
Sieve Analysis (with hydrometer)	ASTM D422	Every 10,000 CY
Atterberg Limits	ASTM D4318 (B)	Every 10,000 CY
Moisture Content	ASTM D2216	Every 10,000 CY

1. QA for the Final Cover shall consist of the following activities:
   a. The QAC shall conduct four (4) depth checks per acre to ensure a minimum of 12 inches prior to placement of closure cap geosynthetic components; and,
   b. Inspect the surface of the final layer prior to the installation of the geosynthetic capping system.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of the subsurface drainage system associated with the subgrade or closure cap system as shown, specified, or required. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D2434- Standard Practice for Permeability of Granular Soils (Constant Head).
3. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D3042 – Standard Test Method for Insoluble Residue in Carbonate Aggregates. (Carbonate Content).

1.3 Submittals

The CONTRACTOR shall submit manufacturer's data sheets, and certification of compliance with specifications for all pipes, fittings and appurtenances, per Section 01300 - Submittals, of these Specifications.

PART 2 PRODUCT

2.1 Materials

A. *Perforated Pipe* – Pipe for the subsurface drainage system shall consist of a 6-inch and 8-inch diameter (as indicated on the Drawings) high density polyethylene (HDPE) corrugated ADS N-12 pipe, or approved equivalent. Perforations shall be 1/8-inch, 1-inch long slots, located staggered 120 degree angles in every corrugation valley, consistent with the ADS Standard CD slotting pattern, or approved equivalent.

B. *Coarse Aggregate* – Shall be USC Classification GW or GP, ASTM No. 57 stone.

C. *Geotextile Wrap* – Nonwoven 16 oz/yd^2 geotextile (See Geotextile Specification Section 02595.)

PART 3 INSTALLATION

3.1 General

A. All piping shall be of the type and size as shown on the Construction Drawings and described in this Section of the Specifications.
B. Pipe segments shall be attached in accordance with manufacturer's recommendations.

3.2 Pre-construction and Construction Testing

A. Refer to Coarse Aggregate and Geotextile sections 02233 and 02595, respectively, in Contract Specifications for pre-construction and construction testing.

3.3 Placement

The drainage system shall be installed as follows:

A. Geotextile filter fabric shall be placed along the flow lines, shown on construction drawings, in a manner that will allow enough material to burrito wrap the subsequent pipe and coarse aggregate with a minimum overlap of 2 foot over the top of the aggregate.
B. A 2-inch coarse aggregate bedding lift shall be placed directly over the geotextile.
C. Corrugated perforated pipe shall be placed in the flow line directly over the 2-inch coarse aggregate bedding.
D. Clean Coarse aggregate shall be placed over the perforated pipe to 6 inches above the top of the pipe.
E. The pipe and the coarse aggregate shall then be burrito wrapped with the previously installed geotextile.
F. The drainage assembly shall subsequently be covered with protective cover.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing, placing the leachate collection layer(s) as shown, specified or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D 1587- Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
3. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
5. ASTM D3042 – Standard Test Method for Insoluble Residue in Carbonate Aggregates.
6. ASTM C128 - Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate.

PART 2 PRODUCTS

2.1 Materials

The material proposed to use for the construction of the leachate collection layer shall extend across the cell floor and up the slopes as shown in the permit drawings and shall meet the following specifications:

A *Sand* - used for the leachate drainage layer shall be USCS Classification SW, SP, SM, SC, SP-SM, or SW-SM, and shall have a hydraulic conductivity of not less than 1.0×10^{-3} cm/sec. (see Note 1).

B *Geotextile* – Overlying the sand shall be 12-oz, non-woven as specified in Section 02595 “Geotextile” (see Note 2).

C Verification of the above specifications shall be supplied to the QAC prior to delivery of the drainage layer material.

NOTE 1: The test frequencies for the above specifications are listed in Table 1 and Table 2 in sections 3.1 and 3.3.
NOTE 2: The test frequencies for the above specifications are listed in Section 02595 "Geotextile"

PART 3 INSTALLATION

3.1 Quality Assurance (QA) Pre-construction Testing

A The QAC shall conduct QA pre-construction sampling/testing to verify compliance with the Specifications listed in section 2.1 at the following frequencies:

TABLE 1
QA Pre-construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	1 per source
Sieve Analysis	ASTM C136	1 per source
Hydraulic Conductivity	ASTM D2434	1 per source
Carbonate Content	ASTM D3042	1 per source

3.2 Placement

A No material shall be placed until the QAC has approved the installation of the underlying geomembrane liner.

B The geotextile or geocomposite drainage layer shall be placed directly over the geomembrane liner as specified in Sections 02595 and 02418, respectively.

C The leachate drain rock layer shall be placed directly above the geotextile in one relatively horizontal lifts and in a manner that will reduce wrinkling of the underlying geomembrane.

D The CONTRACTOR shall use extreme care in the placing of the leachate drain rock layer material over the geomembrane. The material shall be placed in a manner that will maintain a minimum thickness of one foot of material between the primary geomembrane liner and low ground pressure (LGP) (less than or equal to 5 psi) spreading equipment. A minimum distance of 72-inches shall be maintained between exposed geomembrane and heavy equipment transporting drainage layer material. All equipment to be used in this operation shall be low ground pressure, and be approved by the DESIGNER.

E The CONTRACTOR shall take care to ensure that:

1 No foreign material is mixed into the leachate collection layer that may produce clogging or restrict the ability of the layer to transmit liquid.

2 No vehicles shall drive on the uncovered geomembrane.

3 All grade stakes used for survey control during drainage layer placement are removed in their entirety.

F Where applicable, the CONTRACTOR shall ensure that the leachate collection layer material is free of any foreign objects to the complete satisfaction of the DESIGNER prior to placing over the geomembrane.

G The CONTRACTOR shall exercise care during the stockpiling and handling of the leachate collection layer material to avoid the inclusion of fine-grained soil particles or other deleterious materials.

3.3 Leachate Collection Layer Material Quality Control (QC) Construction Testing

A During construction, the thickness of the leachate drainage material shall be measured by the QAC at a frequency of five (5) locations per acre throughout the day to ensure its compliance with Item C section 3.2.

B The QAC shall conduct QC construction sampling/testing to verify compliance with the specifications listed in section 2.1at the following frequencies:

TABLE 2
QC Construction Testing

Test Name	Test Standard	Frequency
Soil Classification	ASTM D2487	Every 3,000 CY
Sieve Analysis	ASTM C136	Every 3,000 CY
Hydraulic Conductivity	ASTM D2434	Every 3,000 CY

PART 4 SURVEYING

A All surveying shall be performed by a land surveyor licensed in the State of Maryland.

B The final as-built thickness of the leachate drainage layer material shall be surveyed on a pre-established 50-foot control grid. The thickness shall be determined by comparison of the as-built survey of the top of the geomembrane layer to the top of the completed drainage layer.

C Tolerance for thickness of the leachate drainage layer is 0.0’ to 0.3’.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A.. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing, and placing the stone in the construction of road surfacing, pipe bedding, or as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D2434 - Standard Practice for Permeability of Granular Soils (Constant Head).
3. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
4. ASTM D3042 – Standard Test Method for Insoluble Residue in Carbonate Aggregates. (Carbonate Content).

PART 2 PRODUCTS

2.1 Material

A. The material shall be clean, sound, tough, durable, angular, subangular, subrounded or round stone, not lumpy, and free from slag, cinders, ashes, rubbish, or other deleterious material. Subangular, angular, subrounded, and round shall be as defined in ASTM D2488, "Standard Practice for Description and Identification of Soils [Visual-Manual Procedure]".

B. The CONTRACTOR shall maintain a uniform gradation of coarse aggregate.

C Aggregate shall be stored in designated areas approved by the DESIGNER. The CONTRACTOR is responsible for maintaining the stone free of contamination, and any stone determined by the DESIGNER to be contaminated shall not be incorporated into the work.

D. Coarse Aggregate for the access road and drainage pipe bedding shall meet the following grading requirements:

1. AASHTO No. 57: Perimeter Access Road & Pipe Bedding

Opening of Sieve Size	Percent Passing by Weight
1-1/2 inch	100
1 inch	95-100
1/2 inch	25-50
No. 4	0-10
No. 8	0-5

2. AASHTO #8 for entrance road surface:

Opening of Sieve Size	Percent Passing by Weight
1/2 inch	100
3/8 inch	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

2.2 Testing

A. The QAC shall submit to the DESIGNER for approval, certification that the materials proposed for use as coarse aggregate comply with Specification for the proposed application. The certification shall include, but not necessarily be limited to, testing provided by the material supplier, including Gradation - ASTM D422.

The following minimum confirmatory testing shall be conducted by the QAC for coarse aggregate used for the leachate collection system:

Test Name	Test Standard	Frequency	Specification
Sieve Analysis	ASTM D422	1 per source	GW or GP
Carbonate Content	ASTM D1603	1 per source & 1/1,000 tons	<15% for Leachate collection System only
Permeability	ASTM D3042	1 per source & 1/1,000 tons	>1 x 10^{-2} cm/sec

B. No material shall be placed unless approved by the QAC.

C. If, in the opinion of the QAC, the material is unsuitable for the proposed application, the CONTRACTOR shall submit to the QAC the required certification, as specified in A. above, for material from a different source.

PART 3 INSTALLATION

3.1 Placement

A. A uniform layer of coarse aggregate shall be placed to the lines, depths and grades as shown on the Permit Drawings.

B. The CONTRACTOR shall place coarse aggregate in such a manner that the material is kept clean and free of foreign materials.

C. The QAC will at any time inspect the stone in the trenches, or in on-site stockpiles for contamination and, if necessary, reject all or portions of the stone.

D. The CONTRACTOR shall use extreme care in the placing of the material over geosynthetics. The material shall be placed in a manner to maintain a minimum thickness of 1-foot between the geosynthetics and the low ground pressure spreading equipment. Low ground pressure equipment shall be used to place all coarse aggregate within the limits of the geosynthetics. Equipment with ground pressure less than 5-psi may travel on a minimum 12-inch thick coarse

aggregate layer. Equipment with a ground pressure equal to or greater than 5-psi must travel on a minimum 72-inch thick coarse aggregate layer.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of protective cover, and other related and incidental work within the designated area and as required for the construction of other work, as shown specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D422 - Standard Method for Particle Size Analysis of Soils.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D 1587 - Standard Practice for Thin-Walled Tube Geotechnical Sampling of Soils.
4. ASTM D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) content of Soil and Rock.
5. ASTM D2487 - Standard Test Method for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
6. ASTM D2922 - Standard Test Methods for Density of Soil and Soil-Aggregate in-Place by Nuclear Methods (Shallow/Depth).
7. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in-Place by Nuclear Methods (Shallow Depth).
8. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.3 Definitions

A Protective Cover – Material used over the geosynthetic components of the closure capping system for the initial 18-inches of the earthen cover layer,

PART 2 PRODUCTS

2.1 Materials

A. Closure Cap

1. Material proposed to use as protective cover shall meet the following specifications.

i. Closure Cap material shall have a USCS classification of GM, GW, GC, SM, SW, SC, ML, or CL in accordance with ASTM D2487. The maximum particle size shall not exceed 1.5-inches, unless otherwise specified. The plasticity index shall be less than, or equal to, 25.
ii. Closure Cap material shall not contain debris, trash, or other deleterious materials. The soil shall not be contaminated with chemicals or other substances that would inhibit the growth of vegetation.
iii. The permeability shall be less than or equal to 1.0 x 10^{-5} cm/sec, as determined by ASTM D5084.
iv. Closure Cap protective cover shall have an internal friction angle greater than 28 degrees as determined by a triaxial shear test (ASTM D4767).

PART 3 INSTALLATION

3.1 Pre-Construction Laboratory Testing – Protective Cover

A. Prior to the placement of the Protective Cover each source of materials shall be tested to determine the moisture-density-permeability "window" to meet the permeability requirements. Table 1 outlines the minimum borrow source testing requirements.

TABLE 1
Minimum Pre-Construction Borrow Source Testing Requirements

Test	Method	Testing Frequency
Moisture Content	ASTM D-2216	1 per 5,000 cy, or fraction thereof, of each material type
Liquid and Plastic Limits	ASTM D-4318	1 per 5,000 cy, or fraction thereof, of each material type
Percent Finer Than No. 200 Sieve	ASTM D-422	1 per 5,000 cy, or fraction thereof, of each material type
Moisture-Density Relationship (Standard Proctor)	ASTM D-698	1 per 5,000 cy, or fraction thereof, of each material type
Remolded Permeability	ASTM D-5084	3 per 5,000 cy, or fraction thereof, of each material type (strategically selected to define the moisture-density-permeability window)
Specific Gravity	ASTM D-854	1 per 5,000 cy, or fraction thereof, of each material type
Internal Friction Angle	ASTM D4767	1 per source

B. The pre-construction laboratory testing must be completed and approved by the QAC before use.

C. Laboratory testing shall not be required for cell liner system protective cover but shall be visually monitored.

3.2 Construction

A. No material shall be placed until the QAC has approved the installation of the underlying geosynthetics.
B. No material shall be placed until the QAC has approved the pre-construction laboratory testing as described in Section 3.1.
C. The Protective Cover layer shall be placed directly over the geocomposite in one 18-inch compacted lift. The cover soil shall be compacted with a smooth-drum roller to 90 percent of the maximum dry density (ASTM D698) as determined by the pre-construction laboratory-testing program. In no case shall the compaction be less than 90 percent. Should the QAC have reason to suspect that the material delivered to the Site has changed from that previously tested and approved; the QAC shall immediately notify the CONTRACTOR's on-Site representative and arrange for additional laboratory testing.
D. Protective Cover field-testing for dry density and compaction moisture content shall be performed using a nuclear gauge (ASTM D-2922/3017) or drive cylinder (ASTM D-2937). During the construction of each lift of protective cover, five (5) field moisture-density tests shall be performed per acre. The frequency of testing may be increased at the discretion of the QAC when visual observations indicate a potential problem (i.e., material change, zones of suspected failing moisture content, zones of failing density, etc.).
E. Protective Cover compaction moisture content shall be wet of the optimum moisture content as established by ASTM D698, and shall fall within the acceptable moisture-density-permeability window developed from the pre-construction laboratory testing.
F. The CONTRACTOR shall use extreme care in the placing all protective cover material over the geosynthetics. The material shall be spread up slope in a manner that will maintain a minimum thickness of one foot of material between the geomembrane liner and low ground pressure (LGP) (less than or equal to 5 psi) spreading equipment. A minimum distance of 36-inches shall be maintained between geosynthetics and heavy equipment transporting any protective cover material.
G. All protective cover materials shall be transported over constructed temporary haul roads or benches to the toe of the slope. Material shall be placed at the toe of the slope by transporting equipment and pushed up slope by LGP spreading equipment. Transporting equipment shall not be allowed on slopes of the capping system under any circumstances. All equipment to be used on the slope shall be low ground pressure, and be approved by the QAC.
H. The CONTRACTOR shall take care to ensure that:
    1. No foreign material is mixed into the protective cover that may damage the under lying geosynthetics.
    2. No vehicles shall drive on the uncovered geosynthetics.
    3. All grade stakes used for survey control during protective cover placement are removed in their entirety.

3.3 Quality Control (QC) Construction Testing

A. Quality control testing shall consist of field-testing for moisture content, dry density, and percent compaction as outlined in Section 3.2.

***** END OF SECTION *****

PART 1 - GENERAL

1.1 Description of Work

A. Furnish all labor, materials, equipment and incidentals necessary to perform all fill and grading required to complete the placement of vegetative support layer shown on the Contract Drawings and specified herein. The work shall include, but not necessarily be limited to, the earthwork required for vegetative support layer placement, and all related work. CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. Comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Tolerances

The minimum thickness of the vegetative support layer is as shown on the Contract Drawings. Tolerances for the thickness of vegetative support layer are -0.0 to +0.4 feet.

PART 2 - PRODUCTS

2.1 Materials

A. Soil material used as vegetative support layer shall be loamy fine sand, loamy sand, sandy clay, sandy clay loam, fine sandy loam, clay loam, silty clay, or sandy loam as defined by the U.S. Department of Agriculture textural classification chart, and shall be suitable to support vegetative growth.

B. The vegetative support layer shall not contain trash or debris, or stones, lumps, roots, or similar objects larger than 1 inch in any dimension.

C. The vegetative support layer shall have a pH between 5.8 and 7.6.

D. Soil material used as the vegetative support layer must be capable of sustaining vegetation, as specified in Section 02936 “Seeding”.

2.2 Testing

A. The CONTRACTOR shall submit, to the QAC for approval, laboratory test results indicating that the material proposed for use as vegetative support layer meets the requirements of Section 2.1. Testing shall include, but not necessarily be limited to, the following:

1.	Grain Size	ASTM D422
2.	Atterberg Limits	ASTM D4318

3.	pH	ASTM D4972
4.	Organic Content	ASTM D2974
5.	Soil fertility	LaMotte or Baker

B. No material shall be placed unless approved by the OWNER and QAC.

C. If, in the opinion of the QAC, the proposed vegetative support layer is unsuitable for the proposed application, the CONTRACTOR shall submit to the QAC the required suitable testing, as specified in (A) above, for soil from a different source.

PART 3 - EXECUTION

3.1 Installation

A. This item shall consist of the placement of the vegetative support layer in all areas disturbed during the course of construction.

B. The CONTRACTOR shall provide all the required materials, labor, and equipment to perform the Work in accordance with these Specifications.

C. No vegetative support layer soils shall be placed until placement of underlying soil (backfill, fill, etc.) is complete and approved by the OWNER.

D. The vegetative support layer shall be installed in a single, 6-inch thick, compacted lift.

E. The CONTRACTOR shall take care to ensure that underlying soil remains intact and does not become mixed with the vegetative support layer during installation.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and placing stone riprap, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.
B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

PART 2 PRODUCTS

2.1 Material

A. Stone riprap shall consist of hard, durable, subangular material. It shall be free from any considerable amount of flat, laminated or elongated particles; and shall be free from cracks, overburden, shells, clay, organic matter, or other deleterious matter.
B. The stone riprap shall sustain a loss of not more than 40 percent after 500 revolutions in the ASTM abrasion test (Los Angles machine - ASTM C535), and shall pass the soundness test (ASTM C88). Stone riprap shall have a minimum specific gravity of 2.50, as defined by ASTM C127.
C. The riprap shall be composed of an evenly distributed mixture such that 50 percent of the mixture, by weight, shall be larger than the d_{50} size, as indicated on the Permit Drawings. The diameter of the largest stone size in such a mixture shall be at least 2.0 times the d_{50} size. The diameter of the smallest stone size in such a mixture shall be greater than 0.5 times the d_{50} size.
D. The breadth or thickness of a single stone shall not be less than 1/3 its length.

2.2 Testing

The supplier shall provide a written certification letter to the CONTRACTOR and DESIGNER stating that the riprap meets project specifications.

PART 3 EXECUTION

3.1 Installation

A. Stone riprap shall be placed to thicknesses as indicated on Permit Drawings.
B. Stone riprap shall be placed in a manner that will not damage geotextile, synthetics, utilities or other facilities. Riprap shall not be dropped from a height exceeding three feet.

C. The tolerance in riprap thickness in place shall be –0.0 to +0.3 feet.
D. No material shall be placed unless approved by the DESIGNER.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. This Section describes requirements and restrictions for handling and disposal of liquids generated during construction activities. Such liquids include potentially contaminated liquids such as, water resulting from vehicle decontamination, gas condensate and leachate; and "clean water" such as wet or saturated zones encountered during construction, and storm water runoff and precipitation entering active excavations. The CONTRACTOR shall furnish all materials, equipment, transportation, and labor necessary to complete the Work.

B. The CONTRACTOR will abide by all pertinent MDE, USEPA, OSHA, and other applicable regulations and guidelines, and the directions of the QAC when performing all work applicable to this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect the Work.

C. In general, water from "clean excavations" may be discharged to the stormwater basins after the CONTRACTOR obtains a "Construction NPDES" Pemit from the appropriate regulatory authority. Other liquids shall be managed separately as described herein.

1.2 Submittals

A. The CONTRACTOR shall submit a description of methods for containing, collecting, and disposing of potentially contaminated liquids generated during construction, including, but not limited to, seeps, gas condensate, leachate, groundwater, and decontamination water.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 On-Site Handling

A. The handling of potentially contaminated liquids shall be done in a manner such that the liquids will be contained on the Site and not be allowed to flow onto the ground or off the Site as surface water discharge.

B. Discharge of collected groundwater or other liquids to adjacent surface waters or ground surface will not be allowed without the required permits from MDE to allow that discharge.

C. Any damage or pollution to adjacent soil or surface waters due to the CONTRACTOR's actions or negligence under this requirement, or any fines, penalties, costs of clean-up or reconstruction required as a result thereof, shall be at the sole expense of the CONTRACTOR. The CONTRACTOR shall

immediately remedy, clean-up, and correct any conditions as a result of its pollution of surface waters.

D. The CONTRACTOR shall furnish secure, watertight temporary storage for potentially contaminated liquids until the liquids can be characterized and disposed appropriately as determined by the QAC. The storage shall be accessible by tanker trucks. The handling of liquids shall be done in a manner such that the liquids remain at acceptable suspended solids levels for the approved disposal facility. Filter or settle as necessary to minimize suspended solids.

E. Separate, segregate, and divert surface water runoff from groundwater encountered during excavation and Site grading activities. Handle groundwater separately from surface water runoff. The CONTRACTOR shall maintain all ground and surface water control measures as necessary and as directed by the DESIGNER.

F. Any non-aqueous liquids encountered shall be immediately brought to the attention of the OWNER and QAC. Non-aqueous liquids shall be collected separately in drums or other containers provided by the CONTRACTOR for temporary storage.

3.2 Transport and Disposal – Aqueous Liquids

A. The CONTRACTOR shall collect, pump, store, handle, and transfer potentially contaminated liquids intercepted, segregated, and collected during performance of the Work.

B. The CONTRACTOR shall coordinate and pay for the off-site disposal of aqueous liquids generated by or as a result of the CONTRACTOR's actions. The CONTRACTOR shall perform any characterization required for this off-Site disposal at no cost to the OWNER.

C. Any non-aqueous liquids found shall be removed by the CONTRACTOR and stored in separate drums prior to disposal. Coordinate with the OWNER to schedule additional testing.

D. Settled solids and used filter materials shall be disposed of in accordance with applicable regulations as approved by the OWNER.

3.3 Management of Non-Aqueous Liquids

A. Containerized non-aqueous or oily liquids or solvents shall be stored at a designated area of the Site satisfactory to the OWNER and provided with secondary containment by the CONTRACTOR. Disposal of non-aqueous or oily liquids or solvents generated by or resulting from the CONTRACTORS actions will be arranged and paid for by the CONTRACTOR.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The Contractor shall furnish all labor, material, and equipment to complete installation of geocomposite drainage layer (GDL), including all necessary and incidental items, in accordance with the Permit Drawings and these Specifications. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, state or federal authorities having jurisdiction.)

1.2 Reference Standards

The latest revisions of the following standards are hereby made a part of these specifications.

A. *American Society of Testing and Materials (ASTM*).

1. ASTM D 1238, Standard Test Method for Flow Rates of Thermoplastics by Extrusion Process Plastometer.
2. ASTM D 1505 Standard Test Method for Density of Plastics by the Density-Gradient Technique.
3. ASTM D4716, Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using Constant Head.
4. ASTM D 4218, Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle Furnace Technique.
5. ASTM D 3786, Standard Test Method for Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabric – Diaphragm Bursting Strength Tester Method.
6. ASTM D 4491, Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
7. ASTM D 4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
8. ASTM D 4632, Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).
9. ASTM D 4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
10. ASTM D4833, Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
11. ASTM D 904, Standard Test Methods for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.
12. ASTM D 5199, Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes.
13. ASTM D 4595, Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
14. ASTM D 1621, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

1.3 Delivery, Storage and Handling

A. Packing and Shipping:

1. Manufacturer shall identify rolls of GDL with following:
   (a) Manufacturer's name.
   (b) Product identification.
   (c) Roll number.
   (d) Roll dimensions.

B. Storage and Protection:

1. OWNER will provide a suitable on-site storage area for geocomposite materials from time of delivery until installed.
2. GDL material shall be stored off the ground on pallets, platforms, or dunage.
3. The integrality of the wrappers shall be maintained or suitable covering shall be installed.
4. On mobilization, the geosynthetic installer shall be responsible for protecting geocomposite from dirt, water, ultraviolet light exposure, and other sources of damage.
5. Preserve integrity and readability of GDL roll labels.

PART 2 MATERIALS

2.1 General Requirements

A. General Requirements:

The geocomposite shall consist of the following.

1. Geonet shall conform to the property values listed in Table 1.
2. Geotextile shall conform to the property values listed in Table 2.
3. Geotextile and geonet used for manufacture of GDL shall be stock products, except when specifically authorized in writing by the DESIGNER, materials shall not be specifically manufactured to meet this project.
4. GDL shall be capable of retaining its structure during handling, placement and long-term service.

B. The polymer used to manufacture the Geonet component of the GDL shall be polyethelene that is clean and free of any foreign contaminants. Regrind material, which consists of edge trimmings and other scraps, may be used to manufacture the Geonet; however, post consumer recycled material shall not be used.

C. The Geonet shall contain UV inhibitors to prevent ultraviolet light degradation.

D. Labels on each roll of GDL shall identify the length, width, lot and roll numbers, and name of Manufacturer.

E. Physical properties of the GDL shall be as shown in Table 1 of this section.

TABLE 1
Required Geocomposite Drainage Layer Properties [1]

PROPERTY	TEST METHOD	UNITS	VALUE
Geonet			
Thickness (min.)	ASTM D 5199	mils	315
Tensile Strength (min.)[2]	ASTM D 5035	lb/ ft	500
Density (min.)	ASTM D 1505	g/cm^3	0.94
Melt Flow Index (max.)	ASTM D 1238	g/10 min	1.0
Carbon Black Content (min.)	ASTM D 4218	%	2.0
Geocomposite			
Ply Adhesion (min.)	ASTM D 7005	lb/inch	0.75
Interface Friction Angle (min.)[3]	ASTM D 5321	(degrees)	30 –geotextile to cover soil 34–geotextile to geomembrane
Transmissivity – Machine Direction MD (min.)[4]	ASTM D 4716	(m^2/sec)	3.0 x 10^{-3} for i=0.333 4.0 x 10^{-3} for i=0.036

Notes:

1) *Tenax Tenflow, or approved equivalent.*
2) *Based on 5 specimens in the machine direction.*
3) *The QAC shall perform laboratory interface friction tests on Geocomposite/Project Specified Geomembrane and Geocomposite/Project Specified Soil interfaces in accordance with ASTM D5321. Normal stresses of 100, 250, 500, and 1,000 psf along with a displacement rate of 0.2 geosynthetic/ geosynthetic / 0.04 geosynthetic/ soil (inches/min) shall be used. Geotextile shall be attached to the Geonet in the same configuration as will be used in the field. All tested interfaces shall exhibit the listed minimum required interface friction angle.*
4) *Conduct test for Transmissivity at a normal compressive load of 1,000 psf and at a hydraulic gradient of 0.036 (top of the landfill) and 0.333 (sideslopes). Boundary conditions from top to bottom are: upper load plate/ soil / geocomposite / geomembrane / lower load plate. Seating period shall be at least 100 hours to meet design criteria, and one (1) hour to meet conformance criteria.*

F. Geotextile shall be heat bonded to both sides of the Geonet. Heat bonding shall be performed by the Manufacturer prior to shipping to the site. The geotextile shall be a nonwoven needle punched synthetic fabric meeting the property requirements of Table 2.

TABLE 2
Required Geotextile Properties

PROPERTY	TEST METHOD	UNITS	VALUE
Weight (MARV)	ASTM D5261	oz/sy	6
AOS (MARV)	ASTM D4751	U.S. Sieve	70
Permittivity (MARV)	ASTM D4491	sec $^{-1}$	1.3
Grab Tensile Strength (MARV)	ASTM D4632	lbs	160
Grab Elongation (MARV)	ASTM D4632	%	50
Puncture Strength	ASTM D4833	lbs	90
UV Resistance @500 Hours	ASTMD4355	%	70

G. The GDL shall be unloaded, transported, stored, and protected in accordance with the manufacturer's recommendations in order not to damage or degrade the properties of the material.

H. The CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work covered by other Sections.

I. The CONTRACTOR shall, during all periods of shipment and storage, protect the geotextile from direct sunlight, ultraviolet light, temperatures greater than 120° F, mud, dirt, dust, debris, and other deleterious sources. GDL shall be maintained, wrapped in a heavy-duty protective covering, until it is installed.

J. If the QAC determines material is damaged, or has excessive sunlight exposure, the CONTRACTOR shall immediately make all repairs and replacements, at no additional cost to the OWNER.

PART 3 EXECUTION

3.1 Submittals

The Contractor shall submit the following to the QAC:

A. *Mill Certificate and Sample:* Prior to shipping to the site, the Contractor shall submit one copy of a mill certificate or affidavit signed by a legally authorized official of the Manufacturer for the GDL attesting that the GDL meets the physical and manufacturing requirements stated in these Specifications. The Contractor shall also submit a sample (12" x 12") of the GDL to be used. The sample shall be labeled with the product name and be accompanied by the Manufacturer's specifications.

B. *Shipping, Handling, and Storage Instructions*: The Manufacturer's plan for shipping, handling, and storage shall be submitted for review.

C. *Delivery Tickets*: The contractor shall provide delivery tickets, or other approved receipts, as evidence for materials received that will be incorporated into the construction.

D. *Quality Control Certificates:* For GDL delivered to the site, quality control certificates, signed by the Manufacturer's quality assurance manager shall be provided for every roll of GDL. Each certification shall have the roll identification number(s), test methods, frequency, and test results. At a minimum, the test results and frequency of testing shall be as shown in Table 3 of this section.

TABLE 3
Required Manufacturer's Quality Control Test Data

Property	Test Method	Frequency
Geonet Tests		
DENSITY	ASTM D1505	50,000 ft^2
MELT FLOW INDEX	ASTM D1238	50,000 ft^2
THICKNESS	ASTM D5199	50,000 ft^2
CARBON BLACK	ASTM D1603	50,000 ft^2
TENSILE STRENGTH-MD	ASTM D5035	50,000 ft^2
Geotextile Tests		
MASS PER UNIT AREA	ASTM D5261	100,000 ft^2
GRAB ELONGATION	ASTM D4632	100,000 ft^2
GRAB TENSILE	ASTM D4632	100,000 ft^2
PUNCTURE	ASTM D4833	100,000 ft^2
PERMITTIVITY	ASTM D4491	1 per lot
AOS, US SIEVE	ASTM D4751	1 per lot
Geocomposite Tests		
PLY ADHESION	ASTM D7005	100,000 ft^2
TRANSMISSIVITY-MD	ASTM D4716	200,000 ft^2

3.2 Quality Assurance Testing

The QAC shall collect samples and test for the following:

TABLE 4
Quality Assurance Testing

Property	Method	Frequency
Geotextile-Geonet peel adhesion	ASTM D 7005	1 per 100,000 sf*
Interface Friction Angle	ASTM D5321	1 set per project

*-Or minimum 1 per lot.

3.3 Handling and Placement

A. After the geomembrane has been installed, seamed, tested, and approved by the QAC, the surface shall be cleaned free of excess dirt and debris.
B. The Contractor and the Installer shall handle all GDL in such a manner to ensure it is not damaged in any way. Precautions shall also been taken to prevent damage to underlying layers during placement of the GDL.
C. The GDL roll should be installed down the slope.
D. In the presence of wind, all GDL shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with cover material.
E. If necessary, the GDL shall be positioned by hand after being unrolled to minimize wrinkles.
F. If the project includes an anchor trench at the top of the side slopes, the GDL shall be properly anchored to resist sliding. Anchor trench compacting equipment shall not come into direct contact with the GDL.

G. If there are any obstructions (such as outlet pipes or monitoring wells) while deploying the GDL, the GDL shall be cut to fit around the obstruction. Care should be taken to make sure there is no gap between the obstruction and the GDL. The GDL should be cut in a way that the lower geotextile and geonet core is in contact with the obstruction and the upper geotextile has an excess overhang. There must be enough of the upper geotextile to be able to tuck the upper geotextile back under the GDL to protect the exposed geonet core. This will prevent any soil particles from migrating into the geonet core flow channels.

H. In applying fill material, no equipment can drive directly across the GDL. The specified fill material shall be placed and spread utilizing vehicles with a low ground pressure (LGP). The earthen cover soil for the cap and Leachate Collection Layer for the liner shall be placed on the GDL from the bottom of the slope proceeding upwards and in a manner that prevents instability of the cover soil or damage to the geocomposite. Placement of the earthen cover soil Leachate Collection Layer shall proceed immediately following placement and inspection of the GDL. Unless otherwise specified by the QAC, all equipment for spreading fill materials overlying the geocomposite shall comply with the following:

Maximum Equipment Ground Pressure (psi)	Minimum Separation Thickness (inches)
<5	12
5 – 10	18
>10	24

I. Compaction of the initial lift placed over the GDL must be performed in a manner that does not damage the GDL. This may be accomplished using a 12-inch compacted lift compacted using a dozer and a steel drum roller. The protective cover is compacted to 90% of standard Proctor (ASTM D698).

J. QAC personnel will observe placement of the GDL and note any thinning of the geotextiles, particularly the geotextiles placed next to the membrane. If any repair or removal of the geotextile is necessary, it will be conducted according to the methods described in Section 3.5-Repair.

3.4 Seams and Overlaps

A. Each component of the GDL (geotextile(s) and geonet) will be secured or seamed to the like components at overlaps.

B. Geonet Component

1. Each component of the geocomposite (geotextile(s) and geonet) will be secured or seamed to the like components at overlaps.
2. Adjacent edges of the geonet along the length of the GDL should be overlap 2-3 inches. These overlaps shall be joined by tying the geonet cores together with white or yellow plastic fasteners or polymeric braid. These ties shall be spaced at a maximum of every 5 feet along the roll length.

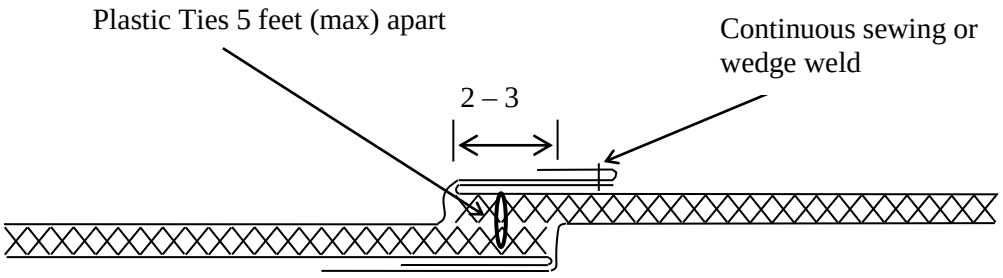


Figure 1: **Overlap along Roll Length ((MD)**

3. Adjoining GDL rolls (end to end) along the width of the roll should be shingled down in the direction of the slope, with the geonet portion of the top GDL overlapping the geonet portion of the bottom geocomposite a minimum of 12 inches across the roll width. The geonet should be tied every 12 inches across the roll width and every 6 inches in the anchor trench or as specified by the QAC.

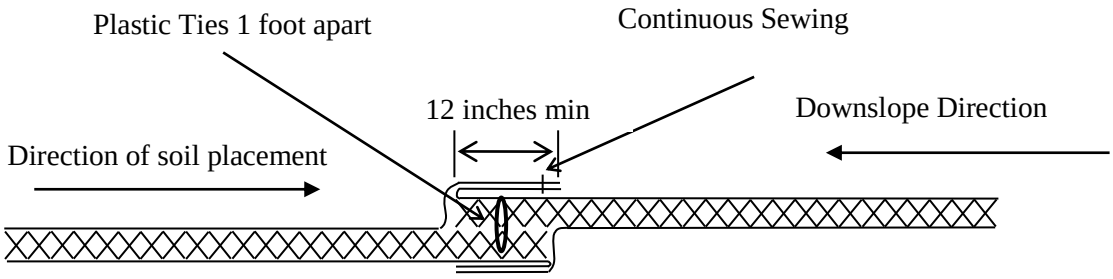
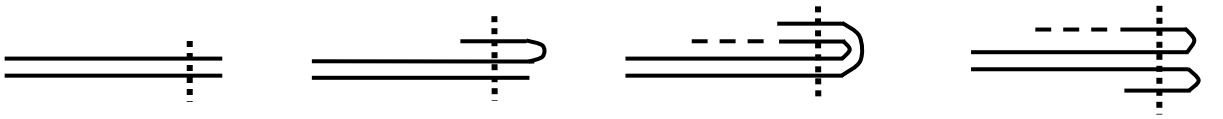


Figure 2: Overlap along Roll Width (CD)

C. *Geotextile Component*

1. The bottom layer of geotextile (if any) shall be overlapped.
2. The top layers of the geotextile shall be sewn together, or at the discretion of the QAC may be heat bonded or wedge weld. Geotextile shall be overlapped a minimum of 4 inches prior to seaming or heat bonding, geotextile sewing seams to be used are Prayer “J”, or Butterfly. The seam shall be a two-thread, double locked stitch, or a double row of single-thread, chain stitch. If heat bonding is to be used, care must be taken to avoid burn through of the geotextile. It is important that the geotextiles be joined continuously along to the roll as to prevent any fugitive particle migration into the geonet core flow channels.



Prayer Seam | Modified Prayer Seam (in case of unequal length) | "J" Seam | Butterfly Seam

3.5 Repair

A. Prior to covering the deployed GDL, each roll shall be inspected for damage resulting from construction.
B. Any rips, tears, or damaged area on the deployed GDL shall be removed and patched by placing a patch extending 12 inches beyond the edges of the damaged area. The patch shall be secured to the original geonet by tying every 6 inches with approved tying devices. If the hole or tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geonet shall be joined as explained above.
C. Any rips, tears, or damaged area on the deployed geotextile shall be removed if necessary and patched by placing a patch extending 12 inches beyond the edges of the damaged area.

3.6 Protection

A. After installation, the geotextile should be visually inspected to assure that no objects are present that could potentially harm the geotextile.
B. Any geotextile damaged during its installation or during placement of cover material, as deemed by the QAC, shall be replaced by the CONTRACTOR, at no additional cost to the OWNER.
C. The work shall be scheduled so that the covering of the geotextile with the material to be placed over it is accomplished within 30 days after placement of the geotextile. Failure to comply with this requirement shall require replacement of an additional geotextile, at no additional cost to the owner.
D. When spot-repairing geotextile with patches, a 3-foot heat-seamed overlap will be used or by a means approved by the QAC.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of furnishing, and placing geotextile, complete with appurtenances, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

The CONTRACTOR shall furnish a mill certificate from the company manufacturing the each type of geotextile attesting that the geotextile meets the chemical, physical, and manufacturing requirements specified. Geotextiles shall be rejected by the QAC, and replaced by the CONTRACTOR, if they are found to have defects, rips, holes, flaws, deterioration, or other damage.

1.3 Product Handling

A. The CONTRACTOR shall protect the work described in this Section before, during, and after installation, and shall protect the installed work covered by other Sections.

B. The CONTRACTOR shall, during all periods of shipment and storage, protect the geotextile from direct sunlight, ultraviolet light, temperatures greater than 120° F, mud, dirt, dust, debris, and other deleterious sources. Geotextiles shall be maintained, wrapped in a heavy-duty protective covering, until it is installed.

C. If the QAC determines material is damaged, or has excessive sunlight exposure, the CONTRACTOR shall immediately make all repairs and replacements, at no additional cost to the OWNER.

1.4 Definitions

On the Permit Drawings and in the Specifications, the word “geotextile” is used and refers to a non-woven geotextile, as described in section 2.1.

1.5 Conformance Testing of Geotextile

A. Filter geotextiles used in the drainage system shall be tested prior to shipment to ensure that the properties of the finished product are in accordance with the construction specifications. The required material properties, test methods, values, and units for nonwoven geotextiles are

presented in sections 2.1 and 2.2. Samples of filter geotextile shall be tested by the manufacturer at a frequency of one (1) sample for every 100,000 square feet (SF) of material produced. Each roll of geotextile will have the product identification, roll number, lot number, date of manufacturer, and manufacturer name clearly marked.

B. Prior to delivery of the geotextile to the Site, the QAC shall obtain certifications for the materials.

C. Upon delivery of the geotextile to the Site, the QAC shall obtain representative samples of the furnished product for conformance testing. Samples of the geotextile will be tested by an independent testing laboratory at a frequency of one (1) sample per lot, but a minimum of one (1) sample per 250,000 square feet of material delivered.

PART 2 MATERIALS

2.1 6 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. The filter geotextile shall be nonwoven.

B. Filter geotextiles shall be placed as indicated on the Permit Drawings. The filter geotextile shall meet the following minimum average required value (MARV) minimum properties.

TABLE 1

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	6.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	160 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	410 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	70 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	1.5 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

2.2 10 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. The nonwoven geotextile to be used for the visual barrier/separation layer between the leachate collection layer and the protective layer, or as otherwise shown on the Contract Drawings, shall consist of needle-punched, continuous filament polyester or polypropylene fabric, and conform to the following minimum requirements:

TABLE 2

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	10.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Trapezoidal Tear Strength	ASTM D4533	100 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	230 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	725 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	100 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	1.2 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

*All values are minimum.

2.3 12 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. The separation geotextile shall maintain separation between the aggregate and the underlying fill in the perimeter road.

B. Cushion geotextiles shall be placed as indicated on the Permit Drawings. The cushion geotextile shall meet the following minimum average required value (MARV) minimum properties:

TABLE 3

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	12.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Trapezoidal Tear Strength	ASTM D4533	125 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	320 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	925 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	100 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	0.8 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

2.4 16 OZ./ S.Y. NONWOVEN GEOTEXTILE

A. This geotextile shall be installed for cushion and layer separation around the coarse aggregate envelope around the leachate collection header and lateral pipes.

B. Cushion geotextiles shall be placed as indicated on the Permit Drawings. The cushion geotextile shall meet the following minimum average required value (MARV) minimum properties:

TABLE 5

Test Name	Test Standard	Value	QC Testing Frequency	QA Testing Frequency
Mass per Unit Area	ASTM D5261	16.0 oz/sy	1 test per 100,000 SF	1 test per 250,000 SF
Trapezoidal Tear Strength	ASTM D4533	145 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Strength	ASTM D4632	380 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Grab Tensile Elongation	ASTM D4632	50 %	1 test per 100,000 SF	1 test per 250,000 SF
Puncture Strength	ASTM D6241	1080 lbs	1 test per 100,000 SF	1 test per 250,000 SF
Apparent Opening Size	ASTM D4751	100 sieve	1 per production lot	1 per production lot
Permittivity	ASTM D4491	0.7 sec^{-1}	1 per production lot	1 per production lot
UV Resistance	ASTM D4355	70 %	Certified by Manufacturer	-

PART 3 EXECUTION

3.1 Site Preparation

A. Site subgrade preparation shall conform to the requirements of this Section, and Section 02223 “Structural and General Fill”.

B. The surface to receive geotextile shall be cleared of sharp objects, boulders, stumps, or any materials that may contribute to fabric punctures, shearing, rupturing or tearing to the satisfaction of the QAC.

C. The base surface or surface of embankments shall be graded as smooth as possible, and compacted with a smooth-drummed roller having a minimum operating weight of 10 tons, capable of vibratory and static compaction. The subgrade shall be inspected for unstable areas or soft spots, before the geotextile is placed. Unsuitable areas shall be over-excavated, and additional fill shall be placed and compacted to eliminate those unstable areas.

3.2 Installation

A. The geotextile shall be placed in the manner and at the locations shown. Geotextile shall be laid smooth and free of tension, stress, folds, wrinkles, or creases.

B. All filter geotextile seams shall be continuously sewn or by means approved by the QAC. Spot sewing is not allowed. Filter geotextiles will be overlapped a minimum of 6-inches prior to seaming.

C. If geotextile is damaged during any step of installation, a piece of geotextile material shall be cut and placed over the damaged area and overlap the undamaged material a minimum of 3-feet in each direction.

D The geotextile shall be placed on side slopes as shown on the Permit Drawings. If necessary, the geotextile shall be positioned by hand after being unrolled to minimize wrinkles. The geotextile shall not be placed in the horizontal direction (i.e. across the slope) on slopes steeper than 10 (horizontal): 1 (vertical) (10H:1V), except as part of a patch.

3.3 Protection

A. After installation, the geotextile should be visually inspected to assure that no objects are present that could potentially harm the geotextile.

B. Any geotextile damaged during its installation or during placement of cover material, as deemed by the QAC, shall be replaced by the CONTRACTOR, at no additional cost to the OWNER.

C. The work shall be scheduled so that the covering of the geotextile with the material to be placed over it is accomplished within 30 days after placement of the geotextile. Failure to comply with this requirement shall require replacement of an additional geotextile, at no additional cost to the owner.

D. When spot-repairing geotextile with patches, a 3-foot lystered overlap will be used or by a means approved by the QAC.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of high-density polyethylene (HDPE) geomembrane installation for the liner system and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. *Pre-installation*: Submit the following prior to geomembrane deployment:

1. Origin (supplier's name and production plant) and identification (brand name and number) of resin used to manufacture geomembrane.
2. Copies of dated quality control certificates issued by resin supplier.
3. Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets Specifications.
4. Statement that amount of reclaimed polymer added to resin during manufacturing did not exceed 2% by weight.
5. List of materials that comprise geomembrane, expressed in following categories as percent by weight:
   a) polyethylene;
   b) carbon black; and,
   c) other additives.
6. Manufacturer's specification for geomembrane, including properties listed and measured using appropriate test methods.
7. Written certification that minimum values given in manufacturer's specification are guaranteed by geomembrane manufacturer.
8. Quality control certificates, signed by geomembrane manufacturer. Each quality control certificate shall include applicable roll identification numbers, testing procedures, and results of quality control tests.
9. Field panel layout and identification code including dimensions and details.
10. Resumes of INSTALLER's Superintendent and Master Seamer, including dates and duration of employment.
11. Installation schedule.
12. List of personnel performing seaming operations, including experience.
13. Certificate that extrusion rod is comprised of same resin as geomembrane liner material.
14. Manufacturer Material and Installation warranties.

B. *Installation*: Submit as installation proceeds.
   1. Quality control documentation recorded during installation.
   2. Subgrade surface acceptance certificates signed by INSTALLER for each area that will be covered directly by geomembrane. Submit on deployment of geomembrane.
   3. Deployment of geomembrane will be considered acceptance of subgrade by the INSTALLER, if certificate is not submitted.

1.3 Pre-Qualifications

A. *Manufacturer:*
Manufacturer shall have minimum 5-years continuous experience in manufacture of HDPE geomembrane, or experience totaling 10,000,000 square feet (sq. ft.) of manufactured HDPE, or geomembrane manufacture for minimum of ten (10) completed facilities.

B. *Fabricator (if applicable):*
Fabricator shall have minimum 5-years continuous experience in fabrication of HDPE geomembrane or experience totaling 2,000,000 sq. ft. of fabricated HDPE geomembrane for minimum of ten (10) completed facilities.

C. *Installer:*
   1. Installer shall have minimum 5-years continuous experience in installation of HDPE geomembrane or experience totaling 2,000,000 sq. ft. of installed HDPE geomembrane for minimum of ten (10) completed facilities.
   2. Personnel performing seaming operations shall be qualified by experience or training. Minimum of one seamer shall have experience seaming minimum 2,000,000 sq. ft. of HDPE geomembrane using same type of seaming apparatus in use at Site. Most experienced seamer, "Master Seamer," shall provide direct supervision, as required, over less experienced seamers.

1.4 Quality Assurance Program

The Manufacturer, fabricator, and installer shall participate in and conform to items and requirements of quality assurance program as outlined in this Section and the Construction Quality Assurance (CQA) Plan.

1.5 Delivery, Storage, and Handling

A. *Packing and Shipping:*
   1. Manufacturer shall identify each roll delivered to site with following:
      a) Manufacturer's name.
      b) Product Identification.
      c) Thickness.
      d) Roll number.
      e) Roll dimensions.

2. The INSTALLER shall protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions during loading, transport, and unloading at site.

B. *Acceptance at Site:*

1. INSTALLER shall be responsible for unloading all geosynthetics delivered to the Site, unless otherwise agreed at the pre-construction meeting.
2. Shipper shall notify INSTALLER, or other party responsible for off-loading materials, 48-hours in advance of material delivery.
3. INSTALLER, or other party responsible for off-loading materials, shall bear all costs (including but not limited to OWNER's, QAC's, 3rd party contractor costs) associated with failure to supply appropriate personnel and equipment required to off-load geosynthetic materials.
4. Perform physical inventory of materials delivered to the Site for use in the work. Perform inventory on delivery, or as soon as practicable thereafter.
5. Conduct surface observations of each roll for defects and damage. This examination shall be conducted without unrolling rolls, unless defects or damages are found or suspected. Note type and extent of defects or damage observed.
6. Defective or damaged rolls, or portions of rolls, will be rejected and shall be removed from Site and replaced, at no additional expense to the OWNER.
7. Rolls or portions of rolls without proper identification or labeling will be rejected and shall be removed from Site.

C. *Storage and Protection:*

1. The geomembranes will be unloaded, transported, stored, and protected in accordance with the manufacturer's recommendations so as not to damage or degrade the properties of the material.
2. OWNER will provide on-site storage area for geomembrane rolls from time of delivery until deployment.
3. The INSTALLER shall protect geomembrane from dirt, water, and other sources of damage.
4. The INSTALLER shall preserve the integrity and readability of geomembrane roll labels.

PART 2 PRODUCTS

2.1 Materials

The geomembrane used for cell construction is a textured on both sides, 60-mil high-density polyethylene (HDPE). The geomembrane shall meet the following properties:

TABLE 1
Minimum Properties for 60-mil HDPE Textured Geomembrane

Testing Properties	Testing Method	60 mil HDPE Value
Thickness mils (min avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D5994	57 mils 54 mils 51 mils
Density g/cc	ASTM D1505 or ASTM D792	0.940 (min avg) (either method)
Asperity Height (min avg.) (1) (2)	GM-12	10 mils
Tensile Properties (min. avg.) (3) • Break strength – lb/in • Break elongation - %	ASTM D6693	 90 100
Tear Resistance – lb (min. avg.)	ASTM D1004	42
Puncture Resistance – lb (min. avg.)	ASTM D4833	90
Stress Crack Resistance (11)	ASTM D5397 (11) (Appendix)	200 hr
Carbon Black Content - %	ASTM D1603 (4)	2.0 to 3.0
Carbon Black Dispersion	ASTM D5596	Note (5)
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	 100 400
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	 ASTM D5721 ASTM D3895 ASTM D5885	 55 80
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	 N.R. (9) 50
Interface Friction Angle (min.) – degrees	ASTM D 5321	34 for geotextile to geomembrane 32 for geomembrane to soil

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double-sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.

(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

A *Geomembrane*: The Geomembrane shall be manufactured from new polyethylene resin, except as noted below:
1. Use of geomembrane recycled during manufacturing process shall be permitted, with written approval from the DESIGNER, if recycled geomembrane does not exceed 2% by weight.
2. Geomembrane manufactured from non-complying resin shall be rejected.

B *Geomembrane Characteristics:*
1. The geomembrane shall contain a maximum of 1%, by weight, of additives, fillers or extenders (not including carbon black).
2. The geomembrane shall contain between 2% and 3%, by weight, of carbon black for ultraviolet light resistance.
3. No pinholes, bubbles or other surface features that compromise geomembrane integrity are allowed. Geomembrane shall be free of blisters, nondispersed raw materials, or other signs of contamination resulting from the manufacturing process. Geomembrane rolls or portions of rolls with these defects shall be rejected.

2.2 Seaming and Testing Equipment

A. *Welding:*
1. The INSTALLER shall maintain a minimum of two (2) spare operable seaming machines on-site unless otherwise agreed upon at pre-construction meeting.
2. Seaming equipment shall not damage geomembrane.
3. Use extrusion welding apparatus equipped with gauges indicating temperature of extrudate at the equipment nozzle, or utilize hand-held gauges to measure extrudate temperatures.
4. Use self-propelled fusion-welding machines that create an air channel between two (2) welded tracks and are equipped with following:
   a. Gauge indicating temperature of heating element; and,
   b. Gauge indicating the speed of travel.
5. Place electric generator on smooth base such that no damage occurs to geomembrane.

B. *Vacuum Testing Equipment:*
   1. The vacuum box assembly shall consist of a rigid housing open at the bottom, with a transparent viewing window on top and a soft neoprene gasket attached to bottom rim of housing, a porthole or valve assembly, and a vacuum gauge;
   2. Pump assembly equipped with pressure controller and pipe connections;
   3. Pressure/vacuum rubber hose with fittings and connections;
   4. Soapy solution to wet test area; and,
   5. Means of applying soapy solution.

C. *Air Pressure Testing Equipment:*
   1. Air pump (manual or motor driven), equipped with pressure gauge, capable of generating, sustaining, and measuring pressure between 24 and 35 psi (160 and 240 kPa), and mounted on cushion to protect geomembrane;
   2. Rubber hose with fittings and connections;
   3. Means of safely sealing weld air channel;
   4. Sharp hollow needle, or other approved pressure feed device; and,
   5. Air pressure monitoring device.

D. *Tensiometer:*
   1. Tensiometers shall be capable of maintaining constant jaw separation rate of 20-inches per minute; and,
   2. Tensiometers shall be calibrated annually. A certificate indicating that the equipment has been calibrated within one (1) year of use in the work shall be maintained with the tensiometer. The INSTALLER will provide the QAC with a copy of the certificate of calibration.

2.3 Source Quality Control

Tests and inspections shall be performed by geomembrane manufacturer as follows:

A. Test geomembranes to demonstrate that resin meets this Specification.
B. Continuously monitor geomembrane during manufacturing process for inclusions, bubbles, or other defects. Geomembranes, which exhibit defects, shall not be acceptable for installation.
C. Monitor thickness continuously during manufacturing process.
D. The MANUFACTURER shall conduct quality control (QC) testing to verify conformance with table 1 in section 2.1, at the following frequencies:

TABLE 2
Quality Control (QC) Manufacturers Testing

Testing Properties	Testing Method	Manufacturer QC Testing Frequency
Thickness mils (min avg.)	ASTM D5994	1 per Roll
Density g/cc	ASTM D1505 or ASTM D792	1 per 50,000 SF
Asperity Height (min avg.) (1) (2)	GM-12	1 per 50,000 SF
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 50,000 SF
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 50,000 SF
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 50,000 SF
Stress Crack Resistance (11)	ASTM D5397	per GRI GM10
Carbon Black Content - %	ASTM D1603 (4)	1 per 50,000 SF
Carbon Black Dispersion	ASTM D5596	1 per 50,000 SF
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	ASTM D3895 ASTM D5885	(11)
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	(11)
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	ASTM D3895 ASTM D5885	(11)

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils
(2) Alternate the measurement side for double sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.

(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) Manufacturer may provide a certification letter. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

PART 3 EXECUTION

3.1 Quality Assurance Sampling and Testing

A. Prior to or upon delivery of the material to the Site, the QAC shall obtain conformance test samples from selected geomembrane. Conformance test samples may be cut at the MANUFACTURER's facilities after the materials represented by such samples have been segregated from all other materials and have been designated for the project. The INSTALLER shall make rolls available and assist QAC in obtaining material inventory and samples. Samples shall be tested in accordance with Table 1 (sec 2.1) at the following frequencies:

TABLE 3
Quality Assurance (QA) Conformance Testing

Testing Properties	Testing Method	Conformance QA Testing Frequency
Thickness mils (min avg.)	ASTM D5994	1 per 200,000 SF*
Density g/cc	ASTM D1505 or ASTM D792	1 per 200,000 SF*
Asperity Height (min avg.) (1) (2)	GM-12	1 per 200,000 SF*
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 200,000 SF*
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 200,000 SF*
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 200,000 SF*
Stress Crack Resistance (11)	ASTM D5397	N/A
Carbon Black Content - %	ASTM D1603 (4)	1 per 200,000 SF*
Carbon Black Dispersion	ASTM D5596	1 per 200,000 SF*
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	N/A
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days or • High Pressure OIT (min. avg.), % retained after 90 days	ASTM D5721 ASTM D3895 ASTM D5885	N/A
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	N/A

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double sided textured sheet.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.

(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 * or minimum 1 per lot.

B. All rolls represented by quality assurance testing shall be rejected if test failure occurs. The INSTALLER may at their expense request additional testing to validate individual rolls. Rolls bracketed by passing tests may be used in the work.

3.2 Surface Preparation

A. The CONTRACTOR is responsible for preparing subgrade surface for geomembrane placement.
B. After prepared subgrade surface has been accepted in accordance with Quality Assurance Plan, report to DESIGNER any change in subgrade surface condition that may require repair work. The CONTRACTOR shall maintain prepared subgrade surfaces with the cooperation and assistance of the INSTALLER.
C. Do not place geomembrane onto an area that has become degraded due to weather conditions. Observe and report surface condition daily to evaluate suitability for geomembrane deployment.
D. Repair damage to prepared surface caused by installation activities at INSTALLER'S expense.

3.3 Installation

A. *Panel Nomenclature:*
   1. Field panels are defined as a roll or portion of roll cut and seamed in the field, excluding patches and cap strips.
   2. Identify each field panel with a unique identification code (number or letter-number). This identification code shall be agreed upon by DESIGNER, INSTALLER, and QAC.
   3. The INSTALLER shall be responsible for marking the panel and roll number on the geomembrane.

B. *Protection:*
   1. Do not use equipment that damages geomembrane.
   2. Ensure subgrade surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable immediately prior to and during geomembrane deployment.
   3. Keep geosynthetic elements immediately underlying geomembrane clean and free of debris.
   4. Do not permit personnel to smoke or wear shoes that can damage geomembranes while working on the geomembrane. Personnel shall not bring glass or metal containers on geomembrane, except as required to perform the work.
   5. Unroll panels in manner that does not cause excessive scratches or crimps in geomembrane and does not damage supporting soil.
   6. Place panels in manner that minimizes wrinkles (especially differential wrinkles between adjacent panels).

7. Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags) that shall not damage geomembrane. In case of high winds, continuous loading is recommended along panel edges.
8. Protect geomembrane in areas where excessive traffic is expected, using geotextiles, extra geomembrane, or other suitable materials.
9. The contractor must protect the work described in this section before, during, and after installation.

C. *Field Panel Deployment:*
1. Install field panels at locations indicated on INSTALLER's layout plan to the greatest extent possible.
2. Replace seriously damaged (torn, twisted or crimped) field panels, or portions thereof, at no cost to OWNER. Repair less serious damage as specified herein. QAC shall determine if material shall be repaired or replaced.
3. Remove from work area damaged panels, or portions of panels, that have been rejected by the QAC.
4. Do not proceed with deployment at ambient temperature below 32° F (0° C) or above 104° F (40° C) unless authorized, in writing, by DESIGNER.
5. Do not deploy during precipitation, in presence of excessive moisture, (fog, dew), in areas of ponded water, or in presence of excessive winds.
6. Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment.
7. Do not deploy more geomembrane field panels in one day than can be seamed during that day.

D. *Seam Layout:*
1. To the greatest extent possible, orient seams parallel to line of maximum slope (i.e., oriented along, not across, slope).
2. No horizontal seams will be permitted on the slope, unless approved, in writing, by the DESIGNER.
3. No horizontal seam shall be less than 5 ft (1.5 m) from toe of slope, unless approved by the QAC.
4. In general, maximize lengths of field panels and minimize number of field seams.
5. Align geomembrane panels to have nominal overlap of 3 in. (75 mm) for extrusion welding and 4 to 6 in. (100 mm to 150 mm) for fusion welding. Final overlap shall be sufficient to allow destructive “peel” tests to be performed on seam.

E. *Temporary Bonding:*
1. Hot air device (Leister) shall be used to temporarily bond the geomembrane panels to be extrusion welded.
2. Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat required to lightly tack the geomembrane panels together. Control the temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
3. Do not use solvent or adhesive.

F. *Seaming Methods:*

1. Approved processes for field seaming are extrusion fillet welding and fusion welding. Proposed alternate processes shall be documented and submitted to DESIGNER for approval. Alternate procedures shall be used only after being approved in writing by the DESIGNER.
2. Use fusion welding as primary method of seaming adjacent field panels.
   a. Cross seam "tees", associated with fusion or extrusion seam welding, shall be patched in accordance with the requirements of this Section.
   b. Place welder on protective pad to prevent geomembrane damage when not in use.
   c. When subgrade conditions dictate, use movable protective layer (e.g. geomembrane rub sheet) directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers. Rub sheet shall be removed from under the liner once seaming is complete.
3. Use extrusion fillet welding as secondary method for seaming between adjacent panels and as primary method of welding for detail and repair work.
   a. Purge heat-degraded extrudate from barrel of extruder.
   b. Place smooth insulating plate or fabric beneath hot welding apparatus when not in use.
   c. Use clean and dry welding rods or extrudate pellets.
   d. Clean dirt and debris from geomembrane surface prior to extrusion welding.
   e. Grind weld area to using suitable hand held equipment to prepare geomembrane surface for extrusion welding. Grind perpendicular to seam. Take care not to over-grind the geomembrane beyond the extents of the extrudate coverage.
   f. Complete extrusion welding within one (1) hour of seaming operation grinding process without damaging geomembrane.

G. *Seaming Procedures:*

1. General Seaming Procedures - Ambient temperature between 32°F (0°C) and 104°F (40°C).
   a. Do not field seam without Master Seamer being present.
   b. Seam only during dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.
   c. Do not seam during excessive winds, except as needed to protect the work. Do not seam if wind creates unsafe working conditions.
   d. If required, use a "rub-sheet" or similar hard surface directly under seam overlap to achieve proper support for seaming apparatus.
   e. Align panels to minimize wrinkles and/or "fishmouths" in welds.
   f. Extend seams to outside edge of panels placed in anchor trench.
   g. Prior to seaming, ensure that seam area is free of moisture, dust, dirt, debris, or foreign material.
   h. "Fishmouths" or wrinkles at seam overlaps shall be cut along ridge of wrinkle in order to achieve flat overlap. Cut "fishmouths"

or wrinkles shall be seamed or patched in accordance with this Section.

2. Cold Weather Seaming Procedures (ambient temperature is below 32°F (0°C)).
   a. No seaming of geomembrane is permitted unless demonstrated to QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded under ambient temperature of 32°F (0°C), at QAC'S discretion.
3. Warm Weather Procedures (ambient temperature is above 104°F (40°C)).
   a. No seaming of geomembrane is permitted unless demonstrated to QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded over ambient temperature of 104°F (40°C), at QAC'S discretion.

H. *Repair Procedures:*
1. Acceptable repair procedures include following:
   a. Patching: A piece of the same geomembrane material extrusion welded into place. Use to repair holes, tears, nondispersed raw materials, and contamination by foreign matter. All panel intersections of three (3) or more geomembrane panels shall be patched.
   b. Capping: Strip of the same geomembrane material extrusion welded into place over an inadequate seam. Use to repair large lengths of failed seams.
   c. Spot welding or seaming (Grind and Weld): Bead of molten extrudate placed on flaw. Use to repair scuffing, dimpling, or other minor, localized flaws. Spot welding shall not be used to repair holes in the geomembrane liner.
   d. Removal and replacement: Remove bad seam and replace with strip of same geomembrane material welded into place. Use to repair large lengths of failed seams.
   e. Extrusion welding a flap associated with double-tracked fusion welded seams: Repairs of this type shall not be used unless approved by QAC, and only if the flap is a minimum of 1.5 inches long. Repairs of this type shall not exceed 100 ft (30 m) in length. A patch as described previously shall be placed at one or both ends if located within the active cover area (excluding the anchor trench).
2. For each repair method:
   a. Ensure surfaces are clean, dry, and prepared in accordance with specified seaming process.
   b. Ensure seaming equipment used in repairing procedures meet requirements of this Specification.

c. Extend patches or caps at least nches (150 mm) beyond edge of defect. The corners of patches shall be rounded with a radius of approximately 6 inches (150 mm). The minimum diameter of any patch repairing a pinhole shall be 12 inches.

I. *Anchor Trench:*

1. The CONTRACTOR shall excavate anchor trenches to lines and grades shown on Permit Drawings prior to geomembrane placement, unless otherwise specified.
2. The CONTRACTOR shall provide anchor trench with slightly rounded corners shall be provided, to avoid sharp bends in geomembrane.
3. The INSTALLER shall provide and use plywood, boards, or other suitable materials, to permit welding machines to weld across, rather than through, anchor trenches.
4. The CONTRACTOR shall dewater the completed anchor trench, to prevent ponding or softening of adjacent soils while trench is open.
5. The CONTRACTOR and INSTALLER shall coordinate operations to minimize time anchor trench remains open and uncovered.
6. The INSTALLER shall provide sufficient temporary ballast, approved by the QAC, to prevent geosynthetics from being pulled or blown from the anchor trench.
7. The CONTRACTOR and INSTALLER shall remove debris related to their respective construction activities, including temporary ballast material, from anchor trench, prior to installation of subsequent materials. The anchor trench shall be cleaned to the satisfaction of the QAC.
8. The CONTRACTOR shall place and compact backfill in the anchor trench as soon as practical after geosynthetic installation is completed. The anchor trench shall be backfilled prior to placing leachate drainage layer material. Refer to specification Section 02223, Structural and General Fill for backfilling procedure

3.4 Field Quality Assurance and Quality Control

A. *Visual Inspection:*

1. The QAC will examine seam and non-seam areas of geomembrane to identify defects, holes, blisters, nondispersed raw materials, and any sign of contamination by foreign matter.

B. *Trial Seams:*

1. Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
2. Make trial seams for each combination of materials to be welded (i.e., textured/smooth, smooth/smooth, textured/textured). Seamers may only weld those combinations for which they have produced acceptable trial welds. Seamers are not required to produce trial seams for material combinations they will not be welding.
3. Make trial seams at beginning of each seaming period, following restart of welding equipment, upon change of seamers, and at least once every five (5) hours, for each production seaming apparatus used that day.

4. Make trial seams using the same materials and under the under same conditions as production welding.
5. Trial seam sample shall be at least 4-feet (1.2 m) long by 1-foot (0.3 m) wide (after seaming) with seam centered lengthwise.
6. Cut six (6) test specimens from sample, using 1-inch (25 mm) wide die cutter. These specimen locations shall be selected randomly along trial seam sample by GEOSYNTHETIC QAC. Test three (3) specimens in peel and three (3) specimens in shear, using field tensiometer. Samples shall fail in film tear bond (FTB) mode. Trial seams shall meet the following minimum strengths:

TABLE 4
Seam Strength Values for Trial Seams and Destructive Sample Testing

PROPERTY	METHOD	60 MIL TEXTURED HDPE SPECIFIED VALUE
Shear Strength	ASTM D4437	120 ppi (min)
Peel Adhesion: Fusion Extrusion	 ASTM D4437 ASTM D4437	 91 ppi (min) 78 ppi (min)
For shear tests, sheet shall yield before failure of seam. For peel adhesion, seam separation shall not extend more than 25 percent of seam width into seam. For either test, testing shall be discontinued when sample has visually yielded. Four (4) out of 5 specimens shall meet the, or exceed, the values listed for shear and peel. The 5th specimen can be as low as 80%.		

7. If the specimen fails, the INSTALLER shall attempt to identify the cause of the failure (e.g., mechanical malfunction, dirt in weld). On correction of the deficiency, the seamer shall produce a second trial seam. If the second trial seam fails, the seamer shall not be permitted to weld production seams until deficiencies are corrected and two (2) consecutive successful trial welds are achieved. If mechanical failure is determined to be the cause of the second trial seam failure, the machine shall be removed from service until suitable repairs are made. The seamer shall be required to produce a passing trial seam with the replacement machine.

C. *Nondestructive Seam Testing:*
1. General:
   a. The purpose of nondestructive testing is to check continuity of the seams. It will not provide quantitative information on seam strength.
   b. Nondestructively test field seams over their full length using vacuum test for extrusion seams, air pressure for double-fusion seams, or other DESIGNER approved method. The INSTALLER shall document all non-destructive testing results.

c. The INSTALLER shall perform nondestructive testing as seaming work progresses.
d. The RM shall observe all non-destructive testing on a procedural basis. The RM shall record all non-destructive testing information at or shortly after the time of testing. The INSTALLER and QAC shall coordinate to ensure that all installation activities are monitored by the RM in accordance with these Specifications.

2. Vacuum Testing for extrusion seam:
   a. Energize vacuum pump and reduce tank pressure to approximately 5 pounds per square inch (psig) (10-inches of Hg) (35 kPa) gauge pressure.
   b. Wet strip of extrusion seam approximately 12-inches by 48-inches (0.3 m by 1.2 m) with soapy solution.
   c. Ensure viewing window is clean.
   d. Place box over wetted area.
   e. Close bleed valve and open vacuum valve.
   f. Ensure that leak-tight seal is created.
   g. For minimum of 10 seconds, apply vacuum and examine geomembrane through viewing window for presence of soap bubbles.
   h. If no bubbles appear within 10 seconds, close vacuum valve and open bleed valve, move box over to next adjoining area with minimum 3-inch (75 mm) overlap and repeat process.
   i. Mark and repair areas where soap bubbles appear.
3. Air Pressure Testing for dual track, hot wedge fusion weld:
   a. Seal both ends of seam to be tested. Take suitable precautions if sealing seam ends with open flame.
   b. Insert needle or other approved pressure feed device into air channel created by fusion weld.
   c. Insert a protective cushion between air pump and geomembrane.
   d. Pressurize the air channel to approximately 30-psig (200 kPa). Close valve and allow pressure to stabilize for approximately two (2) minutes.
   e. Observe air pressure for an additional five (5) minutes after initial stabilization period ends. If pressure loss exceeds 3-psig or pressure does not stabilize, locate faulty area, repair, and retest.
   f. On completion of testing, cut opposite end of tested seam length to verify continuity of air channel. If air does not escape, locate blockage and retest unpressurized area. Repair all cuts and holes created in the air channel.
   g. Cap any seam length that cannot be successfully air pressure tested. The cap seam shall then be vacuum tested as required in subsection 2 (Vacuum Testing).
   h. Remove needle or other approved pressure feed device and repair hole in geomembrane.

4. Leak Location Testing
   a. Leak testing shall be conducted on the geomembrane prior to placement of overlying layers to confirm that there are no holes along seams or within the geomembrane panels. A "water puddle survey" will be used for bare geomembrane. In this method,
      i. A small amount of water is put in contact with the liner.
      ii. A "squeegee" is used to push the water over the geomembrane.
      iii. A low voltage electrical supply is connected to the earth ground and to the leak detector.
      iv. When a hole in the geomembrane is encountered, electrical current will flow through the water and the leak contacting the underlying soils.
      v. The current is monitored using an electronic detector that converts the increase in the current into an audible tone indication, which the technician can hear through headphones.
   b. Leak testing shall be repeated after the placement of the leachate collection layer, as this process of placing the overlying materials can cause damage.
      i. A high voltage isolated DC power supply was used to impress a voltage across the liner using one electrode placed in the operations layer located on top of the primary liner and a second electrode placed in the electrically conducting material located between the liners. Therefore, the geomembrane liner provides an electrical barrier between the electrodes except where there are holes in the geomembrane liner.
      ii. Electrical current flowing through the holes in the geomembrane liner produces localized anomalous areas of high current density near the holes.
      iii. This electrical current path is provided by electrically conducting material such as water, sand, or soil.
5. Inaccessible Seams:
   a. Cap-strip seams that cannot be nondestructively tested.
   b. Cap-strip material shall be composed of same type and thickness geomembrane as geomembrane to be capped.
   c. Examine cap-stripping operations with QAC for uniformity and completeness. Document observations.

D. *Destructive Seam Testing:*
1. General:
   a. The purpose of destructive seam testing to evaluate seam strength.
   b. Destructive seam testing shall be performed as seaming progresses.
   c. The destructive seam sample shall fail if the overlap is insufficient for grips of testing machine to close on sample (available flap is ½ inch long or less).

2. Location and frequency:
   a. Test at minimum frequency of one (1) test location per 500 ft (150 m) of welding length performed by each welding machine. This minimum frequency to be determined as an average taken from the total linear footage of seaming, per machine, at the end of the geomembrane installation.
   b. Test locations shall be determined by the QAC, during seaming operations.
   c. INSTALLER will not be informed in advance of locations where seam samples will be taken.
   d. DESIGNER or QAC reserves right to increase frequency of testing in accordance with performance results of samples previously tested.
3. Sampling Procedures:
   a. Cut samples at locations selected by QAC.
   b. QAC shall number each sample and record sample number and location in panel layout drawing.
   c. QAC shall mark each section of destructive test sample with sample number, seam number, seamer and machine identification, and date.
   d. Repair holes in geomembrane resulting from destructive seam sampling as soon as possible, in accordance with repair procedures described in this Section.
   e. Non-destructively test repairs in accordance with this Section.
4. Sample Dimensions:
   a. Field Testing: Cut two (2) 1-inch (25 mm) wide sample coupons, from each end of seam section identified by QAC. Distance between these two (2) samples shall be approximately 42-inches (1.1 m). Test both samples in peel mode, using field tensiometer. If both samples meet requirements of Table 4 located in section 3.4, B, item 6, collect sample for laboratory testing.
   b. Laboratory Testing: Collect laboratory test sample from seam length between field test sample coupon locations. Cut sample for laboratory testing, approximately 12-inches (0.3 m) wide by a minimum 42-inches (1.1 m) long, with seam centered lengthwise. Cut this sample into three (3) sections. QAC shall distribute sample sections as follows:
      1) Geosynthetic Quality Assurance Laboratory: minimum 18inch (0.5 m) long section for laboratory testing.
      2) INSTALLER: minimum 12-inch (0.3 m) long section for archive or optional laboratory testing.
      3) OWNER: minimum 12-inch (0.3m) long section for archive storage.
   c. Final determination of sample sizes shall be agreed upon at pre-construction meeting. Sample sizes shall be minimized, consistent with laboratory testing requirements.
   d. Submit laboratory sample for quantitative testing.

5. Destructive Test Failure Procedures:
   When a sample fails destructive testing, whether test is conducted in the field or at the Geosynthetic Quality Assurance Laboratory, the INSTALLER has following options:
   a. Repair the entire seam between two (2) passing destructive test locations along the path of machine producing the failed weld bracketing the failed location.
   b. Trace the welding path 10-feet (3 m) minimum in each direction from failed test, and repeat field testing procedures indicated in this Section at each location. If these additional samples pass testing, then collect laboratory test samples. If these laboratory samples pass testing, repair seam between these locations. If either, or both, sample fails, repeat process until passing sample is located. If necessary, tracking will extend back to previous days of welding until a passing sample is located. Repair seam between passing destructive sample locations.
   c. Acceptable repaired seams shall be bound by passing laboratory destructive tests locations. The QAC shall mark and additional destructive test sample for seam cap strip repairs of 150 ft (50 m) or more.
   d. If a destructive test sample fails, the DESIGNER may require additional testing of seams welded by same seamer and/or welding apparatus produced during same time shift as failed seam.

E. *Repair Verification:*
   1. Repairs shall be non-destructively tested.
   2. Nondestructive test results that pass shall indicate adequate repair.
   3. Destructive test samples shall be collected on repairs 100-feet long, or greater. Frequency may be increased at the discretion of the CQC.
   4. In the event destructive or nondestructive tests of repairs fail to meet the requirements of this Section, the work will be redone, at no expense to the DESIGNER, until passing test results are achieved.
   5. QAC shall monitor and document geomembrane repairs, and non-destructive testing.

F. *Large Wrinkles:* Wrinkle is considered to be large when geomembrane can be folded over onto itself.
   1. When seaming of geomembrane is completed, and prior to placing overlying materials, QAC shall identify all large geomembrane wrinkles, to be repaired.
   2. Cut and repair all wrinkles identified by QAC. Welds produced while repairing wrinkles shall be nondestructively tested.
   3. Repair wrinkles identified by QAC. Repair during coldest part of installation period.

*****END OF SECTION*****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of low-density polyethylene (LLDPE) geomembrane installation for the Closure Cap and other related and incidental work within the designated area and as required for the construction of other work, as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Submittals

A. *Pre-installation*: The CONTRACTOR shall submit the following prior to geomembrane deployment:

1. Origin (supplier's name and production plant) and identification (brand name and number) of resin used to manufacture geomembrane.
2. Copies of dated quality control certificates issued by resin supplier.
3. Results of tests conducted by geomembrane manufacturer to verify that resin used to manufacture geomembrane meets Specifications.
4. Statement that amount of reclaimed polymer added to resin during manufacturing did not exceed 2% by weight.
5. List of materials that comprise geomembrane, expressed in following categories as percent by weight:
   a. polyethylene;
   b. carbon black; and,
   c. other additives.
6. Manufacturer's specification for geomembrane, including properties listed and measured using appropriate test methods.
7. Written certification that minimum values given in manufacturer's specification are guaranteed by geomembrane manufacturer.
8. Quality control certificates, signed by geomembrane manufacturer. Each quality control certificate shall include applicable roll identification numbers, testing procedures, and results of quality control tests.
9. Field panel layout and identification code including dimensions and details.
10. Resumes of the INSTALLER’s Superintendent and Master Seamer, including dates and duration of employment.
11. Installation schedule.
12. List of personnel performing seaming operations, including experience.
13. Certificate that extrusion rod is comprised of same resin as geomembrane liner material.
14. Manufacturer Material and Installation warranties.

B. *Installation*: Submit as installation proceeds.
   1. Quality control documentation recorded during installation.
   2. Subgrade surface acceptance certificates signed by INSTALLER for each area that will be covered directly by geomembrane. Submit on deployment of geomembrane.
   3. Deployment of geomembrane will be considered acceptance of subgrade by the INSTALLER, if certificate is not submitted.

1.3 Pre-Qualifications

A. *Manufacturer:*
Manufacturer shall have minimum 5-years continuous experience in manufacture of LLDPE geomembrane, or experience totaling 10,000,000 square feet (sq. ft.) of manufactured LLDPE, or geomembrane manufacture for minimum of ten (10) completed facilities.

B. *Fabricator (if applicable):*
Fabricator shall have minimum 5-years continuous experience in fabrication of LLDPE geomembrane or experience totaling 2,000,000 sq. ft. of fabricated LLDPE geomembrane for minimum of ten (10) completed facilities.

C. *Installer:*
   1. Installer shall have minimum 5-years continuous experience in installation of LLDPE geomembrane or experience totaling 2,000,000 sq. ft. of installed LLDPE geomembrane for minimum of ten (10) completed facilities.
   2. Personnel performing seaming operations shall be qualified by experience or training. Minimum of one seamer shall have experience seaming minimum 2,000,000 sq. ft. of LLDPE geomembrane using same type of seaming apparatus in use at Site. Most experienced seamer, "Master Seamer," shall provide direct supervision, as required, over less experienced seamers.

1.4 Quality Assurance Program

The Manufacturer, fabricator, and installer shall participate in and conform to items and requirements of quality assurance program as outlined in this Section and the Construction Quality Assurance (CQA) Plan.

1.5 Delivery, Storage, and Handling

A. *Packing and Shipping:*
   1. Manufacturer shall identify each roll delivered to site with the following:
      a. Manufacturer's name.
      b. Product Identification.
      c. Thickness.
      d. Roll number.
      e. Roll dimensions.

2. The INSTALLER shall protect geomembrane from excessive heat, cold, puncture, cutting, or other damaging or deleterious conditions during loading, transport, and unloading at site.

B. *Acceptance at Site:*

1. INSTALLER shall be responsible for unloading all geosynthetics delivered to the Site, unless otherwise agreed at the geosynthetics kick-off meeting.
2. Shipper shall notify INSTALLER, or other party responsible for off-loading materials, 48-hours in advance of material delivery.
3. INSTALLER, or other party responsible for off-loading materials, shall bear all costs (including but not limited to OWNER's, QAC's, 3rd party contractor costs) associated with failure to supply appropriate personnel and equipment required to off-load geosynthetic materials.
4. Perform physical inventory of materials delivered to the Site for use in the work. Perform inventory on delivery, or as soon as practicable thereafter.
5. Conduct surface observations of each roll for defects and damage. This examination shall be conducted without unrolling rolls, unless defects or damages are found or suspected. Note type and extent of defects or damage observed.
6. Defective or damaged rolls, or portions of rolls, will be rejected and shall be removed from Site and replaced, at no additional expense to the OWNER.
7. Rolls or portions of rolls without proper identification or labeling will be rejected and shall be removed from Site.

C. *Storage and Protection:*

1. The geomembranes will be unloaded, transported, stored, and protected in accordance with the manufacturer's recommendations so as not to damage or degrade the properties of the material.
2. OWNER will provide on-site storage area for geomembrane rolls from time of delivery until deployment.
3. The INSTALLER shall protect geomembrane from dirt, water, and other sources of damage.
4. The INSTALLER shall preserve the integrity and readability of geomembrane roll labels.

PART 2 PRODUCTS

2.1 Materials

The geomembrane used for the closure is a low-density polyethylene (LLDPE) textured on both sides, 40-mil liner. The geomembrane shall meet the following properties:

TABLE 1
Minimum Properties 40-mil LLDPE Textured Geomembrane

Testing Properties	Testing Method	40 mil LLDPE Value
Thickness mils (min avg.) • Lowest individual for 8 out of 10 values • Lowest individual for any of the 10 values	ASTM D 5994	38 mils 36 mils 34 mils
Density g/cc	ASTM D1505 or ASTM D792	0.939 (max avg) (either method)
Asperity Height (min avg.) (1) (2)	GM-12	10 mils
Tensile Properties (min. avg.) (3) • Break strength – lb/in • Break elongation - %	ASTM D6693	 60 250
Tear Resistance – lb (min. avg.)	ASTM D1004	22
Puncture Resistance – lb (min. avg.)	ASTM D4833	44
Stress Crack Resistance (11)	ASTM D5397 (11) (Appendix)	NA
Carbon Black Content - %	ASTM D1603 (4)	2.0 to 3.0
Carbon Black Dispersion	ASTM D5596	Note (5)
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	 100 400
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	 ASTM D5721 ASTM D3895 ASTM D5885	 35 60
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	 N.R. (9) 35
Interface Friction Angle (min.) –degrees	ASTM D 5321	34 for geotextile to geomembrane 32 for geomembrane to soil

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double-sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in./min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views:9 in Categories 1 or 2 and 1 in Category 3.
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.

(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

A *Geomembrane*: The geomembrane shall be manufactured from new polyethylene resin, except as noted below:
1. Use of geomembrane recycled during manufacturing process shall be permitted, with written approval from the DESIGNER, if recycled geomembrane does not exceed 2% by weight.
2. Geomembrane manufactured from non-complying resin shall be rejected.

B *Geomembrane Characteristics:*
1. The geomembrane shall contain a maximum of 1%, by weight, of additives, fillers or extenders (not including carbon black).
2. The geomembrane shall contain between 2% and 3%, by weight, of carbon black for ultraviolet light resistance.
3. No pinholes, bubbles or other surface features that compromise geomembrane integrity are allowed. Geomembrane shall be free of blisters, nondispersed raw materials, or other signs of contamination resulting from the manufacturing process. Geomembrane rolls or portions of rolls with these defects shall be rejected.

2.2 Seaming and Testing Equipment

A. *Welding:*
1. The INSTALLER shall maintain a minimum of two (2) spare operable seaming machines on-site unless otherwise agreed upon at pre-construction meeting.
2. Seaming equipment shall not damage geomembrane.
3. Use extrusion welding apparatus equipped with gauges indicating temperature of extrudate at the equipment nozzle, or utilize hand-held gauges to measure extrudate temperatures.
4. Use self-propelled fusion-welding machines that create an air channel between two (2) welded tracks and are equipped with following:
   a. Gauge indicating temperature of heating element; and,
   b. Gauge indicating the speed of travel.
5. Place electric generator on smooth base such that no damage occurs to geomembrane.

B. *Vacuum Testing Equipment:*
   1. The vacuum box assembly shall consist of a rigid housing open at the bottom, with a transparent viewing window on top and a soft neoprene gasket attached to bottom rim of housing, a porthole or valve assembly, and a vacuum gauge;
   2. Pump assembly equipped with pressure controller and pipe connections;
   3. Pressure/vacuum rubber hose with fittings and connections;
   4. Soapy solution to wet test area; and,
   5. Means of applying soapy solution.

C. *Air Pressure Testing Equipment:*
   1. Air pump (manual or motor driven), equipped with pressure gauge, capable of generating, sustaining, and measuring pressure between 24 and 35 psi (160 and 240 kPa), and mounted on cushion to protect geomembrane;
   2. Rubber hose with fittings and connections;
   3. Means of safely sealing weld air channel;
   4. Sharp hollow needle, or other approved pressure feed device; and,
   5. Air pressure monitoring device.

D. *Tensiometer:*
   1. Tensiometer shall be capable of maintaining constant jaw separation rate of 20-inches per minute; and,
   2. Tensiometer shall be calibrated annually. A certificate indicating that the equipment has been calibrated within one (1) year of use in the work shall be maintained with the tensiometer. The INSTALLER will provide the QAC with a copy of the certificate of calibration.

2.3 Source Quality Control

Tests and inspections shall be performed by geomembrane manufacturer as follows:

A. Test geomembranes to demonstrate that resin meets this Specification.
B. Continuously monitor geomembrane during manufacturing process for inclusions, bubbles, or other defects. Geomembranes, which exhibit defects, shall not be acceptable for installation.
C. Monitor thickness continuously during manufacturing process.
D. The MANUFACTURER shall conduct quality control (QC) testing to verify conformance with table 1 in section 2.1, at the following frequencies:

TABLE 2
Quality Control (QC) Manufacturers Testing

Testing Properties	Testing Method	Manufacturer QC Testing Frequency
Thickness mils (min avg.)	ASTM D 5994	1 per Roll
Density g/cc	ASTM D1505 or ASTM D792	1 per 50,000 SF
Asperity Height (min avg.) (1) (2)	GM-12	1 per 50,000 SF
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 50,000 SF
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 50,000 SF
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 50,000 SF
Stress Crack Resistance (11)	ASTM D5397	per GRI GM10
Carbon Black Content - %	ASTM D1603 (4)	1 per 50,000 SF
Carbon Black Dispersion	ASTM D 5596	1 per 50,000 SF
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	 (11)
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days, or • High Pressure OIT (min. avg.), % retained after 90 days	 ASTM D5721 ASTM D3895 ASTM D5885	 (11)
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	 (11)

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double sided textured sheet. Both sides are to be measured and considered separately.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in/min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3.
(6) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane.
(7) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response.
(8) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C.
(9) Not recommended since high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples.
(10) UV resistance is based on percent retained value regardless of the original HP-OIT value.
(11) Manufacturer may provide a certification letter. The SP-NCTL test is not appropriate for testing geomembranes with textured or irregular rough surfaces. Test should be conducted on smooth edges of textured rolls or on smooth sheet made from the same formulation as being used for the textured sheet materials, or the texturing act as the notch. Follow procedure listed in ASTM D5397 appendix.

PART 3 EXECUTION

3.1 Quality Assurance Sampling and Testing

A. Prior to or upon delivery of the material to the Site, the QAC shall obtain conformance test samples from selected geomembrane. Conformance test samples may be cut at the MANUFACTURER's facilities after the materials represented by such samples have been segregated from all other materials and have been designated for the project. The INSTALLER shall make rolls available and assist QAC in obtaining material inventory and samples. Samples shall be tested in accordance with Table 1 (sec 2.1) at the following frequencies:

TABLE 3
Quality Assurance (QA) Conformance Testing

Testing Properties	Testing Method	Conformance QA Testing Frequency
Thickness mils (min avg.)	ASTM D 5994	1 per 200,000 SF*
Density g/cc	ASTM D1505 or ASTM D792	1 per 200,000 SF*
Asperity Height (min avg.) (1) (2)	GM-12	1 per 200,000 SF*
Tensile Properties (min. avg.) (3)	ASTM D6693	1 per 200,000 SF*
Tear Resistance – lb (min. avg.)	ASTM D1004	1 per 200,000 SF*
Puncture Resistance – lb (min. avg.)	ASTM D4833	1 per 200,000 SF*
Stress Crack Resistance (11)	ASTM D5397	N/A
Carbon Black Content - %	ASTM D1603 (4)	1 per 200,000 sf*
Carbon Black Dispersion	ASTM D 5596	1 per 200,000 sf*
Oxidative Induction Time (OIT) (min avg.) (6) • Standard OIT, or • High Pressure OIT	 ASTM D3895 ASTM D5885	N/A
Oven Aging at 85°C (7) • Std. OIT (min. avg.), % retained after 90 days or • High Pressure OIT (min. avg.), % retained after 90 days	 ASTM D5721 ASTM D3895 ASTM D5885	N/A
UV Resistance (8) • Std. OIT (min. avg.), or • High Pressure OIT (min avg.) % retained after 1600 hrs	 ASTM D3895 ASTM D5885	N/A

(1) Of 10 readings, 8 out of 10 must be ≥7 mils, and lowest individual reading must be ≥ 5 mils.
(2) Alternate the measurement side for double sided textured sheet.
(3) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 in. at 2.0 in/min.
(4) Other methods such as D4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D1603 (tube furnace) can be established.
(5) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 Or minimum 1 per lot.

B. All rolls represented by quality assurance testing shall be rejected if test failure occurs. The INSTALLER may, at their expense, request additional testing to validate individual rolls. Rolls bracketed by passing tests may be used in the work.

3.2 Surface Preparation

A. The CONTRACTOR is responsible for preparing subgrade surface for geomembrane placement.
B. After prepared subgrade surface has been accepted in accordance with Quality Assurance Plan, report to DESIGNER any change in subgrade surface condition that may require repair work. The CONTRACTOR shall maintain prepared subgrade surfaces with the cooperation and assistance of the INSTALLER.
C. Do not place geomembrane onto an area that has become degraded due to weather conditions. Observe and report surface condition daily to evaluate suitability for geomembrane deployment.
D. Repair damage to prepared surface caused by installation activities at INSTALLER'S expense.

3.3 Installation

A. *Panel Nomenclature:*
1. Field panels are defined as a roll or portion of roll cut and seamed in the field, excluding patches and cap strips.
2. Identify each field panel with a unique identification code (number or letter-number). This identification code shall be agreed upon by DESIGNER, INSTALLER, and QAC.
3. The INSTALLER shall be responsible for marking the panel and roll number on the geomembrane.

B. *Protection:*
1. Do not use equipment that damages geomembrane;
2. Ensure subgrade surface underlying geomembrane has not deteriorated since previous acceptance, and remains acceptable immediately prior to and during geomembrane deployment;
3. Keep geosynthetic elements immediately underlying geomembrane clean and free of debris;
4. Do not permit personnel to smoke or wear shoes that can damage geomembranes while working on the geomembrane. Personnel shall not bring glass or metal containers on geomembrane, except as required to perform the work;
5. Unroll panels in manner that does not cause excessive scratches or crimps in geomembrane and does not damage supporting soil;
6. Place panels in manner that minimizes wrinkles (especially differential wrinkles between adjacent panels);

7. Prevent wind uplift by providing adequate temporary loading and/or anchoring (e.g., sandbags) that shall not damage geomembrane. In case of high winds, continuous loading is recommended along panel edges; and,
8. Protect geomembrane in areas where excessive traffic is expected, using geotextiles, extra geomembrane, or other suitable materials.
9. The contractor must protect the work described in this section before, during, and after installation.

C. *Field Panel Deployment:*
1. Install field panels at locations indicated on INSTALLER's layout plan to the greatest extent possible.
2. Replace seriously damaged (torn, twisted or crimped) field panels, or portions thereof, at no cost to OWNER. Repair less serious damage as specified herein. QAC shall determine if material shall be repaired or replaced.
3. Remove from work area damaged panels, or portions of panels, that have been rejected by the QAC.
4. Do not proceed with deployment at ambient temperature below 32° F (0° C) or above 104° F (40° C) unless authorized, in writing, by DESIGNER.
5. Do not deploy during precipitation, in presence of excessive moisture, (fog, dew), in areas of ponded water, or in presence of excessive winds.
6. Do not undertake deployment if weather conditions will preclude material seaming on same day as deployment.
7. Do not deploy more geomembrane field panels in one day than can be seamed during that day.

D. *Seam Layout:*
1. To the greatest extent possible, orient seams parallel to line of maximum slope (i.e., oriented along, not across, slope).
2. No horizontal seams will be permitted on the slope, unless approved, in writing, by the DESIGNER.
3. No horizontal seam shall be less than 5 ft (1.5 m) from toe of slope, unless approved by the QAC.
4. In general, maximize lengths of field panels and minimize number of field seams.
5. Align geomembrane panels to have nominal overlap of 3 in. (75 mm) for extrusion welding and 4 to 6 in. (100 mm to 150 mm) for fusion welding. Final overlap shall be sufficient to allow destructive “peel” tests to be performed on seam.

E. *Temporary Bonding:*
1. Hot air device (Leister) shall be used to temporarily bond the geomembrane panels to be extrusion welded.

2. Do not damage geomembrane when temporarily bonding adjacent panels. Apply minimal amount of heat required to lightly tack the geomembrane panels together. Control the temperature of hot air at nozzle of any temporary welding apparatus to prevent damage to geomembrane.
3. Do not use solvent or adhesive.

F. *Seaming Methods:*
1. Approved processes for field seaming are extrusion fillet welding and fusion welding. Proposed alternate processes shall be documented and submitted to the DESIGNER for approval. Alternate procedures shall be used only after being approved in writing by the DESIGNER.
2. Use fusion welding as primary method of seaming adjacent field panels.
   a. Cross seam “tees”, associated with fusion or extrusion seam welding, shall be patched in accordance with the requirements of this Section.
   b. Place welder on protective pad to prevent geomembrane damage when not in use.
   c. When subgrade conditions dictate, use movable protective layer (e.g. geomembrane rub sheet) directly below each overlap of geomembrane that is to be seamed to prevent buildup of moisture between sheets and prevent debris from collecting around pressure rollers. Rub sheet shall be removed from under the liner once seaming is complete.
3. Use extrusion fillet welding as secondary method for seaming between adjacent panels and as primary method of welding for detail and repair work.
   a. Purge heat-degraded extrudate from barrel of extruder
   b. Place smooth insulating plate or fabric beneath hot welding apparatus when not in use
   c. Use clean and dry welding rods or extrudate pellets.
   d. Clean dirt and debris from geomembrane surface prior to extrusion welding.
   e. Grind weld area to using suitable hand held equipment to prepare geomembrane surface for extrusion welding. Grind perpendicular to seam. Take care not to over-grind the geomembrane beyond the extents of the extrudate coverage.
   f. Complete extrusion welding within one (1) hour of seaming operation grinding process without damaging geomembrane.

G. *Seaming Procedures:*
1. General Seaming Procedures - Ambient temperature between 32° F (0° C) and 104° F (40° C).
   a. Do not field seam without Master Seamer being present.
   b. Seam only during dry conditions, i.e., no precipitation or other excessive moisture, such as fog or dew.

c. Do not seam during excessive winds, except as needed to protect the work. Do not seam if wind creates unsafe working conditions.
d. If required, use a “rub-sheet” or similar hard surface directly under seam overlap to achieve proper support for seaming apparatus.
e. Align panels to minimize wrinkles and/or “fishmouths” in welds.
f. Extend seams to outside edge of panels placed in anchor trench.
g. Prior to seaming, ensure that the seam area is free of moisture, dust, dirt, debris, or foreign material.
h. “Fishmouths” or wrinkles at seam overlaps shall be cut along ridge of wrinkle in order to achieve flat overlap. Cut “fishmouths” or wrinkles shall be seamed and patched in accordance with this Section.

2. Cold Weather Seaming Procedures (ambient temperature is below 32° F (0° C)).
   a. No seaming of geomembrane is permitted unless demonstrated to the QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded under ambient temperature of 32° F (0° C), at QAC'S discretion.
3. Hot Weather Procedures (ambient temperature is above 104° F (40° C)).
   a. No seaming of geomembrane is permitted unless demonstrated to the QAC that geomembrane seam quality will not be compromised.
   b. Additional destructive samples and/or field test strips shall be cut from seams welded over ambient temperature of 104° F (40° C), at QAC'S discretion.

H. *Repair Procedures:*
1. Acceptable repair procedures include following:
   a. Patching: A piece of the same geomembrane material extrusion welded into place. Use to repair holes, tears, nondispersed raw materials, and contamination by foreign matter. All panel intersections of three (3) or more geomembrane panels shall be patched.
   b. Capping: Strip of the same geomembrane material extrusion welded into place over an inadequate seam. Use to repair large lengths of failed seams.
   c. Spot welding or seaming (Grind and Weld): A bead of molten extrudate placed on flaw. Use to repair scuffing, dimpling, or other minor, localized flaws. Spot welding shall not be used to repair holes in the geomembrane liner.
   d. Removal and replacement: Remove bad seam and replace with strip of the same geomembrane material welded into place. Use to repair large lengths of failed seams.
   e. Extrusion welding a flap associated with double-tracked fusion welded seams: Repairs of this type shall not be used unless approved by QAC, and only if the flap is a minimum of 1.5 inches

long. Repairs of this type shall not exceed 100 ft (30 m) in length. A patch as described previously shall be placed at one or both ends if located within the active cover area (excluding the anchor trench).

2. For each repair method:
   a. Ensure surfaces are clean, dry, and prepared in accordance with specified seaming process.
   b. Ensure seaming equipment used in repairing procedures meet requirements of this Specification.
   c. Extend patches or caps at least 6 inches (150 mm) beyond edge of defect. The corners of patches shall be rounded with a radius of approximately 6 inches (150 mm). The minimum diameter of any patch repairing a pinhole shall be 12 inches.

I. *Anchor Trench:*

1. The CONTRACTOR shall excavate anchor trenches to lines and grades shown on Permit Drawings prior to geomembrane placement, unless otherwise specified.
2. The CONTRACTOR shall provide anchor trench with slightly rounded corners shall be provided, to avoid sharp bends in geomembrane.
3. The INSTALLER shall provide and use plywood, boards, or other suitable materials, to permit welding machines to weld across, rather than through, anchor trenches.
4. The CONTRACTOR shall dewater the completed anchor trench, to prevent ponding or softening of adjacent soils while trench is open.
5. The CONTRACTOR and INSTALLER shall coordinate operations to minimize time anchor trench remains open and uncovered.
6. The INSTALLER shall provide sufficient temporary ballast, approved by the QAC, to prevent geosynthetics from being pulled or blown from the anchor trench.
7. The CONTRACTOR and INSTALLER shall remove debris related to their respective construction activities, including temporary ballast material, from anchor trench, prior to installation of subsequent materials. The anchor trench shall be cleaned to the satisfaction of the QAC.
8. The CONTRACTOR shall place and compact backfill in the anchor trench as soon as practical after geosynthetic installation is completed. The anchor trench shall be backfilled prior to placing leachate drainage layer material. Refer to specification Section 02222, *Structural/General Fill and Intermediate Cover* for backfilling procedure.

3.4 Field Quality Assurance and Quality Control

A. *Visual Inspection:*

1. The QAC shall examine seam and non-seam areas of geomembrane to identify defects, holes, blisters, nondispersed raw materials, and any sign of contamination by foreign matter.

B. *Trial Seams:*

1. Make trial seams on fragment pieces of geomembrane liner to verify that conditions are adequate for production seaming.
2. Make trial seams for each combination of materials to be welded (i.e., textured/smooth, smooth/smooth, textured/textured). Seamers may only weld those combinations for which they have produced acceptable trial welds. Seamers are not required to produce trial seams for material combinations they will not be welding.
3. Make trial seams at beginning of each seaming period, following restart of welding equipment, upon change of seamers, and at least once every five (5) hours, for each production seaming apparatus used that day.
4. Make trial seams using the same materials and under the under same conditions as production welding.
5. Trial seam sample shall be at least 4-feet (1.2 m) long by 1-foot (0.3 m) wide (after seaming) with seam centered lengthwise.
6. Cut six (6) test specimens from sample, using 1-inch (25 mm) wide die cutter. These specimen locations shall be selected randomly along trial seam sample by GEOSYNTHETIC QAC. Test three (3) specimens in peel and three (3) specimens in shear, using field tensiometer. Samples shall fail in film tear bond (FTB) mode. Trial seams shall meet the following minimum strengths:

TABLE 4
Seam Strength Values for Trial Seams and Destructive Sample Testing

PROPERTY	METHOD	40 MIL TEXTURED LLDPE SPECIFIED VALUE
Shear Strength	ASTM D4437	60 ppi (min)
Peel Adhesion: Fusion Extrusion	 ASTM D4437 ASTM D4437	 50 ppi (min) 48 ppi (min)
For shear tests, sheet shall yield before failure of seam. For peel adhesion, seam separation shall not extend more than 25 percent of seam width into seam. For either test, testing shall be discontinued when sample has visually yielded. Four (4) out of 5 specimens shall meet the, or exceed, the values listed for shear and peel. The 5th specimen may be as low as 80%.		

7. If the specimen fails, the INSTALLER shall attempt to identify the cause of the failure (e.g., mechanical malfunction, dirt in weld). On correction of the deficiency, the seamer shall produce a second trial seam. If the second trial seam fails, the seamer shall not be permitted to weld production seams until deficiencies are corrected and two (2) consecutive successful trial welds are achieved. If mechanical failure is determined to be the cause of the second trial seam failure, the machine shall be removed from service until suitable repairs are made. The seamer shall be required to produce a passing trial seam with the replacement machine.

C. *Non-destructive Seam Testing:*

1. General:
   a. The purpose of non-destructive testing is to check continuity of the seams. It will not provide quantitative information on seam strength.
   b. Non-destructively test field seams over their full length using vacuum test for extrusion seams, air pressure for double-fusion seams, or other DESIGNER approved method. The INSTALLER shall document all non-destructive testing results.
   c. The INSTALLER shall perform non-destructive testing as seaming work progresses.
   d. The QAC shall observe all non-destructive testing on a procedural basis. The QAC shall record all non-destructive testing information at or shortly after the time of testing. The INSTALLER and QAC shall coordinate to ensure that all installation activities are monitored by the QAC in accordance with these Specifications.
2. Vacuum Testing for extrusion seam:
   a. Energize the vacuum pump and reduce tank pressure to approximately 5 pounds per square inch (psig) (10-inches of Hg) (35 kPa) gauge pressure.
   b. Wet a strip of extrusion seam approximately 12-inches by 48-inches (0.3 m by 1.2 m) with soapy solution.
   c. Ensure that the viewing window is clean.
   d. Place the box over wetted area.
   e. Close the bleed valve and open vacuum valve.
   f. Ensure that a leak-tight seal is created.
   g. Apply vacuum and examine the geomembrane through viewing window for presence of soap bubbles that would indicate a continuity leak for a minimum of 10 seconds.
   h. If no bubbles appear within 10 seconds, close vacuum valve and open bleed valve, move box over to next adjoining area with minimum 3-inch (75 mm) overlap and repeat process.
   i. Mark and repair areas where soap bubbles indicate continuity leaks.
3. Air Pressure Testing for dual track, hot wedge fusion weld:
   a. Seal both ends of the seam to be tested. Take suitable precautions if sealing seam ends with open flame.
   b. Insert needle or other approved pressure feed device into air channel created by fusion weld.
   c. Insert a protective cushion between air pump and geomembrane.
   d. Pressurize the air channel too approximately 30-psig (200 kPa). Close the valve and allow the pressure to stabilize for approximately two (2) minutes.
   e. Observe air pressure for an additional five (5) minutes after initial stabilization period ends. If pressure loss exceeds 4-psig or pressure does not stabilize, locate faulty area, repair, and retest.

f. On completion of testing, cut opposite end of tested seam length to verify continuity of air channel. If air does not escape, locate blockage and retest unpressurized area. Repair all cuts and holes created in the air channel.
g. Cap any seam length that cannot be successfully air pressure tested. The cap seam shall then be vacuum tested as required in subsection 2 (Vacuum Testing).
h. Remove needle or other approved pressure feed device and repair hole in geomembrane.

4. Inaccessible Seams:
   a. Cap-strip seams that cannot be nondestructively tested.
   b. Cap-strip material shall be composed of same type and thickness geomembrane as geomembrane to be capped.
   c. Examine cap-stripping operations with QAC for uniformity and completeness. The QAC shall document these observations.

D. *Destructive Seam Testing:*

1. General:
   a. The purpose of destructive seam testing is to evaluate seam strength.
   b. Destructive seam testing shall be performed as seaming progresses.
   c. The destructive seam sample shall fail if the overlap is insufficient for grips of testing machine to close on sample (available flap is 1/2 inch long or less).
2. Location and frequency:
   a. Test at a minimum frequency of one (1) test location per 500 ft (150 m) of welding length performed by each welding machine. This minimum frequency shall be determined as an average taken from the total linear footage of seaming, per machine, at the end of the geomembrane installation.
   b. Test locations shall be determined by the QAC, during seaming operations.
   c. INSTALLER will not be informed in advance of locations where seam samples will be taken.
   d. The DESIGNER or QAC reserves right to increase frequency of testing in accordance with performance results of samples previously tested.
3. Sampling Procedures:
   a. Cut samples at locations selected by QAC.
   b. The QAC shall number each sample and record sample number and location in panel layout drawing.
   c. The QAC shall mark each section of destructive test sample with sample number, seam number, seamer and machine identification, and date.

c. Repair holes in geomembrane resulting from destructive seam sampling as soon as possible, in accordance with repair procedures described in this Section.
d. Non-destructively test repairs in accordance with this Section.

4. Sample Dimensions:
   a. Field Testing: Cut two (2) 1-inch (25 mm) wide sample coupons, from each end of seam section identified by QAC. Distance between these two (2) samples shall be approximately 42-inches (1.1 m). Test both samples in peel mode, using field tensiometer. If both samples meet requirements of Table 4 located in section 3.4, B, item 6, collect sample for laboratory testing.
   b. Laboratory Testing: Collect laboratory test sample from seam length between field test sample coupon locations. Cut sample for laboratory testing, approximately 12-inches (0.3 m) wide by a minimum 42-inches (1.1 m) long, with seam centered lengthwise. Cut this sample into three (3) sections. QAC shall distribute sample sections as follows:
      1) Geosynthetic Quality Assurance Laboratory: minimum 18inch (0.5 m) long section for laboratory testing.
      2) INSTALLER: minimum 12-inch (0.3 m) long section for archive or optional laboratory testing.
      3) OWNER: minimum 12-inch (0.3m) long section for archive storage.
   c. Final determination of sample sizes shall be agreed upon at the geosynthetics kick-off meeting. Sample sizes shall be minimized, consistent with laboratory testing requirements.
   d. Submit laboratory sample for quantitative testing

5. Destructive Test Failure Procedures:
   When a sample fails destructive testing, whether the test is conducted in the field or at the Geosynthetic Quality Assurance Laboratory, the INSTALLER has following options:
   a. Repair the entire seam between two (2) passing destructive test locations along the path of machine producing the failed weld bracketing the failed location.
   b. Trace the welding path 10-feet (3 m) minimum in each direction from failed test, and repeat field testing procedures indicated in this Section at each location. If these additional samples pass testing, then collect laboratory test samples. If these laboratory samples pass testing, repair the seam between these locations. If either, or both, sample fails, repeat process until passing sample is located. If necessary, tracking will extend back to previous days of welding until a passing sample is located. Repair the seam between passing destructive sample locations.
   c. Acceptable repaired seams shall be bound by passing laboratory destructive tests locations. The QAC shall mark and additional destructive test sample for seam cap strip repairs of 100 ft (30 m) or more.

d. If a destructive test sample fails, the DESIGNER may require additional testing of seams welded by same seamer and/or welding apparatus produced during same time shift as failed seam.

E. *Repair Verification:*
1. Repairs shall be non-destructively tested.
2. Nondestructive test results that pass shall indicate adequate repair.
3. Destructive test samples shall be collected on repairs 100-feet long, or greater. Frequency may be increased at the discretion of the CQC.
4. In the event destructive or nondestructive tests of repairs fail to meet the requirements of this Section, the work will be redone, at no expense to the OWNER, until passing test results are achieved.
5. QAC shall monitor and document geomembrane repairs, and non-destructive testing.

F. *Large Wrinkles*: Wrinkles are considered to be large when geomembrane can be folded over onto itself.
1. When seaming of geomembrane is completed, and prior to placing overlying materials, QAC shall identify all large geomembrane wrinkles, to be repaired.
2. Cut and repair all wrinkles identified by QAC. Welds produced while repairing wrinkles shall be nondestructively tested.
3. Repair wrinkles identified by QAC. Repair during coldest part of installation period.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all materials, labor, tools and appurtenances required to complete the precast concrete air release and check valve vaults for the leachate force main trunk lines, as described herein and shown on the Contract Drawings. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 Design Requirements

Valve vaults shall be constructed of specified materials to the sizes, shapes, and dimensions shown on the Contract Drawings, or as otherwise approved by the DESIGNER. The height or depth of manholes/drop boxes/vaults will vary with the location.

1.3 Submittals

A. The CONTRACTOR shall submit to the DESIGNER shop drawings and engineering data on precast concrete vaults, manhole frames, covers, and steps.

B. The CONTRACTOR shall submit to the DESIGNER standard (typical) details showing joints and seals between precast riser sections and showing joints between pipes and vault walls.

1.4 Quality Assurance

A. Prior to delivery, all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the DESIGNER, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials that fail to conform to these Specifications shall be rejected.

B. After delivery to the Site, any materials, which have been damaged in transit or are otherwise unsuitable for use in the Work shall be rejected and removed from the Site, at no additional cost to the OWNER.

PART 2 PRODUCTS

2.1 Materials and Construction

A. *Concrete and Reinforcement*

1. Concrete used in vault, drop box, vault construction shall be Class "A" concrete conforming to the requirements of Section 03300 - Cast-In-Place Concrete of these Specifications.
2. Steel reinforcement shall be epoxy coated and conform to the requirements of Section 03200 - Concrete Reinforcement of these Specifications.

B. *Precast Concrete Vaults*

1. Precast concrete vaults shall consist of precast reinforced concrete sections, a flat slab top section, and a base slab section conforming to the typical vault details shown on the Permit Drawings.
2. Precast vault sections shall be manufactured, tested, and marked in accordance with the latest provisions of ASTM C 478.
3. The minimum 28-day compressive strength of the concrete for all sections shall be 4,000 psi.
4. The maximum allowable absorption of the concrete shall not exceed eight (8) percent of the dry weight.
5. The ends of each reinforced concrete vault riser section and the bottom end of the top section shall be so formed that when the vault risers and the top are assembled, they will make a continuous and uniform vault.
6. Each section of the precast vault shall have not more than two (2) holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with rubber stoppers or mortar after installation.
7. Steps shall be installed in each section of the vault in accordance with the Permit Drawings.

C. *Frames, Covers, Attachments, and Steps*

1. Frames and covers shall be per Anne Arundel County Standard D-16.

PART 3 EXECUTION

3.1 Placement of Precast Concrete Vaults

A. Prior to placing precast vaults, a minimum 9-inch-thick layer of coarse aggregate shall be placed as bedding. After approval of bedding by the DESIGNER, vaults shall be placed and invert/bottom elevations established and verified.

B. After placing vault base, inverts shall be constructed using Class "A" concrete in accordance with the Permit Drawings, and inverts shall have the same cross section as the invert of the culverts to which they connect. The vault invert shall be carefully formed to the required size and grade by gradual and even changes in sections.

C. After the base section has been set, and inverts formed, the precast vault sections shall be placed thereon, care being exercised to form the incoming and outgoing pipes into the wall of the vault at the required elevations.

D. The manhole cover and frame for the vault shall be set at the required elevation and properly anchored to the masonry.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and installing reinforced concrete culvert pipe (RCP) as shown, specified, and as otherwise required by the Contract Documents.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect the Work.

1.2 Related Sections

A. 02150 – Shoring and Bracing
B. 02220 – Excavation
C. 02223 – Structural/General Fill and Intermediate Cover
D. 02271 – Stone Riprap

1.3 Submittals

A. Submit to the DESIGNER for favorable review, at least 21 calendar days prior to use, Shop Drawings, catalog cuts, and manufacturer's literature for all pipe and pipe fittings including information on coatings and linings, material specifications, dimensions, tolerances, and all related data. The CONTRACTOR shall furnish the manufacturer's material certificates for all pipe, fittings, and accessories supplied under this Section demonstrating that the requirements of this Section have been met. No material shall be installed prior to furnishing this required information and receiving favorable review.

1.4 Quality Assurance

A. Pipe installation shall be performed by skilled workers. Each pipe laying crew shall have a pipe laying foreman.
B. Accurately install pipe to the lines and grades shown in the Contract Documents, or as directed by DESIGNER so that inverts are smooth.
C. A full circle shall be visible at the far end, when looking through pipes, unless bends are specified or shown in the Contract Documents.
D. Deflections at joints are not permitted without prior written consent from the DESIGNER.
E. The DESIGNER shall be notified whenever an existing pipeline location or other existing feature conflicts with the proposed locations of the Work.
F. Pipe and fittings of the same type shall be the products of a single manufacturer.

G. All piping shall be of the type and size as shown on the Contract Drawings and as described herein.

1.5 Delivery, Storage, And Handling

A. All pipes and fittings shall be carefully handled when loading and unloading. Lift by hoists or lower on skidways in a manner to avoid shock. Avoid damaging the pipe and its coating or lining if present.
B. Where required, due to weight of material and for the safety and protection of workmen, materials, equipment, property, and the Work, use derricks, ropes, or other suitable equipment for lowering pipe into trenches. Take particular care to avoid damaging the pipes.
C. Store piping and related materials so as to cause the least possible interference with the Work, Site operations, streets, sidewalks, driveways, other thoroughfares, parking areas, delivery areas, and the public in general. Should the OWNER so direct, relocate such material and/or equipment which is creating an interference or inconvenience. Relocate such material or equipment which is obstructing the Site or interfering or obstructing other operations or activities of the OWNER or the DESIGNER.
D. The MANUFACTURER's recommended procedures for pipe stacking shall be followed. When pipes are stacked for storage, the heaviest series of pipe shall be placed at the bottom.
E. If any defective pipes are discovered after being laid or placed, removal and replacement with a sound pipe will be required at the CONTRACTOR's sole expense.

PART 2 PRODUCTS

2.1 Reinforced Concrete Pipe

A. Reinforced concrete pipe shall conform to the requirements of AASHTO M170 for Standard Strength Reinforced Concrete Culvert Pipe for Class V Pipe unless otherwise designated on the plans. All pipes 24 inches in diameter or smaller shall be of the bell-and-spigot type. Pipes larger than 24 inches in diameter shall be tongue and groove or bell and spigot.

2.2 Rubber Ring Gaskets

A. Rubber ring gaskets shall conform to ASTM C443 and shall be tough, flexible, chemical-resistant material, and of such size and shape as to ensure satisfactory pipe joints when incorporated in the Work.

PART 3 EXECUTION

3.1 Inspection

A. Each length of pipe and each fitting shall be carefully inspected prior to lowering into trench. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the OWNER and/or DESIGNER, shall be rejected and immediately marked and removed from the Site by the CONTRACTOR. The CONTRACTOR shall provide suitable replacement materials, conforming to these Specifications, at no additional cost to the OWNER.

B. Bedding, subgrade, and other trench conditions shall be carefully inspected prior to laying pipe in each stretch of open trench. All conditions shall be made available to the DESIGNER for inspection purposes, and the OWNER and/or DESIGNER shall be further advised where, in the CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

C. Each stretch of completed pipeline shall be inspected and the direction of flow and percentage of slope verified by the DESIGNER prior to backfilling. The CONTRACTOR shall provide record survey data certified by a Professional Land Surveyor licensed in the State of New Jersey for favorable review by the DESIGNER for compliance with slope requirements. Backfilling operations shall not be initiated prior to inspection and favorable review of survey data by the OWNER and the DESIGNER.

3.2 Laying Of Pipe

A. The laying of pipe shall begin at the downstream end of the pipeline. The lower segment of the pipe shall be in firm contact with the bedding throughout its full length. Bell or groove ends of pipe shall be placed facing upstream.

B. The pipe bedding shall meet the requirements of structural fill in Section 02223 of these Specifications, and shall be placed to conform to pipe shape.

3.3 Pipe Installation

A. Pipes and fittings shall be carefully lowered into the trench.

B. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted. RCP shall be joined using flexible watertight rubber gaskets conforming to ASTM C443.

C. Pipes shall be installed in the locations and to the required lines and grades as shown in the Contract Documents, using a method of control which has been favorably reviewed by the DESIGNER. The OWNER and the DESIGNER have the authority to order the removal or relaying of all pipe laid contrary to the Specifications.

D. Excavate, support, and dewater pipe trenches in accordance with Sections 02150, 02220, and 02221 of these Specifications. Excavations shall be maintained free of water during the progress of the Work. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the OWNER and the DESIGNER.

E. Maintain cleanliness of installed pipe and fittings interiors throughout the work. Plug ends when pipe installation is not in progress. Remove all plugs as required to place pipe into operation. Drainage of construction excavations through new pipes is prohibited.

F. All adjustments to the line and grade of pipe shall be done by scraping away or filling in the bedding under the barrel of the pipe and not by blocking or wedging. Where additional bedding is required, it shall be provided at the CONTRACTOR's sole expense. In all cases, the trench under the joint shall be excavated and suitably shaped to permit an even bearing for the barrel of the pipe. The minimum depth of bedding, as shown in the Contract Documents, shall be maintained at all times.

G. When unsuitable materials or conditions are encountered, excavate below grade until suitable foundation is encountered and the trench backfilled with compacted gravel or crushed stone foundation.

H. Favorable review by the DESIGNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior written consent from the DESIGNER.

I. All installed piping shall form completely connected systems including connections to valves, equipment, structures, existing facilities, and appurtenances specified in other sections to result in a satisfactorily operating installation.

J. Backfill pipes in accordance with Section 02223 of these Specifications.

3.4 Adjust and Clean

A. All sections of piping found defective in material, alignment, grade, joints, or otherwise, shall be corrected to the satisfaction of the OWNER and/or DESIGNER.

B. Leave all the pipes and connections watertight.

C. Upon completion of construction of pipelines and appurtenances, all pipelines shall be thoroughly flushed out with water and all temporary plugs shall be removed. Flushing shall be executed in such manner that dirt or other material will not be discharged into existing watercourses.

***** END OF SECTION *****

PART GENERAL

1.1 Description of Work

A. CONTRACTOR shall furnish all labor, materials, equipment, tools and appurtenances required to complete the work of furnishing and installing High Density Polyethylene (HDPE) piping as shown and specified in the Contract Documents and Contract Drawings.
B. Piping shall be fabricated and installed for operating ranges as follows:
   1. Temperature Range: -40°F to 150°F
   2. Pressure Range: Full Vacuum to 100 psig

1.2 Related Sections

A. 02233 – Coarse Aggregate
B. 02418 - Geocomposite Drainage Layer

1.3 Submittals

A. Before beginning pipe installation, the CONTRACTOR shall furnish MANUFACTURER's certificates that state that the pipes, valves, fittings, and other materials meet this specification. The CONTRACTOR shall prepare and submit to the QAC MANUFACTURERs' information (catalog cuts and/or shop drawings) for each type of pipe, valve, and fitting to be furnished.
B. Shop drawings shall show plans of the piping system, indicating the type and location of all pipe, fittings, and joints to be used, size and length of pipe, size of valves, and the manner in which piping systems shall be supported. All pipe supports, pipe couplings, and specials shall be clearly shown, indicating size, length, and other necessary dimensions.
C. Shop drawings shall be submitted to the QAC and approved prior to delivery of any material to the site.
D. Prior to beginning pipe installation, the CONTRACTOR shall submit to the QAC for approval a measurement recording form for use during pressure testing.
E. Provide: a 4-inch length of each piping type including cross-section sample of a properly prepared joint; and a 4-inch length of each type of metallic locating tape.

1.4 Quality Assurance

A. MANUFACTURER's: Firms regularly engaged in manufacture of HDPE pipe, tube, and fittings of types and sizes required.
B. CONTRACTOR's personnel installing, inspecting, and testing HDPE shall be certified by pipe MANUFACTURER within one year prior to pipe

installation. All necessary training shall be performed by pipe MANUFACTURER's representative, at CONTRACTOR's expense.

C. Pipe shall be accurately routed to the locations shown on the Contract Drawings.

D. Deflections in horizontal alignment at joints are not permitted without the written consent of the QAC. If so approved, the deflections shall not exceed one-half the MANUFACTURER's recommendation.

E. Pipe and fittings of the same type shall be the products of a single MANUFACTURER.

F. Pipe Adapters – Join pipes of different materials with adapters specifically manufactured for that purpose and favorably reviewed by the QAC, or as detailed on the Contract Drawings.

G. All piping shall be of the type and size shown on the Contract Drawings and described in this Section of the Specifications. All underground piping shall be HDPE unless otherwise noted on the Contract Drawings or favorably reviewed by the DESIGNER in writing.

H. Pipe and fittings shall be protected against the damaging ultraviolet rays of the sun when stored for any period. Such protection shall consist of canvas covering, or other material as recommended by the MANUFACTURER. Plastic sheets shall not be used that may allow excessive temperatures to develop where pipe is stored. All pipe, which has been distorted or otherwise negatively affected by high temperatures, shall be rejected, regardless of the pipe's appearance after return to ambient temperatures. Rejected pipe shall be removed from the site of the work at the sole expense of the CONTRACTOR.

I. The MANUFACTURER's recommended procedures for pipe stacking shall be followed. When pipe is stacked for storage, the heaviest series of pipe shall be placed at the bottom.

J. Pipe and fittings shall be protected from damage by sharp objects through all phases of work.

K. If any defective pipe is discovered after being laid or placed, removal and replacement with a sound pipe will be at the sole expense to the CONTRACTOR or the CONTRACTOR's subcontractor.

PART 2 PRODUCTS

2.1 Pipe and Fittings

A. Piping resins shall be high performance, high molecular weight, high density polyethylene conforming to ASTM D1248 (Type III, Class C, Category 5, Grade P34), and ASTM D3350 (Cell Classification PE345434C). The pipe and fittings shall be manufactured from pre-compounded resin manufactured by the pipe MANUFACTURER, with a minimum of two-percent carbon black to withstand outdoor exposure without loss of properties. In plant blending of non-compounded resins is

not acceptable. All polyethylene pipes shall meet the requirements of ASTM F714 for SDR 17.0 High Density Polyethylene (HDPE) pipe as shown on the Contract Drawings. Pipe shall be furnished non-perforated, as required by the application. Each pipe length shall be marked with the MANUFACTURER's name or trademark, size, material code, and standard dimension ratio. All fittings shall be molded.

B. The pipe shall contain no recycled compound except that generated in the MANUFACTURER's own plant from resin of the same specification from the same raw material. The pipe shall be homogeneous throughout and free of visible cracks, holes (other than those manufactured), foreign inclusions, or other deleterious defects, and shall be identifiable in color, density, melt index, and other physical properties.

C. The polyethylene pipe MANUFACTURER shall provide certification that stress regression testing has been performed on the specific product. This stress regression testing shall have been done in accordance with ASTM D2837, Class PE3408, and the MANUFACTURER shall provide a product supplying a minimum hydrostatic design basis (HDB) of 1,600 psi at 63.4 degrees F, as determined in accordance with ASTM D2837.

D. Each pipe shall meet the following cell classification standards:

Flexural Modulus:	110,000 to 160,000 psi
Tensile Strength:	3,000 to < 3,500 psi
Environmental Stress Crack Resistance:	Test Condition C Test Duration 192 hours Maximum % Failure = 20
Hydrostatic Design Basis (23°C)	1,600 psi

2.2 Piping Accessories

A. Bolts, nuts and washers: Type 304 or 316 stainless steel, and not smaller than 1/4-inch; bolts shall have hexagonal heads and nuts shall be hexagonal.

B. Fittings that unite dissimilar metals shall be dielectric insulating type.

C. CONTRACTOR shall provide necessary HDPE spacers, as required to provide adequate clearance for the proper installation of the specified valves and equipment.

D. Flanged connections to valves, equipment and other piping materials shall be made with a HDPE stub-end flange adapter and epoxy coated carbon steel backing unless otherwise approved by DESIGNER.

E. Above ground HDPE shall be continuously supported from underneath using a flat piece of steel or uni-strut and be attached to the underneath support at periodic intervals in accordance with the HDPE pipe manufacture's written recommendations.

PART 3 EXECUTION

3.1 Quality Control

A. Each length of pipe and each fitting shall be carefully inspected prior to lowering into trench. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the QAC, shall be rejected and immediately marked and removed from the job site.

B. Bedding, sub-grade, and other trench conditions shall be carefully inspected prior to laying pipe in each stretch of open trench. All conditions shall be made available to QAC for inspection purposes, and QAC shall be further advised where, in CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

C. The piping shall be installed in complete sections from high points to low points.

D. Each stretch of completed pipeline shall be inspected and direction verified prior to backfilling. Backfilling operations shall not be initiated prior to inspection and favorable review by QAC.

E. The CONTRACTOR shall arrange pipe installation, testing, and backfill to minimize the amount of time and length of open trenches. When trenches are to be left open overnight, they should be covered with plywood and plastic sheeting.

3.2 Preparation

A. Pipe and fitting interiors and joint surfaces, shall be thoroughly cleaned prior to installation. Pipe and fittings shall be maintained clean.

3.3 Pipe Installation

A. Pipes and fittings shall be carefully lowered into the trench.

B. Pipe and fittings shall be installed so that there will be no deviation at the joints and so that inverts present a smooth surface. Pipe and fittings which do not fit together to form a tight fitting joint are not permitted.

C. Unless noted on Contract Documents, all HDPE joints shall be butt-fusion welded. Butt-fusion welds shall be performed as follows unless otherwise recommended by the pipe MANUFACTURER:

1. Clean pipe ends inside and outside with a clean rag to remove dirt, water, grease, and other foreign materials.
2. Square cut end of each pipe section with the facing tool of the fusion machine or plastic pipe cutters. Remove cuttings and burrs from pipe ends.
3. Check lineup of pipe ends in the fusion machine to ensure that pipe ends meet squarely and completely over entire surface to be

fused. Proper alignment is necessary to obtain uniform heating of the pipe ends and uniform bead at fused joint.

4. Heater Plate:
   a. Insert the heater plate between the aligned pipe ends. Bring and hold pipe ends in contact with heater plate.
   b. Maintain contact without pressure and allow pipe to heat and soften approximately:
      (1) 1/8 inch back from pipe end for 2-inch pipe.
      (2) 3/16 inch back from pipe end for 3-inch and larger pipe.
   c. Heater thermometer reading shall be between:
      (1) 500°F and 575°F on coated plates.
      (2) 475°F and 500°F on uncoated plates.
   d. Double check heater plate temperature with a tempilstik or pyrometer for correct surface temperature.
   e. Carefully move pipe ends away from heater plate and remove plate.
   f. If softened material sticks to plate, discontinue the joint. Clean heater plate, resquare pipe ends, and start over.
5. Flash Bead:
   a. Bring heated pipe ends together with firm pressure per MANUFACTURER's recommendation to form a uniform upset flash bead approximately 1/8 inch to 3/16 inch wide around entire circumference of pipe.
   b. Bead will have appearance of double upset flash.
   c. Pressure is necessary to cause heater material to flow together, which gives the fusion bead an appearance that is distinctive in appearance to this type of material.
   d. Maintain pressure until the joint cools.
6. Allow joint to cool (until finger can remain comfortably on bead) and solidify until bead feels hard. After joint is cool, remove from lineup clamps.
7. Inspect finger joint for uniform nonporous appearance. Joints should have uniform double bead/squeezeout to indicate the proper temperature of the heating plate was maintained.
8. If joint appears faulty, cut the joint and repeat procedure.

D. Pipes shall be installed in the locations as shown on the Contract Drawings and provided in these Specifications, using a favorably approved method of control. QAC has the authority to order the removal or relaying of all pipe laid contrary to the Specifications.

E. Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the QAC.

F. Cleanliness of installed pipe and fitting interiors shall be maintained throughout the Work.

G. All adjustments to the line and grade of pipe shall be done by scraping away or compacted filling of the bedding under the barrel of the pipe, and not by blocking or wedging. The minimum depth of bedding, as shown on the Contract Drawings, shall be maintained at all times.

H. Fittings shall be installed as required and in accordance with the Contract Documents. The installation of fittings after the pipeline has been laid will not be permitted without the favorable review of the DESIGNER.

I. Favorable review by the DESIGNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior consent from the DESIGNER.

J. All installed piping shall form completely connected systems including connections to and appurtenances specified in other sections to result in a satisfactorily operating installation.

K. All pipe shall be so laid that, after the line is completed, the interior surface thereof shall conform accurately to the established grade and alignment. No deflections shall be allowed at joints. Piping shall be laid as specified below:

1. Pipe assembly shall be lowered carefully into prepared trench.
2. Line shall not be dropped or subjected to jarring, impact, or unnecessary strain.
3. Sections not carefully lowered in place shall be raised and reinspected. Damaged sections shall be replaced at the sole expense to the CONTRACTOR.
4. Excess stress or strain conditions shall be avoided during installation.
5. Pipe being pulled for placement shall not exceed 500 feet in length.
6. Maximum pulling force that can be applied to a pipe can be estimated by multiplying the maximum allowable stress by the cross sectional area of pipe. Pipe shall not be pulled by flanged end.

L. Minimum pipe lengths of 20 feet (up to maximum pipe lengths of 40 feet) shall be utilized, except that shorter random lengths may be utilized where wyes and tees are present so that the connection can be made. The number of pipe joints shall be minimized. CONTRACTOR shall provide proper smooth and square ends prior to assembling.

M. All below grade pipe shall be buried a minimum of 36 inches below grade in carefully prepared and backfilled trenches in accordance with Contract Drawings.

N. Where the header pipe passes beneath roadways and driveways precautions such as a steel protective sleeve or sufficient pipe wall selections shall be taken to protect the pipe from crushing.

O. Maintain the specified depth and compaction of the embedment materials as shown on the Contract Drawings and as specified below:
   1. Trench/bed width shall be as shown on the Contract Drawings.
   2. Unstable trench wall or bottom shall be corrected in accordance with ASTM D2321.
   3. Bedding:
      a. Clean materials surrounding the forcemain pipes shall be free of rock, stones, and other debris that may cut, scrape, tear or rip the HDPE pipe during installation and operation.
      b. Prior to installation, bedding shall be graded and hand tamped along the entire length of pipe to be installed.
      c. Bedding material shall be a minimum of 6 inches of sand.
   4. Pipe Zone:
      a. Pipe zone shall be filled with sand as shown on the Contract Drawings.
      b. Pipe zone includes an area below pipe to 6 inches above the pipe and between pipes and side walls of trench or other pipes.
      c. Soil in pipe zone may be stabilized with cement-sand mix.
      d. A minimum of 6-inches of clean material must separate adjacent pipes at all times.
   5. Trench backfill shall meet the criteria specified in the Contract Documents and be favorably reviewed by the QAC.

P. Bends
   1. Joints shall not be located in pipe bends.
   2. The radius of the inner curve of such bend shall not be less than 25 times the inside diameter of the pipe.

Q. Thrust Blocking:
   1. If the HDPE pipe MANUFACTURER's engineering evaluation of soil conditions and design of installation determines thrust blocks are required, then thrust blocks shall be provided at branch connections (tees) and at changes in directions (elbows) as required to prevent movement.
   2. Thrust blocking shall be via concrete bearing surfaces set in soil. Pipes shall not be encased in concrete.
   3. Details of thrust blocking for each line size shall be furnished by HDPE pipe MANUFACTURER. Details shall be subject to favorable review by the OWNER.
   4. Thrust blocks shall not be required if heavy wall fittings (SDR 9) are used for mitre bends 12 inches in diameter and larger.

R. Tests

1. Subsequent to the laying of pipe and placing sufficient backfill between the joints to support and prevent movement of the installation, all newly laid pipe or any valved section thereof shall be subjected to testing as specified in the Section 01666.
2. All exposed pipe, fittings, valves, and joints shall be carefully examined during the open trench test. Any damaged or defective pipe, fittings or valves revealed during the pressure test shall be removed and replaced, by CONTRACTOR, at his expense, with sound material, in the manner previously specified, and the test shall be repeated until satisfactory to QAC.
3. The CONTRACTOR shall be furnished a written report of the results of the leakage test that identifies the specific length of pipe tested, the pressure, the duration of the test, and the results. The report shall be signed by CONTRACTOR. QAC will witness all leakage tests.
4. Remedy of Leaks
   a. If any test of pipe laid discloses leakage, locate and repair (or replace if pipe or fittings are defective) the defective joints until the leakage is within the allowable tolerance.
   b. All leaks are to be repaired regardless of the amount of leakage.

*****END OF SECTION*****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment, tools, and appurtenances required to complete the work of the installation of the leachate collection system (LCS) as shown, specified, or required. The CONTRACTOR shall provide a "Competent Person" to implement and supervise all work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State, or Federal authorities having jurisdiction.

1. 2 References

A. American Society for Testing and Materials (ASTM):

1. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.

1.3 Submittals

The CONTRACTOR shall submit manufacturer's data sheets, and certification of compliance with specifications for all pipes, fittings and appurtenances, and leak testing requirements per Section 01300 - Submittals, of these Specifications.

PART 2 PRODUCT

2.1 Materials

A Perforated Pump Carrier Pipe – shall be perforated, High Density Polyethylene (HDPE) SDR 17. The pipe sizes, as well as the size and configuration of the perforations are specified in the Permit Drawings.

B Solid Wall Pump Carrier Pipe – shall be solid High Density Polyethylene (HDPE) SDR 17. The pipe sizes are specified in the Permit Drawings.

C Double Wall Force Main – shall be 6-inch solid High Density Polyethylene (HDPE) SDR 11 pipe inside of 10-inch High Density Polyethylene (HDPE) SDR 17 pipe.

D Geotextile – Nonwoven, 16 oz/yd^2 filter geotextile (See Geotextile Specification Section 02595.)

E Geocomposite – shall meet the requirements of Geocomposite specification 02418.

F Drain Rock – envelope of stone around the leachate collection laterals and headers shall be USCS Classification GW or GP and consist of No. 57 stone, washed gravel and shall have a hydraulic conductivity of not less than 1.0 x 10^{-2} cm/sec, and carbonate content <15%.

G Pumps, Motors, Fittings, and Flexible Hose - See Leachate Side Slope Pump System specification section 02652.

2.2 Delivery, Storage, and Handling

A All pipes and fittings shall be carefully handled when loading and unloading. Lift by hoists or lower on skid ways in a manner to avoid shock.

B Where required, due to weight of material and for the safety and protection of workmen, materials, equipment, property, and the work, use derricks, ropes, or other suitable equipment for lowering pipe into trenches. Take particular care to avoid damaging the pipe.

C Pipe and fittings shall be protected against ultraviolet light damage during storage. Such protection shall consist of canvas covering, or other material as recommended by the manufacturer. Covering which may allow excessive temperatures to develop where pipe is stored shall not be used. All pipes that have been distorted or otherwise negatively affected by high temperatures shall be rejected, regardless of the pipe's appearance after return to ambient temperatures. Rejected pipe shall be marked by the QAC and removed from the Site at the sole expense of the CONTRACTOR.

D The manufacturer's recommended procedures for pipe stacking shall be followed. When pipe is stacked for storage, the heaviest series of pipe shall be placed at the bottom.

E Pipe and fittings shall be protected from damage by sharp objects through all phases of work.

F If any defective pipe is discovered after being laid or placed, removal and replacement with a sound pipe will be required, without cost to the OWNER.

PART 3 INSTALLATION

3.1 General

A Pipe installation shall be performed by skilled workers. Each pipe laying crew shall have an experienced pipe foreman.

B Pipe shall be accurately installed to the lines and grades shown on the Permit Drawings, or as approved by the Quality Assurance Contractor (QAC), so that inverts are smooth.

C The DESIGNER shall be notified in advance whenever an existing pipeline location conflicts with the proposed locations of the Work.

D Pipe Adaptors - Join pipes of different materials with adaptors specifically manufactured for that purpose and as approved by the DESIGNER, or as detailed on the Construction Plans.

E All piping shall be of the type and size as shown on the Permit Drawings and described in this Section of the Specifications.

F Each length of pipe and each fitting shall be carefully inspected prior to placement. All materials not meeting the requirements of these Specifications, or otherwise found defective or unsatisfactory by the QAC, shall be rejected and immediately marked and removed from the job site by the CONTRACTOR.

G Bedding, sub-bedding, and other trench conditions shall be carefully inspected prior to laying pipe in each reach of open trench. All conditions shall be made available to the QAC for inspection purposes, and the QAC shall be further advised where, in the CONTRACTOR's opinion, unstable or otherwise deleterious conditions exist.

H Each reach of completed pipeline shall be inspected prior to backfilling. Backfilling operations shall not be initiated prior to inspection and acceptance by the QAC.

I All HDPE pipe segments shall be attached by butt-fusion welding or electro-fusion fittings.

J Pipe and fitting interiors and joint surfaces, shall be thoroughly cleaned prior to installation. Pipe and fittings shall be maintained clean.

K Pipes shall be installed in the locations and to the required lines and grades as shown on the Permit Drawings and provided in these Specifications, using an approved method of control. The DESIGNER has the authority to order the removal or relaying of all pipe laid contrary to the specifications, his instructions, or during his absence.

L Excavations shall be maintained free of water during the progress of the Work. No pipes shall be laid in water nor shall there be any joints made up in water. All slides or cave-ins of the trenches or cuts shall be remedied to the satisfaction of the DESIGNER.

M Cleanliness of installed pipe and fitting interiors shall be maintained throughout the Work.

N All adjustments to the line and grade of pipe shall be done by scraping away or compacted filling of the bedding stone under the barrel of the pipe, and not by blocking or wedging.

O Approval by the DESIGNER is required prior to changing the location of any of the Work due to field conditions. Changes in pipe sizes are prohibited without prior written consent from the DESIGNER.

P All pipe ends within the cell not terminated by another specific fitting shall have an end cap of the same material fusion welded to the pipe. All pipe end outside the cell not terminated by another specific fitting shall be covered with a slip cap. Slip caps shall not be bonded to the pipe unless otherwise specifically noted on the Permit Drawings.

3.2 Cushion Geotextile

A Cushion geotextile shall be placed as shown on Permit Drawings and as specified in Geotextiles section 02595.

B Cushion geotextile seams shall be sewn with an interlocking stitch as specified in Geotextiles section 02595.

3.3 Geocomposite Drainage Layer

A GDL shall be placed as shown on Permit Drawings and as specified in GDL specification 02418.

B GDL seams shall be sewn with an interlocking stitch as specified in GDL specification 02418.

3.4 Perforated and Solid Wall Pump Carrier Pipe

A Perforated and solid wall pump transfer pipe in the bottom of the sumps shall be placed directly on 1-ince thick, 2-foot wide HDPE flat stock as shown in the Permit Drawings. The HDPE flat stock shall be placed directly on the cushion geotextile and/or geocomposite.

B The perforated and solid wall pump transfer pipes shall be joined as specified in 3.1, I of this Section.

C A temporary anchor system capable of holding the pipe in place shall be employed until sufficient coarse aggregate in the sump and soil backfill on the side slope has been placed.

3.5 Drain Rock

A Drain rock and filter geotextile shall be placed over and around the perforated pipe comprising the leachate collection laterals and headers in the cells to the depths specified in the Permit Drawings.

B Drain rock shall be place in a manner so as not to damage the underlying geomembrane, geocomposite, or geotextile (see HDPE Geomembrane section 02597, Geocomposite Drainage Layer section 02418, Geotextile section 02595, , Leachate Collection Layer section 02232).

3.6 Double Wall Force Main

A The double wall force main pipe shall be placed to the lines and grades shown on the Permit Drawings.

B The double wall force main pipe shall be installed in excavation detailed in the Contract Drawings, and backfilled in accordance with specification 02223.

C Both the internal and external pipes of the dual containment conveyance pipe shall be air pressure or hydrostatically tested to 20 psi for 1 hour. The QAC shall be present during pressure testing. Prior to the installation of the solid-walled polyethylene piping, the CONTRACTOR shall perform a pressure test using the following procedures:

1 Similar sizes of polyethylene piping shall be butt welded together into testing segments not to exceed 2,000 feet (600 m). Segments shall be fitted with a cap on one end and testing apparatus on the other.

2 The segment to be tested should be laid on the ground surface and allowed time to reach constant and/or ambient temperature before initiating the test.

3 The test should be performed during a period when the pipe segment will be out of direct sunlight when possible, i.e., early morning, late evening, or cloudy days. This will minimize the pressure changes that will occur during temperature fluctuations.

4 The CONTRACTOR shall submit verification and results of gauge calibration prior to (no more than 60 days) and after completion of project.

5 The allowable pressure drop observed during the test shall not exceed 1 percent of the testing gauge pressure over a period of 1 hour. This pressure drop shall be corrected for temperature changes before determining pass or failure.

6 The equipment for this testing procedure will be furnished by the CONTRACTOR. This shall consist of a polyethylene flange adaptor with a PVC blind flange equal in size to the blower inlet valve. Tapped and threaded into the blind flange will be a temperature gauge 32°F to 2l2°F (0 to 100°C), a pressure gauge 0 to 20 psi (0 to 1 kg/cm^2), a "tire valve" to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of test. Polyethylene reducers shall be utilized to adapt test flange to size of pipe being tested.

D The following steps shall be performed when a pipe segment fails the 1 percent - 1-hour test:

1 The pipe and all fusions shall be inspected for cracks, pinholes or perforations.

2 All blocked risers and capped ends shall be inspected for leaks.

3 Leaks shall be verified by applying a soapy water solution and observing soap bubble formation.

4 All pipe and fused joint leaks shall be repaired by cutting out the leaking area and re-fusing the pipe.

5 After all leaks are repaired, a retest shall be performed.

PART 4 SURVEYING

A All surveying shall be performed by a land surveyor licensed in the state of Maryland.

B The force main pipes shall be surveyed at a minimum of 50-foot intervals to verify proper fall.

C All pipe inverts, outlets and fittings (i.e., wyes, reducers, and adapters) associated with the leachate collection system and the conveyance pipe, including manholes, shall be surveyed.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall provide all labor, materials, and equipment to install the following:
   1. Pump, complete with specified accessories.
   2. Control panel, mounting, necessary conduits and controls.
   3. All related electrical works, including wire and conduit, necessary to provide power to the pump control panel.
   4. All related mechanical components, including hose, valves, and fittings necessary to provide a connection from the pump to the leachate force main.
   5. Test and demonstrate operation of system.
   6. Submit operation and maintenance manuals, and warranties.

B. The leachate side slope pump system shall consist of pump, hose, controls, valves, fittings, and related electrical and mechanical works necessary to pump the side slope riser (riser provided by others) to the leachate force main. The pumping system shall be of material and construction to be compatible with the material (leachate) to be pumped. This Specification and the Drawings detail the requirements for the construction of the leachate sump pump system. The leachate side slope pump and controls shall be compatible with the system constructed for each cell.

1.2 Submittals

A. *Pumps and Motors:*
The CONTRACTOR shall submit product data for the pump and motor to the QAC, as specified in Part 2.0 and as shown on the Drawings. Pump data shall include, but is not limited to, characteristic curves, dimensional drawings, and materials of construction for all wetted parts, mechanical seals, packings, and shafts. Pump curves shall indicate efficiency, horsepower, proposed number of impeller stages, and electrical characteristics of the motor. The motor data shall include, but is not limited to, motor manufacturer, motor horsepower, rated speed, service factors, voltage, maximum amperage draw, and phase.

B. *Control Panel:*
The CONTRACTOR shall submit detailed panel layout and electrical diagrams showing the panel enclosure, panel face, and wiring diagrams to the QAC for approval. The CONTRACTOR shall also submit product data for transformers, relay modules, motor controllers and starters, circuit breakers, level switches and related controls, receptacles and devices, and other items as specified in Part 2.0, and as shown on the Drawings.

C. *Piping and Related Works:*
The CONTRACTOR shall submit to the QAC product data for all hose, piping, fittings, valves, check valves, and other piping related materials as specified in Part 2.0, and as shown on the Drawings. The product data shall include, but not limited to, materials of construction, pressure ratings, flow ratings, and physical dimensions.

D. *Electrical Works:*
The CONTRACTOR shall submit to the QAC product data for all wire, conduit, breakers, explosion proof fittings, sealing compounds, and other materials as specified in Part 2.0 and as shown on the Drawings

E. *Operation and Maintenance Data:*
The CONTRACTOR shall provide three (3) sets of operation and maintenance (O&M) manuals for the leachate sump pumping system. The O&M manuals shall include at a minimum, all drawings, equipment lists (with manufacturer's name and model number), equipment manuals, recommended spare parts inventory, detailed description of controls sequence of operation, and troubleshooting guide.

1.3 Codes and Regulations

A. Comply with the latest editions of following works, including all supplements thereto and any other authority having jurisdiction within requirements of this specification.
1. Local Codes
2. National Electrical Code, as amended (NFPA No. 70, 71, 72, 72C)
3. Occupational Safety and Health Administration (O.S.H.A.)
4. BOCA Code
5. ASME and ASTM Standard for Materials of Construction.

B. In the event the Drawings or Specification require materials, workmanship, arrangement or construction of higher standard or larger size than is required by codes and regulations, the Drawings and Specifications shall take precedence.

C. Except as described in 1.3.B, should there be direct conflict between above-mentioned regulations and Drawings or Specifications, regulations shall govern.

D. All electrical materials and equipment shall bear the label of Underwriters Laboratories' listed by them in their list of electrical fittings; and approved by them for which they are to be used, unless material and equipment is of type for which Underwriter's Laboratories do not list or provide label.

1.4 Quality Assurance

The CONTRACTOR shall provide a one (1) year warranty on all products.

PART 2 PRODUCTS

2.1 General

A. These Specifications provide an outline of the general requirements for the Work. The CONTRACTOR shall submit to the QAC for approval all necessary product data for the material proposed, for the construction and installation of the leachate Pumping System as described, and as shown on the Drawings.

2.2 Pump and Motor

A. *Pump Models.* The CONTRACTOR shall furnish and install one (1) submersible, pump and motor, suitable for side slope riser installation, capable of delivering the flow rate at the specified total head in Table 1 below. Submersible electric motor shall be suitable for operating on 3-Phase, 460 Volt, 60 Hz service with 100-feet of power cable. CONTRACTOR shall also provide one spare pump and motor of same model described here.

TABLE 1 – LEACHATE SUMP PUMPS

Cell or Sub-cell	Total Head (feet)	Selected Pump EPG Models	Cell or Sub-cell	Total Head (feet)	Selected Pump EPG Models
1	108.9	Model 18-4 HP 5.0	7	107.1	Model 18-3 HP 5.0
2	50.2	Model 18-2 HP 3.0	8	99.1	Model 18-3 HP 5.0
3	35.2	Model 18-1 HP 1.5	9	97.1	Model 18-2 HP 3.0
4	35.3	Model 18-1 HP 1.5	10	107.8	Model 18-3 HP 5.0
5A	93.4	Model 18-1 HP 1.5	11	59.2	Model 18-2 HP 3.0
5B	89.2	Model 18-2 HP 3.0	12	59.3	Model 18-2 HP 3.0
5C	89.4	Model 18-2 HP 3.0	13	55.2	Model 18-1 HP 1.5
5D	87.2	Model 18-2 HP 3.0	14	53.2	Model 18-1 HP 1.5
5E	89.3	Model 18-2 HP 3.0	15	51.5	Model 18-2 HP 3.0
5F	87.1	Model 18-3 HP 5.0	16	51.2	Model 18-1 HP 1.5
6	101.3	Model 18-3 HP 5.0			

B. Each unit shall be fitted with 100-feet (minimum), more as needed, of stainless steel lifting cable of sufficient strength to permit the removal of the unit.

C. Design Parameter:

1. The pump shall be capable of pumping leachate.
2. The pump shall permit the unit to operate on a slope of three (3) feet horizontal to one (1) foot vertical.

3. The pump shall be able to "pump down" to within 1.0 vertical foot of the sump bottom without any loss in performance or damage to the pump.
4. Pump unit, including guide wheels shall not exceed 15.5-inches in diameter.

D. Materials of Construction:

1. Major components shall be manufactured of 304 stainless steel, seal rings shall be made of Teflon. All fasteners shall be 304 stainless steel.

E. Check Valve:

1. Each unit shall include an integral check valve. The check valve housing and disc shall be constructed of 304 stainless steel and the check valve seat shall be constructed of Teflon.

F. *Shaft*:

1. The pump shaft shall be constructed of 304 stainless steel and rotate on product lubricated bearings.

H. *Diffuser Chamber:*

1. Diffuser chamber for each impeller shall be constructed of 304 stainless steel and fitted with Teflon impeller seal rings.

I. *Impeller*:

1. The impeller shall be a closed design and constructed of 304 stainless steel.

J. *Motor*:

1. The motor shall be a submersible, hermetically sealed motor manufactured by Franklin Electric, or approved equivalent. The motor shall be designed for continuous duty, capable of sustaining up to 300 starts per day. The motor shall be connected to the pump via a motor adapter and coupling in 304 stainless steel. The motor shall have thermal protection in the motor windings to protect the windings from overload. The unit will restart automatically after the motor cools down.

K. *Motor Lead Wire*:

1. The lead wire shall contain no splices, be Teflon coated, and be of the length specified previously. The motor leads shall be a minimum copper wire size of AWG #10.

L. *Cathodic Protection*:

1. Pumps shall be provided with a replaceable cathodic protection system.

2.3 Controls Panels and Controls

A. Complete automatic pump control system shall be furnished by the pump manufacturer or certified representative and installed near the top of the side slope riser by the CONTRACTOR as shown on the Drawings and specified herein. The control system shall consist of a pump control panel for housing the controls for the side slope riser pump over a range of 0 to 12.5 feet of leachate depth. The CONTRACTOR shall provide all materials for mounting and wiring the pump control panel.

B. Level Control System:

1. The level control system shall be a point measurement system using a level sensor transducer. Level sensor shall be a fully submersible pressure transmitter.
2. The level sensor shall be 316 stainless steel, compatible with leachate, mounted on the pump carriage.
3. The system shall be easy to maintain and not require recalibration or specialty equipment to maintain.
4. The cable shall be severe duty rated, oil and water resistant, jacketed for submergence in leachate
5. Chemical resistant atmospheric pressure compensating vent tube. The level transducer shall be equipped with 75-feet of continuous, without splices, control cable.
6. Range: 0 – 15 Feet W.C. (0-7 PSIG).
7. Accuracy: 1.25% of operating range.
8. Manufacturer: EPG Level Master, or approved equivalent.

C. Control Panel:

1. The pump controls and electrical equipment shall be housed in a NEMA 4X enclosure. The enclosure shall be equipped with an inner door, stainless steel drip shield, and lock. Two milled keys shall be furnished with each lock. All indicating lights, switches, and indicators shall be mounted on the inner door. The enclosure shall be sized and assembled to provide 20% free space for future controls relays and wires. All components shall be clearly identified by suitable name plates.
2. Control panel shall designed for 3-phase; 460 volts; 60 hertz with conductors sized to accommodate the pump motor and auxiliary usage. Phase monitor lighting and surge suppression shall be installed on all incoming power lines to protect the control panel equipment. The control panel shall be equipped with a main disconnect and fuses/circuit breakers to de-energize the complete control panel, including controls. The control panel enclosure shall be designed to allow access to indicating lights, breakers, receptacles and meter without de-energizing the control panel. The control panel shall include separate auxiliary circuit breakers for pump, alarm and control circuits, GFCI receptacle and space for one (1) future 120 volt breaker.

3. Controls - The pump shall be operated by a HOA selector switch and related controls. The controls shall include a "soft start" motor starter with overload relays with ambient compensated, quick trip characteristics with manual reset and shall be sized for the motor being used. Each starter shall have a minimum of two auxiliary contacts. Panel shall include an anticondensation heater. The panel shall include all necessary relays, low voltage power supplies, transformers and interlocks required for operation of the system as described above.

   The control panel shall include an intrinsically safe level control system to start and stop the leachate pump as required and for high level alarm indication or pump seal failure. The level control system shall maintain the leachate level in the bottom of the side slope riser at below 24 inches.

4. Lights/Indicators
   The control panel shall include:
   a) Pump "running" light;
   b) Pump "fault" light;
   c) Pump "leakage" light;

   d) Leachate level indicator;
   e) Resettable elapsed pump run time meter;
   f) NEMA 4 amber flashing alarm light mounted on top of the control panel (100 Watts) shall illuminate on "High Leachate Level".
   g) Audio alarm for "High Leachate Level"

2.4 Electrical Works

A. The CONTRACTOR shall provide electric service to the pump panels from the existing service panels by means of underground conduit, cables and connections.

B. The CONTRACTOR shall provide all conduit, cables, enclosures and terminations as shown on the contract documents or as required in this specification.

C. Wire

   a) All wiring with the exception of motor lead wires of the submersible pump, shall be Type THWN copper wire having 600 volt insulation. Wiring for light or power shall be not smaller than #12 AWG. The main electrical service shall be sized as appropriate. Aluminum wire shall not be allowed. All main feeders and branch circuits shall be color coded as required by Code. Wire shall be as manufactured by Phelps-Dodge, General Cable, Triangle, Crescent Insulated Wire and Cable Company or Essex Wire & Cable Co. Wire to the pumps and level controls shall be submersible as provided by the pump manufacturer.

b) Properly identify and tag all mains, feeders, and branch circuits in all pull boxes, gutters, troughs, junction boxes, etc., in which they connect. Similarly, identify and tag wires where two or more circuits run to or pass through the same outlet or junction box.

c) On all circuit wiring, allow sufficient slack at splices and outlets to permit connections without straining, generally not less than 6" of slack in junction or outlet boxes and 10" in ducts, troughs or pull boxes. Joints and splices shall only be made in pull boxes, junction boxes and outlet boxes in a mechanically and electrically secure manner using only approved solderless connectors, lugs, etc., as approved by Code.

d) Grounding and bonding shall be in accordance with the NEC and with the requirements of the local Utility Company. All exposed non-current carrying metallic parts of the electrical equipment, and neutral conductor of wiring systems shall be grounded. All grounding conductors shall be of copper. The CONTRACTOR shall provide test results that demonstrate that the resistance to ground for the grounding system is not more than 15 ohms.

D. Conduit

a) Rigid nonmetallic conduit, PVC Schedule 40, may be used underground and under slabs. All PVC conduit passing under roadways shall be Schedule 80. All exposed conduit and upturn elbows and conduit passing through the ground or masonry shall be rigid galvanized steel conduit. Exposed conduit fittings shall be hot-dip galvanized malleable iron fittings, for elbows, unions, and switch boxes; type FS or FD, manufactured by Appleton or Crouse-Hinds. When entering boxes, fittings or cabinets the fittings shall be double-lock-nut-and-bush except at threaded hubs. All conduit, fittings, connections, etc. shall be water tight. Bushings larger than 1" shall be insulating type with plastic, fiber, or bakelite insulating rings molded into hot-dip galvanized malleable iron threaded bushings. All conduit and fittings from the pump control panel down to the pumping area shall conform to Class 1, Division I standards with explosion proof seal off fittings for conduit entrance into the control panels. Conduit size shall be as shown on the contract documents and at a minimum 3/4" in diameter.

b) Where required for proper execution of work, provide all junction and/or pull boxes, each of proper size, gauge and type for location and use, complete with screw covers of size convenient and adequate for proper installation of required number of cable or wires; to conform with code requirements.

PART 3 EXECUTION

A. All installation procedures for the specified pumping system component including but not limited to pumps, couplings, flow meters, valves, controls, and electrical equipment shall be installed per manufacturer's recommendations and instructions.

B. The CONTRACTOR shall utilize a licensed electrician to make all electrical power and control wiring connections between all new and existing electrical distribution equipment, control panels and equipment as specified in this specification and as shown on the Drawings. All power and control conduit runs between control panels and the pumps and level controls located in the Side Slope Riser shall include seal fittings for hazardous locations. The seal fittings shall be properly installed and sealed in accordance with relevant electrical codes for a Class 1, Division I location to prevent the migration of landfill gas (methane) into the Control Panels. These wiring connections shall utilize explosion proof junction boxes or other equipment as required and shall be located to allow disconnection and removal of the pump and level control equipment without entering the Side Slope Riser.

C. Upon completion of the installation, the CONTRACTOR shall test all circuits, control systems and devices, including all condition signals, in the Presence of the OWNER's Representative. All apparatus shall be cleaned, adjusted and made ready for operation after testing. The CONTRACTOR shall make such changes in wiring or connections and such adjustments, repairs or replacements as are necessary to make the circuits, device or control system to function as specified and otherwise comply with the specifications or data on Drawings. The CONTRACTOR shall supply all necessary material labor and equipment for these tests. The pump shall be tested in the presence of the OWNER's Representative to insure that the pumps are adjusted and in proper running order and that said pumps will meet the rated capacities specified. The field test shall include pumping at least three cycles at normal starting levels to check the operation of the pump. Pump tests shall include plotting of pump curve based on field data for each pump. Points on pump curve shall include shutoff head and three (3) other points. During pump testing, inspections shall be performed m the presence of the OWNER's Representative to insure free passage of liquid into the force main. Any problems shall be promptly repaired at the CONTRACTOR's expense.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install two leachate storage facilities as shown on the Contract Drawings and described herein. Each leachate storage facility shall consist of, but not be limited to the following:

1. Two 500,000 gallon leachate storage tanks.
2. Secondary containment area shall be concrete floor and walls as specified in the Contract Drawings.
3. Loadout pad for tanker trucks that pump leachate from the storage tanks shall be provided on the leachate facility access roads shown on Permit Drawings.
4. Master Pump Control Panel in site entrance maintenance building area (see Contract Drawings for depiction of site entrances).
5. Pipe and pipe fittings, including bends, tees, check valves, shut-off valves and all other pipe appurtenances, as required.
6. All related electrical work and accessories.

B. Master Pump Control Panel shall be provided by the manufacturer of submersible pumps in cell sumps.

1.2 System Operation

A. Submersible Pumps in Cell Sumps

1. Submersible pumps are equipped with level sensors to measure the depth of leachate in each cell sump.
2. When the leachate depth reaches 12 inches above the bottom of the sumps, the submersible pump will automatically be activated.
3. When the leachate level reaches a depth of 6 inches above the bottom of cell sump, the pump will automatically shut off.
4. If leachate reaches 16-inches above the bottom of the cell sumps, a red alarm light shall be activated, and the system will trigger an auto-dialer to alert a landfill on-call employee.

B. Leachate Storage Tanks

1. Leachate storage tanks will be equipped with a float system to monitor the liquid level in each tank.
2. When the level in a tank with an overflow pipe connection to a full tank reaches the depth at the top of the overflow pipe, a red alarm light will be activated, submersible pumps will automatically shut off, and an auto-dialer will alert a landfill on-call employee.
3. The landfill manager shall be apprised and shall assess the actions needed to assure adequate containment of the leachate, and implement such actions.

C. *Secondary Containment Area*

1. If leachate spills into the secondary containment area, the leachate must be removed and property stored. The containment area must then be cleaned by pressure washing. The wash water must be pumped to a leachate storage tank.
2. Clean precipitation that accumulates within the secondary containment area shall be pumped to an adjacent perimeter ditch.

D. *Leachate Storage Facility Access Road*

1. A tanker truck loadout pad and appurtenant pumping equipment is provided via leachate storage facility access roads.
2. A landfill staff member shall select the leachate tank to be pumped at the master pump control panel, where opening of piping valves required to pump the tank is activated.
3. Once the tanker truck is filled, the piping valves shall be closed at the master pump control panel.

1.3 Submittals

A. *Shop Drawings*

Submit the following Shop Drawing information to the DESIGNER for approval, prior to fabrication.

1. Leachate Storage Facilities
   a. The CONTRACTOR shall submit detailed drawings showing Leachate Storage Facility layout. Detailed layout shall include leachate storage tanks, secondary containment areas, and all appurtenances required to operate the leachate storage system.
   b. Submit Tank Manufacturer's Literature, including but not limited to:
      i. Tank Construction Drawings
      ii. Tank Construction Specifications
2. Master Pump Control Panel
   a. The CONTRACTOR shall submit a detailed panel layout and electrical diagrams showing the panel enclosure, panel face and wiring diagrams to the DESIGNER for approval prior to fabrication. Detailed wiring diagrams shall show point-to-point wiring information, including wire and terminal numbering system. Field connections shall be clearly denoted. Submit detailed layout of panel face and internals. Detailed layout shall indicate the location of each control and electrical component, including relays, transformers, panel displays, controllers, breakers, and other required items.
   b. Submit supplier's product data for all controls and electrical components including:
      i. Panel displays.
      ii. Relays.
      iii Power conditioners.

iv. Control power transformers.
v. Panel heaters.
vi. Circuit breakers.
vii. Switches, push buttons, lights, etc.
viii Panel Enclosures
ix. Other electrical components as specified in Section 16050.

3. Piping and Valves
Submit supplier's product data including:
a. Ball valves, check valves, electric actuators.
b. Piping, tees, all fittings.

B. *Submit in accordance with Section 01300.*

PART 2 PRODUCTS

2.1 Leachate Storage Tanks

Leachate Storage Tanks shall be 45-foot diameter, 47-foot height glass coated, bolted steel tanks, manufactured by Aquastore., or similar. Refer to Technical specification Section 13211.

2.2 Master Pump Control Panel

Master Pump Control Panel shall be provided by the manufacturer of submersible pumps in cell sumps.

PART 3 INSTALLATION

3.01 General

A All installation for leachate storage tanks, pumps, valves, controls, pipe, and electrical equipment shall be per manufacturer's recommendations.

B. Install pipe, fittings, and all appurtenances in accordance with recognized industry practices achieving permanently leak-proof piping systems, capable of performing each indicated service without piping failure. All joints shall be installed in accordance with the following:
i. Welds shall be sound and free from embedded scale of slag, have tensile strength across weld not less than that of thinner of connected sections, and be watertight.
ii. Use butt-welds for welded joints in the pipe assemblies and fabrication of bends and other specials.
iii.. Use filled welds for flange attachment, in accordance with AWWA C207.

iv. Conform field welding of joints and preparation of pipe ends to AWWA C206 and ASTM A139.

C. The CONTRACTOR shall make all electrical power and control wiring connections between all new and existing electrical distribution equipment, control panels, and equipment. All work shall be performed in accordance with all applicable Codes and Regulations. The CONTRACTOR shall schedule all required inspections, and obtain all required permits.

D. All piping shall be pressure tested in accordance with Section 02650.

E. Upon completion of the installation, all circuits, control systems and devices, including pumps, sensors, and all alarm condition signals, shall be tested in the presence of the QAC by the CONTRACTOR. All apparatus shall be cleaned, adjusted, and made ready for operation after testing. The CONTRACTOR shall make such changes in wiring or connections and such adjustments, repairs or replacements as are necessary to make the circuits, device or control system to function as specified and otherwise comply with the specifications or data on Permit Drawings. The CONTRACTOR shall supply all necessary material, labor, and equipment for these tests.

***** END OF SECTION *****

PART 1 - GENERAL

1.01 Description of Work

A. The CONTRACTOR shall furnish all labor, materials, equipment and appurtenances required for the installation of a complete chain-link fence system. Fencing and gates shall be installed in the locations shown on the Contract Drawings and as otherwise required by the CONTRACTOR and favorably reviewed by the QAC.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, Commonwealth, or Federal authorities having jurisdiction. The CONTRACTOR is responsible for identifying and obtaining all appropriate licenses, approvals, and permits to complete the Work of this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect the Work.

1.02 Submittals

A. Shop Drawings

1. The CONTRACTOR shall submit to the QAC, at least ten (10) days prior to construction, catalog cuts, MANUFACTURER's installation instructions, and dimensioned drawings for fencing, gates, and associated details for installation.
2. Submit detailed layout drawing showing the location of each fence post.

B. Submit in accordance with Section 01300 of these Specifications.

1.03 Delivery and Handling

A. Deliver materials with the MANUFACTURER's tags and labels intact.
B. Handle and store materials in such a manner that will avoid damage.

1.04 Quality Assurance

A. Comply with the standards of the Chain Link Manufacturers Institute and these Specifications.
B. Provide fencing as a complete unit produced by a single manufacturer including the required erection accessories, fittings, and fasteners.

1.05 Codes and Standards

The latest edition of the publications listed below are included as a part of these Specifications.

A. AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

A53	Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless
A123/A123M	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
A153/A153M	Zinc Coating (Hot-Dip) on Iron and Steel Hardware
A392	Zinc-Coated Steel Chain-Link Fence Fabric
A641/A641M,	Zinc-Coated (Galvanized) Carbon Steel Wire

PART 2 - PRODUCTS

2.01 General

A. Height for new fencing shall be six (6) feet as shown on the Contract Drawings. Posts shall be set at no more than 10-foot centers, in concrete footings, poured the full size of the excavated holes. Corner posts shall have the necessary strut and tie bracing. Gates shall be provided as specified the Contract Documents.

B. Where fencing crosses ditches, steep grades, and other unusual conditions, make special provisions to insure that the security, appearance, maintainability and permanence of the standard fencing are maintained.

2.02 Materials and Construction

A. Fence Mesh and General Note: 9 gauge wire, woven to 2-inch squares, zinc-coated (hot-dip galvanized), galvanized after weaving, 6-foot wide roll. Continuous tension wire shall be provided at the lower and upper edges of the mesh. Fence mesh shall be of one continuous piece from top to bottom and between posts. Zinc-coated fabric shall conform to ASTM A392, Class 2.

B. Line Post: 2-1/2-inch O.D. ASTM A53 standard weight Galvanized Pipe (3.65 lbs/ft.)

C. Corner Post: 3-inch O.D. ASTM A53 standard weight Galvanized Pipe (5.79 lbs/ft.)

D. Gate Post: 4-inch O.D. ASTM A53 standard weight Galvanized Pipe (9.11 lbs/ft.)

E. Top Rail: 1-5/8-inch O.D. ASTM A53 standard weight Galvanized Pipe (2.27 lbs/ft.) with extra long pressed steel sleeves.

F. Tension Wire: No. 7 gauge steel spring coil tension wire, zinc-coated (hot-dip galvanized). Zinc-coated wire shall conform to ASTM A641, Class 3.

G. Swing Gates:

1. Frame shall be 2-inch O.D. ASTM A53 standard weight galvanized pipe with galvanized pressed steel or galvanized malleable iron corner ells riveted or bolted at corners.
2. Internal bracing shall be NPS 1 ASTM A53 standard weight galvanized pipe with 3/8-inch diameter galvanized adjustable truss rods and truss fasteners.
3. Bottom hinge shall be galvanized malleable iron pivot type.
4. Top hinge shall allow gate to swing 90° to 180°.
5. Gate shall be complete with padlocking device, center rest, and semi-automatic catch to secure gate in open position.
6. Gates shall be provided to match fence height and with the following minimum widths:
    a. Man Gates: Provide a single gate of 3 feet width.
    b. Vehicular Gates: Provide dual gates of equal width to provide an overall gate width of 16 feet.

H. Hardware, fasteners, and accessories: galvanized and compatible with other fence system components.

I. Brace rail: ASTM A53 standard weight galvanized pipe with 3/8-inch diameter galvanized steel truss rods and truss tighteners.

J. Lifting Eyes: Provide at each end of removable panels of adequate strength and attachment to allow fence panel removal. Provide galvanized steel or stainless steel. Repair damage to galvanized surfaces with Galv-Alloy or other means.

K. Extension Arms (where required):

1. Line Post arms shall be fabricated of pressed steel or malleable iron base with pressed steel extension riveted on.
2. Corner Posts arms shall be fabricated of 11-gauge (minimum) pressed steel or heavy malleable iron base with 11-gauge (minimum) pressed steel extension riveted on.
3. Arms shall be galvanized in accordance with ASTM A123.
4. Arms shall be able to withstand a minimum pull down weight of 300 pounds and of the barbed wire stretched to proper tension.
5. Arms shall be securely fastened to post.

L. Tension Bars and Bands: Tension bars for pulling fence fabric to terminal posts shall be 3/4-inch steel bars, hot-dip galvanized in accordance with ASTM A123. Bands for fastening tension bars to terminal posts shall be 11 gauge by 1-inch wide steel; hot-dip galvanized in accordance with ASTM A123.

M. Barbed Wire: Provide galvanized barbed wire with barbs spaced not more than 10 inches apart.

N. Concrete: Concrete for setting of fence posts shall have a minimum 28-day compressive strength of 3000 psi. Concrete shall be a MD DOT standard mix. CONTRACTOR may propose use of high early strength concrete (Type III) for approval by the QAC.

PART 3 - EXECUTION

3.01 General

A. Fence shall be installed to the lines and grades indicated in the Contract Documents. The area on either side of the fence line shall be cleared to the extent required for proper installation. Line post shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts, however, runs between terminal posts shall not exceed 500 feet.

3.02 Posts

A. Posts shall be set plumb and in alignment. Except where solid rock is encountered, posts shall be set in concrete to the depth of 36 inches. Where solid rock is encountered with no overburden, posts shall be set to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, posts shall be set to a minimum depth of 36 inches unless a penetration of 18 inches in solid rock is achieved before reaching the 36-inch depth in which case depth of penetration shall terminate. All portions of posts set in rock shall be grouted. Portions of posts not set in rock shall be set in concrete from the rock to ground level. Posts set in concrete shall be set in holes not less than 16 inches in diameter for terminal post and 10-1/2 inches in diameter for line posts. Diameters of holes in solid rock shall be at least 1 inch greater than the largest cross section of the post. Concrete and grout shall be thoroughly consolidated around each post so as to be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure for 72 hours prior to attachment of any item to the posts.

3.03 Braces and Truss Rods

A. Braces and truss rods shall be installed as required and in conformance with the standard practice for the fence furnished. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal.

3.04 Tension Wires

A. Tension wires shall be installed along the bottom of the fence line and attached to the terminal posts of each stretch of the fence. Top rails shall be installed as shown on the drawings. Bottom tension wire shall be installed within the bottom 6 inches of the installed fabric. Tension wire shall be pulled taut and shall be free of sag.

3.05 Chain-Link Fabric

A. Chain-link fabric shall be installed on the side of the post indicated. Install fabric on the Site side of the posts if side is not indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. Fabric shall be pulled taut to provide a smooth uniform appearance free from sag. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to tension wires at approximately 24-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be 2 inches (plus or minus ½-inch) above the ground.

3.06 Barbed Wire Supporting Arms and Barbed Wire

A. Barbed wire supporting arms and barbed wire shall be installed as indicated in the Contract Documents similar to the existing fence and as recommended by the MANUFACTURER. Barbed wire shall be pulled taut and attached to the arms with clips or other means that will prevent easy removal.

3.07 Gates

A. Gates shall be installed at the locations shown in the Contract Documents. Hinged gates shall be mounted to swing as indicated in the Contract Documents. Latches, stops, and keepers shall be installed as required in the Contract Documents. Padlocks shall be attached to gates or gate posts with chains to prevent padlock removal.

3.08 Grounding

A. Fences crossed by power lines of 600 volts or more shall be grounded at or near the point of crossing and at distances not exceeding 150 feet on each side of crossing. Ground conductor shall consist of No. 8 AWG solid copper wire. Grounding electrodes shall be ¾-inch by 10-foot long copper-clad steel rod. Electrodes shall be driven into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable electrodes shall be buried a minimum of 12 inches deep and radial from the fence. Top of electrode shall be not less than 2 feet nor more than 8 feet from the fence. Ground conductor shall be clamped to the fence and electrodes with bronze grounding clamps so as to create electrical continuity between fence posts, fence fabric, and ground rods. After installation the total resistance of fence to ground shall not be greater than 25 ohms.

3.09 Cleaning

A. Perform cleaning during installation of the Work and upon completion of the Work. Remove from the Site all fence debris and equipment. Repair all damage resulting from the installation of the chain-link fence system as directed by the QAC or QUALITY ASSURANCE OFFICIAL, at the CONTRACTOR's sole expense.

***** END OF SECTION *****

PART 1 – GENERAL

1.1 Description

A. The Contractor supply all material, labor, equipment required for soil preparations and placement of seeding, in locations as directed by the QAC, or as shown on the Permit Drawings. This work shall include maintenance of established lawns until final acceptance. The CONTRACTOR shall provide and place all topsoil necessary to complete the work.
B. Apply lime, fertilizer, seed, and mulch to all topsoiled areas disturbed by the work not receiving a specific surfacing.

1.2 Requirements of Regulatory Agencies

Pesticides, herbicides, and fungicides shall be used in accordance with the requirements of the prevailing Public Health Authority.

1.3 Submittals

A. Submit full and complete information on vegetative layer sampling and fertility testing results prior to amending topsoil with lime and fertilizer.
B. Submit, to the QAC, certification that seed complies with the Specifications.
C. Submit hydroseed procedure and application rates for approval by QAC.
D. Submit full and complete written maintenance instructions for proper care and development of seeded areas to OWNER, prior to substantial completion.
E. Submit material certification for seed mulch to the QAC.

1.4 Product Handling

Deliver seed, lime, and fertilizer in new, clean, sealed containers.

1.5 Scheduling

A. Schedule planting of seeding areas for optimum germination as follows:
   1. Spring planting schedule is March 15th to June 15th
   2. Fall planting schedule is August 15th to October 15th
B. Seeding dates other than listed above are to be approved by the DESIGNER.

PART 2 – PRODUCTS

2.1 Fertilizer

The fertilizer shall consist of 12-24-24 and 46-0-0 commercial grade fertilizer, unless otherwise needed based on fertility test of vegetative layer.

2.2 Seed

A. Seed shall be brought to the site unmixed unless the mixture is certified and stated on the package as to the quality and mixture. Mixing shall be done at the project site from the original unopened packages. Seed mixtures and application rates shall be as follows:

Common Name	Total Lbs per Acre
Kentucky 31 Fescue	128 lbs
Ladino Clover	2 lbs
Red Top Grass	2 lbs
Season Nurse Crop *	20 lbs

Use seasonal nurse crop in accordance with seeding dates as stated below:

February 16th through April	Annual Rye
May 1st through August 15th	Foxtail Millet
August 16th through October	Annual Rye
November through February 15th	Winter Rye

1 Weeping Lovegrass may be added to the seeding mix during the warmer seeding perids; add 10-20 lbs./acre in mixes.

B. Labels and contents shall conform to all State and Federal regulations.

2.3 Agricultural Ground Dolomitic Limestone

A. Agricultural ground dolomitic limestone shall conform to the standards of the Association of Official Agricultural Chemists, and must comply with all existing State and Federal regulations.

B. The material must comply with the following gradation:

Square Mesh Sieves	Percent Passing by Weight
Pass # 10	100
Pass # 20	90
Pass #100	40

C. The minimum calcium carbonate equivalent shall be 90.

D. The DESIGNER reserves the right to draw such samples and perform such tests as he deems necessary to assure that these Specifications are met.

2.4 Seed Mulch

A. Provide erosion control or hydro-mulch, as required, in areas to be seeded.

B. Seeding mulch shall be wood fiber, straw, or non-woven fibers free from weeds and coarse matter.

PART 3 EXECUTION

3.1 General

Construction methods shall be those established as agronomically acceptable and feasible, as approved by the DESIGNER.

3.2 Seed Bed Preparation

A. The areas shall be made friable and receptive to seeding by approved methods, which will not disrupt the line and grade of the slope surface. In no event will seeding be permitted on hard or crusted soil surface.

B. Fine grade areas to a firm even surface, free from lumps or stones 1-inch or more in any dimension. Installation of grass areas may be done immediately after finish grading provided the seeding bed is in a good condition, and not muddy or hard. If it is hard, till to a friable condition again.

3.3 Seeding Operations

A. Seed areas within the areas disturbed by the CONTRACTOR, as directed by the QAC and Permit Drawings. After cleaning the seeding area of coarse material, maintain finish grades as shown on the Permit Drawings and spread fertilizer and lime uniformly over the areas using an approved mechanical spreader. Fertilizer shall be applied at a rate required to provide one (1) lb. of nitrogen per 1,000 square feet, or as indicated by soil test results. Harrow and rake into topsoil to a depth of 2- inches.

B. The lime application rate will be based on soil fertility test results, and will be broadcasted prior to harrowing and raking of topsoil prior to fertilizing to achieve a soil pH of 6.5 to 7.0. The maximum application rate allowed is 100 lbs per 1,000 square feet.

C. Do not undertake seeding in windy or unfavorable weather, or when the ground is too wet to rake easily, frozen, or too dry. Uniformly sow seed at a rate specified, using drills, seeders or hydroseeding. If hydroseeded, add 10 percent to seeding mixture requirement.

D. If drilled, apply the specified seed mixture uniformly at the rate specified, using a press drill equipped with individually mounted, adjustable spring load, double disk furrow openers fitted with depth control banks, or drums. Make two (2) passes at right angles to one another.

3.4 Replanting

A. The CONTRACTOR shall be required to replant areas damaged by water, wind, fire, equipment or pedestrian traffic, as necessary, or when ordered by the QAC at no cost to the OWNER.

B. All areas and spots that do not show a prompt catch within 60 days shall be reseeded at fifteen (15) day intervals until a growth of grass is established (minimum 70% coverage one (1) year after initial seeding) over the entire area, at no additional expense to the OWNER.

3.5 Compaction

The CONTRACTOR shall keep all equipment, and vehicular and pedestrian traffic off areas that have been seeded to prevent excessive compaction and damage to young plants. Where such compaction has occurred, the CONTRACTOR shall rework the soil to make a suitable seedbed, then reseed and reblanket such areas with the full amounts of the specified materials, at no extra expense to the OWNER.

3.6 Mulching

A. If seeding is done with hydro-mulching, then seeding mixture shall be increased 10 percent.
B. Hydro-mulching of seeding areas shall have approved mulch applied at a rate as recommended by the manufacturer of tacking agent.
C. Other methods of mulching shall not be applied prior to approval by the QAC.

3.7 Maintenance of Grass Areas

A. Water, weed, and reseed throughout the construction contract and/or acceptance by the QAC after seeding areas are substantially established turf areas.
B. Install and maintain temporary protection fences, barriers, and signs, where deemed necessary.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install concrete formwork as required to form reinforced concrete working pads for miscellaneous drainage structures and foundation, and as shown and indicated on the Permit Drawings, as specified herein, or as otherwise required to complete the Work. The CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect all Work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all Work.

1.2 References

The latest editions of the publications listed below are included as a part of these Specifications.

A.	ACI 318	Building Code Requirements for Reinforced Concrete
B.	ACI 347	Recommended Practice for Concrete Formwork
C.	PS 1	US Department of Commerce Product Standard (PS) Construction and Industrial Plywood

1.3 Form Design

The CONTRACTOR shall be responsible for the design and performance of concrete forms. Formwork shall comply with ANSI A10.9 and OSHA Construction Standards, Part 1926, Subpart Q, "Concrete, Concrete Forms, and Shoring".

PART 2 PRODUCTS

2.1 Form Material

Formwork for all concrete, unless otherwise specified, shall not be less than 5/8-inch, 5-ply Douglas fir plywood of exterior structural grade especially processed to resist moisture and conforming to PS 1, B-B Concrete Form Panels. Patented forms may be used, subject to approval by the DESIGNER, provided they are in new, or like-new condition so as to produce a smooth, even surface free from blemishes, defects, and depressions. Approval of patented forms will be based on the final surface finish, and will not relieve the CONTRACTOR of the responsibility for the design and structural soundness of the forms.

2.2 Accessories

A. Form tie assemblies shall be form clamps with smooth tie rods, with a waterstop at the center, permitting tightening of the forms and be of such type as to leave no metal or other material within 1-1/2-inch of the surface after use. The assembly should provide cone-shaped depressions in the cast surface at least 1-inch in diameter and 1-1/2-inch deep to allow filling and patching.

B. Form releasing agent shall be a non-staining form coating compound such as "Cast-Off" by Sonneborn Products Division (Contech, Inc.), or an equal product as approved by the DESIGNER.

PART 3 EXECUTION

3.1 Form Construction

Formwork shall be in accordance with ACI 347 and as follows:

A. Forms shall conform to shape, lines and dimensions of members required and shall be sufficiently rigid and tight to prevent leakage of the cement binder. Forms shall be properly braced or tied together so as to maintain position and shape. Construct forms so that they can be removed readily without hammering or prying against the concrete. Forms for exposed concrete shall be carefully made and accurately placed to obtain correct shape and lines.

B. Joints shall be butted tight on solid bearings. Arrangements of panels shall be orderly and symmetrical, and use of small pieces shall be avoided. Forms shall be chamfered for external corners of concrete, including top of walls, which will be exposed in the finished work.

C. The CONTRACTOR shall be fully responsible for the adequacy of formwork in its entirety. Forms shall support the anticipated loading while maintaining their dimensional and surface correctness to produce members with the required geometry.

D. Block-outs for slots, chases, recesses or other openings shall be provided by the CONTRACTOR as needed by the work of this and any other trades.

E. Install all the inserts to be supported by the formwork as required by the work of this and other trades as needed.

3.2 Tolerance for Formed Surfaces

A. Variation from Plumb: Not more than ±1/4 inch in any 10 feet of length with a maximum for the entire length of ±1/2 inch.

B. Variation from the Level or from the Grades Specified in the Permit Drawings: Not more than ±1/4 inch in any 10 feet of length with a maximum for the entire length of ± 3/4 inch.

C. Variation in the Sizes and Location of Openings and Thickness of Walls: ±1/4-inch.

3.3 Inspection

CONTRACTOR shall give the QAC at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the QAC has observed and given approval of the Work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the CONTRACTOR to minimize errors and in no case will they serve to relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

3.4 Application of Form Coating

Immediately before the placing of reinforcing, faces of all forms in contact with the concrete shall receive a thorough coating of the liquid form-releasing agent specified, applied in compliance with the Manufacturer's instructions.

3.5 Removal of Forms

A. The CONTRACTOR shall assume full responsibility for removal of formwork and forms shall be removed in such a manner as to insure complete integrity and safety of the structure. Forms and shoring for mass concrete, walls, columns, and beams shall remain in place a minimum period of 7 days after casting the concrete. Forms for slabs shall remain in-place a minimum of 24 hours after casting.
B. Wood forms shall be completely removed from all concrete cast to avoid termite infestation.

3.6 Surveying

A. Prior to pouring concrete, accurately survey and measure the size and location of all structures to be placed in the concrete. Survey and record measurements in accordance with Section 01050 of these Specifications.
B. Provide drawings showing surveyed measurements, dimensions, and locations necessary to locate accurately anchors, pipes, tanks, conduit, and other structures buried in or below concrete.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install the concrete reinforcement as shown and indicated on the Permit Drawings, as required by these Specifications, and as specified in this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect all Work.
B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

The latest edition of the publications listed below are included as part of these Specifications.

A. ACI 318 - Building Code Requirements for Reinforced Concrete
B. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures
C. ASTM A82 - Specification for Cold Drawn Steel Wire for Concrete reinforcement
D. ASTM A185 - Specification for Welded Steel Wire Fabric for Concrete Reinforcement
E. ASTM A496 - Deformed Steel Wire for Concrete Reinforcement
F. ASTM A497 - Welded Deformed Steel Wire Fabric for Concrete Reinforcement
G. ASTM A615 - Specification for Deformed and Billet-Steel Bars for Concrete Reinforcement
H. AASHTO-M284 - Epoxy Coating

1.3 Submittals

A. Shop Drawings to be submitted with the CONTRACTOR's Detailed Design submittal. Shop drawings shall show the required bar sizes, spacing, and splice length for all reinforcement; reinforcement placing plans; and, bending details, and complete bar lists. Shop drawings will not be reviewed without such information. Wall reinforcing shall be shown in elevation. Location and arrangement of accessories shall be clearly indicated. Placing drawings, detail drawings and bar lists shall be checked by the fabricator and the CONTRACTOR before being submitted to the QAC for review.
B. Mill tests of reinforcing steel shall be submitted prior to use for each 15 tons or less shipped to the Site. Tests shall be conducted in conformance with ASTM A615, and methods prescribed therein.
    1. Cost of tests shall be borne by the CONTRACTOR.
    2. Three copies of each test report stating whether the material meets the requirements of the ASTM specifications shall be submitted to the QAC.
    3. Certified copies of the mill tests may be considered evidence of compliance provided such tests are regularly conducted by the

reinforcement supplier by experienced, competent personnel using appropriate testing equipment. In case of doubt as to the adequacy or accuracy of the mill tests, the QAC may require the CONTRACTOR to furnish, at no additional cost to the OWNER, test results from an independent testing laboratory acceptable to the QAC on mill samples or delivered steel reinforcement.

PART 2 PRODUCTS

2.1 Reinforcing Bars

Bar reinforcement shall be deformed-type bars conforming to ASTM A615. Reinforcement shall be manufactured from new billet steel of American manufacture, Grade 60, yield strength 60,000 psi, minimum.

2.2 Welded Wire Fabric

Welded wire fabric shall be in flat sheets conforming to ASTM A185 (A497), with wire conforming to ASTM A82 (A496).

2.3 Accessories

A. All chairs and bolsters shall have plastic-covered or galvanized steel legs.
B. For slabs on grade, all reinforcing shall be supported on continuous chairs and/or bolsters as required to properly support the reinforcing steel. The chairs and/or bolsters shall be supported on precast concrete pads bearing on the subgrade. The concrete pads shall be at least 6-inch x 6-inch and no more than 1-inch thick. Pads shall be cast from Class "A" concrete or from mortar made up of one part cement and two parts sand, with tie wires embedded.

PART 3 EXECUTION

3.1 Storage of Materials

Reinforcing steel delivered to the Site shall be stored on clean well draining flat surface. All reinforcing steel shall be stored in bundles with tags. Reinforcing steel shall not be exposed to the elements.

3.2 Inspection of Steel Placement

CONTRACTOR shall give the QAC at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the QAC has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the CONTRACTOR to minimize errors, and in no case will they serve

to relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

3.3 Tolerances

A. Allowable tolerances for fabricating steel reinforcement shall be as follows:

Item	Maximum Tolerance
Sheared length of bars	± 1-inch
Location of bends	± 1-inch

B. Allowable tolerances for placing steel reinforcement shall be as follows:

Item	Maximum Tolerance
Concrete cover from outside of bar to finished surface	+ 1/4-inch
Lateral spacing of bars in plane of reinforcement in slabs and walls	± 1-inch
Height of bottom bars in slabs	± 1/4-inch
Height of top bars in slabs	± 1/4-inch

3.4 Shop Fabrication

A. Reinforcing steel shall be fabricated to required shapes and dimensions in compliance with applicable provisions of ACI 315 and ACI 318.
B. Bars shall be bent cold. Bars shall be prefabricated to detail and delivered to the site plainly tagged and ready to set.

3.5 Epoxy Coating

A. Reinforcing bars shall be coated after fabrication is complete.
B. Epoxy coating shall be satisfactory repaired by wire brush cleaning and painting with an approved epoxy paint provided by the bar coater, using the manufacturers approved procedure.
C. Bars with more than 5% of the coating damage shall be replaced.
D. Bars shall be fastened by the use of epoxy-coated wire only.

3.6 Field Fabrication

A. Field fabrication of reinforcing steel will not be permitted without the approval of the DESIGNER.
B. Field cutting of reinforcing steel shall be performed by shearing or abrasive cutting wheel. Cutting by flame is prohibited.
C. Damaged epoxy coating shall be removed and coating repaired.

3.7 Placement and Anchorage

A. Space metal chairs, bolsters, spacers and hangers in accordance with ACI 315.
B. Reinforcement, at the time concrete is placed, shall be free from any abrasions or damage to the epoxy coating. Repairs shall be made immediately upon discovery.
C. Reinforcement shall be accurately placed in accordance with the shop drawings and shall be adequately secured in position with not less than 16-gauge annealed wire or suitable clips at no less than 50% of the bar intersections. Reinforcement shall be held securely at the required distance from the forms. Nails shall not be driven into outside forms to support reinforcement.
D. Install welded wire fabric reinforcement for concrete sidewalks, equipment pads, and as otherwise indicated. Lap all joints 6-inches and wire securely. Extend mesh to within 2-inches of sides and ends of slabs. Unless otherwise specified, place welded wire fabric between the upper third-point and the mid-point of the slab. Sheets that do not lay flat when in their intended position will be rejected. Tags designating the wire size and spacing shall be left on each sheet until ready for use. Tuck ends of welded mesh well down into edge of beams or walls. Do not leave unreinforced border strips. Welded wire fabric shall not contain loose rust.

3.8 Concrete Cover

Metal reinforcement shall be protected by concrete cover in accordance with ACI 318.

3.9 Splicing

A. Splices shall be Class “C” splice minimum. The location and type of splices desired by the CONTRACTOR must be specifically requested and must meet the approval of the DESIGNER before they can be used.
B. Splices shall not be made at point of maximum stress and shall provide sufficient lap to transfer stress between bars by bond.
C. Splices in top reinforcement shall be made as shown of the reinforcement drawing, and approved by the DESIGNER.
D. Mechanical splices may be used instead of lap splices, provided that their location and type meets with the approval of the DESIGNER.
E. Splice locations shall be staggered with adjacent bars and bar bundles.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish and install the concrete as shown and indicated on the Permit Drawings, as required by these Specifications, and as specified in this Section. The CONTRACTOR shall provide a "Competent Person" to implement, supervise and inspect all Work.

B. The CONTRACTOR shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, State, or Federal authorities having jurisdiction.

1.2 References

The latest edition of the publications listed below form a part of these Specifications:

A. *American Concrete Institute (ACI) Publications*

211.1 Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
301 Specifications for Structural Concrete for Buildings
302.1R Guide for Concrete Floor and Slab Construction
304 Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete
305R Hot Weather Concreting
306R Cold Weather Concreting
318 Building Code Requirements for Reinforced Concrete

B. *U.S. Army Corps of Engineers (COE) Waterways Experiment Station Publications*

CRD-C-621 Handbook for Concrete and Cement, Specifications for Non-shrink Grout, Volume II

C. *American Association of State Highway and Transportation Officials (AASHTO) Publication*

M 182 Burlap Cloth Made From Jute or Kenaf

D. American Society for Testing and Materials (ASTM) Publications

C 31 Making and Curing Concrete Test Specimens in the Field
C 33 Concrete Aggregates
C 39 Compressive Strength of Cylindrical Concrete Specimens
C 94 Ready-Mixed Concrete
C 143 Slump of Portland Cement Concrete
C 150 Portland Cement
C 171 Sheet Materials for Curing Concrete
C 172 Sampling Freshly Mixed Concrete
C 173 Air Content of Freshly Mixed Concrete by the Volumetric Method

C 231	Air Content of Freshly Mixed Concrete by the Pressure Method
C 260	Air-Entraining Admixtures for Concrete
C 309	Liquid Membrane-Forming Compounds for Curing Concrete
C 494	Chemical Admixtures for Concrete
C 595	Blended Hydraulic Cements
C 618	Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete
C 881	Epoxy-Resin-Base Bonding Systems for Concrete

PART 2 PRODUCTS

2.1 Cement

Cement shall be standard Portland cement of American manufacture, conforming to ASTM C-150, Type I. Only one (1) brand of commercial Portland cement shall be used in the exposed concrete of the structure. Cement reclaimed by cleaning bags or from leaking containers shall not be used. Each bag shall weigh approximately 94 pounds and contain one (1) cubic foot.

2.2 Concrete Aggregates

A. Fine aggregate shall be sand having clean, hard, durable, uncoated grains, be free from deleterious substances, and conform to ASTM C-33.
B. Coarse aggregate shall be crushed stone having clean, hard, durable, uncoated particles conforming to ASTM C-33.

2.3 Water

Water used in mixing concrete shall be clean, potable, and free from deleterious amounts of acids, alkalis, or organic materials.

2.4 Waterstops

Where shown on the Permit Drawings in expansion joints and construction joints, waterstops shall be polyvinyl chloride (PVC), and shall incorporate a galvanized steel wire along both edges, which shall be used to secure the waterstop in position by tying to reinforcement during concrete placement. The waterstop shall be of the size noted on the Permit Drawings. The waterstop shall be equal to Wirestop CR-9380, or Burke. The waterstop shall extend the entire length of the joint and all splices shall be heat welded and tested in accordance with the manufacturer's instructions.

2.5 Non-Shrink Grout

Non-shrink grout shall be a ready-to-use non-metallic aggregate product requiring only the addition of water at the jobsite, and shall conform to COE CRD-C-621.

2.6 Admixtures

A. Water reducing admixture shall conform to ASTM C-494, Type A.
B. Water reducing, retarding admixture shall conform to ASTM C-494, Type D.
C. Non-Corrosive, Non-Chloride Accelerator shall conform to ASTM C-494, Type C.
D. Air entraining admixture shall conform to ASTM C-260.
E. High range water reducer (HRWR) shall conform to ASTM C494, Type F or G.
F. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.

2.7 Curing and Sealing Compounds

A. Curing compound shall be acrylic based, conforming to ASTM C-309.
B. Sealing-hardener compound shall conform to ASTM C-309.

2.8 Bonding Compounds

Bonding Compound shall conform to ASTM 881.

PART 3 - EXECUTION

3.1 Concrete Quality

All mix designs shall be proportioned in accordance with ACI 211.1. The proportioning shall be based on the requirements of a well-graded, high density, plastic, and workable mix within the slump range and strengths required. The following class of concrete is required:

Class of Concrete	Compressive Strength @ 28 Days	Slump Range
A	4000	4-inch max.

A. Air Content: All concrete shall have an air content of 5 to 7 percent.
B. Water-Cement Ratio: All concrete shall have a maximum water-cement ratio of 0.45.
C. Admixture Usage: All concrete shall contain a water-reducing admixture or water reducing-retarding admixture, and an air-entraining agent. All concrete placed at air temperatures below 50° F shall contain the specified non-corrosive, non-chloride accelerator.

3.2 Mix Designs

A. The testing laboratory shall be paid for by the CONTRACTOR.
B. The CONTRACTOR shall submit samples, in adequate quantities for each mix design and verification, of all concrete materials to be used on the project to the designated testing laboratory. The CONTRACTOR shall not use any concrete in

this work without acceptance and verification of design mix by the testing laboratory, and the approval of the QAC.

C. The testing laboratory shall make strength tests from trial batches in the laboratory, using materials and mix designs proposed for use by the CONTRACTOR. The testing laboratory shall prepare trial batches in accordance with ACI 211.1.

D. The proposed mix design and supporting data must be submitted, in triplicate, to the testing laboratory for their review and comments at least 21 days prior to the expected start of concreting operations. Within 10 days of receiving this information, the testing laboratory will forward two (2) copies of the submittal to the DESIGNER with their comments. The DESIGNER will review the submittal and return one (1) copy to the CONTRACTOR with the DESIGNER's comments.

E. Compression test specimens made to verify the mixes shall be made in accordance with ASTM C-192. Aggregates shall be tested in accordance with ASTM C-33. All compression test specimens shall be tested in accordance with ASTM C-39.

3.3 Plant Mixing

A. *Proportioning Concrete*

1. Proportions shall be in compliance with approved design mix for each class of concrete.
2. The mixing plant shall be provided with adequate equipment and facilities for accurate measurement and control of the quantities of material and water used in the concrete.
3. Concrete materials shall be measured by weight except that admixtures shall be measured by volume.

B. *Batching*

1. The CONTRACTOR shall provide all necessary equipment to accurately determine and control actual amount of materials entering into the concrete mix. Individual ingredients shall be weighed separately for each batch. Accumulative weighing will be allowed if equipment is in acceptable working order, as determined by the testing laboratory and approved by the DESIGNER. Accuracy of all weighing devices shall be such that successive quantities can be measured to within one (1) percent of the desired amount.
2. Completely discharge contents of the mixer before each new batch is loaded. Use of retempered concrete is not permitted.
3. Ready-mixed concrete shall be mixed and delivered in accordance with requirements of ASTM C-94 and to the following:
   a. A separate water-metering device (not truck tank) shall be used for measuring water added to the original batch.
   b. Use of wash water as a portion of the mixing water is not permitted. Wash water added to empty drums after discharging shall be dumped before a new batch is received.

c. Centrally mixed concrete shall be mixed for the length of time specified herein, not "shrink-mixed".
d. Mixing drums shall be watertight.
e. Concrete shall be discharged within one and a half (1.5) hours from the time concrete was mixed, if centrally mixed, or from time the original water was added, if transit-mixed.
f. Furnish delivery ticket with each load of concrete delivered under these Specifications. Delivery ticket shall show clearly the class and strength of concrete, size of coarse aggregate, water per cubic yard, the slump ordered, quantities of all admixtures, and the date and time of departure from the batching plant.

3.4 Conveying Equipment

A. If concrete is to be transported in carts or buggies, the carts or buggies shall be equipped with pneumatic tires.
B. Equipment for chuting or other methods of conveying concrete shall be of such size and design as to insure a practically continuous flow of concrete at delivery, without segregation of materials.

3.5 Conveying

A. Concrete shall be conveyed from mixer to place of final deposit by methods that will prevent separation or loss of the material.
B. Runway supports shall not bear upon reinforcing steel or fresh concrete.
C. All conveying equipment shall be thoroughly cleaned before each run of concrete is begun.

3.6 Delivery and Protection of Materials

Deliver ready-mixed concrete in compliance with requirements set forth in ASTM C-94.

3.7 Severe-Weather Provisions

A. *Hot-Weather Concreting*
1. Provide adequate methods of lowering temperature of concrete ingredients so that the temperature of concrete when placed does not exceed 90° F.
2. When the weather is such as to raise concrete temperature, as placed, consistently above 90° F, Pozzolith retarder shall be used.
3. Subgrade and forms shall be wetted with water before placing of concrete. All excess water shall be removed before concrete is placed.
4. Curing shall start as soon as practicable to prevent evaporation of water. Flat work shall be protected from dry winds, direct sun, and high temperatures.

B. *Cold-Weather Concreting*

1. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather. No frozen materials, or materials containing ice, shall be used.
2. All concrete materials and all reinforcement, forms, fillers and ground with which concrete is to come into contact shall be free from frost.
3. Whenever the temperature of the surrounding air is below 40° F and falling, all concrete placed in the forms shall have a temperature of between 70° F and 80° F, and adequate means shall be provided for maintaining a temperature of not less than 70° F for three (3) days, or 50° F for five (5) days, or for as much more time as is necessary to insure proper curing of the concrete. If high early strength concrete is used, the requirement for maintenance of 50° F can be reduced to three (3) days.
4. Use only the specified non-chloride accelerator. Calcium chloride or admixtures containing more than 0.1 percent chloride ions are not permitted.
5. Housing, covering or other protection used in connection with curing shall remain in place and intact at least 24 hours after the artificial heat is discontinued.

3.8 Construction Joints and Expansion Joints

Construction Joints: Early in the construction program, the CONTRACTOR shall review with the DESIGNER any construction joints proposed for use that are not indicated on the Permit Drawings. The CONTRACTOR shall not use any construction joints not approved by the DESIGNER. In all cases, construction joints shall occur at sections of minimum shear. Where construction joint is to be made, surface of the concrete shall be roughened (construction joints detailed with key ways in slabs and walls do not need to be roughened) and thoroughly cleaned of foreign matter and laitance. In addition to the foregoing, joints shall be dampened with water, and the specified bonding compound applied, or a slush coat of neat cement grout shall be applied. Additional construction joints requested by the CONTRACTOR and approved by the DESIGNER shall be of the type shown and/or noted on the Permit Drawings for the specific element(s) being considered (i.e., wall slabs, etc.).

3.9 Waterstops

Waterstops shall be installed as indicated and noted on Permit Drawings and, as applicable, shall be made continuous by fusion welds.

3.10 Inspection of Work before Placing

A. The CONTRACTOR shall inspect the forms to receive concrete for any deficiencies that would prevent proper placing of concrete. Do not proceed with placing concrete until such deficiencies are corrected.

B. Give the QAC at least 48 hours notice before any concrete is to be cast. Concrete shall not be cast until the QAC has observed and given approval of the work to be cast including, but not limited to, the placement of all the reinforcing, accessories, forms and the surfaces to be cast against. Such observations are in the nature of assisting the CONTRACTOR to minimize errors and in no case will they serve to relieve the CONTRACTOR of the responsibility to provide the materials and workmanship required by the Contract Documents.

C. Do not place concrete on earth until the fill or excavation has been prepared as set forth under applicable Sections of the Specifications for that work.

D. The CONTRACTOR shall not place in the concrete any item that is not authorized to be placed by the Permit Drawings and Specifications. The CONTRACTOR shall insert all the items as required by the other trades and properly position and secure them in their intended location. Openings other than those that are facilitated by sleeves shall be properly formed and positioned, as required by the other trades.

E. Do not place concrete in forms until all foreign matter has been removed from forms and the reinforcing steel is in proper condition for placement of concrete.

F. Remove hardened, or partially hardened, concrete on forms or reinforcement before placing concrete.

3.11 Placing

A. Deposit concrete as nearly as practicable in its final position to avoid segregation due to rehandling or flowing. Do not deposit concrete on work that has partially hardened or been contaminated by foreign material, and do not use retempered concrete.

B. Concrete shall be placed to avoid the displacement of reinforcing, and coating or spattering the reinforcing steel. The placing of concrete within formwork shall be regulated so that the pressure within formwork does not exceed the design pressure. In placing concrete each layer shall be placed following the preceding layer to prevent lines of separation or "cold joints" in the work. After the concrete reaches its initial set, jarring the formwork or placing strain or vibration on the ends of projecting reinforcing bars shall be carefully avoided.

C. Concrete shall not be dropped more than four (4) feet. For greater distances of drop, concrete shall be handled with metal chutes or tremie pipes.

D. Once concreting is started, it shall be carried on as a continuous operation until placing of the concrete between construction joints is completed. The top surface will be finished to the required alignment.

E. Concrete shall be placed in layers not over 12-inches deep and each layer shall be compacted with the aid of mechanical internal-vibrating equipment supplemented by hand spading. Vibrators shall in no case be used to transport concrete. Use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete. At least one (1) spare vibrator shall be maintained as a relief. Provide backup power source. Duration of vibrator use shall be limited to that necessary to produce satisfactory consolidation without causing objectionable

segregation. Vibrator shall not be lowered into courses that have begun to set. Apply vibrator at uniformly spaced points not further apart than the visible effectiveness of the machine.

F. Type and use of vibrators shall be in accordance with ACI 301.

3.12 Protection

Protect freshly placed concrete from damage or injury due to water, falling objects, persons or anything that may mar or injure finish surface on concrete. Only light use of any floors shall be permitted for the first seven (7) days after placing of concrete.

3.13 Curing

A. All Concrete. After placement and finishing, concrete shall be maintained in a moist condition for at least seven successive days during which the temperature of the concrete is 50° F, or above. For temperatures of 50° F and below, curing period shall be 14 successive days.

B. Concrete shall be kept moist by any one, or combination, of the following methods:

1. Ponding or Immersion: Continually immerse the concrete in water throughout the curing period. Lowest temperature water shall not be more than 20° F colder than the temperature of the concrete.
2. Fog Spraying or Sprinkling: Provide uniform and continuous application of water throughout the curing period.
3. Impervious Sheeting: Wet the entire exposed surface of the concrete thoroughly with a fine spray of water and cover with impervious sheeting throughout the curing period. Lay sheeting directly on the concrete surface and overlap edges 12-inches minimum. Provide sheeting not less than 18-inches wider than the concrete surface to be cured. Secure edges and transverse laps to form closed joints. Repair torn or damaged sheeting or provide new sheeting. Inspect surface of concrete daily for wetness. The surface shall be kept continuously wet during the curing period.

C. Concrete in Formed Surfaces - Keep forms and exposed surfaces wet with water during the curing period. If forms are removed before the end of the curing period, apply a curing compound within one (1) hour after form removal.

3.14 Patching

A. Any concrete which is not formed as shown on the Permit Drawings, or for any reason is out of alignment or level or shows a defective surface, or shows defects which reduce the structural adequacy of a member or members, as determined by the QAC, shall be considered as not conforming with these Specifications and shall be removed from the project by the CONTRACTOR at CONTRACTOR's own expense, unless the QAC grants permission to patch the defective area, which shall be done in accordance with the following procedure:

1. Permission to patch any such area shall not be considered a waiver of the QAC right to require complete removal of the defective work if the patching does not, in the QAC's opinion, satisfactorily restore the quality and appearance of the surface or the structural adequacy of the member or members.

B. After removing the forms, all concrete surfaces shall be inspected and any joints, voids, stone pockets or defective areas permitted by the QAC to be patched and all tie holes, shall be patched. Defective areas shall be chipped away to a depth not less than 1-inch with the edges perpendicular to the surface. Remove defective areas to sound concrete with clean, square cuts. Dampen concrete surfaces to be in contact with patching concrete and apply the specified bonding compound. Place patching concrete over the bonding compound as specified by the manufacturer. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete. Before patching mix is applied, the prepared surface shall first be approved by the QAC.

C. Patching concrete mix (or mortar) shall be subject to the approval of the QAC. The patching concrete shall be compacted into place and screed off so as to leave the patch higher than the surrounding surface. It shall then be left undisturbed for a period of one (1) to two (2) hours to permit initial shrinkage before being finished. The patch shall be finished to match the adjoining surface. All patches shall be cured as specified for the original concrete.

D. Tie holes left by withdrawal of rods or the holes left by removal of ends of wall ties shall be filled solid with mortar after first being wetted. For holes passing through the wall, a plunger-type grout gun shall be used to force the mortar through the wall starting at the back face. A piece of burlap or canvas shall be held over the hole on the outside and when the hole is filled, the excess mortar shall be struck off with the cloth flush with the surface. Holes not passing through the walls shall be filled with a small tool that will permit packing the hole solid with mortar. Any excess mortar at the surface of the wall shall be struck off flush with a cloth.

3.15 Finishes on Formed Surfaces

Upon completion of patching, surfaces of concrete shall be finished as follows:

A. Rubbed stone finish shall be produced by casting concrete against plywood forms and by rubbing the surfaces with carborundum stone and water, after patching of tie holes and depressions, to a true, even and smooth finish of uniform color and texture. No slush coat of cement grout or cement wash will be permitted at any state of the finishing.

B. Areas to be rubbed shall be finished as soon as forms can be stripped. Strip only those forms on areas that can be finished in the same day as the forms are stripped.

C. Common finish shall be produced by filling all tie holes, honeycomb, and depressions, and knocking off and evening of burrs and form marks. All concrete surfaces not receiving a stone-rubbed or rough finish shall receive a common finish.

D. Rough finish shall be produced by filling all tie holes and honeycomb, and in other respects leaving the surface as formed. All concrete surfaces which will be covered by earth and which will not be visible in the completed structure, shall receive a rough finish.

3.16 Testing Laboratory

A. The testing laboratory shall be paid by the OWNER. The laboratory shall have access to all places where concrete materials and concretes are manufactured, stored, proportioned, mixed, placed and tested. Duties shall include, but not necessarily be limited to the following:
   1. Make, store, transport, cure and test compression specimens made during placing of concrete. Compression test specimens shall be tested in accordance with ASTM C-39. Test reports shall show all pertinent data, such as class of concrete, exact location of pour, air temperature, date of pour, time of pour, truck number for ready-mixed concrete, date on which specimen was broken, age of specimen, compressive strength of specimen, slump test results, and air content of pour from which the specimen was made. One (1) copy each of all tests shall be sent to the CONTRACTOR and two (2) copies each to the QAC.
   2. For each class of concrete, take four standard test cylinders from each 100 cubic yards or fraction thereof of concrete placed, not less than four (4) cylinders for each 5,000 square feet of surface area placed in any single day. Two (2) of these cylinders shall be designated for the 28 day test, and shall comprise a test under the definition of these Specifications. One (1) cylinder will be broken at seven (7) days and will be used as an aid in determining the early strength of the concrete and the 28-day strength, and one (1) cylinder retained in reserve for later testing if required.
   3. Periodically inspect the batching plant and file a report with the DESIGNER stating whether the supplier's equipment and methods meet the requirements of these Specifications.

B. Temperature and Placing Record: Temperature record shall be made each day during the concreting operations. Records shall also include location, quantity and starting and finishing time of placement for all concrete work. Copy distribution shall be as specified above for test reports.

3.17 Evaluation of Compression Tests

A. Evaluation of compression test results shall be as follows:
   1. For each class of concrete, compression-strength tests for laboratory-cured cylinders shall be considered satisfactory if the averages of the results of all sets of three consecutive compression-strength tests equal or exceed the 28-day design compression strength specified.
   2. No individual cylinder strength test falls below the required compression strength by more than 500 psi.

3. Strength tests of specimens cured under field conditions may be required by the QAC to check the adequacy of curing and protecting of the concrete placed.
4. Specimens shall be molded by the field quality-control laboratory at the same time and from the same samples as the laboratory-cured specimens.

B. Faulty Concrete: Failure to meet any of the specified conditions constitutes faulty concrete. Unless otherwise directed by the QAC, faulty concrete shall be removed and replaced with concrete as specified, at no expense to the OWNER.

C. Additional Testing: If permitted by the QAC, additional testing shall be subject to the approval of the QAC and at no expense to the QAC. Load test, if permitted by the QAC, shall be conducted in accordance with the loading criteria as required by the design of the structure, as determined by the QAC.

D. Neither the results of laboratory verification tests nor any provision in the Contract Documents shall relieve the CONTRACTOR of the obligation to furnish concrete of the class and strength specified.

3.18 Non-Shrink Grout

All applicable locations noted on the Permit Drawings or in these Specifications shall be grouted with the specified non-shrink, non-metallic grout.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Section Includes

A. Design Criteria for leachate storage tank.
B. Structural steel components for the leachate storage tank.
C. Accessories for the leachate storage tank.
D. Coating materials and procedures for leachate storage tank.
E. Erection materials and procedures for leachate storage tank.

1.2 Related Sections

A. Section 03300 Cast in Place Concrete.

1.3 References

A. AWWA D 103 Standards of the American Water Works Association
B. API 12B – American Petroleum Institute
C. ANSI
D. ASTM
E. SSPC
F. NSF Additives Standard No. 61

1.4 Submittals

A. Shop drawings of tank, anchorage (if required), accessories, appurtenances and coatings shall be submitted.

1.5 Qualification/Experience

A. The tank manufacturer shall be a specialist in the design, fabrication with a minimum of (5) years documented experience and erection of factory coated bolted steel tanks. The manufacturer shall be quality certified, having an active API-Q1 and an ISO 9001 registration.

1.6 Delivery, Storage and Handling

A. All plates, supports, members, and miscellaneous parts shall be packaged for shipment in such a manner to prevent abrasion or scratching of the finish coating.

1.7 Warranty

A. The tank manufacturer shall warrant the tank against any defects in workmanship and materials for a period of one (1) year from date of shipment. In the event a defect should appear, it shall be reported in writing to the manufacturer during the warranty period.

B. 1 year Limited Warranty on interior TRICO BOND EP™ coating.

PART 2 PRODUCTS

2.1 Leachate Storage Tank

A. Acceptable Manufacturers
1. Columbian TecTank, Kansas City, KS
2. Aquastore, DeKalb, Illinois

B. *Bolted Tank Design Criteria* – (See Drawings).

C. Bolted Tank Structure
1. The materials, design, fabrication, and erection of the bolted steel tank shall conform to the Principles of Standard Specification 12B of the American Petroleum Institute, or to the manufacturer's specifications which are derived from engineering principles, industry experiences, and the aforementioned standards and specifications.
2. Standard shell height and diameter meeting requirements for the selected capacity.
3. Storage Capacity:
   Minimum Design Volume = 500,000 per tank
   Depth at Minimum Design Volume = 43 feet
4. Tank Diameter: 45'-00"
5. Tank Height: 47'-00"
6. Steel
   a. Hot Rolled Steel Sheets and Plates
      1) Hot Rolled Steel Sheets and Plates shall meet or exceed the requirements of ASTM A1011 Grade 40 with a minimum yield strength of 40,000 psi.
      2) Minimum thickness shall be 12 gauge (0.0972 in.)
   b. Structural Shapes
      1) Structural shapes shall conform to ASTM A36 or ASTM A992.
      2) Other grades of carbon steel that meet or exceed these standards may be utilized.
7. Bolts/Nuts/Washers
   a. Galvanized Bolts
      1) Galvanized bolts, nuts, washers used in tank joints shall be minimum ½" diameter and shall meet or exceed the requirements of API 12B or AWWA D103.
   b. Encapsulated Bolts
      1) Encapsulated bolt heads shall be used for additional corrosion protection.
   c. Anchor Bolts
      1) Anchor bolts shall meet or exceed the requirements of ASTM A36 or ASTM A325.

d. Other Bolts
   1) Other bolts shall meet or exceed the requirements of ASTM A307 or ASTM A325.
e. Washers
   1) Neoprene backed steel washers shall be provided at all bolts in contact with the stored leachate.

8. Gaskets
   a. All bolted connections shall incorporate an EPDM prefabricated gasket with a minimum width of 1-3/4".
   b. A single piece double punched gasket shall be used at vertical seams which require two vertical rows of punching.
   c. Field caulking (NSF Standard 61 Approved) will be allowed when joining a discontinuous gasket section and at certain joint connections.
   d. All tanks that are to be completely sealed with a mastic coating system only, for long-term service, are not acceptable.

D. Coating

1. All metal plates, supports, members, and miscellaneous parts, except bolts, certain accessories, and appurtenances, shall be factory coated in accordance with the provisions of these specifications.
2. Field coating, except for touch-up will not be permitted.
3. Surface Preparation
   a. Tank parts are to be thoroughly washed (Alkaline at 130 deg F) and rinsed to remove grease, oil and foreign matter.
   b. Parts are then to be immediately oven dried.
   c. Parts are to be grit-blasted to SSPC-SP 10 (Near-White Blast Cleaning) to 1-2 mils profile, minimum.
   d. All parts must be coated by Automated Powder Applicators on both sides within two (2) hours after blasting, and no further processing other then coating application shall be done.
4. Interior Coating
   a. Thermally cured modified epoxy powder, Trico-Bond EP by Columbian TecTank Company (includes underside of the steel floor)
   b. First coat is to be a powder application of NSF approved modified epoxy Trico-Bond EP, 7.0 mils average dry film thickness.
5. Exterior Coating
   a. Thermally cured modified epoxy powder, Trico-Bond EP and acrylic polyurethane by Columbian TecTank Company
   b. First coat is to be a powder application of modified epoxy Trico-Bond EP, 3.0 mils average dry film thickness.
   c. Second coat of acrylic polyurethane, 1.5 mil average dry film thickness.
   d. Coating system to have 4.5 mils average dry film thickness.
6. Curing
   a. Baking ovens to be used after each coat
   b. Initial curing shall take place after powder is applied. A combination of IR boosters and convection ovens will be used to heat parts to approximately 300 deg. F to gel the powder (partial cross-linking).

c. Final curing shall take place after top coat is applied. A combination of IR boosters and convection ovens will be used to heat parts to approximately 350 deg. F for 5-6 minutes to finish curing powder and topcoat.

7. Inspection
   a. MEK rub test to verify proper curing of coating.
   b. Wet sponge test (sponge attached to an electrode with a battery attached and producing a spark, buzzer or bell) to check for holidays (pinhole in coating). Holidays are repaired. 100% of interior sheet coating system is checked for holidays.
8. Preparation for Transport
   a. Material to be marked or tagged with part number for ease of field assembly.
   b. Tank materials to be placed in racks or on pallets to facilitate transportation to jobsite.
   c. Touch-up paint with instructions for application by erection personnel.

E. Appurtenances

1. The contractor shall furnish and install the appurtenances as shown in the contract drawings and as specified below. Unless otherwise noted, standard appurtenances shall be as follows:
2. Hatch
   a. The tank roof hatch shall have a curbed, upward opening 24” square.
   b. The curb shall extend at least 4” above the roof surface.
   c. The hatch cover shall be hinged and have provisions for locking.
   d. The hatch cover lip shall extend 2” below the top of the 4” curb.
3. Inlet and Outlet Connections
   a. Inlet, outlet, and overflow connections shall conform to the sizes and locations specified on the contract drawings.
4. Vent
   a. A mushroom screened vent shall be furnished above maximum water level of sufficient size to accommodate normal inlet and outlet flow.
   b. The overflow pipe shall not be considered to be a tank vent.
   c. The vent with stainless steel screen is so designed and constructed as to prevent the entrance of birds, animals, or insects.
5. Flush Cleanout Door/Shell Manway (Optional)
   a. The flush cleanout door shall measure 24” x 46” and be located as shown on the contract drawings.
   b. The shell manway shall have a 36” opening complete with hinged cover, and shall be located as shown on the contract drawings. (Optional)
6. Outside Ladder
   a. An outside galvanized ladder, meeting OSHA specifications, shall be furnished at the location shown on the contract drawings.

7. Guardrail and Toeboards
   a. Galvanized guardrail with toeboard shall be furnished as shown on the contract drawings.

PART 3 EXECUTION

3.1 Installation

A. Erection

1. Field erection of factory coated bolted steel tanks shall be in strict accordance with the tank manufacturers recommendations.
2. Particular care shall be exercised in handling and bolting of the tank plates, supports, and members to avoid abrasion or scratching of the coating.
3. Touch-up coating shall be done in accordance with the tank manufacturer's recommendations where and as directed.

B. Testing

1. Following completion of erection and cleaning of the tank, the tank shall be tested for leachate tightness by filling the tank to it's' overflow elevation.
2. Any leaks disclosed by this test shall be corrected by the erection contractor in accordance with the tank manufacturer's recommendations.
3. The Owner shall provide clean water free of charge at the time of erection completion, for hydrostatically testing the tank.
4. Filling and emptying the tank shall be the responsibility of the Contractor.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

This specification defines the sequence of operation and controls required for the leachate pumps and storage tanks.

PART 2 PRODUCTS

2.1 This specification provides only performance criteria. Contractor shall provide actual system components.

2.2 Contractor shall provide 5 copies of submittals of all system components for review and approval by the Engineer.

2.3 Contractor shall coordinate with Owner and install power supply to the cell leachate sump pumps, the leachate storage tanks, the operations office, and the leachate control building.

2.4 All products, system components, and assembled systems shall be in conformance with all applicable local, State, and Federal regulations, ordinances, codes, laws, and industry standards.

PART 3 GENERAL SYSTEM COMPONENTS AND OPERATION REQUIREMENTS

3.1 Leachate Sumps at Landfill Cells

A system control panel shall be provided at each of the leachate riser location that have the following general components:

A. Time and Date display;
B. Flow meter that displays current and totalized leachate flow;
C. Manual pump on/off control switch; and,
D. Red alarm light display.

3.2 Leachate Sumps Flood Lights

A. Contractor shall provide a flood light near the control panels at the leachate riser locations that have the following general components:
   1. The flood light shall be of a pole type arrangement approximately 12 feet in height or per manufacturer's requirements. The flood light shall operate on 120 VAC and be provided with automatic dust-to-dawn operation, high pressure sodium and mercury-vapor lights at 150 watts.
   2. Flood light shall be McMaster-Carr part number, 1643K85 or equivalent.

3. The contractor shall provide a step down transformer of 120 volts in the control panel at each of the leachate riser locations.

3.3 Leachate Pump House

A. Contractor shall provide a minimum 10' x 20' leachate pump house at the top of the Leachate Side Slope Risers to each cell.
B. This pump house will provide shelter to workers servicing and monitoring the pumps operation at each cell sump.
C. The pump house shall have temperature controls to maintain temperatures above 50-degrees Fahrenheit and below 90-degrees Fahrenheit year-round.
D. Methane detectors with alarms shall be located in the building.
E. An overhead door will be provided to heavy equipment (e.g., heavy-duty pickup truck, D-3 bulldozer, etc.) can drive into the pump house to support pump serving and removal, as well as leachate line cleanout efforts, as needed.

3.4 Leachate Storage Tanks

A. A system control panel shall be provided at leachate load-out pad that has the following general components:
   1. Time and Date display;
   2. Liquid level in each leachate storage tank and the sump tank;
   3. Flow meter that displays current and totalized leachate flow (pumped out);
   4. Manual cell leachate sump pump on/off control switches; and,
   5. Red alarm light display.

3.5 Leachate Storage Facility Control Building

A. Contractor shall provide a minimum 30'x20' prefabricated building with concrete slab at each Leachate Storage Facility, to contain the main leachate control panel. This building shall be appropriately heated, cooled, ventilated, and secured. The leachate control building shall have a master control panel that allows for full and complete control of the leachate pumping and storage system, associated with that leachate storage facility.
B. The master control panel shall have the following components:
   1. Time and Date display;
   2. Liquid level in each leachate storage tank and the sump tank;
   3. Flow meters that display current and totalized leachate flows into and out of leachate tanks;
   4. Manual cell pump on/off control switches; and,
   5. Red alarm light display.

3.5 System Operation

A. Leachate Sump Pumps

1. The leachate pumps shall be equipped with transducers to measure the depth of leachate build-up in the cell sump.
2. When the depth measured in the cell sump reaches a depth of 2.5 feet, the leachate pump shall automatically be turned on.
3. If the depth measured in the cell sump reaches a depth of 3.0 feet, a high-level alarm will be triggered and the autodailer will contact the landfill manager.
4. When the leachate level in the sump reaches a depth of 9 inches, the leachate pumps shall be automatically turned off.
5. If automatic pump on and off events fail, the red alarm light shall turn on, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager or cell phone.

B. *Leachate Tanks*

1. The leachate tanks shall be equipped with a float system to monitor the liquid level in each tank.
2. When the level in either tank reaches a depth of 33 feet, the red alarm light shall light, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager. This is the High Level Alarm.
3. When the level in either tank reaches a depth of 37 feet, the red alarm light shall light, the leachate pumps shall automatically be turned off, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager. This is the High-High Level Alarm.
4. When the level in either tank reaches a depth of 40 feet, the red alarm light shall light, the leachate pumps shall automatically be turned off, and the system shall activate an auto-dialer to alert a landfill on-call employee by pager. This is the Overflow Level Alarm.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. This specification is provided to the CONTRACTOR to define the sequence of operation and controls interconnection between the leachate cell pump and leachate storage tanks.

1.2 Related Sections

A. Section 02220 - Excavation
B. Section 13214 - Leachate Pumping and Storage Control System

PART 2 PRODUCTS

Not Used.

PART 3 INSTALLATION METHODS

3.1 Description

Each cell in the Rubble Landfill shall have one sump, each with one (1) primary leachate pump. Contractor shall provide a second leachate pump for each cell at the time of construction, to be stored in the pumphouse for ready installation when the primary pump is swapped out for service or repair. Each pump shall have three (3) modes of operation.

1. Empty cell - (semi-automatic)
2. Working or full cell (automatic)
3. Off - the pump may be "off" for servicing or operational problems

Semi-Automatic
The purpose of the semi-automatic mode is to allow rainwater to be pumped from an inactive cell approximately twice per week. This mode of operations shall be controlled by a seven-day time clock. An inactive cell's pump mode switches are to be left in the semi-automatic mode.

Automatic
When a new cell is opened, its pump mode switches are set to automatic. This mode automatically starts each pump to run until “dry” (i.e., liquids level are at the pump intake level). This allows the leachate accumulated in the cell to be pumped out until pumpable leachate is removed. In automatic mode, each pump is also regularly restarted with the pump controller's capability of providing an adjustable preset time period from six (6) minutes to four (4) hours. Adjustment will be required to initially set

the preset time and to change this time period based on cell's production of pumpable leachate.

General Information
All leachate pumps are disabled if a high-high level condition in the associated leachate storage tanks occurs, and are enabled for semi-automatic or automatic operation with no alarms are at the tanks. Alarm indicators for the cell pumps are reported on the system duplicate control panel at the Leachate Storage Facility Control Building.

3.2 Leachate Storage Tanks

A. During normal leachate pumping operation to the leachate storage tanks, one of the two inlet valves (Valves V-104 or V-204) is open and the other is closed.
B. When high level, high-high, or overflow level alarm is reached, an alarm signals the auto dialer to dial the pre-programmed series of telephone numbers using a pre-programmed message that an alarm has been triggered.
C. If a high-level alarm occurs in either holding tank, the auto dialer is activated and the appropriate inlet valve closes (V-104 or V-204) and the appropriate inlet valve opens to direct flow to the second holding tank.
D. Cell pumps are automatically shut-off if any of the following conditions occurs:
    1. A high-high level condition in either of the leachate storage tank occurs;
    2. A high level alarm occurs in both leachate storage tanks; or,
    3. Overflow into secondary containment occurs.
E. Both outlet valves (Valves V-105 and V-205) remain closed under normal operations. The outlet valves are only opened upon command of the loadout truck operator.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Scope of Work

A. The CONTRACTOR shall furnish and install Pump Houses located on the landfill perimeter berm top width, perpendicular to each cell sump, as shown on Permit Drawing. Each Pump House shall have appurtenances consisting of, but not limited to, the following:

1. Two (2) electric submersible pumps, complete with flexible hoses, disconnects, and stainless steel pulling cables.
2. Lower level (with leachate leak detection device) and force main connection.
3. Pump control panel.
4. Stainless steel pipe and fittings, including, bends, tees, check valves, shut-off ball valves, and supports for pipes and fitting, as required.
5. All related electrical work and accessories, including junction boxes.

B. The Pump Manufacturer shall furnish a Pump Control Panel, with equipment specified under Specifications Section 02652.

1.2 Submittals

A. *Shop Drawings*

Submit the following Shop Drawing information to the QAC for approval, prior to fabrication.

1. Cell Leachate Pump House
   a. The CONTRACTOR shall submit detailed drawings showing Pump House layout. Detailed layout shall include all items required to construct the Pump House, including the locations of pump, carrier pipes, pipes, pipe connections, doors, and other required appurtenances.
   b. Submit Pump Manufacturer's Literature for all pumps and required equipment, including, but not limited to the following.
      1) Pump and motor performance curves, including NPSH, efficiency, horsepower, impeller size, and pump materials of construction for all fluid contact parts, mechanical seals, packings, and shafts.
      2) Pump outline drawing.
      3) Detailed electrical drawing.
      4) Typical installation guides.
      5) Technical manuals.
      6) Parts list.
      7) Printed warranty.
      8) Manufacturer's equipment storage recommendations.

9) Manufacturer's standard recommended start-up report form.

2. Pump Control Panel
   a. The CONTRACTOR shall submit a detailed panel layout and electrical diagrams showing the panel enclosure, panel face and wiring diagrams to the QAC for approval prior to fabrication. Detailed wiring diagrams shall show point-to-point wiring information, including wire and terminal numbering system. Field connections shall be clearly denoted. Submit detailed layout of panel face and internals. Detailed layout shall indicate the location of each control and electrical component, including relays, transformers, panel displays, controllers, breakers, and other required items.
   b. Submit supplier's product data for all controls and electrical components including:
      1) Panel displays.
      2) Relays.
      3) Power conditioners.
      4) Control power transformers.
      5) Panel heaters.
      6) Circuit breakers.
      7) Switches, push buttons, lights, etc.
      8) Panel Enclosures
      9) Other electrical components as specified in Section 16050.
3. Piping and valves.
   Submit supplier's product data including:
   a. Ball valves, check valves, electric actuators.
   b. Piping, tees, all fittings.
4. Level Sensor and level display.
   Submit Pump Manufacturer's product data including:
   a. Equipment supplier cut sheets.
   b. Mounting requirements.
   c. Instrument manufacturer's specifications.
   d. Wiring and power requirements.

B. *Manufacturer's Pump Operation and Maintenance Manual*
1. Include record copies of the Shop Drawing information to be provided in accordance with Part 1.2A of this Section.
2. Submit Pump Operation and Maintenance Manual, containing the following minimum information:
   a. Installation guide.
   b. Technical manuals.
   c. Parts list.
   d. Printed warranty.
   e. Manufacturer's equipment storage recommendations.
   f. Manufacturer's standard recommended start-up report form.

3. Pump Manufacturer's Sample O&M Manual is provided in Section 10.0, Appendix A.

C. *Submit in accordance with Section 01300.*

1.3 Quality Assurance

A. The Leachate Pump House and Pump Control Panel shall be designed to meet all applicable Codes, Laws, and Regulations.

B. All electrical materials and equipment shall bear the label of Underwriter's Laboratories, unless material and equipment is of type for which Underwriter's Laboratories do not list or provide label.

C. Start-Up Service
The CONTRACTOR shall provide Pump Manufacturer's representative services at the Site to inspect the installation and instruct the OWNER's personnel on the operation and maintenance of the pumps and appurtenances.

D. During the initial inspection, the Pump Manufacturer's service representative shall review recommended operation and maintenance procedures with the OWNER's personnel.

PART 2 PRODUCTS

2.1 Leachate Pump Houses

Leachate Pump Houses shall be constructed to meet dimensional and material requirement specified on Drawing 26. Shop drawings (per Part 1.2A of this Section) shall be signed and sealed by a Professional Engineer, registered in Maryland.

2.2 Submersible Pumps

A. *Manufacturer* – All submersible pumps shall be manufactured by EPG Companies. Pump sizes were determined per description in Specifications Section 02652. Pump(s) to be installed in each landfill cell are shown on Contract Drawings.

B. *Requirements* – Furnish and install pump(s) in each cell sump per Specification Section 02652. Pumps shall be provided with equipment specified in Specification Section 13215.

2.3 Pump Control Panel

A. Pump Control Panel, in accordance with Pump Manufacturer's Literature, shall be mounted inside the associated Cell Leachate Pump House.

B. The controls and electrical equipment shall be housed in a NEMA 4X enclosure.

PART 3 EXECUTION

A. All installation procedures for Leachate Pump House, pumps, couplings, valves, controls, pipes, and electrical equipment shall be per Pump Manufacturers' recommendations.

B. All wire and cable for pumps and floats shall be arranged in an organized manner, and hung from a coated rack. Locations of rack, floats, and level transmitter shall be accessible without confined space entry.

C. Install pipe, fittings, and all appurtenances in accordance with recognized industry practices achieving permanently leak-proof piping systems, capable of performing each indicated service without piping failure. All joints shall be installed in accordance with the following:
   1. Welds shall be sound and free from embedded scale of slag, have tensile strength across weld not less than that of thinner of connected sections, and be watertight.
   2. Use butt-welds for welded joints in the pipe assemblies and fabrication of bends and other specials.
   3. Use filled welds for flange attachment, in accordance with AWWA C207.
   4. Conform field welding of joints and preparation of pipe ends to AWWA C206 and ASTM A139.

D. The CONTRACTOR shall make all electrical power and control wiring connections between all new and existing electrical distribution equipment, control panels, and equipment. All work shall be performed in accordance with all applicable Codes and Regulations. The CONTRACTOR shall schedule all required inspections, and obtain all required permits.

E. All piping shall be pressure tested in accordance with Section 02650.

F. Upon completion of the installation, all circuits, control systems and devices, including pumps, sensors, and all alarm condition signals, shall be tested in the presence of the QAC by the CONTRACTOR. All apparatus shall be cleaned, adjusted, and made ready for operation after testing. The CONTRACTOR shall make such changes in wiring or connections and such adjustments, repairs or replacements as are necessary to make the circuits, device or control system to function as specified and otherwise comply with the specifications or data on Permit Drawings. The CONTRACTOR shall supply all necessary material, labor, and equipment for these tests.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description

A. CONTRACTOR shall furnish and install work specified in this Section, including:
   1. Thermal insulation for piping and storage tank.
   2. Electrical heat tracing temperature controllers to the extent indicated in the Contract Documents and this Section.

1.2 References

A. National Fire Protection Agency (NFPA) Standards
   1. NFPA 255 Method of Test of Surface Burning Characteristics of Building Materials

B. National Electric Code (NEC)
C. American Society of Testing and Materials (ASTM)

1.3 Quality Assurance

A. Insulation products shall be NFPA rated materials having a Flame Spread Rating not exceeding 25 and Smoke Developed Rating not exceeding 50.
B. Installation shall be performed by workers skilled in the fitting and installation of heat tracing and insulation products.

1.4 Submittals

A. *Shop Drawings*:
   1. Submit manufacturer's installation instructions, catalog cuts, performance data, and all other information required to demonstrate compliance with the Contract Documents. Provide product data for all components including insulation, heat tracing, temperature controllers, support pins, and bands. Provide the following information:
      a) Materials of construction.
      b) Thicknesses.
      c) Thermal conductivity and water permeability.
      d) Power requirements and ratings.
      e) Temperature ratings.
      f) Certification of hazardous classification ratings.

B. *Samples*
   1. Not Required

C. *O&M Manual*
   1. Include record copies of the Shop Drawing information to be provided in accordance with Part 1.4A of this Section.

D. Submit above in accordance with Section 01300.

PART 2 PRODUCTS

2.1 Pipe Insulation

A. *Materials*

1. Premolded fiber glass thermal insulation in accordance with ASTM Standards, fabricated for standard pipe sizes, fittings and valves. Fiberglass insulation shall be rigid one-piece construction with jacket constructed of high density, white kraft bonded to aluminum foil, reinforced with fiberglass yarn.
2. Maximum thermal conductivity of 0.28 BTU.in/h.ft 2.F at 75 degrees F in accordance with ASTM C335.
3. Maximum water vapor permeability of 0.02 perm-in when tested in accordance with ASTM E96.
4. Meet NFPA fire safety requirements.
5. Utilize installation adhesives and joint sealants as recommended by the insulation manufacturer.
6. For all piping, install minimum of 24 gauge stainless steel jacketing over insulation. Retain jacketing by stainless steel bands.
7. Insulation products shall be Schuller, CertainTeed, Knauf, Owens-Corning, or equal, as approved by the DESIGNER.

B. *Description*

1. Insulate and heat trace all outside aboveground piping, valves and fittings and all piping less than 4 feet below grade.
2. Piping insulation thickness shall be minimum of 1-1/2-inches.

2.2 Electric Heat Tracing

A. *Self-Regulating Heat Tracing*

1. 16 AWG copper bus wire with self-regulating, semi-conductive core
2. Stainless steel overbraid over bus wire and core
3. Thermoplastic jacket over shield
4. Nominal wattage of 5 watts/foot at 50 degrees F. Maximum temperature shall not exceed recommended operating temperature of pipe.
5. Nominal service voltage is 120 volts AC unless noted otherwise
6. Coordinate circuit sizing with available electrical circuits shown on the Contract Drawings
7. Provide power connection kits, splice kits, end seals and other accessories required for a complete operating system. Electrical accessories shall meet requirements for Division I, Class II, Groups C and D hazardous locations.

8. Provide aluminum tape under and overheat tracing to be installed on pipes.
9. System shall be designed, and installed for Division I, Class II, Groups C and D hazardous locations.
10. Heat trace system shall be suitable for FRP piping systems.
11. Heat trace all outside above ground condensate piping, valves, fittings.
12. Heat trace system shall be BriskHeat, Raychem, Thermon, or equal.

B. *Temperature Controllers*

1. Nominal service voltage is 120 volts AC unless noted otherwise
2. Temperature controller shall be epoxy-sealed and installed for Division I, Class II, Groups C and D hazardous locations.
3. Setpoint shall be preset and have an operating range of 45 F to 55 F.
4. Temperature controller shall have a power rating of up to 120/240Volts AC at 25 amps.
5. Provide temperature controllers in accordance with the following schedule:

Controller	Equipment
One	Aboveground leachate piping outside Leachate Pre-Treatment Building
Two	Aboveground leachate piping at Leachate Storage Tank

6. Temperature controllers shall be BriskHeat, Raychem, Thermon, or equal.

PART 3 EXECUTION

3.1 Pipe Insulation

A. Install on all above-grade piping.
B. Insulation shall be installed in accordance with manufacturer's recommendations.
C. Seal edges of pipe insulation with approved plastic and/or sealant to create water-proof and vapor-proof seals.
D. Insulation bonding must be by glue, self-adhesive lap or tape. Staples are not permitted. Seal all vapor barrier punctures.
E. Surface to be insulated shall be clean and dry during installation.

3.2 Electric Heat Tracing

A. Install heat tracing in strict accordance with the heat trace manufacturer's and pipe manufacturer's instructions prior to insulation.
B. Spiral heat tracing around pipe to equalize distribution of heat. Provide additional heat trace around valves and fittings as required to attain wattage densities noted.

C. Provide additional wattage for valves and fittings in accordance with the manufacturer's instructions.
D. Secure heat trace cable to piping and components.
E. Coordinate heat trace installation with the electrical work.
F. Provide aluminum tape under and over heat trace.
G. Provide markers cautioning "DO NOT CUT INSULATION - ELECTRIC HEAT TRACING - SHOCK HAZARD". Apply markers per manufacturer's installation instructions.

3.3 Temperature Controllers

A. Install heat tracing in strict accordance with the manufacturer's instructions prior to insulation.
B. Secure temperature controllers to equipment.
C. Provide separate circuit breaker for each temperature controller. Coordinate with electrical work.

***** END OF SECTION *****

PART 1 GENERAL

1.1 Description of Work

A. The CONTRACTOR shall furnish all labor, material, equipment, tools, and appurtenances required to setup and install all electrical components presented on the Permit Drawings, mentioned herein, or both. The CONTRACTOR shall provide a "Competent Person" to implement, supervise, and inspect all Work.

B. The CONTRACTOR shall comply with all applicable codes, ordinances, rules, regulations and laws of local, municipal, State or Federal authorities having jurisdiction. The CONTRACTOR shall also comply with all applicable health and safety regulations as required by OSHA and in accordance with the CONTRACTOR's Health and Safety Plan and basic electrical requirements specifically applicable to Division 16 – Electrical, in addition to Division 1 - General Requirements.

1.2 Submittals

Submit under provision of Section 01300 of these specifications.

1.3 Regulatory Requirements

A. Conform to applicable Federal, State, and local Building Codes.
B. Electrical: Conform to NFPA 70.
C. Obtain permit, and request inspections for authority having jurisdiction.

1.4 Project/State Conditions

Install Work in locations shown on the Permit Drawings, unless prevented by project conditions.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used

***** END OF SECTION *****

SECTION 15

CLOSURE AND POST-CLOSURE PLAN

CLOSURE AND POST-CLOSURE PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND



PREPARED FOR:

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PROJECT NO. 2018-3854

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15.0 CLOSURE AND POST-CLOSURE PLAN

15.1 Closure

15.1.1 General

This Closure and Post-Closure Plan for the Chesapeake Terrace Rubble Landfill has been prepared in accordance with the requirements of COMAR 26.04.07.21-22 Regulations closure of sanitary landfills.

This Closure and Post-Closure Plan describes the closure sequencing, Final Cover, Closure Cap, erosion and sedimentation control, and maintenance of the completed Closure Cap system for the Chesapeake Terrace Rubble Landfill. The closure has been designed to minimize long-term maintenance and minimize infiltration of precipitation into the rubble landfill and other adverse environmental impacts.

The Construction Quality Assurance (CQA) Plan and the Technical Specifications for the materials to be used in the closure construction are provided in Sections 13 and 14, respectively, in the Phase III Application.

A deed notification shall be placed on the property at the time of permitting indicating that the land has been used as a solid waste disposal site. Any future use of the land is restricted, and requires MDE pre-approval.

15.1.2 Closure Activities

15.1.2.1 Closure Plan Time Frame

The landfill, Cells 1-16 will be closed as each cell, or group of cells, reaches its top of waste elevations as shown on Drawings 30 and 31. The Final Cover and Closure Cap system details are provided on Drawings 34 and 35. The size of the individual cells was selected to optimize the floor grading and the disposal volume. The cells designated as Cells 5A through 5F are considered and will function as individual cells, each with their own sump. Cells 1, 7 and 10 are larger and the owner/operator may choose based on waste filling rates to divide these cells into subcells at a later date for operational considerations, but will only do so with prior approval from MDE.

The 24-inch (min.) thick Final Cover shall be placed within 30 days of waste levels reaching the Top of Waste grades presented on Drawings 30 and 31. Installation of the Closure Cap shall begin no later than six (6) months after reaching the Top of Waste grades and shall be completed no later than thirty-six (36) months from the date of completion of the final lift. The area shall be permanently vegetated within 30 days after the final earthen cover is placed. Temporary seeding or stabilization to meet the requirements of the AASCD (see Drawing 62). The designated life span for filling of the landfill is 12 years. Closure of the each landfill cell can begin when the cell reaches its top of waste elevations as presented on Drawing 30 and 31. The current vision of the sequencing is as follows:

- Beginning in the East Section, Cells 11, 16, 12, 13, 14, and 15.

- In the West Section, Cells 2, 3, and 4; Cells 1, 5E and 5F; Cells 10 and 5D; Cells9 and 5C; Cells 8, 5A and 5B; Cell 6 and 7.

More details of the envisioned sequencing are discussed in Section 7.0 of the Phase III Application and Drawings 64 through 81.

Though this permit is for the operation and closure of the entire Chesapeake Terrace Rubble Landfill (East Section and West Section), the East Section may complete final closure and enter into its post-closure period independent of the West Section.

15.1.2.2 Closure Performance

The landfill closure design system isolates the rubble waste from the surrounding environment to minimize infiltration of surface water into the landfill and erosion/sedimentation of the closure area. The erosion and sedimentation controls, such as the erosion control benches, sedimentation ponds, seeding, and downchutes, will be constructed as the completed Closure Cap advances.

15.1.2.3 Inventory Removal and Disposal

The rubble waste landfill equipment should not require decontamination and all routine equipment maintenance would be performed in a manner so as not to result in adding waste to the rubble landfill. All lubricants, fuel, waste oil, and other residues will be properly managed and disposed at an approved off-site facility. All landfill equipment and temporary structures used during normal operations will be removed after their usefulness ends.

15.1.2.4 Closure of Surface Impoundments

The sediment and stormwater management basins constructed as part of the rubble landfill construction will remain after closure. During landfill operations and through Closure Cap construction, the basins will serve in a sediment control capacity. After completion of the Closure Cap construction, the basins will remain to serve as supplemental stormwater management basins to mitigate peak stormwater runoff from the landfill.

15.1.2.5 Closure Cap Design

The closure operation will be performed progressively as each landfill construction phase is completed to fulfill the design requirements depicted in the project design plans and the description below:

- The top of waste elevations are designed to ensure that storm water runoff occurring after addition of the 24-inch (min.) thick Final Cover and 24-inch (min.) thick Closue Cap will be directed to sediment and stormwater basins around the north and east side of the landfill. The drainage areas have been designed to minimize erosion of the landfill following closure. The maximum closure side slopes have been designed not to exceed 4H:1V (Horizontal:Vertical);
- As the rubble material reaches the top of waste grades shown on Drawings 30 and 31, the rubble will be covered with (from top to bottom):

  - 6-inch thick layer of vegetative support layer (topsoil or other material capable of supporting vegetation);
  - 18-inches of protective cover soils, with a permeability not exceeding $1x10^{-5}$ cm/sec;
  - A geocomposite drainage layer, with a triplanar drainage net and 8 oz./s.y. nonwoven geotextile heat-bonded to both sides; and,
  - 40-mil textured on both sides, linear low density polyethylene (LLDPE) geomembrane with a permeability less than or equal to 1×10^{-10} cm/sec.
  - 24-inch layer of intermediate cover.
- Erosion control terraces have been designed into the final cover every 30 (max) vertical feet (120-feet of slope). Downchutes direct the surface water runoff from the erosion control terraces to one of the sediment and stormwater management basins surrounding the landfill.

Construction quality assurance and quality control (QA/QC) procedures for the geosynthetic and soil components of the closure cap system are presented in the Construction Quality Assurance (CQA) Plan (See Section 13 of the Phase III Application). Closure material descriptions and construction methods are included in the project Technical Specifications (see Section 14 of the Phase III Application).

15.1.2.5.1 Erosion and Sedimentation Control Plan

An Erosion and Sedimentation Control Plan, prepared by Century Engineers, was approved by the Anne Arundel Soil Conservation District (AASCD) on April 26, 2010. A revised version of the Erosion and Sedimentation Control Plan is being finalized and submitted to the AASCD concurrently with this revised Phase III Permit Application. Proof of AASCD approval of the revised Erosion and Sedimentation Control Plan will be forwarded to MDE as soon as it is received.

The revised Erosion and Sedimentation Control Plan is prepared to manage surface water, minimize soil erosion, and control sedimentation during construction, operation, and closure. The Erosion and Sedimentation Control Plan was developed following the requirements of the COMAR Regulations for Rubble Landfills and the 2011 Maryland Specifications for Soil Erosion and Sediment Control.

The revised Erosion and Sedimentation Control Plan includes the following:

- The landfill final closure design grades, developed to minimize erosion and subsequent soil loss;
- Erosion control terraces, designed into the final cover every 30 vertical feet (120-feet of slope).
- Downchutes to direct the erosion control bench terrace water flow off of the final cover to one of the sedimentation basins surrounding the landfill;(details shown on Drawings 41 and 42);
- A total of 24-inches of Closure Cap soils (combined thickness of protective cover soil and vegetative support layer) to be placed and seeded for stabilization;
- Runoff concentration areas, such as downchutes have been designed

with energy dissipaters and erosion control structures as shown in plan on Drawings 38 and 39 with details shown on Drawings 41 through 43;

- Temporary and permanent drainage channels, designed to route surface water runoff from disturbed and closed areas and run-on from upgradient areas;
- Culverts, designed to pass drainage under access roads (Drawing 44); and,
- Sedimentation basins, designed to collect surface water runoff, control sediment, and discharge to natural watercourses.

The erosion and sedimentation controls will be constructed in phases as landfill construction and closure progresses. Calculations for the erosion and sedimentation control diversion and collection systems are included in the Design Report.

Erosion and sedimentation control details and notes, updated to meet the requirements of the 2011 Maryland Specifications for Soil Erosion and Sediment Control, are included in the Soil Erosion and Sediment Control Drawings (Drawings 60 and 61).

15.1.2.5.2 Settlement Subsidence and Displacement

The base grade settlement analyses indicate a potential differential settlement of <18 inches beneath the point of maximum refuse height and the perimeter of the landfill. This differential settlement of the base grade should not cause any adverse impacts of the integrity of the geosynthetic liner. The minimum design base grade slope is sufficient to maintain a two percent (2%) slope after settlement occurs. Specifically, the minimum grade at the time of construction is three percent (3%).

The Final Cover and Closure Cap system will experience some settlement relative to the base grade settlement due to waste consolidation. In the event that non-uniform settlement occurs, minor regrading and repair of the soil component above the closure geosynthetics may be required. However, the effectiveness of the closure geomembrane and drainage geocomposite should not be reduced since the synthetic components are flexible. They will retain their integrity under minor differential settlement, which further supports their selection for the barrier layer of the closure cap system.

Landfill slope stability analyses have demonstrated that the landfill slopes and perimeter berms are stable for both static and pseudo-static (i.e., seismic) conditions. The detailed calculations are provided in Section 9.0, Attachment 9J of the Phase III Permit Application.

15.1.2.5.3 Freeze - Thaw

The regional depth of frost penetration is 10 inches per the publication, “Evaluating Cover Systems for Solid and Hazardous Waste” (USEPA September 1982). The extreme depth of frost penetration in the Anne Arundel County, Maryland area is approximately 20 inches for the 5 year return period and 25 inches for the 10 year return period per the “Atlas of Soil Freezing Depth Extremes for the Northeastern United States (the Northeast Regional Climate Center, March 1996). The cover soil depth over the geosynthetic components of the Closure Cap is 24 inch thickness, which includes a minimum six inches of topsoil.

Since the extreme depth of frost is less than the cover soil thickness, the integrity of the composite closure cover will not be damaged by frost action.

15.1.3 Groundwater Monitoring System

The permanent groundwater monitoring system consists of six (6) upgradient and twenty-six (26) downgradient wells in the Unconfined WBZ. Sampling of the groundwater monitoring wells will continue throughout the closure period. Annual and semi-annual groundwater monitoring reports will be submitted to the MDE. Specific details of the groundwater monitoring system and methods are presented in the Groundwater Monitoring Plan, included in Section 16 of the Phase III Permit Application.

15.1.4 Leachate Collection System

The leachate collection system within the landfill area consists of a high permeability, high flow geocomposite drainage layer overlain by 24-inch thickness of sandy soils. The leachate will be collected into the leachate collection sumps and pumped to the on-site leachate storage tanks and subsequently transported by tanker truck to a water treatment facility. The off-site treatment/disposal facility will be Environmental Recovery Corporation (ERC) located in Baltimore. NWM may elect to utilize alternate treatment/disposal facilities, but will notify MDE in advance when or if such a change is made. Depending on the volume and characteristics of leachate being generated, NWM may pursue an on-site treatment alternative. If such an alternative is chosen, NWM recognizes that it will be subject to MDE permitting and approval processes including industrial NPDES permitting and modification of the landfill permit.

The flow of leachate through the closed landfill was modeled with the “Hydraulic Evaluation of Landfill Performance” (HELP) computer simulation developed by the US Army Engineer Waterways Experiment Station. Design details of the leachate collection system are shown on Drawings 17 through 21.

15.1.5 Gas Collection System

Some of the rubble waste is organic and degrades to produce landfill gas. The management of the landfill gas is described in the Chesapeake Terrace Landfill Gas Management Plan (LFGMP) (Section 11 of the Phase III Permit Application). The LFGMP has been prepared assuming that sufficient degradable organic waste is disposed in the landfill and warrants the use of an active landfill gas collection system configuration. Vertical wells will be constructed as shown on Detail 2 of Drawing 88. The landfill gas wells will be situated as shown on Drawings 86 and 87. The headers and laterals required for operation of an active gas recovery system are situated below the Closure Cap geomembrane, therefore; they will be installed prior to capping. The header pipe will include condensate drains tied into sumps set into the waste at locations that coincide with low points in the header pipes (See Detail 4 on Drawing 88). The LFGMP also requires gas monitoring probes located around the perimeter of the waste disposal areas. Gas monitoring probes will be installed in accordance with Detail 3 on Drawing 88.

These probes will be routinely monitored and the results will be reported to the MDE. If actual landfill gas monitoring determines that explosive gases generated by the facility do

not exceed 25 percent of the lower explosive limits for the gases in facility structures, and the lower explosive limit for the gases at the property boundary, then the facility may request MDE approval to operate the landfill gas system as a passive system instead of an active system (See Section 11 for additional details).

15.1.6 Schedule for Closure

The rubble waste cells will be developed in a staged manner and closure construction will be conducted as part of normal operating procedures. Final closure will begin after the rubble in each cell is brought to final grade.

Beneficial use of the rubble waste may extend the life of the rubble landfill. Sedimentation and stormwater management basins, intermediate terraces, downchutes, and permanent perimeter channels will remain following landfill closure. The groundwater monitoring system will remain in-place during the closure and post-closure periods.

15.1.7 Posting

One sign will be posted at the site entrance to the rubble landfill notifying all persons of the final closure of the landfill, and prohibition against further receipt of rubble. Unauthorized access to the site will be controlled by a fence and gate. A locked gate at the landfill entrance will prohibit entry to the site after closure. Other signs shall be posted on the perimeter fence at intervals and with information required by other sections of the Phase III Report.

15.1.8 Notification

The facility will be used primarily for the disposal of rubble waste from the State of Maryland. The operation of the landfill is established as 12 years. The closure operations will proceed as an ongoing operation of landfill operation. The landfill filling sequence described on Drawing 63 and the construction/filling stages are depicted in Section 7 of the Phase III Report. Permit Drawings 36 and 37 depict the Top of Final Cover grades for the west and east sections, respectively.

As described in COMAR 26.04.07.21 the construction of the Closure Cap will begin no later than 24 months from the date of completion of the final lift of the landfill and will be completed no later than 36 months from the date of completion of the final lift of the landfill. The 24-inch (min.) Thick Final Cover Layer must be placed within 90 days after placement of the final waste lift. An updated Closure and Post-Closure Plan will be provided to the MDE at least 180 days prior to the cessation of the waste disposal and the landfill will be closed in accordance with the approved closure plan. MDE will inspect the closed facility prior to entering into post-closure.

The Construction Quality Assurance (CQA) Plan and the Technical Specifications for the materials to be used in the closure construction are provided in Sections 13 and 14, respectively, in the Phase III Permit Application.

Within 90 after completion of the cap NWM will submit a final report, including certified as-built plans, to MDE for approval. This report will certify that the closure of the landfill or cell

was completed in accordance with the closure plan, the construction quality assurance plan, construction specifications, and Permit Drawing Sheets. The final report will be certified by a construction Quality Assurance Consultant's professional engineer, registered in Maryland, that the closure construction and the final report meet the requirements of the solid waste permit and regulations.

15.2 Post Closure

15.2.1 Post-closure Contact

The post-closure contact for the rubble waste landfill will be as follows:

Emergency Coordinator
Stephen N. Fleischman, Vice President
National Waste Managers
c/o The Halle Companies
2900 Linden Lane, Suite 300
Silver Spring, MD 20910
(301) 495-1520
(301) 495-9452 Fax
(301) 370-6301 Cell
sfleischman@hallecompanies.com

MDE will be notified if the above information changes.

15.2.2 Security

The landfill entrance/exit gate will be locked when the landfill is closed. No waste will remain exposed after completion of the landfill closure. Although the site will be closed to the public and has no planned alternate end use, the closed landfill will not pose a health hazard in the event that the public or domestic livestock accidentally wander onto the landfill property.

15.2.3 Post-Closure Maintenance Plan

Inspection of the closed landfill facility will be conducted by NWM personnel or their designee(s) to detect deterioration of the facilities. Any damage to facilities will be repaired to maintain the erosion control facilities and prevent a breach of the containment structures. Table 1 includes a schedule for inspection and maintenance and Table 2 includes an inspection checklist.

15.2.3.1 Leachate Collection System

The leachate collection system will require little maintenance during the post-closure period as it will be completely buried by the waste. The sump pumps within the cells will require monitoring and regularly scheduled maintenance. The automatic controls tied to the leachate sump pumps should alert the post-closure maintenance contractor if the system is not performing as it should, through its auto-dialer mechanism. Service to the auto-dialer may be provided through traditional landlines or internet-based service, if

available. The leachate collection system will be maintained in an operational state throughout the post-closure period.

15.2.3.2 Leachate Storage System

Initially, during the post-closure period, the leachate storage tanks will be inspected weekly to review the following conditions:

- Determine the liquid levels in the tanks;
- Inspect for possible leaks from the tanks, or corrosion that could jeopardize tank integrity;
- Check for accumulated water in the secondary containment walls; and,
- Assess the performance of the automated controls tied to the sump pumps still in operation in the cells.

The automatic controls tied to the leachate storage system should alert the post-closure maintenance contractor if the system is not performing as it should, through its auto-dialer mechanism.

The frequency of inspections may be reduced with MDE approval over the post-closure period as the generation of leachate dwindles in the last operated cells.

15.2.3.3 Security Devices

Security controls such as locks, gates, and fencing will be inspected on a monthly basis. Security locks will be replaced immediately if damaged. Perimeter fencing will be repaired by a contractor or site personnel after a need has been identified.

15.2.3.4 Erosion Damage

Erosion damage to the vegetative support layer on the final cover system will be repaired when the gullies are greater than six inches deep. The eroded areas will be filled with soil capable of sustaining vegetative growth. The soil surface will then be seeded, fertilized, and mulched to reestablish vegetation. Topsoil used to make erosion repairs will be stockpiled on-site. Straw mulch or other suitable material will also be stored on-site or brought in as required.

The cause of the erosion will be evaluated and a permanent remedy implemented. Possible causes of erosion include:

- Settlement of stormwater channels, allowing overtopping or flow outside of the channel
- Differential settlement of the cover, depressions.

15.2.3.5 Settlement, Subsidence, and Displacement

In areas where settlement, subsidence, or displacement has occurred, the area will be filled with soil and regraded to re-establish the design grades in the surrounding area or re-establishing positive drainage of the area. A stockpile of soil will be maintained on-site

during post-closure for repairs. The soil surface will then be seeded, fertilized, and mulched to reestablish vegetation.

15.2.3.6 Run-on and Run-off Control Structures

Routine maintenance of run-on and run-off control structures include cleaning sediment from structures such as ditches, culverts, sedimentation ponds, down-chutes, and, pond outlets. Repair of these structures will typically be performed by outside contractors who will bring in heavy equipment such as backhoes, dump trucks, dozers, and scrapers. Materials such as silt fence, straw bales, and soil will be kept on-site to implement short-term repairs while waiting for permanent repairs.

15.2.3.7 Groundwater Monitoring Wells

Routine maintenance of groundwater monitoring wells such as replacing locks and regrading of soil areas around the wells will be performed by NWM personnel or their designee(s). Other maintenance work such as protective casing repair, well replacement, and repair of sampling pumps will be performed by specialty contractors.

15.2.4 Inspection Plan

Inspection of the closure cap system, drainage system, and monitoring well system will be performed semi-annually and after major storm events for at least five years. Inspection reports will be submitted to MDE within 60 days of the inspection. Inspection of the closed landfill facility will be conducted by NWM personnel or their designee(s) to detect any deterioration of the facilities. Any damage to facilities will be repaired to maintain the erosion control facilities and prevent a breach of the containment structures. Table 15-1 is a Post-Closure Inspection Schedule.

15.2.5 Post-Closure Monitoring Plan

15.2.5.1 Water Quality Monitoring

Water quality monitoring will occur throughout the five year post-closure period and includes groundwater monitoring wells and the stormwater management basins. The groundwater monitoring requirements are included in the Groundwater Monitoring Plan in Section 16 of the Phase III Permit Application. Any requirements for sampling of the surface water sedimentation basins will be a requirement of the Construction NPDES Permit.

15.2.5.2 Gas Control Monitoring

The landfill gas perimeter probes, wells, collection pipes, and flare system will be monitored as described in the in the Landfill Gas Management Plan in Section 11 of the Phase III Permit Application.

15.2.6 Post-Closure Uses

After closure, the landfill will be maintained as grass-covered. Development of the area for uses other than passive recreation will be determined at the time of the closure, and will be subject to MDE approval.

15.2.7 Vegetation Mowing

During the first year of closure, the rubble landfill will not be mowed in order to allow the vegetation to fully establish. After the first year of vegetation growth, the disposal facility will be mowed two times per year.

15.2.8 Training

NWM or their designee(s) will maintain training for the post-closure inspection and maintenance staff. NWM employees or their designee(s) for landfill closure and post-closure operations will receive training to maintain the closed landfill in accordance with the requirements of this Closure and Post-Closure Plan. The training will be performed by the Landfill Supervisor, NWM technical staff, or their designee(s). The subjects to be covered include the following:

- Drainage system inspection and maintenance;
- Groundwater well monitoring and sampling;
- Leachate collection system monitoring, sampling, inspection and maintenance;
- Landfill gas collection system operations and maintenance;
- Operation and maintenance of the closed landfill maintenance equipment; and,
- Site safety and emergency programs.

15.3 Post-Closure Period

The post-closure period shall be for 5 years after the compete installation of the landfill cap, as required by COMAR 26.04.07.22. This period may be extended under limited circumstances, as follows:

- The concentrations of monitored parameters in the groundwater monitoring system have elevated levels above MQDL values that are directly attributable to the landfill; or,
- The leachate collection system continues to collect and convey leachate to the leachate storage tanks.

15.4 Plan Revision

This Closure and Post-Closure Plan will be reviewed annually to verify that it accurately reflects site and permit conditions. Revisions will be provided to MDE.

TABLES

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: _____ **Personnel On-site:** _____

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Landfill Closure Cap Inspection	Disturbance of cover? Poor Vegetation (areas of any size with < 30% vegetation)? Presence of woody vegetation? Erosional Features Cracks (> 1/4 inch in width and 2 inches in depth)? Other Disturbances of the soil cover? Ponding Water?			
Landfill Paved Driveway Inspection	Differential settlement? Ponding of water? Potholes? Splitting or cracking of asphalt?			

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: _____ **Personnel On-site:** _____

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Security Fence	Is security fence maintenance required? Security fence maintenance issues include removal of deadfall, vegetation clearing, outwash of soil at base of fence. If maintenance is required, please specify.			
Stormwater Basins	Visually inspect the basin and outlet structure and channel monthly. Is maintenance required on the basin, outlet, and/or channel? Any evidence of erosion upgradient or downgradient? Any bare spots where vegetation is required? Any debris blocking the outlet?			
Leachate Storage Tanks	Visually inspect these tanks. Is maintenance required on either tank? Is water ponded in the secondary containment area? **Record the levels in the tanks below.**			

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: _____ **Personnel On-site:** _____

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Perimeter Road and Closure Cap Road Maintenance	Does any roadway need maintenance, repair, and/or resurfacing? If yes, which area of roadway needs maintenance and what type of maintenance is required (such as additional stone, grading, drainage, etc..?			
Mowing	The capped area should be mowed at least twice per year. One mowing event should be performed on or around mid-September of each year. Is mowing of the capped area required? Is mowing needed around the security fence and remediation compounds/equipment?			
Signage	Is replacement of "No Trespassing" signs needed? Is maintenance/replacement of site notice (property ownership) sign needed?			
Manholes & Protective Casings	Visually inspect toe drain manhole and gas tuning wells and gas monitoring probes and protective casings. Is maintenance required on any manhole/well, if so specify?			

TABLE 15-2
CLOSURE AND POST-CLOSURE PLAN - INSPECTION CHECKLIST
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Date of Inspection: _____ **Personnel On-site:** _____

On a monthly basis, the following items are to be visually inspected and conditions noted on this form/checklist. If a condition on-site exists that may result in a regulatory non-compliance issue and/or site security issue, contact site Project Manager immediately. To make identification of the site area that needs maintenance, a site plan with grids is attached. In addition to the regularly scheduled inspections, the Landfill Cap Closure Inpsection should be completed as soon as possible after major storm events.

Area of Concern	Action	Yes	No	Grid
Monitoring Wells	Visually inspect the off-site monitoring wells for enclosure conditions: ie. Does the fence need repaired? Does brush need to be cleared? **Specifiy what and where work needs to be performed.**			
Snow Removal	Snow removal is required after each 3-inch snowfall. Has this snow removal been completed? Is snow removal required?			

SECTION 16

GROUNDWATER MONITORING PLAN

GROUNDWATER MONITORING PLAN

FOR
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND



PREPARED FOR:

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16.0 GROUNDWATER MONITORING PLAN

16.1 INTRODUCTION

National Waste Managers, Inc. (NWM) proposes to construct a 114.4 acre Rubble Waste Landfill on a 480-acre parcel located near Odenton, Maryland. Pursuant to the requirements of the Code of Maryland Regulations (COMAR) for Rubble Waste Landfills the proposed facility will be an engineered landfill with composite liner system, leachate collection and removal system, composite cap, storm water management system and groundwater monitoring network.

This Groundwater Monitoring Plan (GWMP) has been prepared by AGC Montrose to present the configuration of the proposed groundwater monitoring network, the procedures for collecting and analyzing samples collected from the groundwater monitoring network, and criteria for data evaluation and reporting. The purpose of the GWMP is to monitor groundwater quality in the vicinity of the landfill before, during and after the operating life of the landfill. If groundwater monitoring identifies negative impacts to groundwater quality then appropriate measures can be taken to identify and mitigate the source of such impacts. This GWMP has been prepared in accordance with the Maryland Department of the Environment (MDE) technical guidance and procedures, and current industry standards.

16.2 SITE BACKGROUND

16.2.1 Site Description

The proposed Chesapeake Terrace Rubble Landfill Site is located in western Anne Arundel County between the Patuxent and Little Patuxent Rivers. The parcel of land which contains the Chesapeake Terrace Rubble Landfill is approximately 480 acres. The parcel is bordered on the northeast by Patuxent Road, on the west by the Amtrak railroad tracks, and on the southwest by Conway Road. The boundary of the proposed rubble fill area within the property is shown on Exhibit 1. The total proposed waste fill area is approximately 114.4 acres. The total operations area (fill area, access roads, stormwater management, etc.) will be approximately 140 acres.

16.2.2 Geology and Hydrogeology

The Site has been the subject of multiple investigations for the purpose of defining the site-specific geologic and hydrogeologic conditions. Those investigations have documented that unconsolidated deposits associated with the cretaceous Potomac Group are the predominant geologic unit beneath the Site. However, quaternary deposits represent a significant portion of the surficial geology in the eastern portions of the Site.

The Site is underlain by two primary water bearing zones. These are referred to in the Phase II Report as the unconfined water bearing zone (Unconfined WBZ), and the confined water bearing zone (Confined WBZ). The Unconfined WBZ is the shallower of the two zones, and represents the remnants of the Upper Patapsco Aquifer (UPA) and saturated quaternary terrace and alluvial deposits (Quaternary Deposits). The Confined WBZ represents the deeper of the two zones and is the Lower Patapsco Aquifer which exhibits a vertically upward hydraulic gradient across the entire Site. A clay unit, referred to as the Middle Confining Unit (MCU) separates the Upper and Lower Patapsco Aquifers (UPA and LPA, respectively).

The Unconfined WBZ exists as a perched zone over the MCU in the western portions of the site where the surface of the MCU is present at or above elevation 70+/- ft amsl. The Unconfined WBZ becomes part of the regional surficial water table when the top of the MCU is below elevation 70 +/- ft amsl. Hard lateral boundaries for the perched portion of the Unconfined WBZ exist at outcrops of the contact between the UPA and MCU along the railroad right-of-way, located along the west boundary of the Site, and at the area of exposed MCU at the ground surface towards the north. To the east, the contact between the bottom of the UPA and the top of the MCU dip below elevation 70 and becomes part of the regional surficial water table found in the quaternary alluvial deposits in the floor of the Little Patuxent River valley.

For the purposes of groundwater monitoring it is beneficial to consider the Site as two separate areas. These areas are designated as Areas A and B. Area A represents those portions of the Site connected to the regional surface water table. Area B represents those portions of the Site where the Unconfined WBZ is perched atop the MCU and vertically separated from the Confined WBZ. Additionally, within Area A, the potentiometric surface of the Confined WBZ protrudes into the regional surface water table (i.e., discharges vertically into the Quaternary deposits/remnants of the UPA), while the potentiometric surface of the Confined WBZ exists within the MCU in Area B. The contact between “Area A” and “Area B” is presented on Exhibit 1.

The proposed landfill bottom elevations are designed to be a minimum of 3 feet above the highest observed groundwater elevations for the Unconfined WBZ. The presence of the MCU and the natural upward gradient of the Confined WBZ mean that if impacts from the proposed operations were to occur, they will be identified in the Unconfined WBZ. Therefore, this GWMP focuses on the Unconfined WBZ.

16.2.3 Baseline Groundwater Quality from Phase II Application

Pursuant to COMAR 26.04.07.15, the Phase II Permit Application (Advanced GeoServices Corp, June 2020) presented and discussed the results of groundwater samples collected from the Unconfined WBZ and Confined WBZ during sampling events completed in January/February 2020 and March 2020. Those groundwater samples were collected from eighteen (18) wells screened in the Unconfined WBZ, and nine (9) wells screened in the Confined WBZ and Transition Zone. Additional sampling events were completed in May 2020 and July 2020, and those results were compiled with the January/February and March 2020 data in an Addendum to the Phase II Permit Application t submitted to MDE on September 9 2020.

Low level VOC detections of acetone and chloroform were identified in the Unconfined WBZ; and low level VOC detections of tetrachlorethene and cis-1,2-dichloroethene were identified in the Confined WBZ. Only one VOC sample result was above its respective screening criteria (tetrachloroethene = 7 µg/L, Confined WBZ well MW-14 February 3, 2020). Arsenic, barium, chromium, lead and zinc were detected in unfiltered samples obtained from the Unconfined WBZ, but were never above their corresponding screening levels. Barium, chromium, lead and zinc were detected in unfiltered samples obtained from the Confined WBZ, but were never above their corresponding screening levels. Based on the results of groundwater sampling conducted in 2013 and 2014, total inorganic concentrations in groundwater from either WBZ are sensitive to the amount of turbidity present in the sample. Based on this observation, proper groundwater sampling utilizing low flow sampling techniques, or other techniques intended to minimize turbidity, is critical to obtaining representative groundwater samples. The use of bailers

should only be utilized as a last resort and when used filtered samples should be used for evaluation of inorganic constituents.

16.3 PERMANENT GROUNDWATER MONITORING NETWORK

16.3.1 Proposed Groundwater Monitoring Network

As stated above, the proposed permanent groundwater monitoring network will focus on the Unconfined WBZ. The permanent groundwater monitoring network will consist of one (1) existing and fifteen (15) new wells around the perimeter of the Area A disposal cells (Cells 11 through 16), and sixteen (16) new wells around the perimeter of the Area B disposal cells (Cells 1 through 4, 5A through 5E, and 6 through 10). The proposed well locations are shown on Figure 16-1, which also shows the highest observed/predicted water levels for the Unconfined WBZ. As presented on Figure 16-1, the wells for the permanent groundwater monitoring network along the downgradient sides of the proposed Area A and Area B disposal areas are spaced at approximately 300 feet on center perpendicular to the direction of groundwater flow. Up gradient wells are located approximately 750 feet on center.

All of the wells for the permanent groundwater monitoring network will be new wells, except existing well PMW-6. The wells will target the saturated interval corresponding to the Unconfined WBZ. Table 1 (attached) lists the proposed wells with their approximate anticipated ground surface elevation, estimated elevation of the top of the MCU and highest observed/predicted groundwater elevation. The typical well will be constructed with a 5 foot long screened interval (beginning approximately at the highest observed/predicted groundwater elevation). At those locations where the highest observed/predicted groundwater surface is within 5 feet of the ground surface, the top of the screen will begin 5 feet below the ground surface.

The new wells will be installed following approval of the requested waste disposal permit. The new wells will be installed under the supervision of a professional geologist, in accordance with the procedures described in Attachment 16A. Soil samples will be collected continuously, and the lithology will be recorded as the permanent monitoring wells are installed.

Table 1 provides a summary of the proposed Permanent Groundwater Monitoring Wells.

16.3.2 Abandonment of Existing Wells

Existing groundwater monitoring wells screened in the Unconfined WBZ will remain in-place as long as possible for depth to groundwater measurements, as described below. With the exception of PMW-6, no existing wells will be subject to groundwater sampling as part of the GWMP. Wells screened within the Confined WBZ (and Transition Zone), and located outside of the footprint of the waste disposal area shall remain in-place and be maintained in the event that future groundwater sampling of the Confined WBZ is necessary.

Wells located within the footprint of the proposed waste disposal area, and wells interfering with supporting roads, facilities and appurtenances shall be abandoned before the well is lost or damaged during construction. Any wells which are to be abandoned, will be abandoned in accordance with the applicable requirements in the following regulations:

- Maryland Code 26 04.04.34 – Well Abandonment and Sealing Standards – General

- Maryland Code 26 04.04.35 – Well Sealing Materials
- Maryland Code 26 04.04.36 – Well Sealing Procedures

The abandonment procedure for the wells will include:

- Measure the depth to water and total well depth using a water level indicator for the presence of any obstructions inside the well casing.
- Remove the concrete pad and flush-mount or above-grade protective cover and cut the well casing so the top is 0.5-1 foot below grade.
- Casing will be removed, drilled out and the entire well and sand pack completely filled with Portland cement grout from the base of the former boring to the ground surface using the tremie method.
- After completing the field activities, a completed Water Well Abandonment Sealing Report will be prepared for each well and submitted to MDE by a Maryland licensed well driller in accordance with the appropriate section of the Well Drilling regulations.

16.4 GROUNDWATER MONITORING PROCEDURES

16.4.1 Groundwater Potentiometric Surface

Prior to all groundwater sampling events, depth-to-water will be measured in each permanent groundwater monitoring well and all remaining existing wells screened in the Unconfined WBZ. Depth to water levels shall be measured using an electronic water level indicator. The synoptic measurements will include the measurement of water levels in as short a timeframe as possible to determine the potentiometric surface across the Site. Existing groundwater monitoring wells screened in the Unconfined WBZ will remain in-place as long as possible after installation of the new monitoring wells to provide as many data points for estimation of the potentiometric surface of the Unconfined WBZ as possible. In addition, depth to water measurements will be obtained for the months when sampling is not performed to provide monthly water level data during construction and operation of the landfill.

The potentiometric surface will be mapped for each gauging event within 2 weeks of the completion date of data collection, and the results compared against the highest observed/predicted groundwater levels established in the Phase II Permit Application. If the newly mapped surface is higher than the observed/predicted groundwater surface developed in the Phase II Permit Application a more detailed review shall be performed to determine if the new levels will be within 3 feet of the bottom of the liner system in any portion of the landfill (closed, active or proposed). If the groundwater level is less than 3 feet from the bottom of the liner system the MDE shall be notified in writing within 5 business days and meetings/discussions held to determine appropriate measures to address the issue.

16.4.2 Monitoring Well Maintenance

The sampling team is responsible for making a physical inspection of the monitoring wells for damage during each sampling event. They will document the results of the inspection on the field book. If there is a problem, it will be their responsibility to bring it to the attention of the NWM site manager at the end of the sampling event. It is the NWM site manager's responsibility to make arrangements to correct any problems within 30 days of identification of the problem.

16.4.3 Groundwater Sampling and Analysis

Groundwater from the permanent groundwater monitoring network wells will be sampled a minimum of 4 consecutive quarters prior to the start of waste placement. The results from the 4 initial sampling events (plus any previous results from PMW-6) will be used to establish a statistical database for groundwater quality. The first sampling event will begin approximately 2 to 3 weeks after the completion of well installation and development. Subsequent sampling events will be performed once each calendar quarter.

The groundwater samples collected from the permanent monitoring wells will be analyzed for the parameters specified by the MDE in the Permit. All parameters measured will be analyzed to their Practical Quantitation Limits (PQLs) (see Tables 2 and 3).

16.5 Groundwater Sampling Protocols

16.5.1 General Procedures

Groundwater sampling will be performed in accordance with the procedures in Attachment 16B.

16.5.2 Field Measurements

Field measurements that will be performed during well purging will include pH, specific conductivity, temperature, oxidation/reduction potential (ORP), dissolved oxygen (DO), and turbidity. Measurements will be collected by inserting the appropriate probe in a closed non-dedicated plastic container (flow-through-cell) that is rinsed with deionized water prior to purging the well. Turbidity samples will be collected from the flow through cell outflow. pH, temperature, specific conductance and turbidity will be utilized to determine completeness of purging efforts.

16.5.3 Meter Calibration

Calibration of the instruments will be completed at the beginning of each sampling day, checked in the middle of the day, and as otherwise necessary based on the functioning of the meters and equipment. The following items outline the calibration of each meter. Each meter will be field calibrated in accordance with the manufacturer's specifications and appropriate calibration solutions. All calibrations will be recorded in the field logbook. Field calibration procedures at a minimum will include the following:

- Calibration of the field instruments will be performed by trained technicians prior to the start of sampling and half way through the day. All the instruments will be calibrated as specified by the manufacturer. Standard solutions will also be checked to determine stability. All results of field calibrations and measurements will be maintained in bound field logbooks. The recorded calibration information will include date and time of calibration results, name of the person performing the calibration, reference standards used and instrument readings. If equipment fails calibration or equipment malfunction is noted during calibration or use, the equipment will not be used.
- Turbidity meter will be calibrated with one standard of known turbidity, as prepared by the manufacturer of the instrument, daily prior to use.

- Pump and equipment will be decontaminated before and between each well. sampling

16.5.4 Sample Labeling and Field Notes

The sample containers will be identified by the use of sample tags/labels with the well identification (e.g., BW-3-DATE, etc.). Each sample label will be completed by the sampler to avoid possibility of sample misidentification and attached to the sample container. Indelible ink shall be used to complete the sample labels. Each sample label will be labeled at the time of collection with, at a minimum, the following information:

- Sample identification number,
- Initials of the sample collector,
- Time and date of the sample collection,
- Site name and location number,
- Requested analyses,
- Any preservative added or field preparation performed, and,
- Sample designation if this sample is a quality assurance sample.

A new pair of gloves will be used at each sample location by each member of the sampling team.

Containers for collecting samples for volatile organics will be filled to slightly more than full before the cap is placed on the container to ensure that it is headspace free.

All sampling procedures, measurements, and observations will be recorded on the Field Sampling Field Book and Purge Sheets, which will include the following information:

- Facility site name, sample point identification number, and other pertinent identifiers;
- Depth to groundwater;
- Information regarding purging the well prior to sampling (see Attachment 16B);
- Time of sample collection;
- Sampling method;
- Filtration, if used;
- Field test results, including pH, temperature, specific conductance, dissolved oxygen, and turbidity;
- Field observations (e.g., well condition);
- Appearance of sample (i.e., color, turbidity, sediment, or soil on surface); and,
- Sampler's identity and signature.

16.6 Sample Preservation and Shipment, Duplicates, and Blanks

16.6.1 Sample Preservation

Since multiple analyses will be required, use of different types of containers and preservatives will be necessary. Multiple pre-labeled containers will be supplied by the laboratory for each sampling point. The appropriate preservatives will have been added to each container (as required) during sample bottle preparation.

16.6.2 Blanks and Duplicate Samples

To ensure internal laboratory quality control, field blanks and blind duplicate samples will be collected during each sampling event. These samples will be analyzed for the same parameters as the other samples. A trip blank for volatile organic analysis will also be collected.

16.6.3 Chain-of Custody Forms

A Chain-of-Custody Form will be completed and placed in the sample chest. Upon transfer of sample possession to subsequent custodians, the Chain-of-Custody Form will be signed by the person taking custody of the sample container. Upon receipt of the samples at the laboratory, the date and time of arrival will be noted on the Chain-of-Custody Forms.

The custody records will be included in the analytical report prepared by the laboratory, and will be considered an integral part of that report.

16.7 Responsibilities of Site Personnel for Groundwater Monitoring

16.7.1 Sampling Team

A qualified groundwater scientist will sample or oversee qualified environmental technicians who sample the wells semiannually at the intervals specified in the approved Groundwater Monitoring Plan.

The Sampling Team will have the following responsibilities:

- Inspecting the wells during the sampling events, documenting any damage or problems, and reporting needed repairs to the NWM Site Manager.
- Sampling the wells in conformance with the groundwater sampling protocols.
- Maintenance and decontamination of sampling equipment.
- Insuring that appropriate containers and preservatives are used for each of the analytical parameters.
- Preparation of chain-of-custody forms and shipment to the lab within analyte holding times.

16.7.2 Site Manager

The Site Manager, or his designee, will have the following responsibilities:

- Verification that the monitoring wells have been installed in accordance with procedures described in Attachment 16A – Permanent Monitoring Well Installation Specifications.
- Maintenance, repair, and protection of the monitoring wells as well as maintenance of the access roads to the wells.
- Documentation and reporting to the MDE of any sampling or reporting delays.
- Informing the sampling team of any changes in the well conditions, or accessibility.

16.8 Data Evaluation and Reporting

A groundwater quality data report will be submitted to the MDE within 60 days of the close of each sampling event. The report will be signed by a qualified groundwater professional and include the following:

1. A laboratory report indicating the analytical method on each data sheet and the detection limits.
2. Presentation of the analytical data from each well in a numerical table formatted so that the water quality data for each well can be observed simultaneously, emphasizing the analytes above the reporting limit. Where applicable, the table will show corresponding groundwater standards and/or criteria.
3. Intrawell control charts will be used to monitor the inherent statistical variation of the data collected within a single well, and to flag anomalous results. In addition to allowing statistical analysis, control charts provide a quick visual evaluation of the data.
    a. Time series analysis (plotting concentrations over time) is extremely useful for identifying trends in monitoring data.
    b. Combined Shewhart-cumulative sum (CUSUM) control charts will be constructed for each detected constituent at each well to provide a visual tool of detecting both trends and abrupt changes in concentration levels. The mean of replicate values at a point in time will be computed and plotted together with upper and/or lower predetermined limits on a chart where the x-axis represents time. If a result falls outside these boundaries, then the process will be declared to be “out-of-control”; otherwise, the process will be declared to be “in control”. Data points lying outside the established boundaries will be investigated.
    c. A significant positive trend in the data from a downgradient monitoring well may provide sufficient evidence to conclude that the landfill unit is affecting the well. Such trends should be evident in several parameters since contaminant migration from the landfill would likely result in an influx of multiple constituents into the groundwater flow system.
4. Groundwater surface maps and an analysis of variations in groundwater levels.

If primary groundwater standards are exceeded then the MDE will be notified within 24 hours of receipt of the laboratory report detecting the occurrence and the monitor well(s) will be resampled within 30 days of the date of receipt of the laboratory analysis. The data from the resampling will be submitted to the MDE no later than the 15th day of the following month. Failure of the Landfill to resample is acknowledgement that the exceedance of the primary

standard is representative of current groundwater conditions at the facility and the groundwater contamination contingency plan will go into effect.

16.9 Groundwater Contamination Contingency Plan

The groundwater quality data generated by the groundwater monitoring program will be evaluated for exceedance of groundwater standards and/or baseline groundwater quality. If exceedances are identified then the following actions will be taken to identify and address potential releases of contaminants from the landfill to groundwater:

1. Implement an accelerated (monthly) sampling schedule for the affected well(s) to confirm or refute the elevated concentrations.

2. Install additional monitoring wells as required to define the extent of confirmed elevated concentrations.

3. Determine whether groundwater standards are being exceeded.

4. Perform modeling or flow calculations to determine the source of the elevated concentrations and predict concentrations at the site boundary and at potential receptors.

5. Install additional wells as required to calibrate the model/flow calculations.

6. Identify and evaluate human and ecologic exposure pathways.

7. Implement remedial action to block exposure pathways if excessive risk is identified. Remedial actions such as pump and treat, in situ bioremediation, venting, etc. will be considered. The remedy selected will be contingent on the nature of the contaminant and the hydrogeologic framework at the point of release.

16.10 Residential Well Water Level Monitoring and Contingency Plan

The purpose of residential well monitoring is to determine whether operations at the landfill will have an impact on off-site residential wells through lowering of the perched water table.

The proposed permanent monitoring well network will be maintained and used to evaluate the impact of the landfill on perched water levels. Four (4) permanent groundwater monitoring wells (PMWs-120, 121, 122 and 123) are proposed between the landfill and the shallow residential wells along Conway Road and Collins Avenue (screened in Unconfined WBZ).

Water levels in the new permanent groundwater monitoring wells will be measured monthly following issuance of the refuse disposal permit. These water level data will be used to prepare a series of Unconfined WBZ water table contour maps. NWM and the MDE will use these contour maps to evaluate whether landfill activities have impacted the perched water table along Conway Road and Collins Avenue.

Water levels in the residential wells will be monitored in accordance with the protocols described in Section 16, Attachment 16C. Eight potentially impacted wells are identified and the

circumstances under which mitigation measures will be provided (at the landfill's expense) are described. Specific response criteria as listed in Attachment 16C, are as follows:

- The well is not capable of meeting either daily or cycle demand previously determined for each well.
- The water level in the well is below the drought water level as determined during the baseline period, and/or the water level is low relative to landfill monitoring/observation wells.
- A special exception may be made for inaccessible wells (e.g. buried wells) if there is evidence of drawdown in onsite monitoring wells or nearby residential wells and the well is unable to meet daily needs.

The water level monitoring plan described in Attachment 16C pertains to eight residences south of the landfill where the Unconfined WBZ water table may be impacted by landfill operations. Monitoring of the water supply wells for these residences will be contingent upon (1) verification that they are screened in the Unconfined WBZ and (2) the owner's approval and agreement to abide by the protocol in Attachment 16C.

The Unconfined WBZ under the western portion of the landfill was modeled during earlier submissions of the Phase 2 investigation when dewatering of the Unconfined WBZ was being proposed, to predict the impact of the dewatering on the sources of drinking water supply for the nearby residents. The final landfill design does not penetrate the Unconfined WBZ and dewatering is not required; therefore, the modeling is considered to be an overly conservative representation of the impacts to groundwater levels in the Unconfined WBZ when the Area B disposal area is constructed. Despite the overly conservative nature of the modeling, NWM is still proposing to perform the previously agreed upon residential water level monitoring to confirm that the reduction in pervious area caused by the proposed cell liner systems do not negatively impact the neighboring Unconfined WBZ wells.

The amount of lowering of the Unconfined WBZ predicted by the previously completed groundwater flow model is shown on Figure 1, in Attachment 16C. There are eight residences located with the area in which 1-foot of drawdown was predicted that could potentially be impacted, either because well completion reports indicate they have wells completed in the Unconfined WBZ (2944 and 2987 Conway Road) or because detailed information regarding the depth of the well screened interval was not available. Information on the wells supplying water to these eight residences is as follows:

Well Permit	Map No.	Address	Total Depth	Screen Top	Screen Bot.	Screen Dia	Pumping Hrs	Pumping GPM	Level Before	Level During
A	58	1245 COLLINS	-	-	-	-	-	-	-	-
A	60	254A COLLINS	-	-	-	-	-	-	-	-
A	62	1257 COLLINS	-	-	-	-	-	-	-	-
AA738073	48	2944 CONWAY	105	64	69	2	1	10	75	80
A	46	2946 CONWAY	90(b)	-	-	-	-	-	-	-
A	47	2948 CONWAY	315(b)	-	-	-	-	-	-	-
a	43	2973 CONWAY	c	-	-	-	-	-	-	-

AA811580	40	2987 CONWAY	72	60	72	4	3	18	40	51

a. No permit tag on well. b. Depth reported by resident.
c. Well depth of 30 feet reported by owner Albert Rollins in 1990; however, at hearing on 12/3/01 Mr. Rollins stated his well is 335-feet deep.

In the unlikely event that the residential wells are shown to be impacted as described in Attachment 16C, the landfill will contact a commercial provider within one hour of the determination to request delivery of water from a water tank truck at a rate that equals or exceeds the affected well's baseline yield. The landfill will arrange and pay for the action. This water delivery will continue until the residential well(s) recover to their baseline yield(s), or until mitigation measures are implemented, whichever comes first. Mitigation measures include, but are not limited to: installation of pressure tank(s) and modified pump; lowering the pump; redeveloping the well; and/or drilling a new well.

16.11 References

Advanced GeoServices Corp, "Phase II Permit Application, Chesapeake Terrace Rubble Landfill," dated June 2020.

MSA. 12/5/03. *Phase 2 Addendum for Chesapeake Terrace Rubble Landfill*. prepared for National Waste Managers for submission to the Maryland Department of the Environment.

MSA, 12/22/04. *Responses to Comments on Phase 2 Addendum Report for Chesapeake Terrace Rubble Landfill*. prepared for National Waste Managers for submission to the Maryland Department of the Environment.

MD DNR, 1982, *The Quantity and Natural Quality of Groundwater in Maryland*, MD DNR, 1982),

Mack, F, and D. Andreasen. 1991. Geohydrologic Data for the Coastal Plain Sediments Underlying Broadneck Peninsula, Anne Arundel County, Maryland. MGS Open File Report No. 92-02-6, Mack and Andreasen, 1991).

TABLES

TABLE 1

SUMMARY OF PERMANENT GROUNDWATER MONITORING WELLS
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Monitoring Well IDs	Description	Approx. Elev. (ft MSL)			Well Depth * (feet)
		Proposed Grade	Top of Clay Surface	Potentiometric Surface	
AREA A					
PMW-101	Up gradient	124	47	80	53
PMW-102	Up gradient	136	45	78	67
PMW-103	Up gradient	110	45	77	42
PMW-104	Downgradient	94	35	75	28
PMW-105	Downgradient	84	30	72	21
PMW-106	Downgradient	80	26	71	18
PMW-107	Downgradient	80	28	68	21
PMW-108	Downgradient	76	30	66	19
PMW-109	Downgradient	80	36	67	21
PMW-110	Downgradient	88	36	67	29
PMW-6 (exist)	Downgradient	82	36	63	28
PMW-111	Downgradient	80	39	67	22
PMW-112	Downgradient	80	46	73	16
PMW-113	Downgradient	78	56	72	15
PMW-114	Downgradient	76	54	72	15
PMW-115	Downgradient	88	60	82	15
AREA B					
PMW-116	Up gradient (3 ft screen)	120	112	117	10
PMW-117	Up gradient (possibly dry)	144	118	118	28
PMW-118	Up gradient	149	106	118	40
PMW-119	Downgradient	155	102	117	56
PMW-120	Downgradient	174	94	106	77
PMW-121	Downgradient	192	88	96	105
PMW-122	Downgradient	175	88	94	90
PMW-123	Downgradient	170	85	90	88
PMW-124	Downgradient	182	70	86	105
PMW-125	Downgradient	164	76	93	80
PMW-126	Downgradient	156	86	101	80
PMW-127	Downgradient	150	90	102	57
PMW-128	Downgradient	167	79	94	82
PMW-129	Downgradient	166	70	90	85
PMW-130	Downgradient	155	60	80	84
PMW-131	Downgradient	125	52	81	53

Note: The screened interval for the typical Unconfined WBZ wells will begin at approximately the highest observed/predicted groundwater level as presented on Table 1 (above) or a minimum of 7 feet below the ground surface (whichever is greater). When the interval from the highest observed/predicted groundwater level to the top of the MCU is less than 5feet but greater than 3 feet, utilize the full 5 ft screen length and set the bottom of the screen into the MCU. When the interval is less than 3 feet, set the bottom of the screen 2 feet into the MCU and set the top of the screen above the highest observed/predicted groundwater level, as necessary to maintain the 5 foot screen length. Where the 7 feet of separation between the top of the screen and ground surface cannot be maintained using a 5 foot screen length, reduce the screen length as necessary to maintain the minimum 7 feet of separation.

TABLE 2
GROUNDWATER SAMPLING
MEASUREMENT PARAMETERS AND PRACTICAL QUANTITATION LIMITS
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Metals	PQL	General Parameters	PQL
Barium	5 ug/l	Chloride	1 mg/l
Calcium	100 ug/l	Nitrate	0.1 mg/l
Iron	50 ug/l	Phosphate	0.05 mg/l
Magnesium	20 ug/l	Total Dissolved Solids	10 mg/l
Manganese	2 ug/l	Sulfate	1 mg/l
Potassium	500 ug/l	Total Alkalinity	1 mg/l
Sodium	100 ug/l	Ammonia	0.2 mg/l
Antimony*	2 ug/l	Chemical Oxygen Demand	10 mg/l
Arsenic*	2 ug/l	Hardness	0.5 mg/l
Beryllium	2 ug/l	**Field Parameters**	**PQL**
Cadmium	2 ug/l		
Chromium	5 ug/l	pH	NA
Cobalt	5 ug/l	Conductance	10 umhos/cm
Copper	5 ug/l	Temperature (°C)	NA
Lead	2 ug/l	Turbidity	0.1 NTU
Nickel	2 ug/l	Dissolved Oxygen	2 mg/l
Selenium*	2 ug/l	**Volatile Organic Compounds by EPA Method 6260**	
Silver*	1 ug/l		
Thallium*	2 ug/l		
Vanadium	5 ug/l	See Table 3 for individual VOCs and PQLs	
Zinc	5 ug/l		
Mercury	0.2 ug/l		

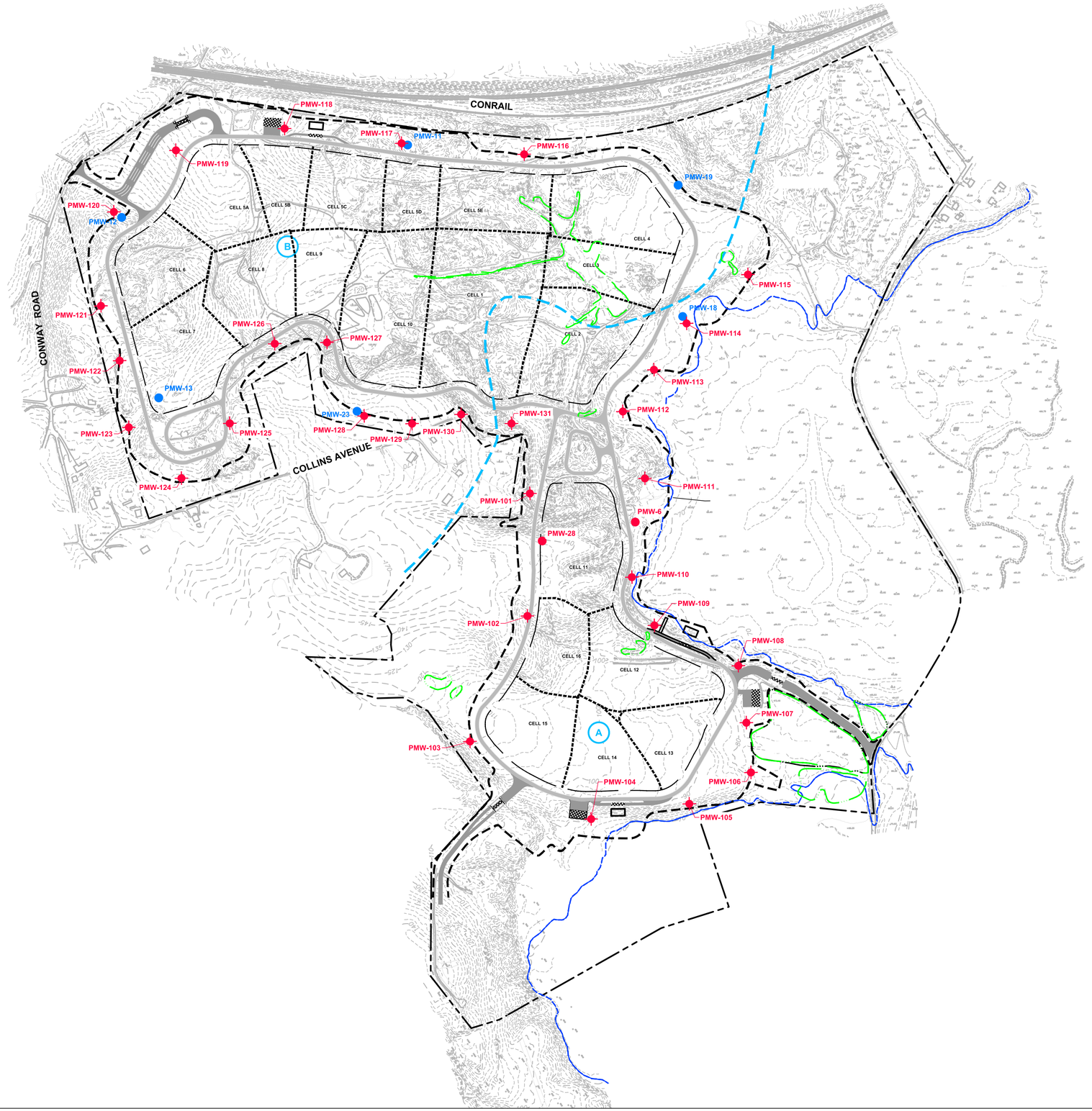
*ICPMS

TABLE 3
GROUNDWATER SAMPLING
VOLATILE ORGANIC COMPOUINDS AND PRACTICAL QUANTITATION LIMITS
CHESAPEAKE TERRACE RUBBLE LANDFILL
ODENTON, ANNE ARUNDEL COUNTY, MARYLAND

Parameter	PQL (ug/L)	Parameter	PQL (ug/L)
Acetone	5	Dichloropropane(1,2-)	1
Acrolein	50	Dichloropropane(2,2-)	1
Acrylonitrile	50	Dichloropropane(1,3-)	1
Benzene	1	Dichloropropene(cis 1,3-)	1
Bromobenzene	1	Dichloropropene(trans 1,3-)	1
Bromochloromethane	1	Ethylbenzene	1
Bromodichloromethane	1	Hexachlorobutadiene	1
Bromoform	1	Hexanone(2-)	1
Bromomethane	1	Isopropylbenzene	1
Butanone(2-)(MEK)	5	Isopropyltoluene(4-)	1
Butylbenzene(n-)	1	Methyl(4-)-Pentanone(2-)	1
Butylbenzene(sec-)	1	Naphthlalene	1
Butylbenzene(tert-)	1	Propylbenzene(n-)	1
Carbon Disulfide	1	Styrene	1
Carbon Tetrachloride	1	Tetrachloroethane(1,1,1,2-)	1
Chlorobenzene(Mono-)	1	Tetrachloroethane(1,1,2,2-)	1
Chloroethane	1	Tetrachloroethene	1
Chloroethylvinyl(2-) Ether	5	Toluene	1
Chloroform	1	Trichlorobenzene(1,2,3-)	1
Chloromethane	1	Trichlorobenzene(1,2,4-)	1
Chlorotoluene(2-)/(o-)	1	Trichloroethane(1,1,2-)	1
Chlorotoluene(4-)/(p-)	1	Trichloroethane(1,1,1-)	1
Dibromochloromethane	1	Trichloroethene	1
Dibromoethane(1,2-)	1	Trichlorofluoromethane	1
Dibromomethane	1	Trichloropropane(1,2,3-)	1
Dibromo(1,2-)chloropropane(3-)	1	Trimethylbenzene(1,3,5-)	1
Dichlorobenzene(1,2-)/(o-)	1	Trimethylbenzene(1,2,4-)	1
Dichlorobenzene(1,3-)/(m-)	1	Vinyl Acetate	5
Dichlorobenzene(1,4-)/(p-)	1	Vinyl Chloride	1
Dichlorodifluoromethane	1	Xylene(O-)	1
Dichloroethane(1,2-)	1	Xylene(M&P-)	1
Dichloroethane(1,1-)	1	Xylenes, total (M&P- + O-)	1
Dichloroethene(1,1-)	1	Iodomethane (Methyl Iodide)	1
Dichloroethene(cis-1,2-)	1	Dichloro(trans 1,4-)-butene (2-)	1
Dichloroethene(trans-1,2-)	1	Chloro (3-)-propene (1-)	1
Dichloromethane	1	Methyl-tert-butyl-ether (MTBE)	1
Dichloropropene(1,1-)	1		

Compounds not on 2020 Parameter List

FIGURE



LEGEND

- PROPERTY LINE
- LANDFILL PERIMETER ACCESS ROAD (FUTURE)
- SITE ENTRANCE (FUTURE)
- LANDFILL LIMITS (FUTURE)
- LANDFILL CELL SEPARATION BERM (FUTURE)
- LIMIT OF DISTURBANCE (FUTURE)
- MODIFIED 100–YEAR FLOODPLAIN
- PMW-6 — EXISTING PERMANENT MONITORING WELL (SCREENED ABOVE MCU)(SEE REFERENCE 2)
- PMW-112 — PROPOSED PERMANENT MONITORING WELL (SCREENED ABOVE MCU)
- PMW-19 — EXISTING PERMANENT MONITORING WELL (SCREENED BELOW MCU) (SEE REFERENCE 2)
- HYDROGEOLOGIC AREA DIVIDE (SEE REFERENCE 2)
- (A) HYDROGEOLOGIC AREA (SEE REFERENCE 2)
- JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE REFERENCE 6)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) EXISTING MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

4.) HYDROGEOLOGIC AREAS & BOUNDARIES TAKEN FROM "PHASE II PERMIT APPLICATION", PREPARED BY ADVANCED GEOSERVICES CORP DATED JUNE 2020.

5.) THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3.

6.) JURISDICTIONAL WETLAND BOUNDARIES OBTAINED FROM FIGURES ATTACHED TO THE ARMY CORPS OF ENGINEERS PUBLIC NOTICE DATED NOVEMBER 22, 1991, AND AS SUBSEQUENTLY AMENDED IN WRITING BY MCCARTHY AND ASSOCIATES ON APRIL 2, 1997

NOTES

1.) THE CONRAIL TRACKS ARE ALSO SHARED WITH AMTRAK FOR HIGH–SPEED COMMUTER TRAINS BETWEEN BOSTON, MASSACHUSETTS AND WASHINGTON, D.C.

2.) THE PROPERTY WAS PREVIOUSLY USED FOR SAND AND GRAVEL MINING ACTIVITIES. PORTIONS OF THE SITE CURRENTLY HAVE NO VEGETATION AND ARE BARREN.

3.) WATER LEVELS IN WELLS MW–2, MW–7, MW–8, MW–9, MW–11, MW–23, MW–26, AND MW–31 WERE NOT OBTAINED DURING FIELD ACTIVITIES BY GOLDER ASSOCIATES IN 2014 AND ADVANCED GEOSERVICES IN 2019 AS THE WELLS COULD NOT BE LOCATED.

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch =300 ft.

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645

REVISION:

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1978 ARLETON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.2276 www.advancedgeoservices.com

PROPOSED MONITORING WELL LOCATIONS

PROJECT MANAGER:	VEF
CHECKED BY:	VEF
DRAWN BY:	KHF
SCALE: AS NOTED	
PROJECT NUMBER:	2018 – 3854
DATE:	06/25/2020

FIGURE 16–1

N:\Projects\2018\3018854 - Chesapeake Terrace LF\CAD\DWG\AC D_Groundwater Sampling Plan\2018854-0010 - GW Monitoring Plan.dwg

Attachment 16A

Permanent Monitoring Well Installation Specifications

PERMANENT MONITORING WELL INSTALLATION SPECIFICATIONS
Chesapeake Terrace Rubble Landfill

1. All of the monitoring wells will be installed by a Maryland-licensed well-driller in accordance with all pertinent State and local laws and regulations. Permits to drill each well will be obtained from the Anne Arundel County Health Department prior to well installation.

2. All monitoring well casings and screens will be constructed of 2" inner-diameter (ID) pipe composed of Schedule 40 Polyvinylchloride (PVC), joined using threaded couplings. No solvents, glues, or lubricants will be used in the construction of the wells. No reduction fittings will be used in the construction of the wells.

3. The screened intervals of the monitoring wells will consist of 5 feet of pre-constructed, commercially manufactured well screen of the same material and inner diameter as the main well casing. The screened interval for the typical Unconfined WBZ wells will begin at approximately the highest observed/predicted groundwater level as presented on Table 1 (above) or a minimum of 7 feet below the ground surface (whichever distance below the ground surface is greater). When the interval from the highest observed/predicted groundwater level to the top of the MCU is less than 5 feet but greater than 3 feet, utilize the full 5 ft screen length and set the bottom of the screen into the MCU. When the interval is less than 3 feet, set the bottom of the screen 2 feet into the MCU and set the top of the screen above the highest observed/predicted groundwater level, as necessary to maintain the 5foot screen length, provided the 7 feet separation between the top of the screen and the ground surface is maintained. Where the 7 feet of separation between the top of the screen and ground surface cannot be maintained using a 5 foot long screen, reduce the screen length as necessary to maintain the minimum 7 feet of separation. Slot size of the screens will be selected based on the visual classification of the soil sample(s) collected from the targeted screen interval so that, with the sand pack, it will preclude clogging and excessive turbidity in the well. Based on the results of previous sampling the target screen interval in most areas will be variable and require the use of finer screen slot size (generally 0.010"), although the actual size will be selected by the professional geologist. The bottom of the screen will be capped.

4. The diameter of the boring into which the casing is set will exceed the diameter of the casing by at least four inches (4") (e.g., a two inch well must be installed in a hole at least six inches in diameter), so that the gravel pack and grout may be properly placed in the annular space between the casing and the sides of the hole.

5. For wells greater than 50 feet deep, at least three (3) centralizers will be installed to center the well casing in the annular space, with one at the screen and the others spaced evenly along the well casing. The centralizers will be composed of the same material as the casing and screen.

6. The annular space of the typical well will be packed with sand of a size compatible with the selected screen slot size (example for 0.010” slots use #000 (35 mesh sand)) from the base of the well to a level two feet (2') above the top of the screen. The sand pack used will be

selected by the professional geologist so that it prevents fine-grained sediment in the screened formation from clogging the slots in the screen or causing excessive turbidity in the well, and it will have a permeability at least approximately equal to or higher than the permeability of the monitored formation. Two feet (2') of bentonite pellets will be placed above the sand, to prevent the entry of grout into the sand pack, and to act as a long-term barrier to liquid, which might seep down the formation/grout interface. Two (2) hours will be allowed for hydration of the bentonite prior to grout emplacement. All materials used to construct the well including the sand pack, seal, and grout, will be clean, new materials meeting NSF/ANSI Standard 61 and the AWWA Standard B100-09 – cuttings will not be placed back in the hole. In addition, the sand pack will be composed of quartz or a similar inert mineral. If any wastes, contaminated soils or contaminated liquids are produced during the drilling process, they will be disposed of properly. If the sand pack is emplaced with auger flights or temporary casing still in the hole, the augers or casing will be backed out by increments as the sand pack is emplaced to insure that the sand pack sets properly without bridging and without displacing the well casing when the casing or augers are extracted.

7. The annular space of all the wells will be grouted with 100% Portland cement or a 90% Portland cement/10% bentonite slurry from the top of the pelletized bentonite seal to the surface. The grout will be installed by means of a tremie pipe inserted into the annular space of the well to a point just above the bentonite seal, and will not be installed until the two-foot (2') bentonite seal has had two (2) hours to hydrate.

8. After the grout has set up, some additional grout may have to be added to replace grout volume lost due to shrinkage. Regardless of the type of grout used, the top three feet will be composed of 100% Portland cement. All wells will be provided with a means of protection from tampering, vandalism, and accidental damage. All wells will be protected by either, 1) a steel outer casing with a diameter at least 2" greater than the main casing anchored three feet (3') into the cement grout, with a hinged, locking steel cap which allows access to the main casing inside only when open, or 2) a ground-level anti-vandalism manhole with a bolted lid.

   At the ground surface, a concrete form will be provided during grout installation for the construction of a square concrete pad at least 18"x18" centered around the well, which extends from three inches above to three inches below the undisturbed ground surface. The height of the protective casing will be two feet (2') above the top of the cement pad ± two inches (2"), unless otherwise approved. The top of the PVC casing inside will be provided with a removable cap that fits just under the locking protective steel cap, and be accessible for cap removal with normal tools.

   High-traffic areas such as maintenance areas and parking lots may require special installations such as concrete posts (“bollards”) set around the well to prevent damage by vehicles. Such barriers will be painted a highly visible color, and will be spaced so as to protect the well but still allow a vehicle to back up to it for sampling and repairs.

9. After the grout has thoroughly cured, the wells will be developed to insure that a satisfactory hydraulic connection exists between the well and the monitored formation. Development will consist of alternating mechanical- and/or air-surging techniques with pumping, to remove fine materials that may remain in the well, sand pack, and the formation nearest the well,

which would otherwise threaten sample quality. Jetting or other techniques will be employed when necessary to speed this process, particularly when the drilling method used to install the wells is the mud-rotary method, or a variant. Wells will be developed so that the water produced has a measured turbidity of 10 NTUs (Nephelometric Turbidity Units) or less. If the desired turbidity cannot be attained within two (2) hours of development and continued improvement is not being observed, the professional geologist may make the determination that development is considered complete and halt continued efforts to reduce turbidity. If wells pump dry during development efforts, development will be temporarily halted and water levels allowed to recover to at least 75% of the starting water column height before efforts are resumed. If water levels do not achieve at least 75% of the starting water column height within 24 hours, up to 10 gallons of potable water may be added to the well to facilitate development. All wells must be allowed to sit for a minimum of 2 weeks between the completion of development and the start of sampling.

10. All wells will be properly tagged, with the well construction permit number and monitoring well designation (e.g., PMW-102) clearly visible from the outside of the well, and flagged or otherwise made visible so that they can be located for sampling and avoided by on-site heavy equipment. The inner plastic casing will be carefully sealed prior to any spray-painting or any other work on the protective casing, which could introduce contaminants into the well.

11. Well completion reports will be fully completed for each well installed, and a copy of the well completion report forms submitted to the County Health Department will be forwarded to the MDE within thirty (30) days of well completion. A project summary describing the installation procedure will accompany the copies of the completion reports, and will contain an accurate map depicting the precise location of all wells installed at the site in relation to known landmarks; a detailed description of the construction of the wells installed including casing/screen, sand pack and grout intervals; the elevation of the top of the concrete pad installed at the base of the protective outer well casing; the top-of-casing elevation for the protective steel casing or manhole rim elevation, elevation of the top of the PVC casing; and both the static and pumping water levels to the nearest one-hundredth of a foot.

12. The well driller or the supervising engineer or geologist will notify the MDE via telephone at least three (3) work days prior to initiation of drilling, so that representatives may be present to observe the well installation.

13. All regulatory requirements will be met concerning the application for, permitting of, construction of and completion of all monitoring wells. It is understood that wells not constructed in accordance with the regulations (COMAR 26.04.04) and these specifications will not be accepted by the MDE unless a variance is obtained prior to or during well construction.

14. It is recognized that geologic conditions at a site may require that changes to these general specifications be made in order that the monitoring system installed is adequate for monitoring the intended geologic formations, while not creating an additional hazard to groundwater quality. Variances from the specifications described will be sought from the MDE Project Geologist.

15. Any wells which are to be abandoned, will be abandoned so that the appropriate section of the Well Drilling regulations addressing abandonment is carefully followed. Casing will be removed, drilled out, or thoroughly split or pierced, and the entire well and sand pack completely filled with Portland cement grout from the base of the former boring to the ground surface.

16. Wells will not be overdrilled to a depth greater than 5' below the elevation at which the screen is to be set, to avoid cross-contamination of deeper zones and averaging of hydraulic pressure across the open interval. If overdrilling occurs, the hole will be grouted with Portland cement up to the bottom of the selected screened interval and the grout allowed to fully cure before the screen is set. The well will be developed with care to avoid residual cement contamination in subsequent water samples.

17. Split-spoon sampling will be performed so that the correct location of the screen can be verified during drilling. The anticipated zone in which the screen will be set will be established and approved by the MDE prior to drilling. If conditions are not sufficiently well defined to permit absolute identification of the conditions to be encountered beforehand, then a protocol for choosing the proper zone will be established in advance.

18. All monitoring wells will be accessible to 4-wheel drive vehicles. Roads will be maintained such that access to the wells is possible upon reasonable request without prior notice.

Attachment 16B

Groundwater Sampling Protocols

GROUNDWATER SAMPLING PROTOCOLS
Chesapeake Terrace Rubble Landfill

A. GROUNDWATER PURGING

A.1 Water Level and Purge Volume Determination

Groundwater sampling shall be performed utilizing low flow sampling techniques. The amount of water that must be purged from a well when utilizing low flow sampling techniques is determined by field parameter stabilization.

1 GENERAL EQUIPMENT CONSIDERATIONS

1.1 A bladder type pump will be used to purge the well when utilizing low flow sampling techniques.

2 INITIAL INSPECTION

2.1 Verify the identification of the monitoring well.
2.2 Remove the well cover and remove all standing water around the top of the well casing (manhole) before opening the well cap.
2.3 Inspect the exterior protective casing of the monitoring well for damage, document the results of the inspection if there is a problem and report it to the NWM site manager.
2.4 Inspect the well lock and determine whether the cap fits tightly. Inspect the condition of the bolts and washers as well as the casing threads and document the results of the inspection in the field book, if there is a problem report it to the NWM site manager.

3 WATER LEVEL MEASUREMENTS: Use an electronic probe to determine the water level.

3.1 Use an electronic probe to determine the water level.
3.2 Decontaminate all equipment before use.
3.3 Measure the depth to groundwater from the top of well casing to the nearest 0.01 foot and always measure from the same reference point or survey mark on the PVC well casing. If there is no reference mark, measure from the high side of the PVC casing.
3.4 Record the measurement and the reference point.

4 WATER COLUMN DETERMINATION

4.1 Do not determine the total depth of the well by lowering the probe to the bottom of the well before purging and sampling. If the well must be sounded before sample collection, delay purging and sampling activities for at least 24 hours after the well was sounded. Alternatively, collect samples before sounding the well using the most recent depth to bottom measurement to calculate height of water column.
4.2 Subtract the depth to the top of the water column from the total well depth to determine the length of the water column.

5 WELL WATER VOLUME

5.1 Calculate the total volume of water in gallons in the well using the following equation for a 2" diameter well set in a 6" (nominal) diameter hole with 40% void in sand pack:

$V = (0.022\ ft^3/ft + 0.070\ ft^3/ft) \times (h) \times (7.47\ gals/ft^3)$

Where: V = volume in gallons

h = height of the water column in feet

5.2 Record all measurements and calculations on the purge sheets.

A.2 Well Purging Techniques

The selection of the purging technique and equipment is dependent on the hydrogeologic properties of the aquifer, especially depth to groundwater and hydraulic conductivity. The intent of proper purging is to stabilize the water level in the well and minimize the hydraulic stress to the hydrogeologic formation. Every attempt will be made to match the pumping rate with the recharge rate of the well before evaluating the purging completion criteria.

1 MEASURING THE PURGE VOLUME:

The volume of water that is removed during purging will be recorded by one of the following methods:

1.1 Collect the water in a graduated container and multiply the number of times the container was emptied by the volume of the container, or

1.2 Estimate the volume based on pumping rate. This technique will be used only if the pumping rate is constant. Determine the pumping rate by measuring the amount of water that is pumped for a fixed period of time.

1.3 Make new measurements each time the pumping rate is changed.

2 PURGE RATE:

The depth to water shall be measured at 3 to 5 minute increments at the start of purging to help ensure that purge rate and recharge rates are in equilibrium as determined by a stabilized draw down level <0.33 feet from initial water level measurement (before insertion of sampling equipment), and every 5 to 10 minutes through the completion of sampling. Record purge rates and depth to water on the purge sheet, with stabilization measures. If the initial purge rates result in a drawn down level >0.33 feet, the purge rate shall be set at the lowest possible rate that can sustain a flow and the water level allowed to recover to <0.33 feet before higher purge rates can be resumed.

3 STABILIZATION MEASUREMENT FREQUENCY:

The purge parameters shall be measured at 3 to 5 minute increments and recorded on the purge sheet begin immediately after purge and recharge rates have reached equilibrium.

4 PURGING COMPLETION:

A flow-through container shall be used to measure the stabilization parameters discussed below. Purging is considered complete when the criteria in section 4.1, 4.2 or 4.3 below are satisfied.

4.1 Three (3) consecutive measurements of the four (4) parameters listed below must be within the stated limits. The measurements evaluated must be the last three consecutive measurements taken before sample collection begins. The range

between the highest and the lowest values for the last three measurements of temperature, pH and specific conductance cannot exceed the stated limits. The last three consecutive measurements of turbidity must all be at or below the listed thresholds, otherwise filtered and unfiltered samples for inorganics analysis must be collected.

- *Temperature: ± 0.2° C*
- *pH: ± 0.2 Standard Units*
- *Specific Conductance: ± 5.0% of reading*
- *Turbidity: ≤20 NTU*
- Document and report the following on the purge sheets (use a separate purge sheet for each well), as applicable:
- *Purging rate.*
- *Drawdown in the well, if any.*
- *Pump or tubing intake placement.*
- *Length and location of the screened interval.*

4.2 If the criteria in section 4.1 above for turbidity cannot be met, then three (3) consecutive measurements for pH, temperature and specific conductance must be within the above stated limits, and the last three consecutive measurements for turbidity shall be:

- *Turbidity: ± 5 NTUs or 10%, whichever is greater*

4.3 If the stabilization parameters in either section 4.1 or 4.2 cannot be met, and all attempts have been made to minimize the drawdown, check the instrument condition and calibration, purging flow rate and all tubing connections to determine if they might be affecting the ability to achieve stable measurements. All measurements that were made during the attempt must be documented. The sampling team leader may decide whether or not to collect a sample or to continue purging in the event the well purges dry or after 2 hours of purging.

If the decision is to forego additional purging and collect a sample, the well will be allowed to recover to within 0.33 feet of the starting water level, or recover up to the maximum amount possible within 24 hours, before proceeding with sample collection. Sample collection shall be performed utilizing the same bladder pump, tubing and flow through cell utilized for initial purging. When samples are collected field parameters, purge rates, depth to water levels and purge volumes associated with sample collection shall be recorded at the beginning and end of sample collection.

4.4 Collect samples as soon as possible after purging is complete. The time period between completing the purge and sampling cannot exceed twenty-four (24) hours. If sample collection does not occur within one (1) hour of purging completion, re-measure the four (4) field parameters Temperature, pH, Specific Conductance, and Turbidity just prior to collecting the sample. If the measured values are not within 10 percent of the previous measurements, re-purge the well. The exception is “dry” wells (see section 4.3 above).

5. LANYARDS

5.1 Securely fasten lanyards, if used, to any downhole equipment (pumps, etc.).
5.2 Use lanyards in such a way that they do not touch the ground surface.

A.3 Purging Wells

1 PUMP PLACEMENT

- Do not lower the pump to the bottom of the well. Position the intake for the pump at the midpoint of the submerged screened interval.
- The same pump must be used for both purging and sampling,

2 NON-DEDICATED (PORTABLE) PUMPS

Bladder Pump

- Install new or dedicated bladder in pump, following pump manufacturer recommendations.
- Attach new, or dedicated tubing to the discharge side of the pump and the opposite end to the flow through cell.
- Lower pump to middle of submerged screened interval, and begin purging.
- Measure and record the depth to groundwater at 3 to 5 minute intervals.
- Adjust the purging rate so that it is equivalent to the well recovery rate to minimize drawdown.
- If the water table continues to drop during pumping, lower the pump at the approximate rate of drawdown so that the water is removed from the middle of the water column.
- Record the purging rate each time the rate changes.
- Measure and record the purge volume.
- Collect samples.
- Obtain and record final water level reading
- Remove pump and tubing from well being careful not to cross contaminate equipment. Remove dedicated bladder from pump and place bladder and dedicate tubing in plastic bag. Close top using twist ties or similar measure to prevent inadvertent opening and label bag with well number on adhesive label applied to bag. Use separate bags for each well.
- Measure and record the purge volume.

B. GROUNDWATER SAMPLING TECHNIQUES

1 EQUIPMENT CONSIDERATIONS

1.1 Collect the sample into the sample container from the sampling device. Do not use intermediate containers.

1.2 In order to avoid contaminating the sample or loss of analytes from the sample:

1.2.1 Handle the sampling equipment as little as possible.

1.2.2 Minimize the equipment that is exposed to the sample.

1.2.3 Minimize aeration of samples collected for VOC analysis.

1.2.3.1 Reduce flow rates to $\leq$ 100 mL/minute when collecting VOC samples.

1.3 Dedicated Sampling Equipment

1.3.1 Whenever possible, use dedicated equipment because it significantly reduces the chance of cross-contamination.

1.3.2 Suspend dedicated bailers above the water column if they are stored in the well.

B.1 Sampling Monitoring Wells

1. SAMPLING WITH PUMPS:
   - Teflon or Polyethylene bladder pumps. The delivery tubing must be Teflon, Polyethylene or PP.
   - Do not lower the pump to the bottom of the well.

1.1 Bladder Pump

1.1.1 Volatile Organics:

1.1.1.1 Collect samples from the discharge end of the delivery tubing (Remove the discharge end of the delivery tubing from the flow through cell if not already removed for collection of other samples).

1.1.1.2 Carefully allow the groundwater to drain into the sample vials. Avoid turbulence. Do not aerate the sample. The flow rate must be < 100 mL/minute.

1.1.1.3 Preserve (if required), label and complete field notes.

1.1.2 Inorganics

1.1.2.1 Collect samples from the discharge end of the delivery tubing (Remove the discharge end of the delivery tubing from the flow through cell if not already removed for collection of other samples).

1.1.2.2 Preserve (if required), label and complete field notes.

B.2. Filtering Groundwater Samples

1 FILTERING GROUNDWATER FOR METALS:

1.1 Where possible use low-flow sampling techniques to minimize turbidity.

1.2 Measure turbidity at the end of purging. Do not filter if the turbidity is less than 20 NTU.

1.3 Use the following field filtration protocols for samples for metals analysis if the turbidity is greater than 20 NTU:

1.3.1 Use a disposable, high capacity, 0.45-µm in-line filter.

1.3.2 Insert the filter on the end of the delivery tubing. Hold the filter upright with the inlet and outlet vertical. Before collecting the sample, pump water from the aquifer through the filter until all atmospheric oxygen has been removed.

1.4 Do not use the following equipment for filtering groundwater samples for metals:

1.4.1 Any pump and apparatus combination in which the filter is on the vacuum (suction) side of the pump.

1.4.2 Any type of syringe or barrel filtration apparatus.

1.4.3 Any filter that is not encased in a one-piece, molded unit.

Attachment 16C

Residential Well Water Level Monitoring Program and Mitigation of Impacts

RESIDENTIAL WELL WATER LEVEL MONITORING PROGRAM
AND MITIGATON OF IMPACTS
Chesapeake Terrace Rubble Landfill

I. INTRODUCTION

Results of the residential/potable well survey, summarized in the Phase II Application, identified four wells along Conway Road (residential wells 40, 43, 46 and 48) screened in the Unconfined WBZ. These would be considered down-gradient of the proposed landfill based on the groundwater contours for the Unconfined WBZ. None of the wells with known depths on Collins Avenue or Lucinda Lane are shown to be screened in the Unconfined WBZ, however three (3) wells along Collins Avenue (residential wells 58, 60 and 62) are of unknown depth. One well along 5th Ave (residential well 23) and two (2) wells along Patuxent Road at the north end of the Site (residential wells 13 and 14) are screened in the Unconfined WBZ, but are up-gradient or cross-gradient from the proposed landfill footprint. Only one residential well in the Unconfined WBZ is located downgradient of Area A. This well (residential well 27 on Table 2) is reported to be an unpermitted dug well. It is located approximately 1,000 feet downgradient of the proposed landfill footprint.

The purpose of residential well monitoring is to determine whether landfill operations have impacted off-site residential wells through drawdown. This protocol provides mitigation measures at the expense of the Landfill if impacts are determined.

II. PARTICIPATION AND DURATION

A. Private Domestic Wells

The selection of potential participants is based on the results of a computer model of landfill impacts on the perched water table elevation, that was performed as part of previous design configurations that proposed establishing the bottom of the Area B disposal cells in the MCU and dewatering the Unconfined WBZ in Area B. As presented in this version of the Phase III design, the Area B disposal cells will not extend to the MCU and dewatering of the Unconfined WBZ is not required or proposed. Despite the fact that the proposed design no longer penetrates the Unconfined MCU and dewatering is no longer required, NWM will be monitoring wells screened in the Unconfined WBZ for potential water level impacts because the area of infiltration for the Site will be reduced as a result of the impermeable liner system. The reduced area of infiltration means a reduced volume of infiltration reaching the Unconfined WBZ. This may result in a decrease in water levels in the Unconfined WBZ at nearby residential wells. We are proposing to monitor the same residential wells identified in the original computer model as potentially being impacted by a drop in the Unconfined WBZ.

Potentially impacted wells as indicated by the original computer model for Unconfined WBZ dewatering are shown on Figure 1 and are listed as follows:

Well Permit	Map No.	Address	Total Depth	Screen			Pumping		Level Before	Level During
				Top	Bot.	Dia	Hrs	GPM		
a	58	1245 COLLINS	-	-	-	-	-	-	-	-
a	60	254A COLLINS	-	-	-	-	-	-	-	-
a	62	1257 COLLINS	-	-	-	-	-	-	-	-
AA738073	48	2944 CONWAY	105	64	69	2	1	10	75	80
a	46	2946 CONWAY	90(b)	-	-	-	-	-	-	-
a	47	2948 CONWAY	315(b)	-	-	-	-	-	-	-
a	43	2973 CONWAY	c	-	-	-	-	-	-	-
AA811580	40	2987 CONWAY	72	60	72	4	3	18	40	51

a. No permit tag on well. b. Depth reported by resident.
c. Well depth of 30 feet reported by owner Albert Rollins in 1990; however, at hearing on 12/3/01 Mr. Rollins states his well is 335-feet deep.

Letters will be sent via certified mail to each of the homeowners soliciting their participation in the monitoring program. Proof of notification will be sent to the Department.

B. Monitoring Wells

Five (5) new Unconfined WBZ monitoring wells (PMWs-120 through 124) are proposed between the landfill and the potentially impacted shallow residential wells along Conway Road and Collins Avenue (screened in Unconfined WBZ).

Water levels in the Unconfined WBZ monitoring wells southwest of Area B disposal cells 5D and 10 will be measured monthly for at least a year before any landfilling takes place in this area of the Site (filling in cells 1 through 4 and 5E may be performed during the one year period of water level readings). Quarterly water level measurements will continue through the operating life for disposal cells 5A through 5D and cells 6 through 10. These data will be used to prepare Unconfined WBZ water table contour maps. NWM and the MDE will use these contour maps to evaluate whether landfill activities have impacted the Unconfined WBZ water table along Conway Road and Collins Avenue.

III. EQUIPMENT AND TRAINING

The NWM hydrogeologic consultant (currently AGC Montrose) will select the appropriate equipment to measure water levels based on the available technology at the time when monitoring begins (currently that would be a continuously recording submersible pressure transducer) for the residential wells. The NWM site manager will be provided with the appropriate software and training to download the data in the field and change out batteries.

Drinking water grade tubes will be installed in wells that have an unobstructed path for setting the transducer at a fixed point below the anticipated low level groundwater

surface, but away from the area from the area of turbulence created by the well pump. The monitoring system will be installed at the expense of the landfill and will not affect residential use.

IV. PROCEDURE

A. Baseline Water Level Measurements

It is important to determine baseline water level readings (static water levels) to determine drought water level conditions in each well. Therefore, with the approval of the homeowners, pressure transducers (or similar measurement and recording device) will be installed by AGC Montrose staff beginning at the start of Area A construction. Based on the currently anticipated landfill construction/filling sequence, this will provide at least 5 years of groundwater data before any cell construction begins in Area B. Willing homeowners will be contacted for participation. The measuring device will be programed to collect data at 6 hour increments to ensure that levels are collected during periods when the pump has been idled/inactive.

B. Residential Well Assessment

All wells in the monitoring plan will be surveyed for surface and well elevations. Each participating residential well will be inspected to determine specific well specifications, i.e., depth of well, casing depth and diameter, pump intake depth, and discharge rate (i.e., gallons per minute (gpm)), and a well completion tag number. Well completion reports will be obtained if available. If well completion reports are not available, then the wells will be inspected by a licensed well driller to provide the above information. After completion of the well assessment, a determination will be made as to the need to install drinking water grade tubes in the wells as explained in Section III above.

A report will be written and provided to each participating homeowner after completion of the well assessment. The well assessment will provide information to the homeowners regarding well specifications and possible ways to improve the production of the well. Those improvements to the wells will be at the expense of the owners of the landfill. Possible mitigation measures for well improvements are: lowering the pump; replacing the pump; redeveloping the well; or replacing the well.

C. Well Performance Test

The performance test includes pumping each participating residential well for one hour. The purpose of the pumping test will be to determine how the water level in the well responds to pumping, i.e., how long it takes to recover to static or near static. The pumping test will be run at each wells' specific maximum yield. The protocol for the pumping test will include the following:

1. Minimum usage from the homeowner one day prior to the pumping test, no usage overnight prior to the morning of the pumping test, and no usage during the pumping and recovery time. (It will be in the best interest of the owners to use the well as little as possible since this will maximize the baseline well capacity.)

2. Measure the static water level prior to the pumping test.

3. Fully open the outside spigot(s) and measure flow and water levels during the one-hour pumping test. Flow will be reduced if the water level reaches the pump intake.

4. Measure water levels during the recovery for a minimum of one hour or until water levels return to 90 percent of the original static water level.

The results of the pumping and recovery test will determine how long each well must stand idle before water level measurements can be considered representative of the static water level.

D. Long Term Water Level Readings

The pressure transducers will be set to record water levels at 6 hour increments this is expected to provide water levels during the middle of the night when no pumping has occurred for at least 4 hours. Residents will be contacted by landfill personnel regarding the best time(s) that data can be downloaded. These times will be coordinated with the residents' schedules to minimize as much as possible any inconvenience to the residents and account for inclement weather conditions.

E. Demonstration of Hydraulic Connection

Water levels in the Unconfined WBZ monitoring wells (existing and proposed) will be measured monthly for at least a year before any landfilling takes place in Area B. Quarterly water level measurements will continue through the operating life of disposal cells 5A through 5D and cells 6 through 10. These data will be used to prepare Unconfined WBZ water table contour maps. NWM and the MDE will use these contour maps to evaluate whether landfill activities have impacted the perched water table along Conway Road and Collins Avenue.

The potentially impacted domestic wells are located on the south side of the landfill (near cells 6 and 7) and landfill operations will begin on the north side; therefore, it will be at least five years before there is any landfill activity near the potentially impacted wells. This will allow the generation of several years of water level data in both the domestic wells and landfill perched-zone monitoring wells PMWs-120 through 124.

The water level data in the domestic wells and the landfill wells may also be compared to hydrograph data for nearby USGS and MGS observation wells. Deviation in water level trends may provide evidence of an impact from landfill activities on the Unconfined zone.

V. REPORTING AND CONCLUSIONS

The NWM manager will download data from the pressure transducers and maintain electronic and hard copies in the facility operating records. An electronc copy will be provided to the Landfill hydrogeologic representative (currently AGC Montrose). An electronic copy will be emailed to the Residential owners when requested by the homeowner.

Annual reports will be available upon request within two months at the end of a 12 month measurement period. A copy of the annual report will be submitted to MDE and provided

to the well owner. Requests for the annual report by other parties must be submitted in writing to the NWM site manager. A copy can also be obtained from MDE through FOIA (Freedom of Information Act). The annual report will include, but will not be limited to, a spreadsheet of water levels of all participants, graphs to show any trends, and a written summary of landfill affects.

VI. CONTINGENCY PLAN

If a residential well is shown to be impacted, the Landfill will assist the well owner. This section presents the criteria that will be used to determine whether the landfill has impacted the well, followed by a description of mitigation measures that will ensue.

A. Response Criteria

The landfill will provide relief for neighbors that meet the following criteria:

- A hydraulic connection between the residential well and the landfill has been demonstrated as described above in section IV(E).
- The well is not capable of meeting either daily or cycle demand previously determined for each well.
- The water level in the well is below the drought water level as determined during the baseline period.

B. Relief Measures

1. Immediate Response

a. Water Supplements

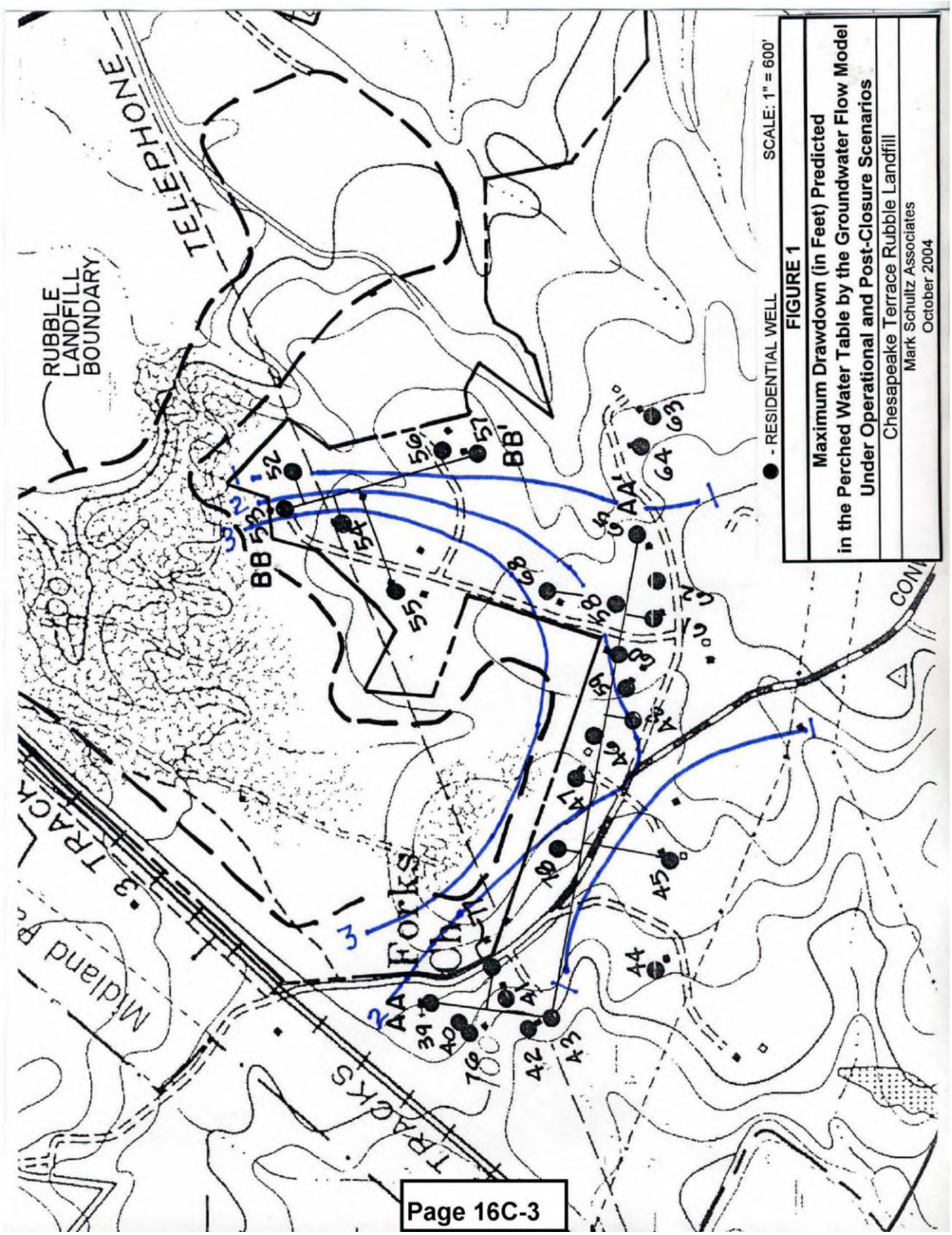
The landfill will contact a commercial provider within one hour of the determination stated above to request delivery of water from a water tank truck at a rate that equals or exceeds the affected well's baseline yield. The landfill will arrange and pay for the action. This water delivery will continue until the residential well(s) recover to their baseline yield(s), or until the mitigation measures listed below are implemented, whichever comes first.

2. Longer Term Response

The landfill will immediately begin to implement one of the mitigation measures described in section IV(B) above. As stated in that section, the appropriate mitigation measure(s) for each well in the program would have been previously selected from a list that includes but is not limited to the following list: installation of pressure tank(s) and modified pump; lowering the pump; redeveloping the well; and/or drilling a new well.

Attachment 16D

Maximum Observed Groundwater Elevations Map
(from Phase II Permit Application


TELEPHONE
RUBBLE LANDFILL BOUNDARY
BB'
AA'
TRACKS
Midland R
Forks
Creek
CONN
SCALE: 1" = 600'
- RESIDENTIAL WELL
FIGURE 1
Maximum Drawdown (in Feet) Predicted in the Perched Water Table by the Groundwater Flow Model Under Operational and Post-Closure Scenarios
Chesapeake Terrace Rubble Landfill
Mark Schultz Associates
October 2004

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LIMIT OF WASTE AT LANDFILL PERIMETER BERM (FUTURE)

LIMIT OF CONSTRUCTION (FUTURE)

CONRAIL\AMTRAK

PMW-12 CONFINED WBZ

MW-16 UNCONFINED WBZ HIGH WL 104.51

MW-19 UNCONFINED WBZ HIGH WL 113.99

PMW-11 CONFINED WBZ

MW-18 UNCONFINED WBZ HIGH WL 116.28

MW-17 UNCONFINED WBZ HIGH WL 117.74

MW-28 TRANSITION ZONE WELL

MW-10 TRANSITION ZONE WELL

PMW-19 TRANSITION ZONE WELL

CELL 5A

CELL 5B

CELL 5C

CELL 5D

CELL 5E

CELL 5

CELL 4

CELL 3

CELL 2

CELL 1

CELL 6

CELL 7

CELL 8

CELL 9

CELL 10

CELL 11

CELL 12

CELL 13

CELL 14

CELL 15

CELL 16

MW-26 MIDDLE CONFINING UNIT

MW-27 UNCONFINED WBZ HIGH WL 109.52

MW-23* MIDDLE CONFINING UNIT

MW-24 UNCONFINED WBZ HIGH WL 109.99

MW-20 UNCONFINED WBZ HIGH WL 108.46

MW-21 UNCONFINED WBZ HIGH WL 100.38

MW-22 UNCONFINED WBZ HIGH WL 101.80

MW-9* MIDDLE CONFINING UNIT HIGH WL 99.21

MW-14 TRANSITION ZONE WELL

MW-1 UNCONFINED WBZ HIGH WL 72.56

EXISTING SITE ENTRANCE

PMW-18 TRANSITION ZONE WELL

MW-11* TRANSITION ZONE WELL

MW-29 UNCONFINED WBZ HIGH WL 96.76

MW-6 UNCONFINED WBZ HIGH WL 75.43

MW-25 UNCONFINED WBZ HIGH WL 80.92

MW-31* MIDDLE CONFINING UNIT

MW-30 UNCONFINED WBZ HIGH WL 107.66

PMW-13 CONFINED WBZ

MW-15 UNCONFINED WBZ HIGH WL 90.87

PMW-23 CONFINED WBZ

MW-12* UNCONFINED WBZ HIGH WL 80.66

PROPERTY LINE

PMW-6 UNCONFINED WBZ HIGH WL 63.41

PMW-28 UNCONFINED WBZ HIGH WL 78.28

LIMIT OF WASTE AT LANDFILL PERIMETER BERM (FUTURE)

100-YEAR FLOOD PLAIN

TYPICAL CELL SEPARATION BERM (FUTURE)

MW-13* UNCONFINED WBZ HIGH WL 80.15

MW-4 UNCONFINED WBZ HIGH WL 71.42

MW-3* UNCONFINED WBZ HIGH WL 70.12

MW-5 UNCONFINED WBZ HIGH WL 75.98

CONWAY ROAD

COLLINS AVENUE

PATUXENT ROAD

NORTH

GRAPHIC SCALE

200 0 100 200 400 800

(IN FEET)
1 inch =200 ft.

LEGEND

- HYDROGEOLOGIC AREA DIVIDE
- A — HYDROGEOLOGIC AREA
- PROPERTY LINE
- LANDFILL LIMITS (FUTURE)
- LANDFILL CELL SEPARATION BERM (FUTURE)
- LIMIT OF DISTURBANCE (FUTURE)
- 100-YEAR FLOOD PLAIN (AFTER 2012) (SEE REFERENCE 2) (SEE NOTE 4)
- UNCONFINED WATER BEARING ZONE DISCHARGE TO GROUND SURFACE/SURFACE WATER
- WBZ — WATER BEARING ZONE
- HIGH WL — HIGHEST OBSERVED WATER LEVEL (SEE TABLE 4)
- AREA OF EXPOSED CLAY OF MIDDLE CONFINING UNIT AT GROUND SURFACE
- JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE NOTE 5)
- HIGHEST OBSERVED/PREDICTED GROUNDWATER CONTOUR
- MONITORING WELL (MONITORING WELLS MARKED WITH AN * ARE LOST, DAMAGED OR MCU WELL NOT SUBJECT TO MONITORING
- HISTORICAL BOREHOLES
- BORING LOCATIONS TO REFINE AREA A–B TRANSITION (B–101 TO B–105) COMPLETED APRIL/MAY 2013
- ADDITIONAL BORINGS LOCATIONS REQUESTED BY MDE (B–106 AND B–107) COMPLETED APRIL/MAY 2013

REVISION:

DATE:	REVISION:
4/30/2020	REVISED TO ADDRESS MDE COMMENTS (PGS/VEF)
6/5/2020	EDITORIAL REVISIONS/NEW LANDFILL BOTTOM (PGS/VEF)
9/3/2021	REVISED TO ADDRESS MDE COMMENTS (PGS)

STATE OF MARYLAND — DAVID STRAWMAN — 21661 — PROFESSIONAL ENGINEER

NATIONAL WASTE MANAGERS
PHASE II PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1525 ARMORY DRIVE, SUITE A, WEST CHESTER, PA. 19382
tel 610.430.8000 fax 610.430.8010 www.AdvancedGeoServices.com

HIGHEST OBSERVED/PREDICTED GROUNDWATER CONDITION– UNCONFINED ZONE

REPORT CODE: A		FILE NAME: 20183854A012	
PROJECT MANAGER:	VEF	SCALE:	AS NOTED
CHECKED BY:	VEF	PROJECT NUMBER:	2018–3854
DRAWN BY:	EEE	DATE:	7/31/2019

FIGURE 12

N:\Projects\2018\2018538\54 - Chesapeake Terrace\1\ACAD\MXD\BC_A Phase II Application\2018538A012 - Highest Unconfined WL\H2O-1-21.dwg

PHASE III PERMIT APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
ANNE ARUNDEL COUNTY, MARYLAND

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STORMWATER MANAGEMENT

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17.0 SURFACE WATER MANAGEMENT SYSTEM

As part of the design of the landfill and associated improvements, stormwater management features were designed. These features included perimeter channels, terraces and downchutes, roadside channels, roadway crossing culverts, and four (4) stormwater management detention basins and a water quality basin along the East Entrance Road. This design confirmed that the peak stormwater runoff rates from the proposed improvements during the 25-year and 100-year, 24-hour storm events will be less than the existing conditions of the site for the same storm events.

This narrative presents the supporting technical rationale behind the design of the new features.

17.1 Design Criteria for Surface Water Management System

The primary objective of the surface water management system is to convey rainwater off the landfill cap surface quickly and effectively. Since the surface water management features are to perform in support of a landfill, the modeled design storms selected as the 25-year, 24-hour storm event, which has a corresponding rainfall depth of 5.9 inches for this County, while giving consideration to the 100-year, 24-hour storm event, based on the NOAA (National Oceanic and Atmospheric Administration) Atlas 14 rainfall value of 8.5 inches.

Water quality impacts from the proposed improvements were provided in accordance with the 2000 Maryland Stormwater Design Manual Unified Stormwater Sizing Criteria (revised May 2009).

17.2 Existing Conditions

17.2.1 Climate

The mean annual precipitation for this area is approximately 45 inches, while the mean annual evaporation from lakes and shallow reservoirs is approximately 37 inches (Viessman et al., 1989). Gabler, et al. (1987), describe this climate as “humid subtropical” in the Köppen classification, with a growing season of approximately 170 days.

17.2.2 Soils

The Site’s historical use for mining classifies the Site soil profile as “manmade.” The Soil Conservation Service categorizes soils hydrologically into four types (A through D, from permeable to impermeable) based upon the soil’s ability to drain. Based on site-specific information, a hydrologic soil type of “C” was assumed for the existing capped conditions.

17.2.3 Land Use

The existing land use of the project area is undeveloped with a significant portion of the area wooded. (The site has been subject to surface mining operations in the past that have created irregular grading of the site.) The site generally slopes from west to east towards wetland areas along Patuxent Road, and drains to the Little Patuxent River.

17.3 Stormwater Management

In order to design new features at the site for the landfill use, the surface water runoff flow rates were determined for each surface water feature using methods described in Urban Hydrology for Small Watersheds, identified as Technical Release 55 (or TR-55), developed by the Soil Conservation Service (June 1986). This runoff rate was used to back-calculate the required geometric configuration for the new features.

The Program HydroCAD Version 8.50 was utilized to perform the stormwater analysis of the site to document compliance with the peak runoff rate requirements for each feature.

The following sections define the methods and input parameters used to evaluate the performance of the surface water management system and resulting design of the proposed repairs.

Runoff rates calculated from TR-55 were utilized to design the proposed stormwater management basins for the project. Basin routing calculations for the basins were performed to show compliance with the peak rate requirements during the 25-year and 100-year storm events.

17.3.1 Stormwater Management – Input Parameters

The input parameters for the TR-55 calculations consist of the following:

- Watershed delineation
- Watershed areas
- Curve numbers
- Times of concentration
- Storm type
- Design storm event

These input parameters are described in the following paragraphs.

Watershed Delineation
Watersheds for each drainage feature were delineated using the Site topographic maps at a contour interval of 2 feet. Off-site portions of the watersheds were delineated from 2011 topographic survey data downloaded from the County's website. The outlet points for each watershed were typically selected as the points of discharge from the five basins (Point of Study).

Watershed Areas
After performing the watershed delineation, the drainage area to each basin was determined within AutoCAD.

Curve Numbers
The curve number (CN), which assists in the estimation of the runoff, was evaluated using the projected future land uses in combination with the soil descriptions and hydrologic classifications. The CN values were obtained from the CN tables presented in the manual for TR-55. The curve numbers were calculated by overlaying the watershed areas over the soils data and aerial photography of the area. Existing conditions cover type for the site consisted of

Woods in good condition. Offsite existing conditions consisted of Woods in good condition, and a composite curve number value based upon the zoning. The two zoning areas were RA and R-2. For the proposed conditions, the onsite areas consisted of impervious areas, woods, good condition for undisturbed areas, Open Space, Good for disturbed areas to be maintained as grass, and the Closure Cap areas. Offsite areas curve numbers matched the existing conditions. The Cap was assumed to be a D soil type. All disturbed areas were reduced one hydrologic soil group in the proposed condition.

Time of Concentration

The time of concentration for each watershed was determined by evaluating the time that is required for water to travel from the hydrologically most distant point in the watershed to the discharge point. After selecting this point, the time of concentration was estimated by summing the travel times for sheet flow, shallow concentrated flow, channel flow, and pipe flow, where applicable. The calculations for these travel times were performed using methods outlined in the manual for TR-55. All of these computations involve the surface roughness, the length and the slope of the path selected. Sheet flow length was calculated for a maximum length of 100 feet. Shallow concentrated flow and trapezoidal channel flow were the other types of flow modeled in the time of concentration calculations.

Storm Type

The intensity and pattern of a storm varies, depending upon the Site's location relative to geographic features, such as mountains, large waterbodies, etc. TR-55 defines four storm types (I, II, IIA, and III) and maps the geographic regions where each type occurs. The storm type for this county is Type II, which represents the most intense short duration rainfall storm type of the four available.

Design Storm Event

Design storm events can last from 1 minute to 24 hours with a recurrence interval of 1 year to 500 years. EPA CFR Title 40 § 264.301 and §258.26 requires that surface water is managed based upon a 25-year, 24-hour storm event. Although not required for the Site, the 100-year, 24-hour storm event based upon NOAA Atlas 14 rainfall data was also modeled for conservatism. The NOAA Atlas 14 100-year 24-hour storm of 8.5 inches of rain for Anne Arundel County was selected over MDE's Unified Stormwater Sizing Criteria value of 7.4 inches for a 100 year 24-hour storm event, providing a larger volume for modeling.

A formal discussion as well as copies of the references are included in Attachment 17A.

17.4 Stormwater Management – Analysis Results

After developing the input parameters described above, the storm water analyses were performed for existing and proposed conditions. First, the watershed area, curve number, time of concentration, and storm type for existing conditions were input into the program HydroCAD 8.50. The output from this program is a runoff hydrograph based upon the TR-55 methodology for each watershed that provides the peak stormwater runoff rates for each watershed and corresponding drainage feature

17.4.1 Existing Conditions

The existing peak runoff rate to each point of study was utilized to provide the maximum runoff rate allowed to discharge from the proposed condition discharge points for ready comparison.

The formal calculation and supporting HydroCAD model for the existing conditions are provided in Attachment 17B.

Discharge Point	25 year, 24 hour Peak Flow (cfs)	100 year, 24 hour Peak Flow (cfs)
1	178.07	358.75
2	58.42	109.65
3	105.36	244.80
4	124.88	259.87
Subtotal	466.73	973.07
Conrail	22.09	48.87
East Entrance (incl WQv area)	389.64	739.58
TOTAL	**810.82**	**1,629.55**

17.4.2 Basin Routing

The watershed area, curve number, time of concentration, and storm type for the proposed conditions to each point of study were input into the program HydroCAD 8.50. Stage-Storage-Discharge calculations for the five (5) proposed basins (one (1) water quality basin and four (4) detention basins) were entered into the program, and a dynamic routing of each basin performed. The discharge from each basin along with the unmanaged area within each point of study were added together within the program and compared to the existing conditions peak rate to ensure the proposed conditions peak rate is less than the existing conditions peak rate for both design storms so as to not negatively impact the downstream hydrologic system.

Feature	Basin No. 1	Basin No. 2	Basin No. 3	Basin No. 4	WQv
Bottom of Basin (ft MSL)	79.0	72.0	72.0	76.5	88.0
Top of Wet Storage (ft MSL)	81.0	74.0	74.0	78.5	N/A
Invert of low flow Orifice (ft MSL)	81.0	74.0	74.0	78.5	88.0
Size of low flow Orifice (inches)	9	8	6	6	3
Elevation of Riser (ft MSL)	84.5	77.0	77.0	83.6	89.5
Dimensions of Riser (ft x ft)	3 x 6.5	3 x 6.5	3 x 6.5	7 x 10	4 x 4
Shape of Riser	rectangle	rectangle	rectangle	rectangle	rectangle
Invert of Emergency Spillway (ft MSL)	90.0	78.0	78.5	88.15	90.8
Width of Emergency Spillway (ft)	250	45	100	90	20
25-year, 24-hour storm event routing					
Peak Qin (cfs)	386.46	49.6	195.44	186.05	19.12
Peak Qout (cfs)	140.81	3.75	54.16	95.11	15.6
Max Water Surface Elev (ft MSL)	86.60	77.06	77.89	84.49	90.11
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	No	No	No	No	No
% Reduction	64	92	72	49	18
Total Qout = 309.43 cfs					

Feature	Basin No. 1	Basin No. 2	Basin No. 3	Basin No. 4	WQv
100-year, 24-hour storm event routing					
Peak Qin (cfs)	672.36	110.04	314.99	399.01	32.48
Peak Qout (cfs)	255.13	58.51	193.46	184.84	26.48
Max Water Surface Elev (ft MSL)	90.22	77.93	79.10	88.13	91.10
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	Yes	No	Yes	No	Yes
% Reduction	62	47	59	54	18
Total Qout = 718.42 cfs					

The analysis is presented in Attachment 17C.

17.4.3 Channel Design

The peak runoff rate to each channel was calculated with the TR-55 methodology described above. The runoff rates were then used to determine the drainage channel configuration, using Manning's Equation for open channel flow, where:

$$Q = \frac{1.49}{n} S^{1/2} R_h^{2/3} A$$

such that:

Q	=	runoff rate (cfs)
n	=	Manning's roughness coefficient
S	=	channel longitudinal slope (ft/ft)
R_h	=	hydraulic radius (ft) = A/P
A	=	area of flow
P	=	wetted perimeter

17.4.3.1 Channel and Culvert - Input Parameters

The input parameters for the TR-55 calculations and Manning's equation consist of the following:

- Manning's roughness coefficient
- Channel slope
- Channel geometry

These input parameters are described in the following sections.

Manning's Roughness Coefficient

In order to design the channels, which convey runoff from the Landfill, the Manning's roughness coefficient was required. This coefficient is related to the resistance provided by the type and condition of the channel lining. For example, a concrete lined channel has a lower roughness coefficient than a grass lined channel. This coefficient inversely impacts the flow capacity of the channel.

Channel Slope
The channel slope directly impacts the channel capacity and velocity. As a result, it is required input information. The channel slope is determined by dividing the elevation difference by the channel length. A channel slope must be selected to ensure positive drainage, and to assess the channel cross-section and channel velocity.

Channel Geometry
The channel geometry directly impacts the channel capacity. Therefore, the channel shape and dimensions are input. Several channel configurations were evaluated to select the most efficient channel geometry.

17.4.3.2 Channel –Analyses Results

After developing all of the input parameters described above, the storm water analyses were performed. First, the peak rates of discharge were calculated as described above for the 25-year and 100-year storm events. The runoff rates were developed using HydroCAD, V 8.5 and are presented in Attachment 17D.

The minimum channel design flow depth required to convey the peak runoff rate was back-calculated using Manning's equation for open channel flow incorporating the channel slope, the channel lining (i.e., Manning's roughness coefficient), and various geometric configurations. The channel depth was calculated by adding the design flow depth to an appropriate freeboard (0.5 feet), and then rounding this sum to the nearest tenth-foot. Freeboard is the unused capacity in the channel under the defined flow rate. This avoids channels flowing bank full during storms. Bank full channels can be overtopped, are blown by wind, and can over-saturate underlying soils. The proposed configuration of the channels is a trapezoidal channel lined with articulated concrete block.

Four types of channels will be used: terraces, downchutes, access road channels, and perimeter channels. The terraces will convey stormwater runoff horizontally from the landfill slope faces to downchutes. The downchutes will convey the water down the exterior slopes of the landfill cells to the perimeter channel, which will convey the water to the basins. The access road channels is located along the inside edge of the final cover access road and typically discharges into a downchute, at locations where the access road crosses the downchute.

A summary of the resulting channel sizes are below:

Channel ID	Channel Dimensions			25-year, 24-hour storm event		100-year, 24-hour storm event	
	Base Width	Depth	Side Slope	Qout (cfs)	V (fps)*	Qout (cfs)	V (fps)*
DOWNCHUTES							
DC- 1	15.3	1.0	2H:1V	60.95	12.1	94.79	14.4
DC- 2	13.8	1.0	2H:1V	54.36	12.0	85.88	14.3
DC- 3	17.9	1.0	2H:1V	70.96	12.1	113.02	14.4
DC- 4	13.8	1.0	2H:1V	49.88	11.6	80.10	13.9
DC- 5	13.8	1.0	2H:1V	51.59	11.8	82.86	14.1
DC- 6	17.9	1.0	2H:1V	68.55	11.9	107.42	14.2
DC- 7	17.9	1.0	2H:1V	65.04	11.9	103.58	14.0
DC- 8	17.9	1.0	2H:1V	59.62	11.4	100.17	13.8
DC- 9	12.4	1.0	2H:1V	47.30	11.8	74.71	14.0
DC- 10	16.5	1.0	2H:1V	58.89	11.6	93.03	14.0
DC- 20	11.0	1.0	2H:1V	35.77	11.0	57.44	13.3
DC- 21	15.1	1.0	2H:1V	53.31	11.6	85.62	13.9
DC- 22	9.6	1.0	2H:1V	29.30	10.7	47.05	12.8
DC- 23	11	1.0	2H:1V	42.90	11.9	68.89	13.9
PERIMETER CHANNELS							
PC- 1	9.6	2.5	2H:1V	64.62	5.7	158.72	6.6
PC-2	4.1	2.0	2H:1V	31.83	5.7	57.96	6.6
PC-3A	4.1	2.0	2H:1V	15.97	6.4	24.83	7.6
PC- 3B	9.6	2.0	2H:1V	80.84	7.7	128.22	4.7
PC- 3C	13.8	2.6	2H:1V	140.25	8.2	228.15	9.0
PC- 3D	15.1	2.6	2H:1V	197.64	7.0	319.29	9.7
PC- 3E	15.1	3.2	2H:1V	282.93	9.1	455.14	10.6
PC- 4A	4.1	2.0	2H:1V	40.72	6.1	63.32	6.9
PC- 4B	13.8	2.0	2H:1V	109.16	7.2	170.64	8.4
PC- 4C	13.8	2.5	2H:1V	160.59	7.7	253.31	8.9
PC- 4D	15.1	2.8	2H:1V	210.30	8.8	333.21	10.2
PC- 4E	15.1	3.3	2H:1V	281.05	9.1	445.99	10.5
PC- 4F	15.1	3.5	2H:1V	347.91	9.7	552.08	11.2
PC- 5	9.6	2.2	2H:1V	81.01	8.9	126.24	10.3
PC- 6	8.3	2.0	2H:1V	24.00	7.4	65.73	10.5
PC- 7	2.8	2.0	2H:1V	17.34	8.9	26.77	10.1
PC- 8A	2.8	2.0	2H:1V	36.51	7.2	57.29	8.1
PC- 8B	8.3	2.0	2H:1V	113.80	8.4	180.49	9.3
PC- 8C	17.9	2.2	2H:1V	279.88	8.1	444.63	9.4
PC- 9A	8.3	2.6	2H:1V	48.18	5.4	76.42	6.2
PC- 9B	9.6	2.6	2H:1V	91.08	6.4	145.31	7.4
PC- 9C	13.8	2.6	2H:1V	122.84	4.6	195.09	5.3
PC- 10	9.6	2.0	2H:1V	68.46	8.4	164.87	11.2

This analysis is presented in Attachment 17F.

The final terrace design is: Triangular channel,
4H:1V on one side; 10H:1V on the other
1 foot deep.
Grassed lined.

The final cover access road channel will be the following configuration:

Trapezoidal channel,
4H:1V on one side; 2H:1V on the other
3 foot base width
1 foot deep.
Grassed lined.

17.4.4 Culvert - Analyses Results

The runoff rates developed from TR-55, ran through HydroCAD, were used to size the culverts within the channels using the nomographs provided by smooth-walled HDPE drainage pipe manufacturers. The culverts are to be used at the road crossings of downchutes and perimeter channels. In the perimeter channels culverts will be covered and used as a driveway to access the leachate pump buildings.

Culvert ID	Inflow Channel	25-year, 24-hour Q (cfs)	100-year, 24-hour Q (cfs)	Culvert Dimensions		
				Culvert Dia	# Culverts	Material
1	PC-5	418.56	673.39	60 inches	2	HDPE
2	PC-4F	347.91	552.08	30-inches	4	HDPE
3	PC-10	68.46	164.87	48-inches	1	HDPE
4	PC-8C	279.9	444.63	54-inches	2	HDPE
5	PC-2	31.8	57.96	24-inches	2	HDPE
6	PC-1	44.0	101.3	30-inch	2	HDPE
7	PC-6	24.0	65.73	30-inch	1	HDPE
8	Off-site flow to Basin 4	186.05	399.01	48-inches	1	HDPE
AR-1	DC-2	67	106	24-inches	3	HDPE
AR-2	1/2 DC-1	30	47	18-inches	2	HDPE
AR-4 3	PC-8A	36.5	57.3	24-inches	2	HDPE

Note: Modification of the landfill slopes from 33% to 25% reduced the number of top of cap access culverts. Therefore, there are now only 3 AR Culverts (2 on the West Area and 1 on the East Area).

This analysis is presented in Attachment 17F.

17.4.5 Water Quality

The methodology described within Chapter 2 – Unified Stormwater Sizing Criteria from the 2000 Maryland Stormwater Design Manual (Manual, revised May 2009) was utilized to calculate the required and provided water quality for the project. The purpose of the unified sizing criteria are to “meet pollutant removal goals, maintain groundwater recharge, reduce channel erosion,

prevent overbank flooding, and pass extreme floods." These requirements are met by designing stormwater management features that meet the Water Quality Volume, Recharge Volume, and Channel Protection Storage Volume.

17.4.5.1 Water Quality Volume

The Water Quality Volume (WQv) is based upon the following equation:

WQV = [(P)(Rv)(A)] /12, where

P= rainfall depth in inches and is equal to 1.0 inches
Rv=volumetric runoff coefficient = 0.05 + 0.009(I)
A=area in acres
I=percent impervious cover

In addition, a minimum WQv of 0.2 inches per acre shall be met at sites or in drainage areas that have less than 15% impervious cover. The WQv is required to be controlled only for the specific project and not for off-site areas.

17.4.5.2 Recharge Volume

The recharge volume is a fraction of the WQv and is dependent on the pre-evelopment soil hydrologic group. It is based upon the following equation:

Rev=[(S)(Rv)(A)]/12, where

S=soil specific recharge factor in inches (0.38, 0.26, 0.13, or 0.07 for A, B, C, or D soils, respectively)
Rv=volumetric runoff coefficient = 0.05 + 0.009(I)
A=area in acres
I=percent impervious cover

Per the Manual "(t)he recharge volume is considered part of the total WQv that must be provided at a site and can be achieved either by a structural practice (e.g., infiltration, bioretention), a nonstructural practice (e.g., buffers, disconnection of rooftops), or a combination of both."

We have designed structural practices (detention basins) with dead storage to meet both the recharge volume and water quality volume requirements

This analysis is presented in Attachment 17G

17.5 Soil Loss

As part of this design effort, the existing conditions were evaluated for potential soil loss. The method of evaluation is the Universal Soil Loss Equation (USLE):

A = RK(LS)CP (tons/acre/year), where

A = Annual soil loss (tons/acre/year)
R = rainfall and runoff erosivity factor
K = soil erodibility
LS = slope length and steepness factor
C = cover-management factor
P = practice factor

per the USEPA guidance document titled "Evaluating Cover Systems for Solid and Hazardous Waste," 1982.

Based upon the soil erosion potential of the modeled conditions, the USLE calculations indicate that, with the existing Site topography and soil types, the potential for soil erosion can be reduced by maintaining a good stand of vegetation (i.e. >75% cover) on the existing clayey cover soils. The potential soil losses for the modeled, well vegetated existing conditions was approximately 1.86 tons/acre/year for the maximum inclination location (see Attachment 17G). This is consistent with the USEPA recommended guidance value of less than 2 tons/acre/year (USEPA, 1982).

17.6 Conclusion

The post-construction peak discharge rates for the 25-year and 100-year storm events is less than peak discharge rates under existing conditions.

Condition	**25-year, 24-hour storm event Qout (cfs)**	**100-year, 24-hour storm event Qout (cfs)**
Existing (prior to landfill construction)	466.73	973.07
Proposed (after closure)	309.43	718.42
Proposed < Existing??	Yes	Yes
% Reduction	34	26

ATTACHMENT 17A

Design Storm Selection

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Design Storm Rainfall Depth		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-04-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 2

Reviewed by PGS 08/27/2021

Objective: To determine the rainfall depth associated with the design storms.

Design Approach and Assumptions:

One of the requirements of COMAR 26.04.07 and 40 CFR 257 is the management of surface water run-on from upgradient sources and the management of stormwater runoff from landfills. 40 CFR 257 and 258 list requirements for coal-combustion residual and municipal solid waste facilities. 40 CFR 258.26 (a) specifically requires

> "(1) A run-on control system to prevent flow onto the active portion of the landfill during the peak discharge from a 25-year storm;
> (2) A run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm."

As this is a Rubble Waste facility, these federal requirements are not applicable. However, they are relevant and appropriate. Thus, surface water/stormwater runoff controls at the Chesapeake Terrace Rubble Landfill were designed for the 25-year, 24 hour storm event.

In light of the increased intensity of rainfall events and record rainfall in 2018, for due diligence, the stormwater management features will also be evaluated for the 100, year 24-hour storm event

Review of the available literature to determine the rainfall associated with each storm event:

Source	25-year, 24 hour storm event Rainfall (inches)	100 Year, 24-hour storm event Rainfall (inches)
Anne Arundel County Design Manual (inches)	5.9	7.4
MD Stormwater Manual 2009	N/A	6.2
NOAA Atlas 14	6.2	8.5

Conclusions:

Use the rainfall depths shaded in blue for the design storms.

e. Time of Concentration

The methods described in the latest version of TR-55 shall be used to compute time of concentration in each sub-area. The maximum length of overland flow shall be 200 feet.

f. Reach Routing

Reach routing shall be computed in accordance with procedures found in the latest TR-20 manual. Rating curves for representative cross-sections shall be derived using Manning's Equation for normal depth, or backwater computations from HEC-2.

g. Structure Routing

The TR-20 storage-indication routing shall be used for structure routing. Provide a schematic diagram for the TR-20 run. A sketch of the device's controls shall be included in the design computations with performance curves plotted.

h. Rainfall

The following rainfall depths shall be used in hydrologic computations:

Frequency	24 Hour - Type II Storm Rainfall
1 year	2.7"
2 year	3.3"
5 year	4.3"
10 year	5.2"
25 year	5.9"
50 year	6.5"
100 year	7.4"

Free Board Hydrograph Storm (NRCS National Engineering Handbook)

Antecedent Moisture Condition (AMC) II and the NRCS Type II Rainfall Distribution shall be used for all design analysis.

D. Construction Drawings

1. Stormwater Management Plans

a. Review Submittals

The owner shall make the following submittals to PACE for review:

Chapter

2.0

Unified Stormwater Sizing Criteria

Table 2.2 Rainfall Depths Associated with the 1,2,10 and 100-year, 24-hour Storm Events

County	Rainfall Depth			
	1 yr - 24 hr	2 yr-24 hr	10 yr-24 hr	100 yr-24 hr
Allegany	2.4 inches	2.9 inches	4.5 inches	6.2 inches
Anne Arundel	2.7	3.3	5.2	7.4
Baltimore	2.6	3.2	5.1	7.1
Calvert	2.8	3.4	5.3	7.6
Caroline	2.8	3.4	5.3	7.6
Carroll	2.5	3.1	5.0	7.1
Cecil	2.7	3.3	5.1	7.3
Charles	2.7	3.3	5.3	7.5
Dorchester	2.8	3.4	5.4	7.8
Frederick	2.5	3.1	5.0	7.0
Garrett	2.4	2.8	4.3	5.9
Harford	2.6	3.2	5.1	7.2
Howard	2.6	3.2	5.1	7.2
Kent	2.7	3.3	5.2	7.4
Montgomery	2.6	3.2	5.1	7.2
Prince George's	2.7	3.3	5.3	7.4
Queen Anne's	2.7	3.3	5.3	7.5
St. Mary's	2.8	3.4	5.4	7.7
Somerset	2.9	3.5	5.6	8.1
Talbot	2.8	3.4	5.3	7.6
Washington	2.5	3.0	4.8	6.7
Wicomico	2.9	3.5	5.6	7.9
Worcester	3.0	3.6	5.6	8.1

NOAA Atlas 14, Volume 2, Version 3
Location name: Odenton, Maryland, USA*
Latitude: 39.0389°, Longitude: -76.7264°
Elevation: 65.6 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.347 (0.315-0.382)	0.415 (0.377-0.457)	0.494 (0.447-0.545)	0.552 (0.499-0.608)	0.624 (0.560-0.688)	0.677 (0.605-0.748)	0.730 (0.649-0.808)	0.780 (0.689-0.867)	0.843 (0.737-0.944)	0.892 (0.773-1.00)
10-min	0.555 (0.503-0.611)	0.664 (0.602-0.731)	0.791 (0.717-0.872)	0.882 (0.797-0.972)	0.994 (0.892-1.10)	1.08 (0.964-1.19)	1.16 (1.03-1.28)	1.24 (1.09-1.38)	1.33 (1.17-1.49)	1.40 (1.22-1.58)
15-min	0.693 (0.629-0.763)	0.835 (0.757-0.919)	1.00 (0.906-1.10)	1.12 (1.01-1.23)	1.26 (1.13-1.39)	1.37 (1.22-1.51)	1.47 (1.30-1.62)	1.56 (1.38-1.74)	1.68 (1.47-1.88)	1.76 (1.53-1.99)
30-min	0.950 (0.862-1.05)	1.15 (1.05-1.27)	1.42 (1.29-1.57)	1.62 (1.46-1.78)	1.87 (1.68-2.06)	2.06 (1.84-2.27)	2.25 (2.00-2.49)	2.43 (2.15-2.70)	2.67 (2.33-2.99)	2.85 (2.48-3.21)
60-min	1.19 (1.08-1.31)	1.45 (1.31-1.59)	1.82 (1.65-2.01)	2.11 (1.90-2.32)	2.49 (2.23-2.74)	2.79 (2.49-3.08)	3.09 (2.75-3.42)	3.41 (3.01-3.79)	3.83 (3.35-4.29)	4.17 (3.61-4.69)
2-hr	1.40 (1.27-1.55)	1.71 (1.55-1.88)	2.16 (1.96-2.38)	2.51 (2.27-2.77)	3.01 (2.71-3.31)	3.41 (3.05-3.75)	3.83 (3.40-4.22)	4.26 (3.76-4.72)	4.89 (4.25-5.45)	5.38 (4.64-6.05)
3-hr	1.52 (1.38-1.67)	1.84 (1.67-2.04)	2.34 (2.12-2.58)	2.73 (2.46-3.01)	3.28 (2.94-3.62)	3.74 (3.33-4.13)	4.22 (3.73-4.67)	4.74 (4.14-5.26)	5.47 (4.72-6.11)	6.07 (5.17-6.83)
6-hr	1.87 (1.71-2.07)	2.27 (2.06-2.51)	2.87 (2.60-3.17)	3.36 (3.03-3.71)	4.08 (3.65-4.51)	4.70 (4.17-5.19)	5.37 (4.71-5.95)	6.09 (5.29-6.78)	7.16 (6.11-8.04)	8.06 (6.78-9.11)
12-hr	2.28 (2.05-2.56)	2.75 (2.48-3.09)	3.50 (3.14-3.93)	4.14 (3.70-4.64)	5.12 (4.52-5.74)	5.98 (5.23-6.71)	6.94 (5.98-7.80)	8.01 (6.81-9.04)	9.64 (8.01-11.0)	11.1 (9.02-12.6)
24-hr	2.65 (2.41-2.93)	3.20 (2.92-3.55)	4.12 (3.75-4.56)	4.92 (4.46-5.44)	6.16 (5.53-6.77)	7.26 (6.47-7.95)	8.50 (7.50-9.28)	9.92 (8.65-10.8)	12.1 (10.4-13.1)	14.0 (11.8-15.1)
2-day	3.07 (2.79-3.39)	3.71 (3.38-4.10)	4.76 (4.33-5.26)	5.67 (5.13-6.25)	7.03 (6.32-7.72)	8.22 (7.34-9.01)	9.54 (8.45-10.4)	11.0 (9.66-12.1)	13.3 (11.4-14.5)	15.2 (12.9-16.6)
3-day	3.23 (2.94-3.56)	3.91 (3.57-4.31)	5.01 (4.56-5.52)	5.95 (5.40-6.55)	7.37 (6.65-8.08)	8.61 (7.71-9.42)	9.98 (8.87-10.9)	11.5 (10.1-12.6)	13.8 (12.0-15.1)	15.8 (13.6-17.3)
4-day	3.39 (3.10-3.74)	4.10 (3.76-4.53)	5.25 (4.80-5.78)	6.24 (5.68-6.85)	7.71 (6.97-8.45)	8.99 (8.08-9.83)	10.4 (9.29-11.4)	12.0 (10.6-13.1)	14.4 (12.5-15.7)	16.5 (14.2-18.0)
7-day	3.94 (3.61-4.32)	4.74 (4.35-5.21)	5.99 (5.49-6.57)	7.07 (6.46-7.73)	8.67 (7.87-9.46)	10.0 (9.07-11.0)	11.6 (10.4-12.6)	13.3 (11.8-14.4)	15.8 (13.8-17.2)	17.9 (15.6-19.6)
10-day	4.49 (4.13-4.89)	5.39 (4.97-5.87)	6.73 (6.19-7.33)	7.85 (7.20-8.54)	9.48 (8.66-10.3)	10.8 (9.86-11.8)	12.3 (11.1-13.3)	13.9 (12.5-15.1)	16.2 (14.4-17.6)	18.2 (16.0-19.8)
20-day	6.05 (5.62-6.52)	7.20 (6.69-7.76)	8.70 (8.08-9.37)	9.92 (9.19-10.7)	11.6 (10.7-12.5)	13.0 (11.9-14.0)	14.4 (13.2-15.5)	15.9 (14.5-17.1)	18.0 (16.2-19.3)	19.6 (17.6-21.1)
30-day	7.48 (6.97-8.02)	8.84 (8.26-9.49)	10.5 (9.81-11.3)	11.9 (11.1-12.7)	13.7 (12.7-14.7)	15.2 (14.1-16.3)	16.7 (15.4-17.9)	18.3 (16.8-19.6)	20.4 (18.6-21.9)	22.0 (19.9-23.7)
45-day	9.40 (8.83-10.0)	11.1 (10.4-11.8)	13.0 (12.2-13.8)	14.4 (13.5-15.3)	16.3 (15.3-17.3)	17.8 (16.6-18.9)	19.2 (17.9-20.4)	20.6 (19.1-21.9)	22.4 (20.7-23.9)	23.7 (21.8-25.4)
60-day	11.2 (10.6-11.9)	13.2 (12.4-14.0)	15.2 (14.3-16.1)	16.8 (15.8-17.8)	18.8 (17.6-19.9)	20.3 (19.0-21.4)	21.7 (20.3-23.0)	23.0 (21.5-24.4)	24.8 (23.0-26.3)	26.0 (24.1-27.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

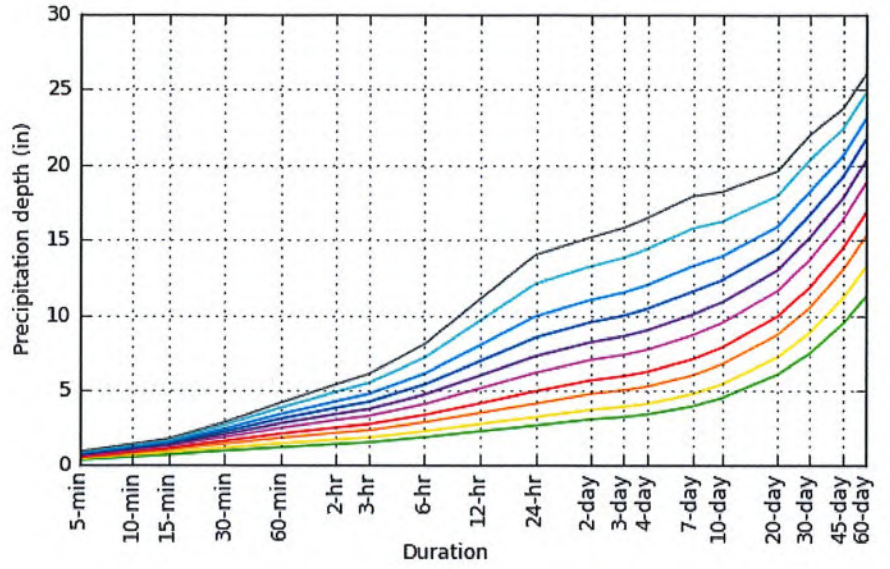
Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

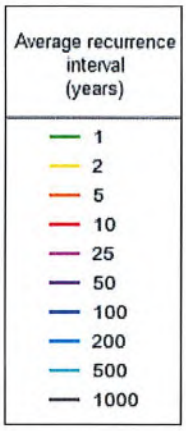
Please refer to NOAA Atlas 14 document for more information.

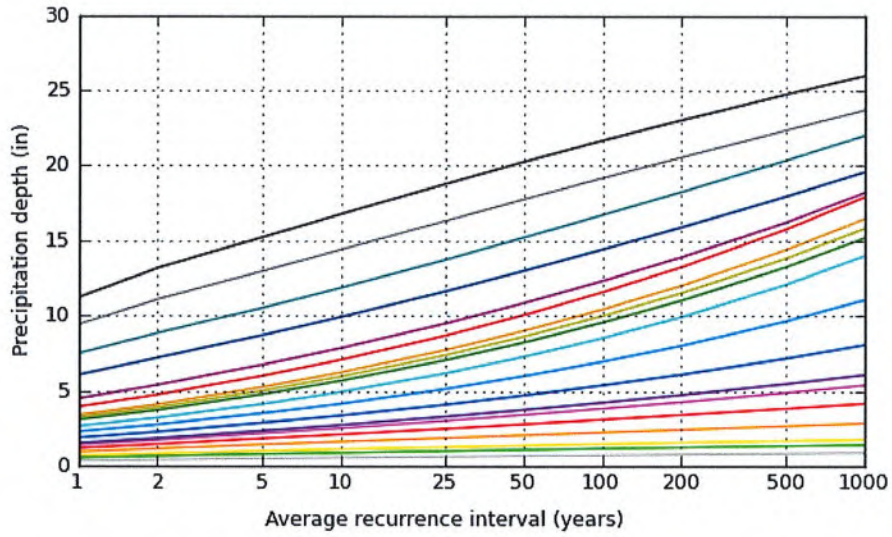
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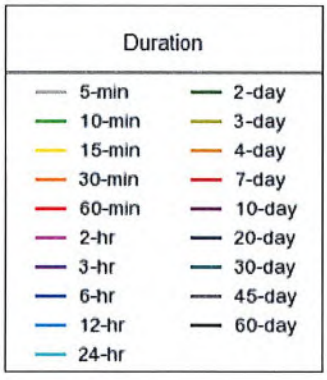
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 39.0389°, Longitude: -76.7264°









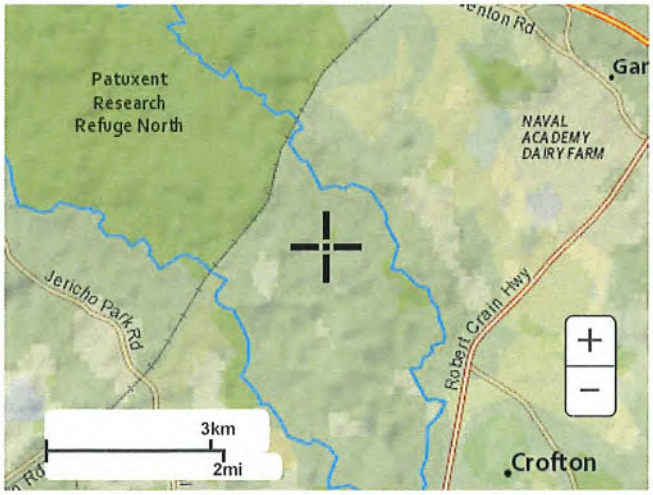
NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Tue Mar 12 16:20:25 2019

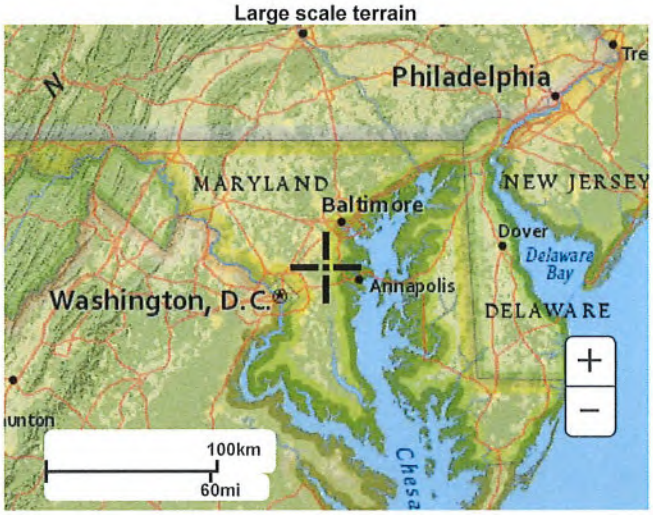
Back to Top

Maps & aerials

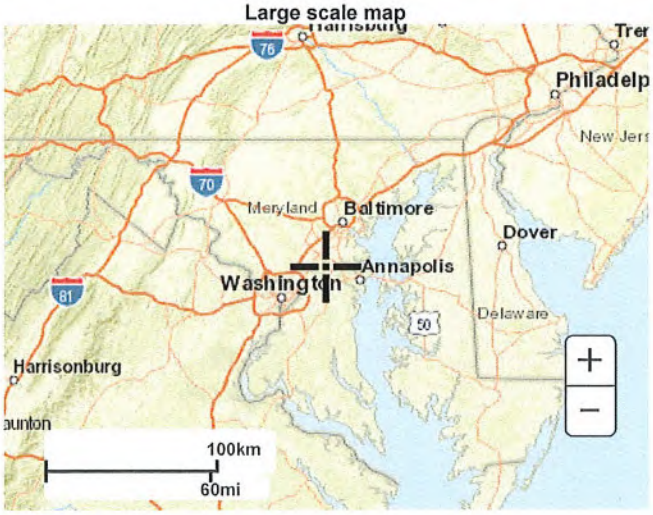
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

ATTACHMENT 17B

Existing Conditions

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Stormwater Management – Existing Conditions		
	Job No. 2018-3854	Made by: RP	Date 07-15-20
	Ref.	Checked by: VEP	Sheet 1 of 1

Reviewed by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the existing conditions stormwater runoff at the discharge points which align with the future stormwater management basin locations.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) Drainage areas – determine the contributing drainage area to the discharge location based upon the topographic data of the area. Use the "area" function in AutoCAD to find the area of the drainage area boundary.
2) Based on the soils types and the vegetative cover, determine the areas of multiple soil types and cover conditions in each drainage area. Aerial photographs visible through GoogleEarth along with pictures of the site taken by team members were used to review the vegetative cover. Calculate a "weighed" curve number. HYDroCAD actual does this calculation for you.
3) Determine the time of concentration for water to flow from the longest distance (in time) from the outlet. Measure the length and slope of the tc flow path and the surface condition.
4) Although the site is location along the eastern seaboard, this is a Type II storm event because the DelMarVa peninsula shields it from the affects of the ocean.
5) Determine the peak flows for the 25-year, 24 hour (5.9 inches of rain) and 100 year, 24 hour (8.5 inches of rain) storm events.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

Conclusions:

A summary of the discharge from the site under existing conditions is provided in the table below.

Discharge Point	25 year, 24 hour Peak Flow (cfs)	100 year, 24 hour Peak Flow (cfs)
1	178.07	358.75
2	58.42	109.65
3	105.36	244.80
4	124.88	259.87
Subtotal	466.73	973.07
Conrail	22.09	48.87
East Entrance (incl WQv area)	389.64	739.58
TOTAL	**810.82**	**1,629.55**

References:

1. HydroCAD, V8.5.

EXISTING CONDITIONS

CONRAIL

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	492,929	165,243	0	327,686	0	492,929
OFFSITE						
WOODS						
RA						
R-2						
TOTAL	492,929					492,929

Discharge Pt 1 (BASIN 1)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	4,652,379	743,289	0	3,361,697	547,393	4,652,379
OFFSITE	768,602					
WOODS		37,872	0	44,000	11,366	93,238
RA		381,005	59,413	234,946	0	675,364
R-2		0	0	0	0	0
TOTAL	5,420,981					5,420,981

Discharge Pt 2 (BASIN 2)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS		80,990		739,718	99,116	919,825
OFFSITE						
LOD						0
RA						0
R-2						0
TOTAL	0					919,825

Discharge Pt 3 (BASIN 3)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS		994,213	0	1,781,386	294,248	3,069,847
OFFSITE						
WOODS						0
RA		682,280	54,406	81,022	92,696	910,404
R-2						0
TOTAL						3,980,251

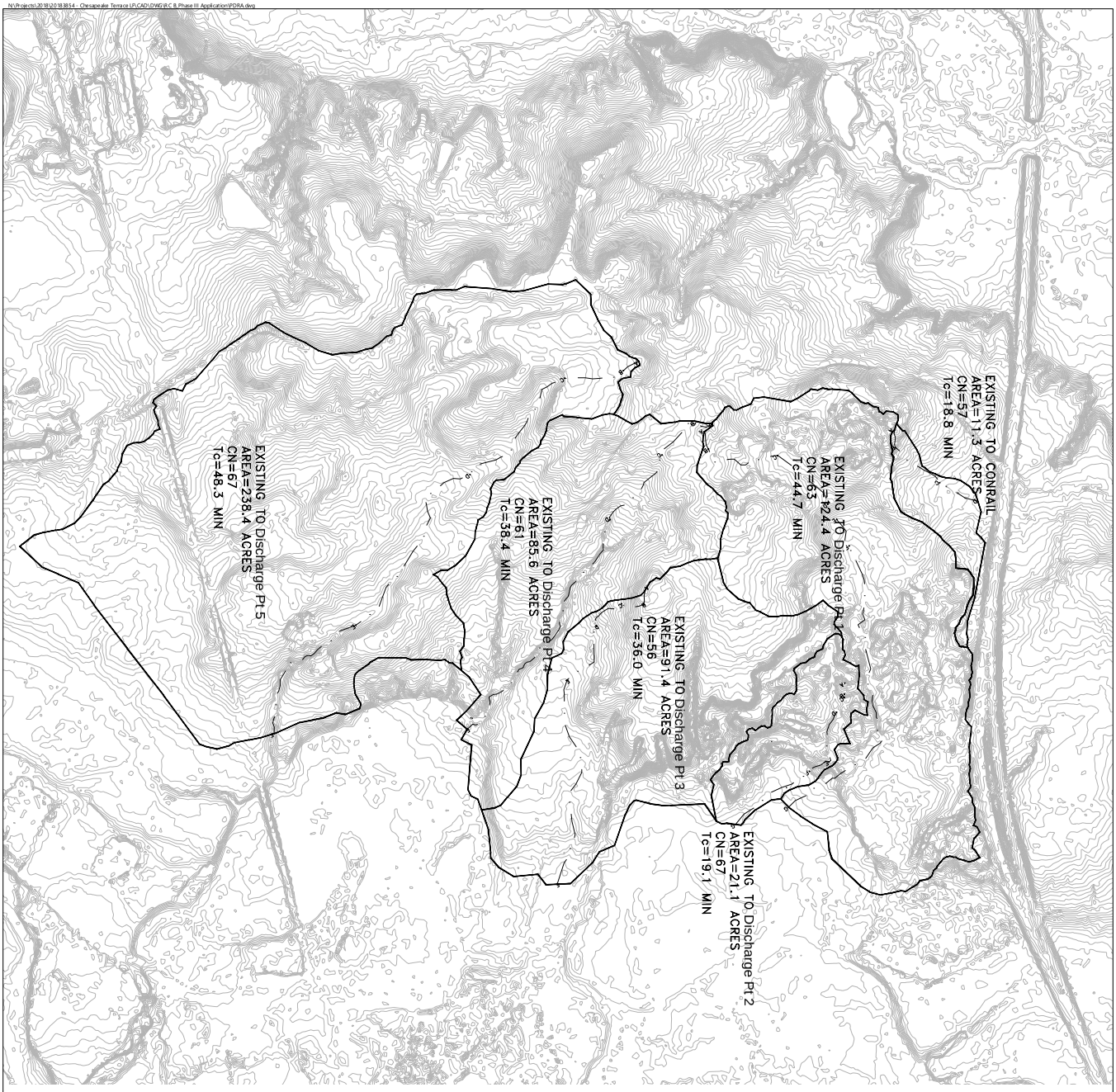
Discharge Pt 4 (BASIN 4)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	636,520	78,295	22,838	416,198	119,189	636,520
OFFSITE	3,093,191					
WOODS						0
RA		911,186	281,741	75,531	0	1,268,458
R-2		545,259	676,106	321,526	281,842	1,824,732
TOTAL	3,729,710					3,729,710

Discharge Pt 5 (WQv FACILITY)

		SOILS				
	TOTAL AREA	A	B	C	D	TOTAL CHECK
ONSITE						
WOODS	131,621	29,870	71,699	30,052	0	131,621
OFFSITE	10,252,576					
LOD		95,827	91,822	223,317	39,093	450,060
RA						0
R-2		3,240,207	2,914,445	2,748,808	899,056	9,802,517
TOTAL	10,384,197					10,384,198

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GRAPHIC SCALE
(IN FEET)
1 inch = 400 ft.

DA-1

EXISTING DRAINAGE AREA PLAN

PROJECT MANAGER:	VEF	SCALE:	AS SHOWN
CHECKED BY:	VEF	PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE	DATE:	

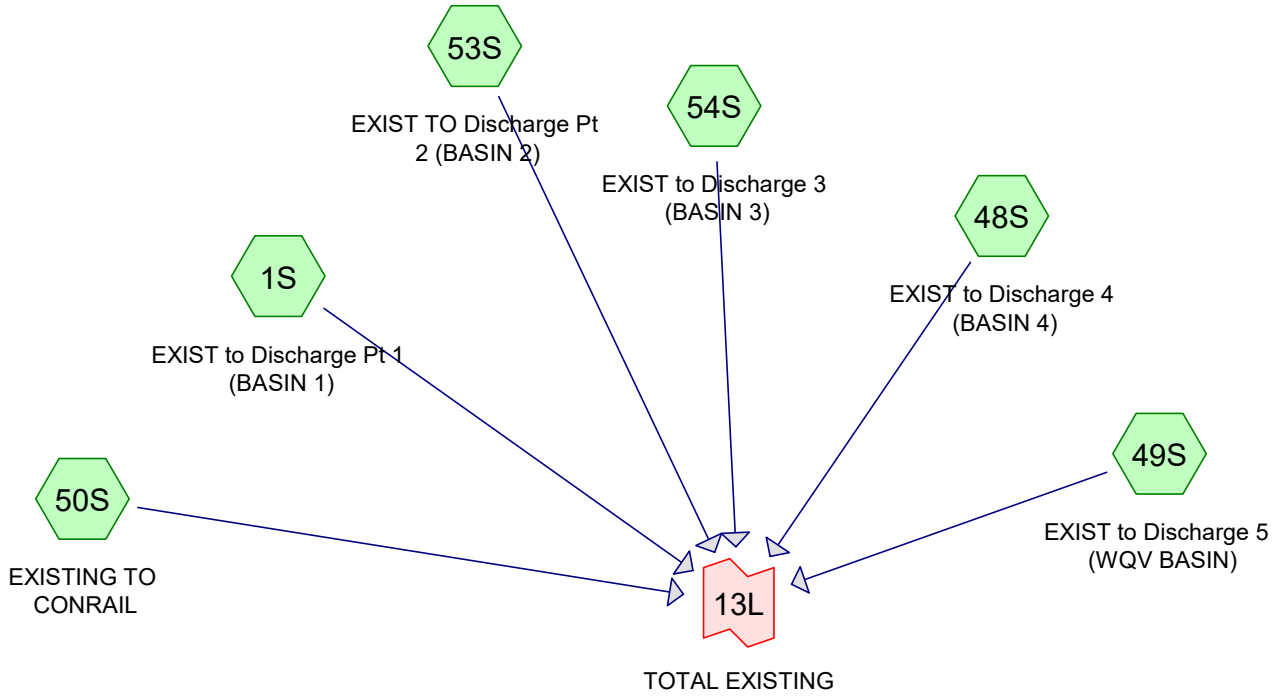
ADVANCED GeoServices
A Montrose Environmental Group Company

1008 ANDREW DRIVE, SUITE A, WEST CHESTER PA, 19380
tel 610.840.9100 fax 610.840.9199 www.advancedgeoservices.com

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

DATE:	REVISION:

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645



Subcat Reach Pond Link

Drainage Diagram for CT_Existing condtions_07152020
Prepared by {enter your company name here}, Printed 7/18/2020
HydroCAD® 8.50 s/n 005690 © 2007 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
48.023	30	Woods, Good, HSG A (1S,48S,49S,50S,53S,54S)
2.200	30	Woods, Good, HSG A (OFFSITE LOD) (49S)
0.869	30	Woods, Good, HSG A (OFFSITE) (1S)
45.328	42	RA ZONING A SOILS (1S,48S,54S)
86.902	50	R2 ZONING, A SOILS (48S,49S)
2.170	55	Woods, Good, HSG B (48S,49S)
2.108	55	Woods, Good, HSG B (OFFSITE LOD) (49S)
9.081	64	RA ZONING B SOILS (1S,48S,54S)
82.427	70	R2 ZONING, B SOILS (48S,49S)
152.819	70	Woods, Good, HSG C (1S,48S,49S,50S,53S,54S)
5.127	70	Woods, Good, HSG C (OFFSITE LOD) (49S)
1.010	70	Woods, Good, HSG C (OFFSITE) (1S)
8.988	76	RA ZONING C SOILS (1S,48S,54S)
24.332	77	Woods, Good, HSG D (1S,48S,53S,54S)
0.897	77	Woods, Good, HSG D (OFFSITE LOD) (49S)
0.261	77	Woods, Good, HSG D (OFFSITE) (1S)
70.485	80	R2 ZONING, C SOILS (48S,49S)
2.128	82	RA ZONING D SOILS (54S)
27.109	85	R2 ZONING, D SOILS (48S,49S)
572.264		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
51.092	HSG A	1S, 48S, 49S, 50S, 53S, 54S
4.278	HSG B	48S, 49S
158.956	HSG C	1S, 48S, 49S, 50S, 53S, 54S
25.490	HSG D	1S, 48S, 49S, 53S, 54S
332.448	Other	1S, 48S, 49S, 54S
572.264		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EXIST to Discharge Pt Runoff Area=124.449 ac 0.00% Impervious Runoff Depth=2.11"
Flow Length=4,561' Tc=39.7 min CN=63 Runoff=178.07 cfs 21.850 af

Subcatchment 48S: EXIST to Discharge 4 Runoff Area=85.621 ac 0.00% Impervious Runoff Depth=1.94"
Flow Length=3,617' Tc=33.5 min CN=61 Runoff=124.88 cfs 13.834 af

Subcatchment 49S: EXIST to Discharge Runoff Area=10,384,180 sf 0.00% Impervious Runoff Depth=2.45"
Flow Length=4,899' Tc=42.5 min CN=67 Runoff=389.64 cfs 48.767 af

Subcatchment 50S: EXISTING TO Runoff Area=492,925 sf 0.00% Impervious Runoff Depth=1.62"
Flow Length=983' Tc=14.9 min CN=57 Runoff=22.09 cfs 1.524 af

Subcatchment 53S: EXIST TO Discharge Pt Runoff Area=21.116 ac 0.00% Impervious Runoff Depth=2.45"
Flow Length=1,689' Tc=19.1 min CN=67 Runoff=58.42 cfs 4.320 af

Subcatchment 54S: EXIST to Discharge Runoff Area=3,980,251 sf 0.00% Impervious Runoff Depth=1.54"
Flow Length=3,050' Tc=30.5 min CN=56 Runoff=105.36 cfs 11.708 af

Link 13L: TOTAL EXISTING Inflow=810.82 cfs 102.002 af
Primary=810.82 cfs 102.002 af

Total Runoff Area = 572.264 ac Runoff Volume = 102.002 af Average Runoff Depth = 2.14"
100.00% Pervious = 572.264 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)

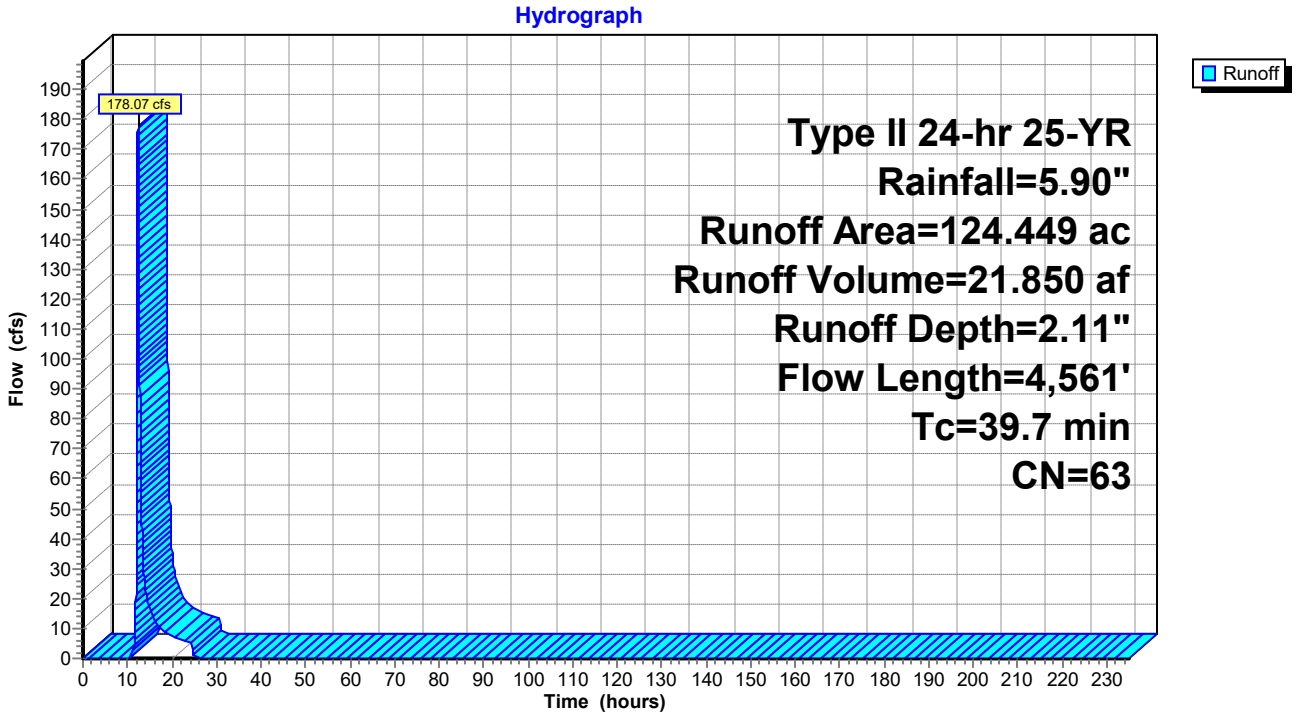
Runoff = 178.07 cfs @ 12.39 hrs, Volume= 21.850 af, Depth= 2.11"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
	17.064	30	Woods, Good, HSG A
	77.174	70	Woods, Good, HSG C
	12.566	77	Woods, Good, HSG D
*	0.869	30	Woods, Good, HSG A (OFFSITE)
*	1.010	70	Woods, Good, HSG C (OFFSITE)
*	0.261	77	Woods, Good, HSG D (OFFSITE)
*	8.747	42	RA ZONING A SOILS
*	1.364	64	RA ZONING B SOILS
*	5.394	76	RA ZONING C SOILS
	124.449	63	Weighted Average
	124.449		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.8	735	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.4	597	0.0200	2.28		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.4	149	0.1300	5.80		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.6	262	0.0300	2.79		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
15.7	2,718	0.0200	2.88	14.40	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 10.0 '/' Top.W=15.00' n= 0.035 Earth, dense weeds
39.7	4,561	Total			

Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)



Summary for Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)

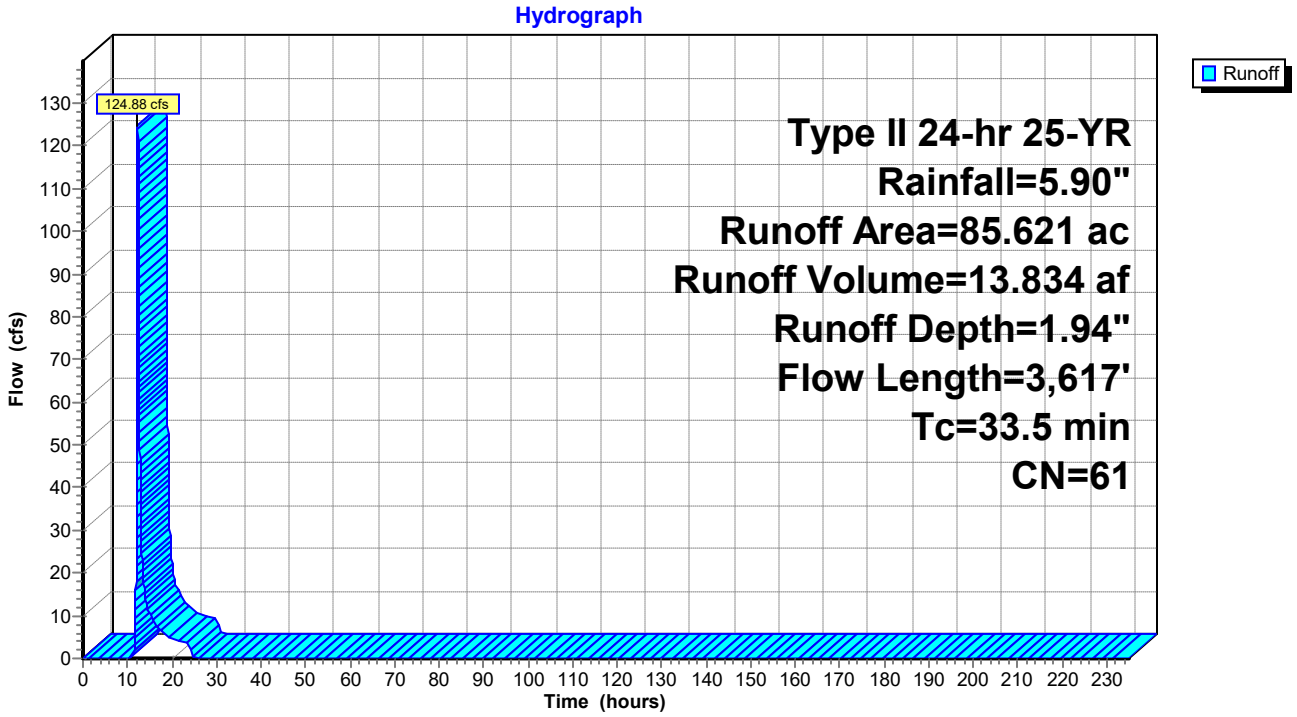
Runoff = 124.88 cfs @ 12.32 hrs, Volume= 13.834 af, Depth= 1.94"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
	1.797	30	Woods, Good, HSG A
	0.524	55	Woods, Good, HSG B
	9.555	70	Woods, Good, HSG C
	2.736	77	Woods, Good, HSG D
*	20.918	42	RA ZONING A SOILS
*	6.468	64	RA ZONING B SOILS
*	1.734	76	RA ZONING C SOILS
*	12.517	50	R2 ZONING, A SOILS
*	15.521	70	R2 ZONING, B SOILS
*	7.381	80	R2 ZONING, C SOILS
*	6.470	85	R2 ZONING, D SOILS
	85.621	61	Weighted Average
	85.621		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	466	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.1	728	0.0600	3.94		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.2	2,323	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
33.5	3,617	Total			

Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)



Summary for Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)

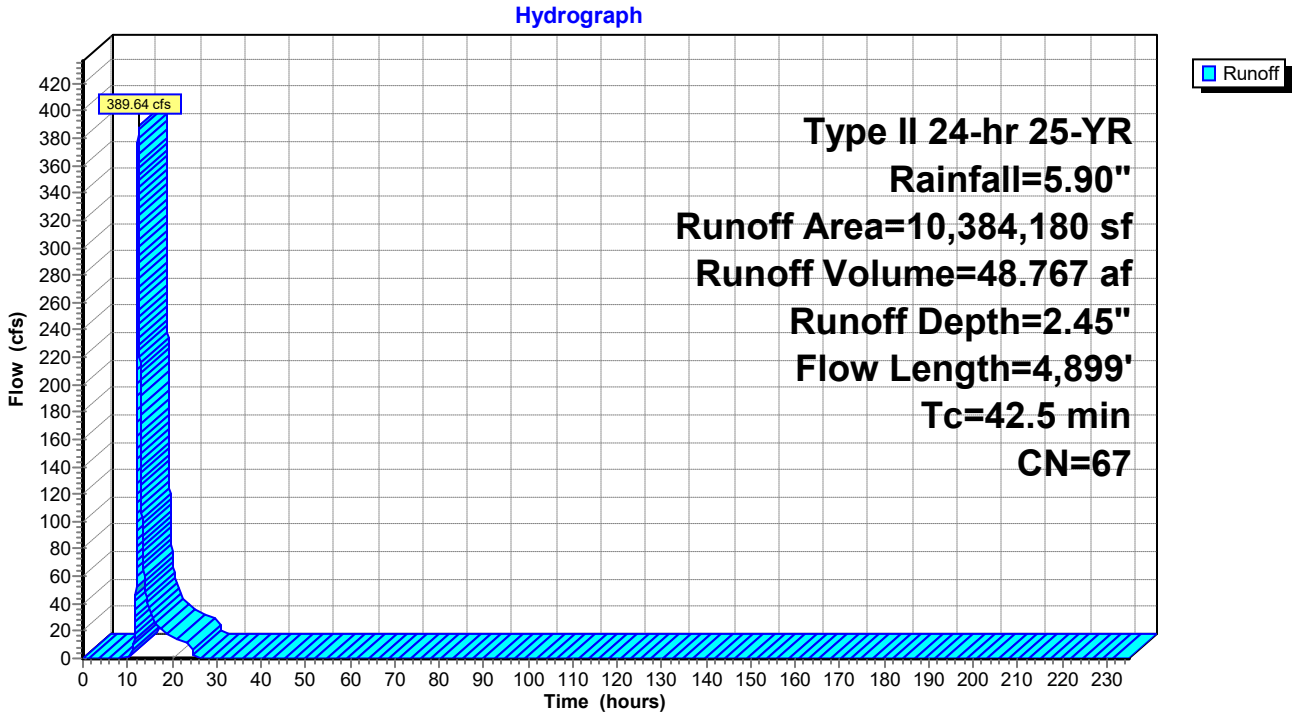
Runoff = 389.64 cfs @ 12.42 hrs, Volume= 48.767 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	29,882	30	Woods, Good, HSG A
	71,700	55	Woods, Good, HSG B
	30,056	70	Woods, Good, HSG C
*	95,832	30	Woods, Good, HSG A (OFFSITE LOD)
*	91,824	55	Woods, Good, HSG B (OFFSITE LOD)
*	223,332	70	Woods, Good, HSG C (OFFSITE LOD)
*	39,073	77	Woods, Good, HSG D (OFFSITE LOD)
*	3,240,211	50	R2 ZONING, A SOILS
*	2,914,425	70	R2 ZONING, B SOILS
*	2,748,810	80	R2 ZONING, C SOILS
*	899,035	85	R2 ZONING, D SOILS
	10,384,180	67	Weighted Average
	10,384,180		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	558	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.1	1,221	0.0400	3.98	17.89	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 10.0 '/' Top.W=14.00' n= 0.035 Earth, dense weeds
9.8	1,723	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
7.2	1,297	0.0200	2.99	17.96	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=7.00' D=0.50' Z= 10.0 '/' Top.W=17.00' n= 0.035 Earth, dense weeds
42.5	4,899	Total			

Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)



Summary for Subcatchment 50S: EXISTING TO CONRAIL

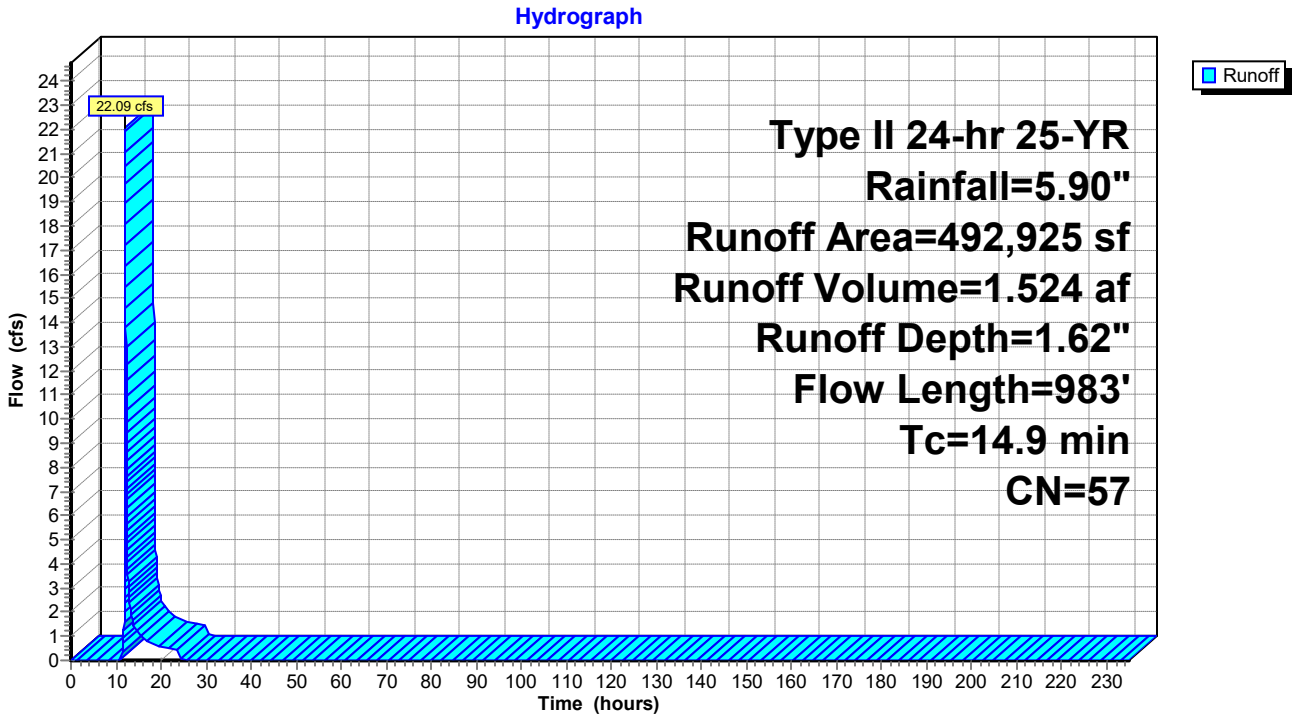
Runoff = 22.09 cfs @ 12.08 hrs, Volume= 1.524 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
165,223	30	Woods, Good, HSG A
327,702	70	Woods, Good, HSG C
492,925	57	Weighted Average
492,925		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.1100	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	527	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.1	356	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.9	983	Total			

Subcatchment 50S: EXISTING TO CONRAIL



Summary for Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)

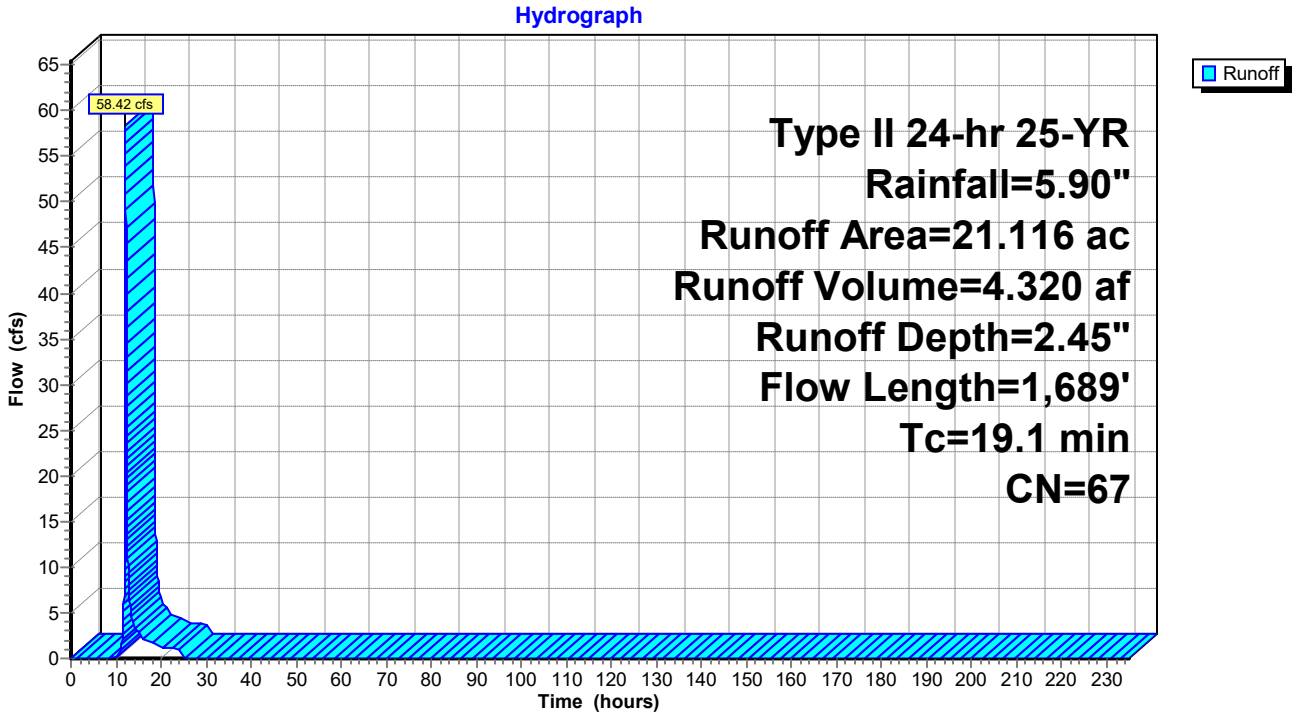
Runoff = 58.42 cfs @ 12.12 hrs, Volume= 4.320 af, Depth= 2.45"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
1.859	30	Woods, Good, HSG A
16.982	70	Woods, Good, HSG C
2.275	77	Woods, Good, HSG D
21.116	67	Weighted Average
21.116		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	100	0.1300	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	26	0.1900	7.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.8	152	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	451	0.0100	2.24	9.52	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
0.5	192	0.0800	6.33	26.91	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
4.1	768	0.0200	3.12	35.10	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=15.00' D=0.50' Z= 15.0 '/' Top.W=30.00' n= 0.035 Earth, dense weeds
19.1	1,689	Total			

Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)



Summary for Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

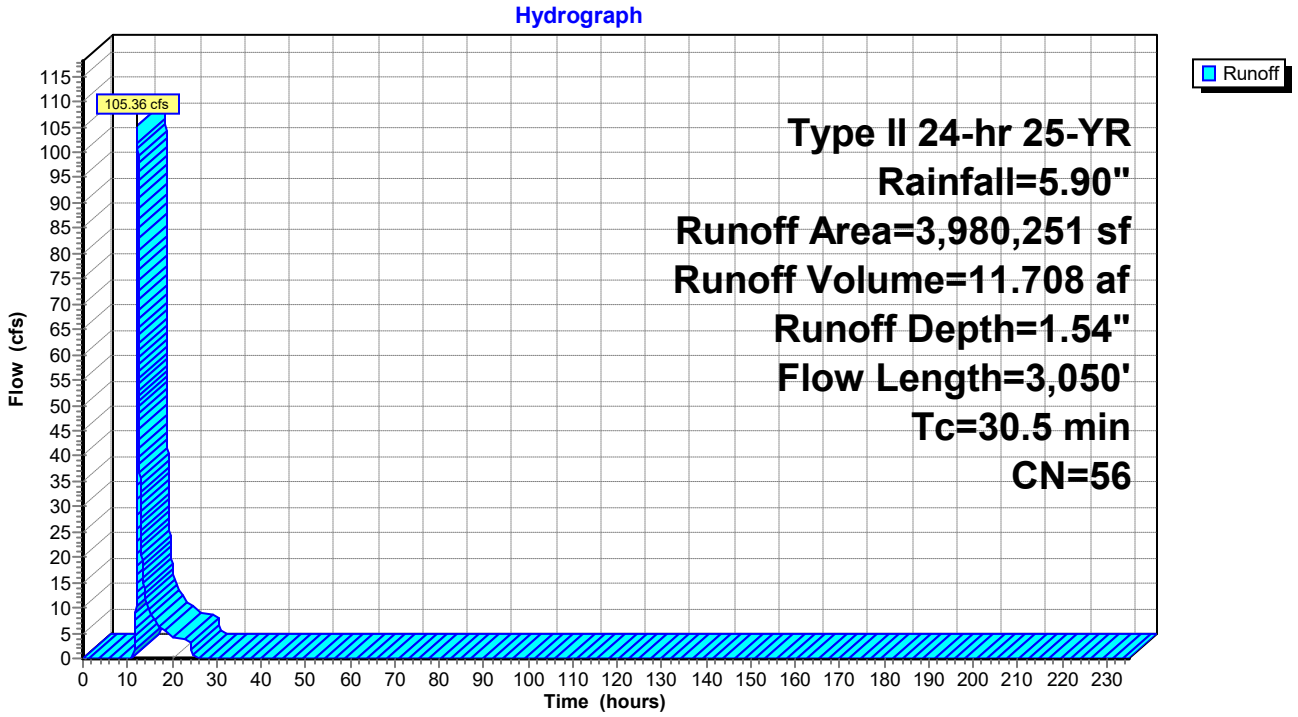
Runoff = 105.36 cfs @ 12.30 hrs, Volume= 11.708 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	994,213	30	Woods, Good, HSG A
	1,781,386	70	Woods, Good, HSG C
	294,248	77	Woods, Good, HSG D
*	682,280	42	RA ZONING A SOILS
*	54,406	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	92,696	82	RA ZONING D SOILS
	3,980,251	56	Weighted Average
	3,980,251		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	247	0.1400	6.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	328	0.0700	4.26		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	576	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
10.2	1,799	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
30.5	3,050	Total			

Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

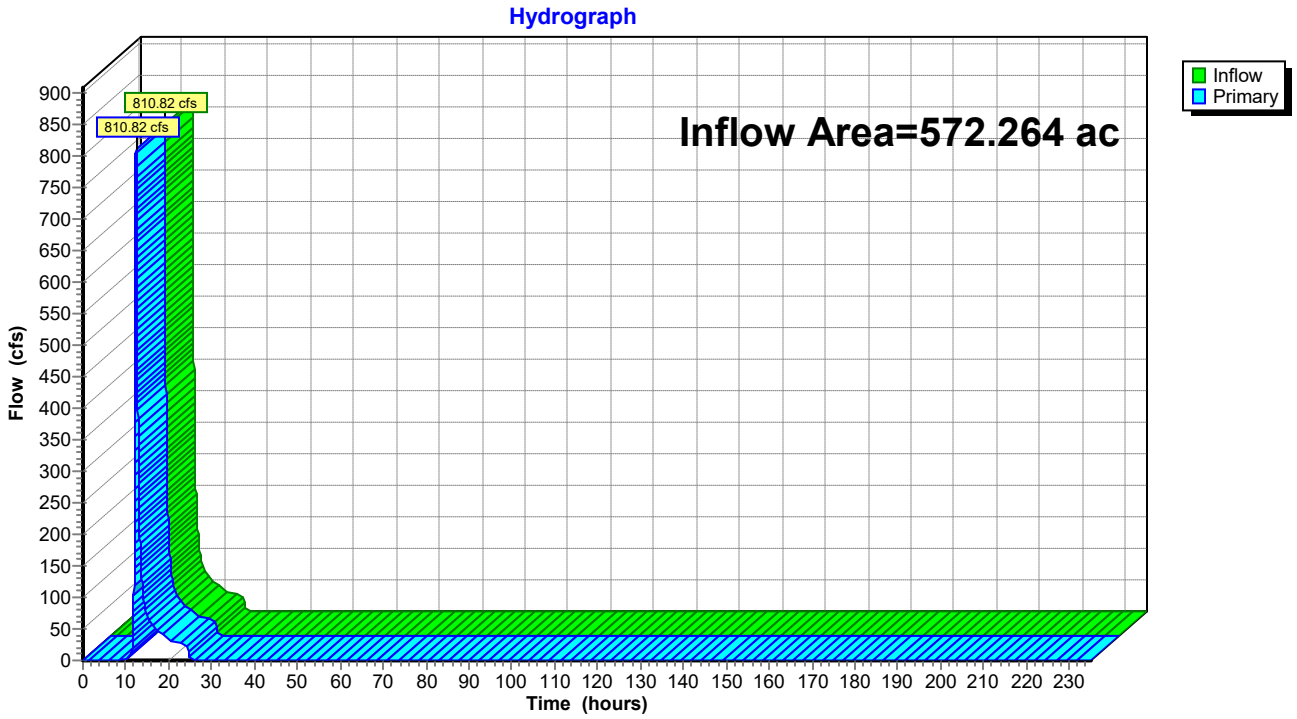


Summary for Link 13L: TOTAL EXISTING

Inflow Area = 572.264 ac, 0.00% Impervious, Inflow Depth = 2.14" for 25-YR event
Inflow = 810.82 cfs @ 12.36 hrs, Volume= 102.002 af
Primary = 810.82 cfs @ 12.36 hrs, Volume= 102.002 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 13L: TOTAL EXISTING



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: EXIST to Discharge Pt Runoff Area=124.449 ac 0.00% Impervious Runoff Depth=4.07"
Flow Length=4,561' Tc=39.7 min CN=63 Runoff=358.75 cfs 42.165 af

Subcatchment 48S: EXIST to Discharge 4 Runoff Area=85.621 ac 0.00% Impervious Runoff Depth=3.83"
Flow Length=3,617' Tc=33.5 min CN=61 Runoff=259.87 cfs 27.329 af

Subcatchment 49S: EXIST to Discharge Runoff Area=10,384,180 sf 0.00% Impervious Runoff Depth=4.54"
Flow Length=4,899' Tc=42.5 min CN=67 Runoff=739.58 cfs 90.182 af

Subcatchment 50S: EXISTING TO Runoff Area=492,925 sf 0.00% Impervious Runoff Depth=3.36"
Flow Length=983' Tc=14.9 min CN=57 Runoff=48.87 cfs 3.171 af

Subcatchment 53S: EXIST TO Discharge Pt Runoff Area=21.116 ac 0.00% Impervious Runoff Depth=4.54"
Flow Length=1,689' Tc=19.1 min CN=67 Runoff=109.65 cfs 7.988 af

Subcatchment 54S: EXIST to Discharge Runoff Area=3,980,251 sf 0.00% Impervious Runoff Depth=3.25"
Flow Length=3,050' Tc=30.5 min CN=56 Runoff=244.80 cfs 24.722 af

Link 13L: TOTAL EXISTING Inflow=1,629.55 cfs 195.557 af
Primary=1,629.55 cfs 195.557 af

Total Runoff Area = 572.264 ac Runoff Volume = 195.557 af Average Runoff Depth = 4.10"
100.00% Pervious = 572.264 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)

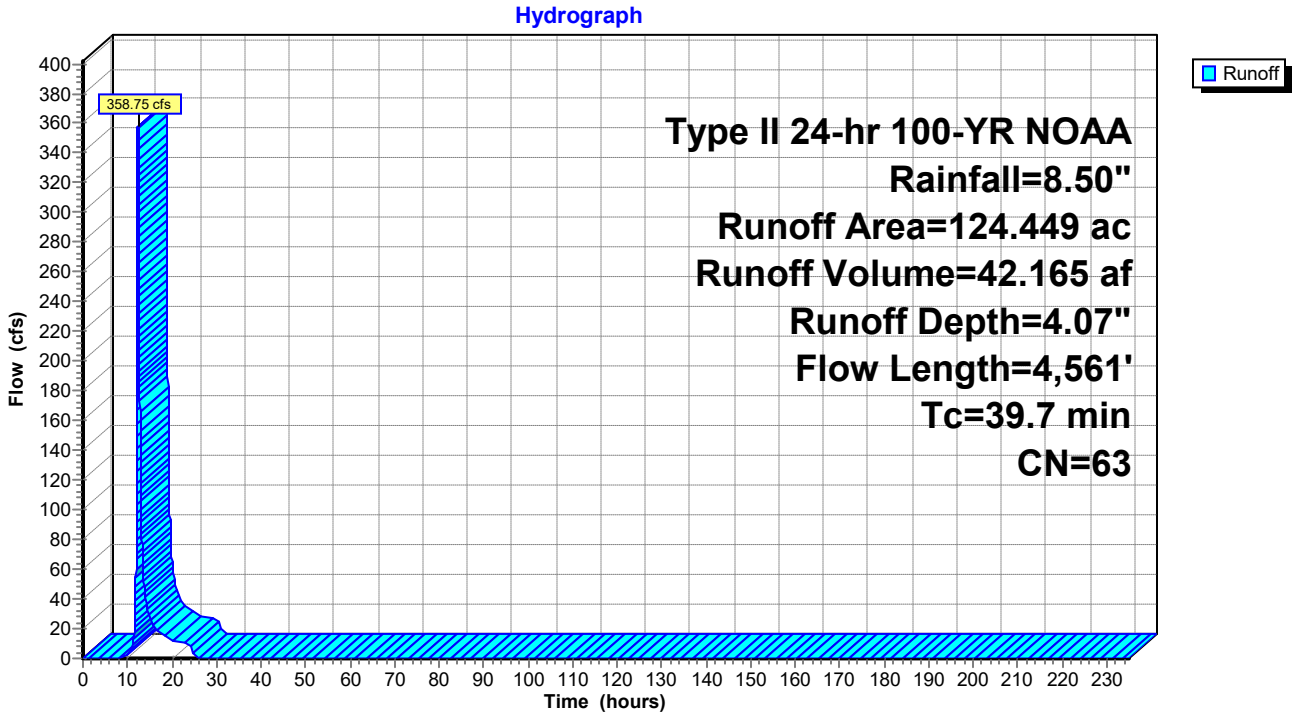
Runoff = 358.75 cfs @ 12.39 hrs, Volume= 42.165 af, Depth= 4.07"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
	17.064	30	Woods, Good, HSG A
	77.174	70	Woods, Good, HSG C
	12.566	77	Woods, Good, HSG D
*	0.869	30	Woods, Good, HSG A (OFFSITE)
*	1.010	70	Woods, Good, HSG C (OFFSITE)
*	0.261	77	Woods, Good, HSG D (OFFSITE)
*	8.747	42	RA ZONING A SOILS
*	1.364	64	RA ZONING B SOILS
*	5.394	76	RA ZONING C SOILS
	124.449	63	Weighted Average
	124.449		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.8	735	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
4.4	597	0.0200	2.28		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
0.4	149	0.1300	5.80		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
1.6	262	0.0300	2.79		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
15.7	2,718	0.0200	2.88	14.40	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 10.0 '/' Top.W=15.00' n= 0.035 Earth, dense weeds
39.7	4,561	Total			

Subcatchment 1S: EXIST to Discharge Pt 1 (BASIN 1)



Summary for Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)

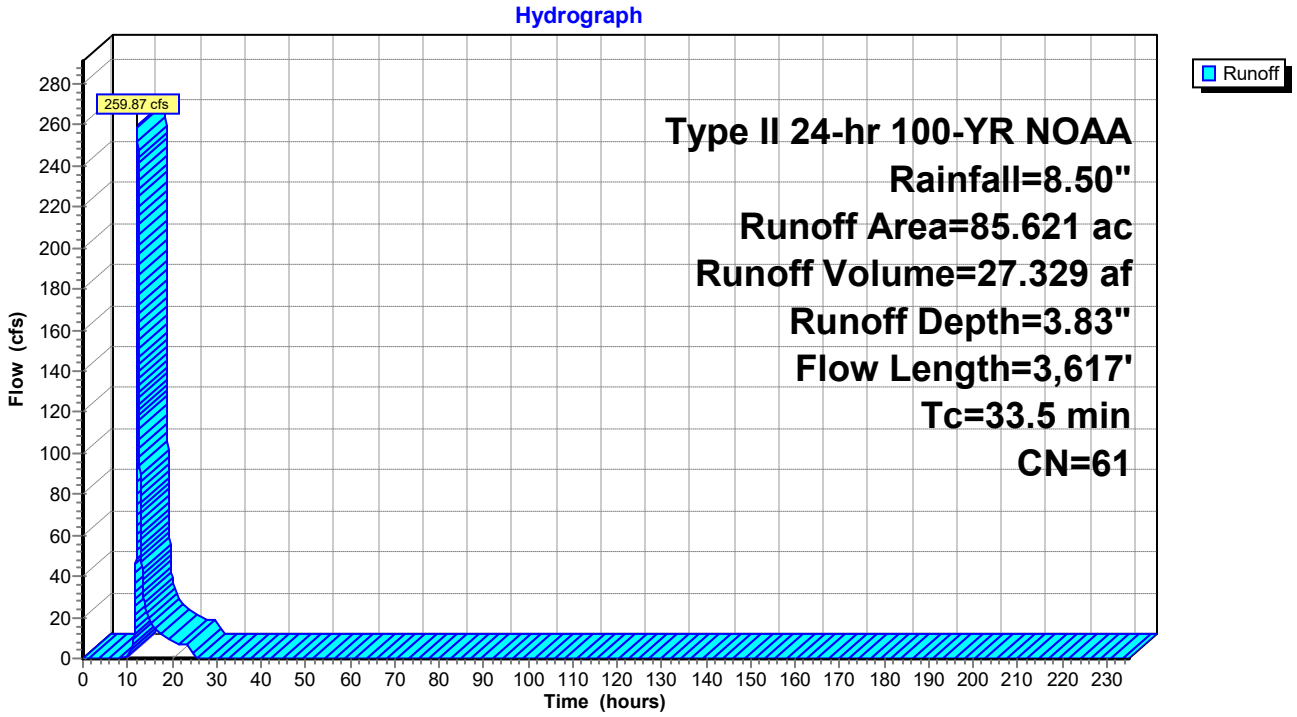
Runoff = 259.87 cfs @ 12.29 hrs, Volume= 27.329 af, Depth= 3.83"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
	1.797	30	Woods, Good, HSG A
	0.524	55	Woods, Good, HSG B
	9.555	70	Woods, Good, HSG C
	2.736	77	Woods, Good, HSG D
*	20.918	42	RA ZONING A SOILS
*	6.468	64	RA ZONING B SOILS
*	1.734	76	RA ZONING C SOILS
*	12.517	50	R2 ZONING, A SOILS
*	15.521	70	R2 ZONING, B SOILS
*	7.381	80	R2 ZONING, C SOILS
*	6.470	85	R2 ZONING, D SOILS
	85.621	61	Weighted Average
	85.621		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.8	100	0.0600	0.12		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
3.4	466	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.1	728	0.0600	3.94		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
13.2	2,323	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
33.5	3,617	Total			

Subcatchment 48S: EXIST to Discharge 4 (BASIN 4)



Summary for Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)

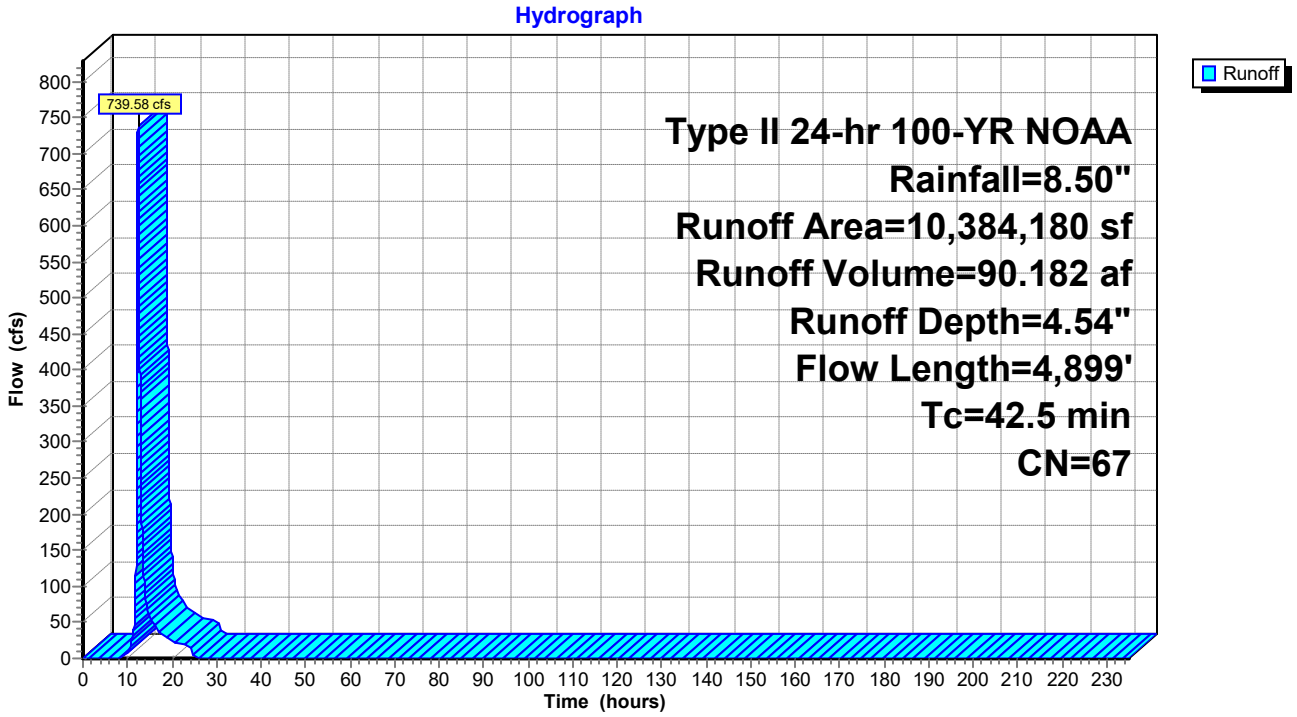
Runoff = 739.58 cfs @ 12.42 hrs, Volume= 90.182 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	29,882	30	Woods, Good, HSG A
	71,700	55	Woods, Good, HSG B
	30,056	70	Woods, Good, HSG C
*	95,832	30	Woods, Good, HSG A (OFFSITE LOD)
*	91,824	55	Woods, Good, HSG B (OFFSITE LOD)
*	223,332	70	Woods, Good, HSG C (OFFSITE LOD)
*	39,073	77	Woods, Good, HSG D (OFFSITE LOD)
*	3,240,211	50	R2 ZONING, A SOILS
*	2,914,425	70	R2 ZONING, B SOILS
*	2,748,810	80	R2 ZONING, C SOILS
*	899,035	85	R2 ZONING, D SOILS
	10,384,180	67	Weighted Average
	10,384,180		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3	100	0.0400	0.10		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
4.1	558	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.1	1,221	0.0400	3.98	17.89	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 10.0 '/' Top.W=14.00' n= 0.035 Earth, dense weeds
9.8	1,723	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
7.2	1,297	0.0200	2.99	17.96	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=7.00' D=0.50' Z= 10.0 '/' Top.W=17.00' n= 0.035 Earth, dense weeds
42.5	4,899	Total			

Subcatchment 49S: EXIST to Discharge 5 (WQV BASIN)



Summary for Subcatchment 50S: EXISTING TO CONRAIL

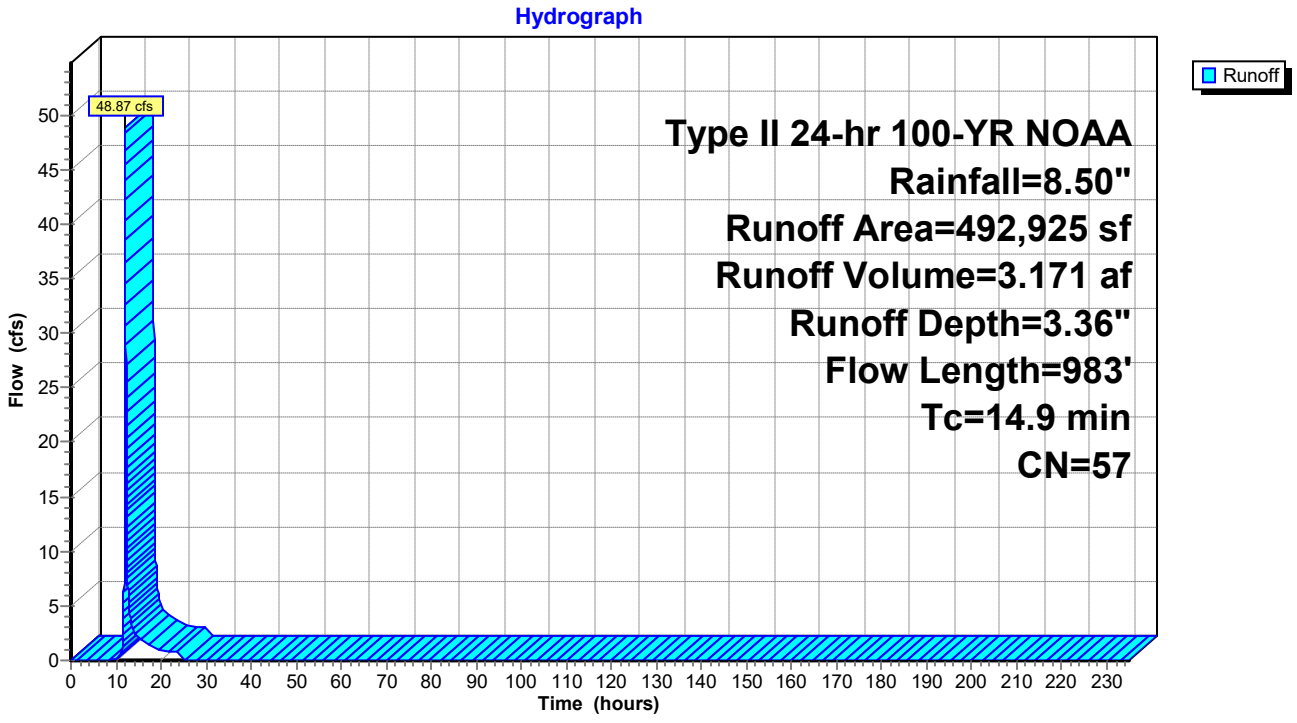
Runoff = 48.87 cfs @ 12.07 hrs, Volume= 3.171 af, Depth= 3.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
165,223	30	Woods, Good, HSG A
327,702	70	Woods, Good, HSG C
492,925	57	Weighted Average
492,925		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.9	100	0.1100	0.15		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
1.9	527	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.1	356	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.9	983	Total			

Subcatchment 50S: EXISTING TO CONRAIL



Summary for Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)

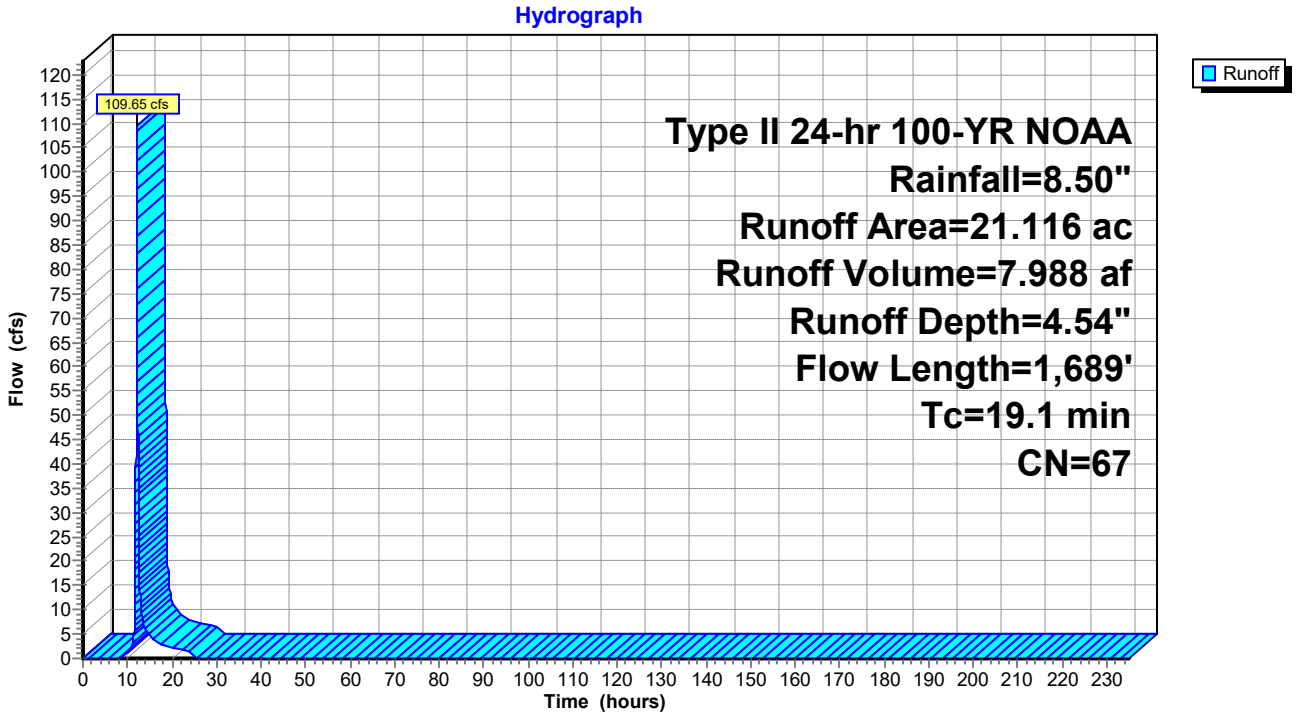
Runoff = 109.65 cfs @ 12.12 hrs, Volume= 7.988 af, Depth= 4.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
1.859	30	Woods, Good, HSG A
16.982	70	Woods, Good, HSG C
2.275	77	Woods, Good, HSG D
21.116	67	Weighted Average
21.116		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
10.2	100	0.1300	0.16		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.1	26	0.1900	7.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.8	152	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	451	0.0100	2.24	9.52	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
0.5	192	0.0800	6.33	26.91	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 5.0 '/' Top.W=11.00' n= 0.035 Earth, dense weeds
4.1	768	0.0200	3.12	35.10	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=15.00' D=0.50' Z= 15.0 '/' Top.W=30.00' n= 0.035 Earth, dense weeds
19.1	1,689	Total			

Subcatchment 53S: EXIST TO Discharge Pt 2 (BASIN 2)



Summary for Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

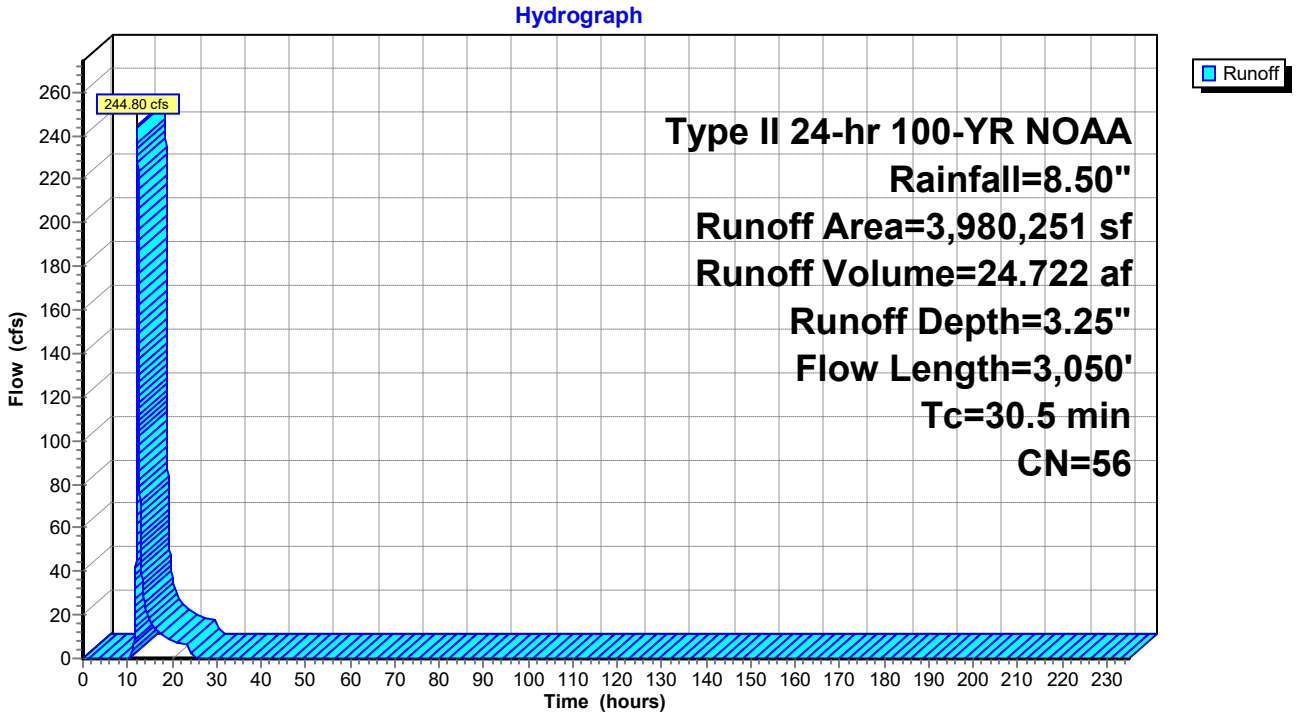
Runoff = 244.80 cfs @ 12.27 hrs, Volume= 24.722 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	994,213	30	Woods, Good, HSG A
	1,781,386	70	Woods, Good, HSG C
	294,248	77	Woods, Good, HSG D
*	682,280	42	RA ZONING A SOILS
*	54,406	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	92,696	82	RA ZONING D SOILS
	3,980,251	56	Weighted Average
	3,980,251		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.7	247	0.1400	6.02		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	328	0.0700	4.26		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
3.4	576	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
10.2	1,799	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
30.5	3,050	Total			

Subcatchment 54S: EXIST to Discharge 3 (BASIN 3)

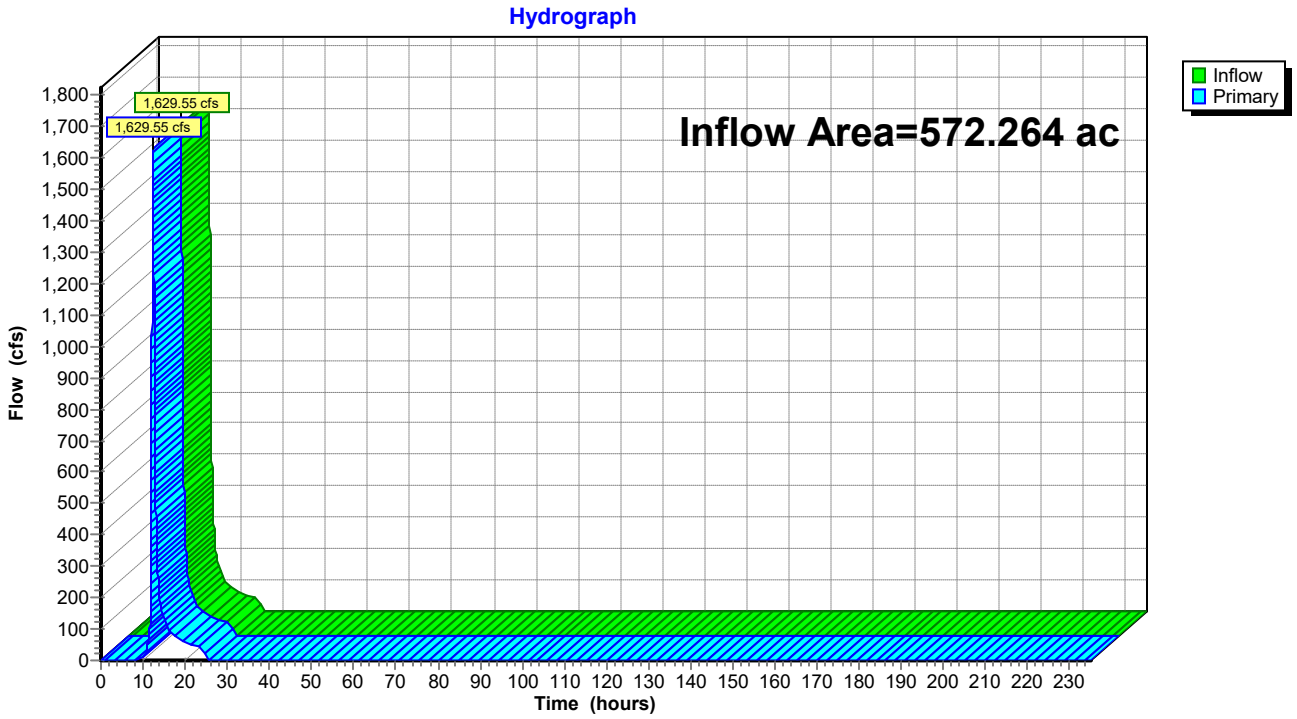


Summary for Link 13L: TOTAL EXISTING

Inflow Area = 572.264 ac, 0.00% Impervious, Inflow Depth = 4.10" for 100-YR NOAA event
Inflow = 1,629.55 cfs @ 12.33 hrs, Volume= 195.557 af
Primary = 1,629.55 cfs @ 12.33 hrs, Volume= 195.557 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 13L: TOTAL EXISTING



ADVANCED GeoServices
a Montrose Environmental Group company

ATTACHMENT 17C

Proposed Basin Routing

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Stormwater Management – Proposed Basin Routing		
	Job No. 2018-3854	Made by: RP	Date 07-15-20
	Ref.	Checked by: VEF	Sheet 1 of 2

Reviewed by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the proposed conditions – determining the stormwater runoff from the proposed Landfill and routing the runoff through stormwater management basin locations.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) Drainage areas – determine the contributing drainage area to the discharge location based upon the topographic data of the area. Use the "area" function in AutoCAD to find the area of the drainage area boundary.
2) Based on the proposed soils types and the vegetative cover, determine the areas of soil types and cover conditions in each drainage area. Calculate a "weighed" curve number. HydroCAD actually does this calculation based upon data entry.
3) Determine the time of concentration for water to flow from the longest distance (in time) from the outlet. Measure the length and slope of the tc flow path and the surface condition.
4) Although the site is location along the eastern seaboard, this is a Type II storm event because the DelMarVa peninsula shields it from the affects of the ocean.
5) Determine the peak flows for the 25-year, 24 hour (5.9 inches of rain) and 100 year, 24 hour (8.5 inches of rain) storm events.
6) Based on the proposed Basin configuration, routing the contributing inflow from the contributing drainage areas through the basins to determine whether they are adequately sized.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater management – Existing Conditions," dated July 15, 2020.

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Stormwater Management – Proposed Basin Routing		
	Job No. 2018-3854	Made by: RP	Date 07-15-20
	Ref.	Checked by: VEF	Sheet 2 of 2

Reviewed by PGS 08/27/2021

Conclusions:

A summary of the inflow and the proposed Basin area provided in the table below.

Feature	Basin No. 1	Basin No. 2	Basin No. 3	Basin No. 4	WQv
Bottom of Basin (ft MSL)	79.0	72.0	72.0	76.5	88.0
Top of Wet Storage (ft MSL)	81.0	74.0	74.0	78.5	N/A
Invert of low flow Orifice (ft MSL)	81.0	74.0	74.0	78.5	88.0
Size of low flow Orifice (inches)	9	8	6	6	3
Elevation of Riser (ft MSL)	84.5	77.0	77.0	83.6	89.5
Dimensions of Riser (ft x ft)	3 x 6.5	3 x 6.5	3 x 6.5	7 x 10	4 x 4
Shape of Riser	rectangle	rectangle	rectangle	rectangle	rectangle
Invert of Emergency Spillway (ft MSL)	90.0	78.0	78.5	88.15	90.8
Width of Emergency Spillway (ft)	250	45	100	90	20
25 year ,24 hour storm event routing					
Peak Qin (cfs)	386.46	49.6	195.44	186.05	19.12
Peak Qout (cfs)	140.81	3.75	54.16	95.11	15.6
Max Water Surface Elev (ft MSL)	86.60	77.06	77.89	84.49	90.11
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	No	No	No	No	No
% Reduction	64	92	72	49	18
Total Qout = 309.43 cfs					
100 year ,24 hour storm event routing					
Peak Qin (cfs)	672.36	110.04	314.99	399.01	32.48
Peak Qout (cfs)	255.13	58.51	193.46	184.84	26.48
Max Water Surface Elev (ft MSL)	90.22	77.93	79.10	88.13	91.10
Riser Engaged?	Yes	Yes	Yes	Yes	Yes
Emergency Spillway Engaged?	Yes	No	Yes	No	Yes
% Reduction	62	47	59	54	18
Total Qout = 718.42 cfs					

Comparing the proposed condition with existing conditions peak flow rates:

Condition	25 year, 24 hour storm event Qout (cfs)	100 year, 24 hour storm event Qout (cfs)
Existing (prior to landfill construction)	466.73	973.07
Proposed (after closure)	309.43	718.42
Proposed < Existing??	Yes	Yes
% Reduction	34	26

While the total volume of stormwater runoff is higher under the proposed conditions, the stormwater management basins hold the water and release it from site at a slower pace, mitigating flows such that they are even lower than under existing conditions.

Reviewed by PGS 08/27/2021

CHESAPEAKE TERRACE
BASIN 1
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	84.5	5.5	5.100
	84	5	3.957
	83	4	2.700
	82	3	1.670
Bottom Orifice	79	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
84.5	427,754		5.100	
		67,005		4.11
84	360,749		3.957	
		131,071		10.94
83	229,678		2.700	
		117,882		14.99
82	111,796		1.670	
		111,796		37.19
79	0		0.000	
			Total=	**67.23 hours**
			=	**2.8 days**

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CHESAPEAKE TERRACE
BASIN 2
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	77	3	2.740
	76.4	2.4	2.420
	76	2	2.170
	75	1	1.370
Bottom Orifice	74	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
77	77,190		2.740	
		18,841		2.03
76.4	58,349		2.420	
		12,074		1.46
76	46,275		2.170	
		24,499		3.84
75	21,776		1.370	
		21,776		8.83
74	0		0.000	
			Total=	**16.16 hours**
			=	**0.7 days**

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CHESAPEAKE TERRACE
BASIN 3
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	77	3	1.570
	76.4	2.4	1.390
	76	2	1.250
	75	1	0.820
Bottom Orifice	74	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
77	204,126		1.570	
		47,232		8.86
76.4	156,894		1.390	
		30,661		6.45
76	126,233		1.250	
		65,733		17.64
75	60,500		0.820	
		60,500		40.99
74	0		0.000	
			Total=	**73.94 hours**
			=	**3.1 days**

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CHESAPEAKE TERRACE
BASIN 4
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	83.6	5.1	2.080
	82.1	3.6	1.730
	80	1.5	1.060
	79.1	0.6	0.560
Bottom Orifice	78.5	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
83.6	163,820		2.080	
		56,574		8.25
82.1	107,246		1.730	
		69,211		13.78
80	38,035		1.060	
		23,687		8.12
79.1	14,348		0.560	
		14,348		14.23
78.5	0		0.000	
			Total=	**44.38 hours**
			=	**1.8 days**

Reviewed by PGS 08/27/2021

CHESAPEAKE TERRACE
WQV
DEWATERING TIME

Rating Table			
	Elevation (ft.)	H (height from dewater hole) (ft.)	Q (cfs)
Crest of Riser	89.5	1.5	0.280
	89.2	1.2	0.250
	88.7	0.7	0.180
	88.4	0.4	0.120
Bottom Orifice	88	0	0

Dewatering Time				
Elevation (ft)	Volume (ft^3)	ΔStorage (ft^3)	Discharge (cfs)	time (hours)
89.5	5,400		0.280	
		1,166		1.22
89.2	4,234		0.250	
		1,848		2.39
88.7	2,386		0.180	
		1,051		1.95
88.4	1,335		0.120	
		1,335		6.18
88	0		0.000	
			Total=	**11.74 hours**
			=	**0.5 days**

Reviewed by PGS 08/27/2021

PROPOSED CONDITIONS

BASIN 1

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								16.52%
WOODS	332,365		131,028	25,995	489,387			0.00%
OPEN SPACE	411,144		669,712	274,313	1,355,168			73.99%
IMPERVIOUS	74,126	0	172,868	32,057	279,051	5.19%		9.49%
CAP	402,941		3,134,813	203,513	3,741,267		123.40	1.00
					0			
OFFSITE					0			
WOODS	33,629		51,548		85,177			
RA	403,214	103,642	214,775	55,609	777,240			
R-2					0			
TOTAL					6,727,291		6,727,291	

BASIN 2

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								28.36%
WOODS	122,667		43,308	3,323	169,299			0.00%
OPEN SPACE	75,069		193,145		268,214			71.64%
IMPERVIOUS	12,756		39,104		51,859	14.30%		0.00%
CAP	15,027		27,590		42,617		8.33	1.00
					0			
OFFSITE					0			
WOODS					0			
RA	547,893	9,866	81,020	37,070	675,849			
R-2					0			
TOTAL					1,207,839		1,208,511	

BASIN 3

	SOILS							
	A	B	C	D	TOTAL CHECK	% IMPERVIOUS	DISTURBED AREA	% SOIL TYPE IN DIST AREA
ONSITE								9.74%
WOODS					0			0.00%
OPEN SPACE	68,751		252,304	29,508	350,562			85.38%
IMPERVIOUS	9,226		110,479	19,790	139,495	7.74%		4.88%
CAP	97,612		1,176,328	38,616	1,312,556		41.38	1.00
					0			
OFFSITE					0			
WOODS					0			
RA					0			
R-2					0			
TOTAL					1,802,613		1,802,614	

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PROPOSED CONDITIONS

BASIN 4

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE								12.12%
WOODS	395,927	5,767	404,259		805,954			9.96%
OPEN SPACE	35,334	18,850	198,718	50,619	303,522			61.68%
IMPERVIOUS	7,436	16,314	18,955	6,703	49,407	14.00%		16.24%
CAP					0		8.10	1.00
					0			
OFFSITE					0			
WOODS					0			
RA	1,043,104	281,741	75,531		1,400,376			
R-2	692,547	599,476	322,638	281,842	1,896,503			
TOTAL					4,455,761		4,455,761	

WQV

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			0.00%
WOODS		**9,223**	**6,232**		15,455			57.83%
OPEN SPACE		**20,644**	**16,961**		37,605			42.17%
IMPERVIOUS		**8,752**	**4,475**		13,227	26.02%		0.00%
CAP					0		1.17	1.00
					0			
OFFSITE					0			
LOD					0			
RA					0			
R-2		**65,742**	**18,740**		84,482			
TOTAL					150,769		150,783	

UNMANAGED

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			29.30%
WOODS					0			7.34%
OPEN SPACE	40,015	**9,812**	**68,391**	16,061	134,279			52.49%
IMPERVIOUS	12,080	**3,237**	**24,939**	3,262	43,518	24.48%		10.87%
CAP					0		4.08	1.00
					0			
OFFSITE					0			
LOD					0			
RA					0			
R-2					0			
TOTAL					177,796			

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PROPOSED CONDITIONS

WQV + UNM

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			22.79%
WOODS	0	9,223	6,232	0	15,455			18.57%
OPEN SPACE	40,015	30,456	85,352	16,061	171,884			50.20%
IMPERVIOUS	12,080	11,989	29,414	3,262	56,745	24.82%		8.45%
CAP	0	0	0	0	0		5.25	1.00
	0	0	0	0	0			
OFFSITE	0	0	0	0	0			
LOD	0	0	0	0	0			
RA	0	0	0	0	0			
R-2	0	65,742	18,740	0	84,482			
TOTAL	0	0	0	0	328,565			

UNMANAGED Discharge Pt 2

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			0.00%
WOODS	4,417		86,043	184,932	275,391			0.00%
OPEN SPACE			2,038	21,669	23,707			8.60%
IMPERVIOUS					0	0.00%		91.40%
CAP					0		0.54	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					299,098			

UNMANAGED Discharge Pt 2

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			38.60%
WOODS			7,354	7,236	14,590			0.00%
OPEN SPACE	24,838		25,224	14,292	64,354			39.20%
IMPERVIOUS					0	0.00%		22.21%
CAP					0		1.48	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					78,944			

Reviewed by PGS 08/27/2021

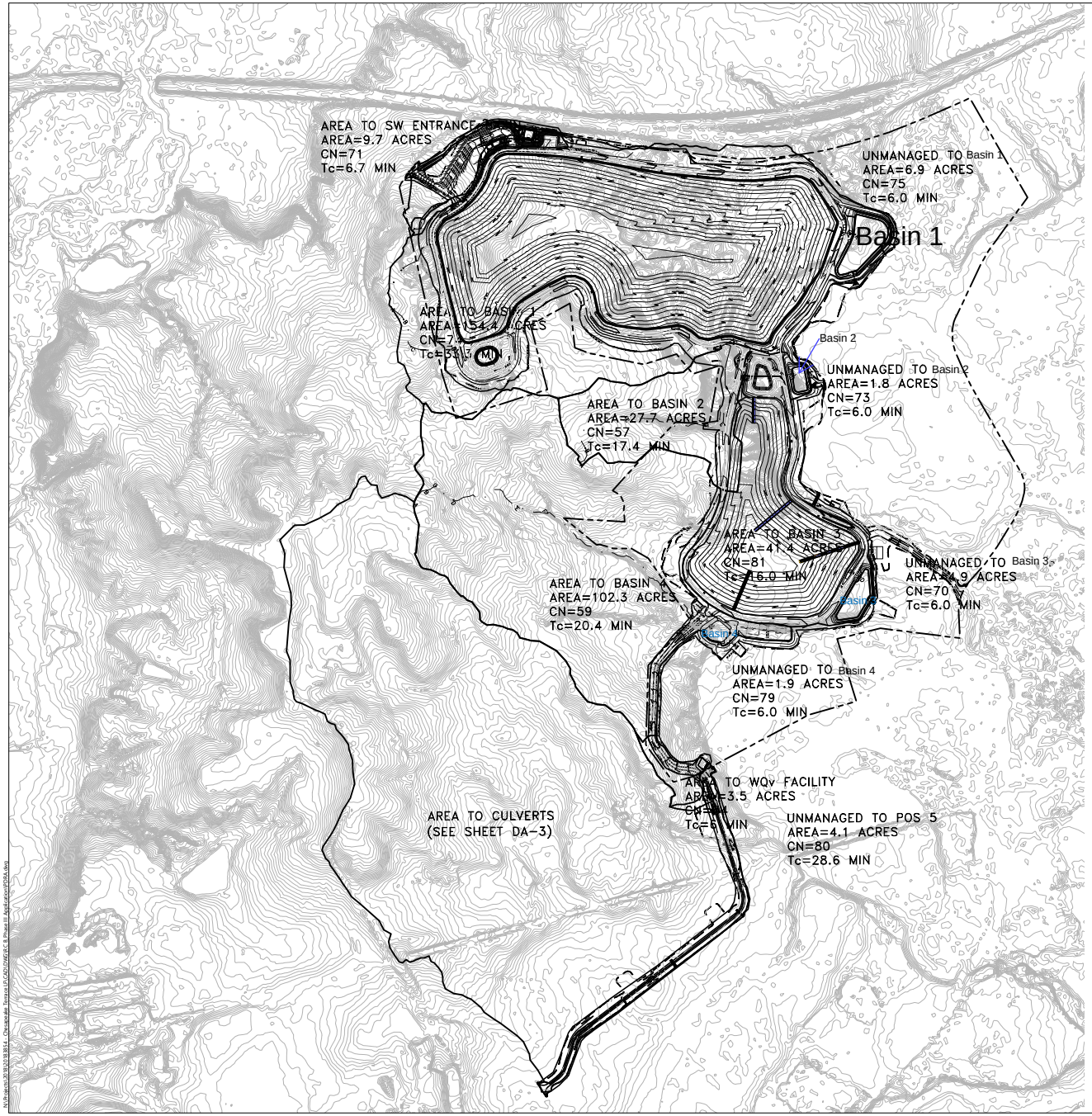
PROPOSED CONDITIONS

UNMANAGED Discharge Pt 3

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			24.12%
WOODS	25,681		11,227	20,676	57,584			0.00%
OPEN SPACE	37,410		32,984	84,713	155,107			21.27%
IMPERVIOUS					0	0.00%		54.62%
CAP					0		3.56	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					212,691			

UNMANAGED Discharge Pt 4

	SOILS							
	A	**B**	**C**	**D**	**TOTAL CHECK**	**% IMPERVIOUS**	**DISTURBED AREA**	**% SOIL TYPE IN DIST AREA**
ONSITE					0			4.36%
WOODS					0			6.18%
OPEN SPACE	3,590	5,089	14,725	58,907	82,311			17.89%
IMPERVIOUS					0	0.00%		71.57%
CAP					0		1.89	1.00
OFFSITE								
LOD					0			
RA					0			
R-2					0			
TOTAL					82,311			



Reviewed by PGS 08/27/2021

GRAPHIC SCALE

400 0 200 400 800 1600

(IN FEET)
1 inch =400 ft.

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
NO # 35645

REVISION:

DATE:

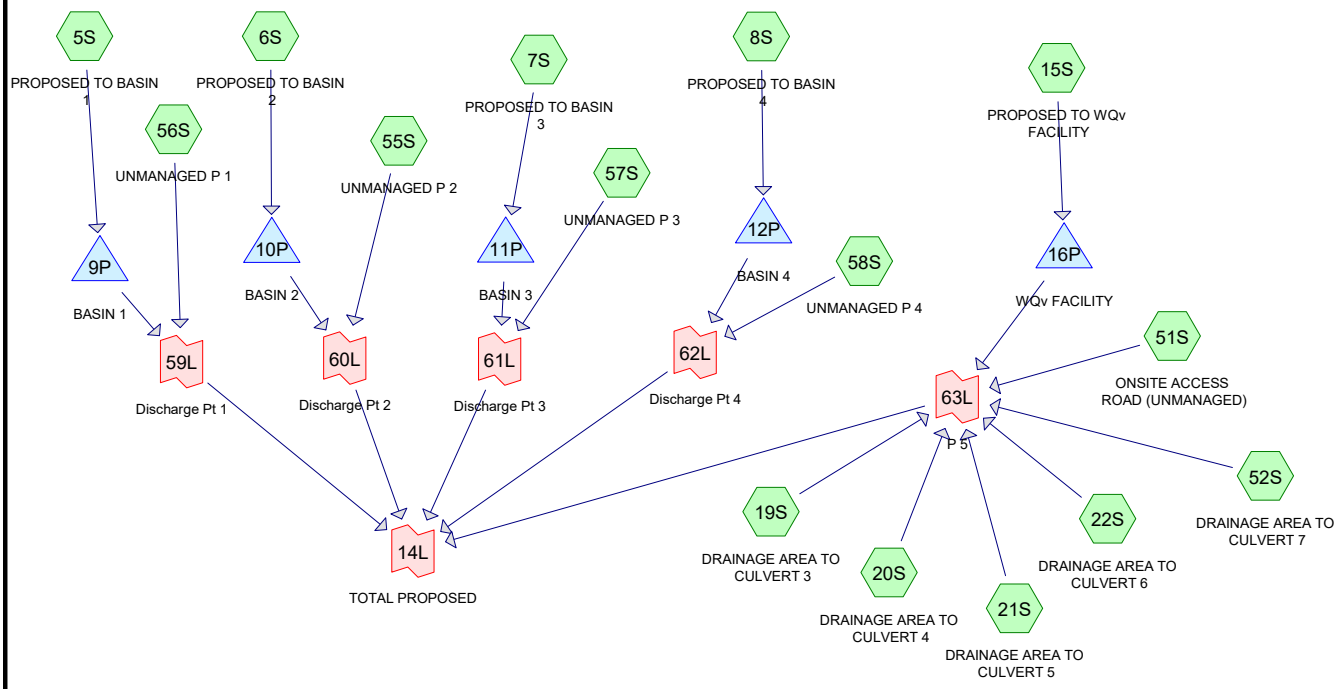
NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
Membrane Environmental Group Company

PROPOSED DRAINAGE AREA PLAN

PROJECT MANAGER: VEF
CHECKED BY: VEF
DRAWN BY: CEC
SCALE: AS SHOWN
PROJECT NUMBER: 2018-3854
DATE:

DA-2



Reviewed by PGS 08/27/2021

Subcat Reach Pond Link

Drainage Diagram for CT_Prop Basins_07152020
Prepared by {enter your company name here}, Printed 7/18/2020
HydroCAD® 8.50 s/n 005690 © 2007 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
0.691	30	Woods, Good, HSG A (56S,57S)
19.535	30	Woods, Good, HSG A (ONSITE) (5S,6S,8S)
0.772	30	Woods, Good, HSG A OFFSITE (5S)
21.835	42	RA ZONING A SOIL (5S,6S)
23.946	42	RA ZONING A SOILS (8S)
86.984	50	R-2 ZONING A SOILS (8S,20S,21S,22S,52S)
0.212	55	Woods, Good, HSG B (15S)
0.132	55	Woods, Good, HSG B (ONSITE) (8S)
0.660	61	>75% Grass cover, Good, HSG B (DISTURBED A) (20S,21S)
1.723	61	>75% Grass cover, Good, HSG B (ONSITE A SOIL) (6S)
9.439	61	>75% Grass cover, Good, HSG B (ONSITE A SOILS) (5S)
4.820	61	>75% Grass cover, Good, HSG B (ONSITE A) (7S,8S,51S,55S,57S,58S)
2.605	64	RA ZONING B SOIL (5S,6S)
6.468	64	RA ZONING B SOILS (8S)
78.284	70	R-2 ZONING B SOILS (8S,15S,19S,20S,21S,22S,52S)
2.545	70	Woods, Good, HSG C (15S,55S,56S,57S)
13.283	70	Woods, Good, HSG C (ONSITE) (5S,6S,8S)
1.183	70	Woods, Good, HSG C OFFSITE (5S)
1.472	74	>75% Grass cover, Good, HSG C (DISTURBED B) (19S,20S,21S)
1.249	74	>75% Grass cover, Good, HSG C (ONSITE B) (8S,15S,51S,58S)
6.791	76	RA ZONING C SOIL (5S,6S)
1.734	76	RA ZONING C SOILS (8S)
4.886	77	Woods, Good, HSG D (55S,56S,57S)
0.673	77	Woods, Good, HSG D (ONSITE) (5S,6S)
6.558	80	>75% Grass cover, Good, HSG D (7S,8S,20S,51S,55S,56S,57S,58S)
1.768	80	>75% Grass cover, Good, HSG D (DISTURBED C) (19S,20S,22S,52S)
0.201	80	>75% Grass cover, Good, HSG D (DISTURBED D) (52S)
4.434	80	>75% Grass cover, Good, HSG D (ONSITE C SOIL) (6S)
15.374	80	>75% Grass cover, Good, HSG D (ONSITE C SOILS) (5S)
14.034	80	>75% Grass cover, Good, HSG D (ONSITE C) (7S,8S,15S,51S,55S,56S,57S,58S)
6.297	80	>75% Grass cover, Good, HSG D (ONSITE D SOILS) (5S)
31.110	80	CAP (6S,7S)
85.888	80	CAP AREA (5S)
70.697	80	R-2 ZONING C SOILS (8S,15S,20S,21S,22S,52S)
2.128	82	RA ZONING D SOIL (5S,6S)
27.167	85	R-2 ZONING D SOILS (8S,20S,52S)
0.332	98	Paved parking & roofs (21S,22S)
0.953	98	Paved parking & roofs (ONSITE A) (6S,7S,8S,51S)
0.650	98	Paved parking & roofs (ONSITE B) (8S,15S,51S)
4.545	98	Paved parking & roofs (ONSITE C) (6S,7S,8S,15S,51S)
0.683	98	Paved parking & roofs (ONSITE D) (7S,8S,51S)

Area Listing (all nodes) (continued)

Area (acres)	CN	Description (subcatchment-numbers)
1.702	98	Paved parking & roofs A ONSITE (5S)
0.050	98	Paved parking & roofs A SOILS (20S)
0.081	98	Paved parking & roofs B SOILS (19S,20S)
3.969	98	Paved parking & roofs C ONSITE (5S)
0.353	98	Paved parking & roofs C SOILS (19S,20S,52S)
0.736	98	Paved parking & roofs D ONSITE (5S)
0.080	98	Paved parking & roofs D SOILS (20S,52S)
571.713		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
20.998	HSG A	5S, 6S, 8S, 56S, 57S
16.986	HSG B	5S, 6S, 7S, 8S, 15S, 20S, 21S, 51S, 55S, 57S, 58S
19.731	HSG C	5S, 6S, 8S, 15S, 19S, 20S, 21S, 51S, 55S, 56S, 57S, 58S
54.225	HSG D	5S, 6S, 7S, 8S, 15S, 19S, 20S, 22S, 51S, 52S, 55S, 56S, 57S, 58S
459.772	Other	5S, 6S, 7S, 8S, 15S, 19S, 20S, 21S, 22S, 51S, 52S
571.713		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: PROPOSED TO BASIN Runoff Area=154.439 ac 4.15% Impervious Runoff Depth=3.10"
Flow Length=5,552' Tc=33.3 min CN=74 Runoff=386.46 cfs 39.909 af

Subcatchment 6S: PROPOSED TO Runoff Area=1,207,838 sf 4.29% Impervious Runoff Depth=1.62"
Flow Length=2,643' Tc=17.4 min CN=57 Runoff=49.60 cfs 3.733 af

Subcatchment 7S: PROPOSED TO Runoff Area=1,802,614 sf 7.74% Impervious Runoff Depth=3.79"
Flow Length=2,398' Tc=16.0 min CN=81 Runoff=195.44 cfs 13.079 af

Subcatchment 8S: PROPOSED TO Runoff Area=4,455,761 sf 1.11% Impervious Runoff Depth=1.78"
Flow Length=3,075' Tc=20.4 min CN=59 Runoff=186.05 cfs 15.131 af

Subcatchment 15S: PROPOSED TO WQv Runoff Area=150,762 sf 8.78% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=74 Runoff=19.12 cfs 0.894 af

Subcatchment 19S: DRAINAGE AREA TO Runoff Area=0.556 ac 8.99% Impervious Runoff Depth=3.10"
Tc=6.0 min CN=74 Runoff=3.07 cfs 0.144 af

Subcatchment 20S: DRAINAGE AREA TO Runoff Area=96.992 ac 0.16% Impervious Runoff Depth=2.54"
Flow Length=4,594' Tc=30.4 min CN=68 Runoff=208.26 cfs 20.565 af

Subcatchment 21S: DRAINAGE AREA TO Runoff Area=12.910 ac 1.93% Impervious Runoff Depth=2.28"
Flow Length=1,337' Tc=13.2 min CN=65 Runoff=39.97 cfs 2.452 af

Subcatchment 22S: DRAINAGE AREA TO Runoff Area=3,681,542 sf 0.10% Impervious Runoff Depth=2.37"
Flow Length=3,556' Tc=26.2 min CN=66 Runoff=184.60 cfs 16.666 af

Subcatchment 51S: ONSITE ACCESS Runoff Area=177,797 sf 24.48% Impervious Runoff Depth=3.69"
Tc=28.6 min CN=80 Runoff=13.49 cfs 1.255 af

Subcatchment 52S: DRAINAGE AREA TO Runoff Area=27.906 ac 1.27% Impervious Runoff Depth=3.29"
Flow Length=1,920' Tc=28.5 min CN=76 Runoff=82.38 cfs 7.660 af

Subcatchment 55S: UNMANAGED P 2 Runoff Area=78,944 sf 0.00% Impervious Runoff Depth=3.01"
Tc=6.0 min CN=73 Runoff=9.72 cfs 0.454 af

Subcatchment 56S: UNMANAGED P 1 Runoff Area=299,039 sf 0.00% Impervious Runoff Depth=3.20"
Tc=6.0 min CN=75 Runoff=39.01 cfs 1.829 af

Subcatchment 57S: UNMANAGED P 3 Runoff Area=212,691 sf 0.00% Impervious Runoff Depth=2.73"
Tc=6.0 min CN=70 Runoff=23.85 cfs 1.109 af

Subcatchment 58S: UNMANAGED P 4 Runoff Area=82,311 sf 0.00% Impervious Runoff Depth=3.59"
Tc=6.0 min CN=79 Runoff=11.91 cfs 0.565 af

Pond 9P: BASIN 1 Peak Elev=86.60' Storage=718,710 cf Inflow=386.46 cfs 39.909 af
Outflow=140.81 cfs 39.794 af

Pond 10P: BASIN 2 Peak Elev=77.06' Storage=79,209 cf Inflow=49.60 cfs 3.733 af
Outflow=3.75 cfs 3.729 af

Pond 11P: BASIN 3 Peak Elev=77.89' Storage=277,110 cf Inflow=195.44 cfs 13.079 af
Outflow=54.16 cfs 13.036 af

Pond 12P: BASIN 4 Peak Elev=84.49' Storage=200,499 cf Inflow=186.05 cfs 15.131 af
Outflow=95.11 cfs 15.125 af

Pond 16P: WQv FACILITY Peak Elev=90.11' Storage=7,923 cf Inflow=19.12 cfs 0.894 af
Outflow=15.60 cfs 0.894 af

Link 14L: TOTAL PROPOSED Inflow=638.18 cfs 125.279 af
Primary=638.18 cfs 125.279 af

Link 59L: Discharge Pt 1 Inflow=143.29 cfs 41.622 af
Primary=143.29 cfs 41.622 af

Link 60L: Discharge Pt 2 Inflow=10.19 cfs 4.183 af
Primary=10.19 cfs 4.183 af

Link 61L: Discharge Pt 3 Inflow=56.90 cfs 14.146 af
Primary=56.90 cfs 14.146 af

Link 62L: Discharge Pt 4 Inflow=96.41 cfs 15.691 af
Primary=96.41 cfs 15.691 af

Link 63L: P 5 Inflow=505.10 cfs 49.637 af
Primary=505.10 cfs 49.637 af

Total Runoff Area = 571.713 ac Runoff Volume = 125.447 af Average Runoff Depth = 2.63"
97.53% Pervious = 557.579 ac 2.47% Impervious = 14.133 ac

Summary for Subcatchment 5S: PROPOSED TO BASIN 1

Runoff = 386.46 cfs @ 12.28 hrs, Volume= 39.909 af, Depth= 3.10"

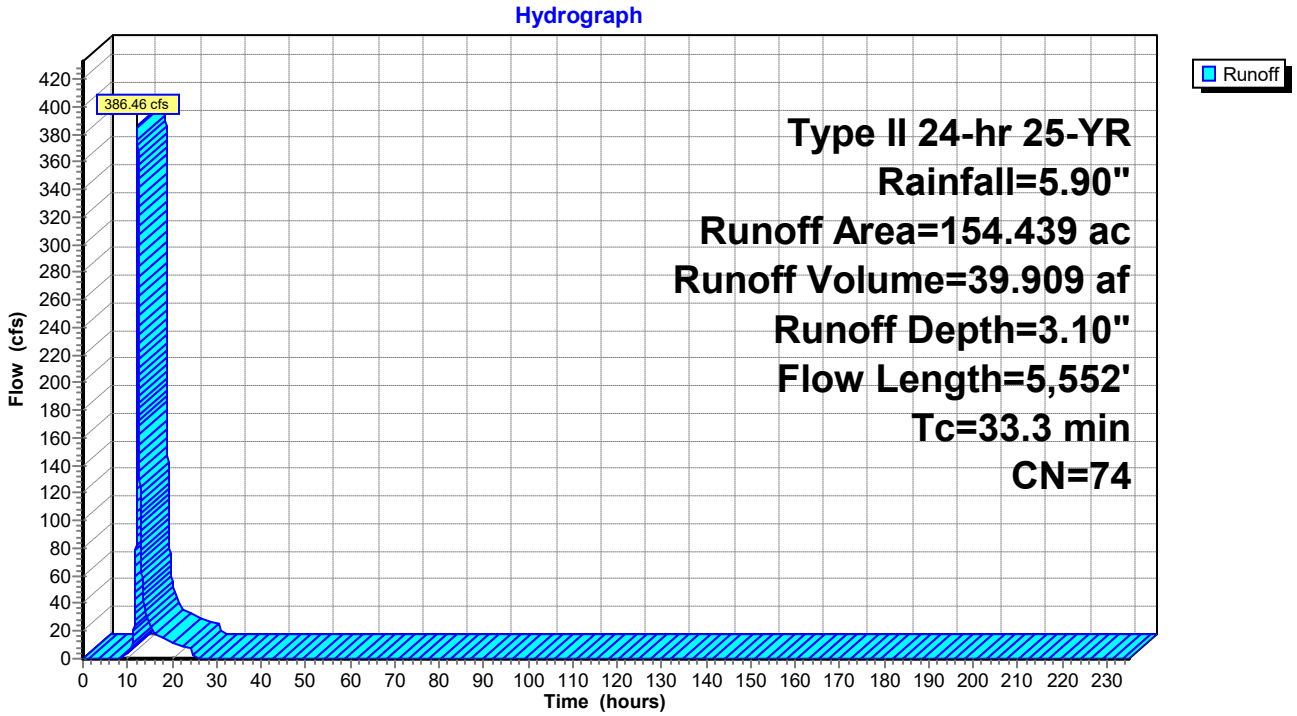
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	7.630	30	Woods, Good, HSG A (ONSITE)
*	3.008	70	Woods, Good, HSG C (ONSITE)
*	0.597	77	Woods, Good, HSG D (ONSITE)
*	9.439	61	>75% Grass cover, Good, HSG B (ONSITE A SOILS)
*	15.374	80	>75% Grass cover, Good, HSG D (ONSITE C SOILS)
*	6.297	80	>75% Grass cover, Good, HSG D (ONSITE D SOILS)
*	1.702	98	Paved parking & roofs A ONSITE
*	3.969	98	Paved parking & roofs C ONSITE
*	0.736	98	Paved parking & roofs D ONSITE
*	85.888	80	CAP AREA
*	0.772	30	Woods, Good, HSG A OFFSITE
*	1.183	70	Woods, Good, HSG C OFFSITE
*	9.257	42	RA ZONING A SOIL
*	2.379	64	RA ZONING B SOIL
*	4.931	76	RA ZONING C SOIL
*	1.277	82	RA ZONING D SOIL
	154.439	74	Weighted Average
	148.032		Pervious Area
	6.407		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.26		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
1.2	295	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	272	0.0200	3.44	32.28	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=16.00' D=0.50' Z= 6.0 & 5.0 '/' Top.W=21.50' n= 0.035 Earth, dense weeds
6.5	1,025	0.0100	2.64	73.81	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
9.4	2,107	0.0200	3.73	104.38	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
0.3	165	0.0050	7.89	55.74	**Circular Channel (pipe), F-G** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
1.1	380	0.0600	5.78	17.35	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
5.1	724	0.0100	2.36	7.08	**Trap/Vee/Rect Channel Flow, H-I** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00'

n= 0.035 Earth, dense weeds					
1.9	376	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, I-J** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
0.2	108	0.0050	10.33	164.33	**Circular Channel (pipe), J-K** Diam= 54.0" Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.011 Concrete pipe, straight & clean
33.3	5,552	Total			

Subcatchment 5S: PROPOSED TO BASIN 1



Summary for Subcatchment 6S: PROPOSED TO BASIN 2

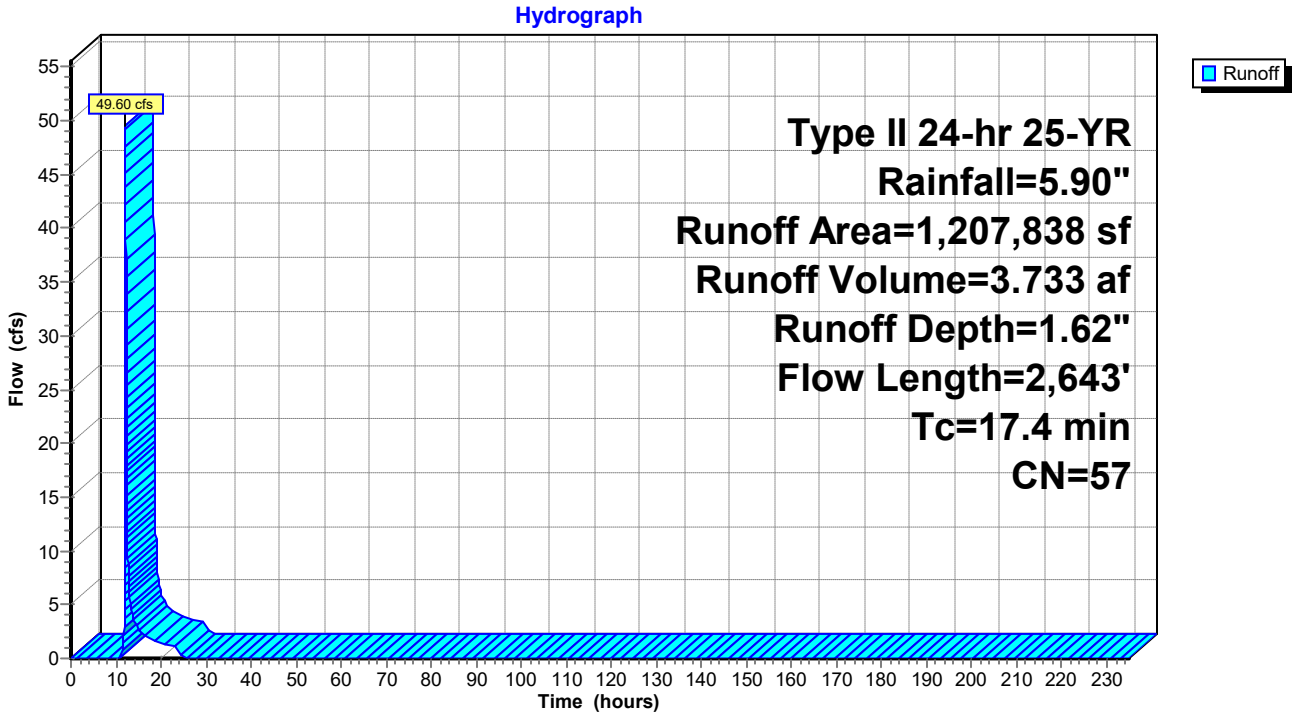
Runoff = 49.60 cfs @ 12.12 hrs, Volume= 3.733 af, Depth= 1.62"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	122,667	30	Woods, Good, HSG A (ONSITE)
*	43,308	70	Woods, Good, HSG C (ONSITE)
*	3,323	77	Woods, Good, HSG D (ONSITE)
*	75,069	61	>75% Grass cover, Good, HSG B (ONSITE A SOIL)
*	193,145	80	>75% Grass cover, Good, HSG D (ONSITE C SOIL)
*	12,756	98	Paved parking & roofs (ONSITE A)
*	39,104	98	Paved parking & roofs (ONSITE C)
*	42,617	80	CAP
*	547,893	42	RA ZONING A SOIL
*	9,866	64	RA ZONING B SOIL
*	81,020	76	RA ZONING C SOIL
*	37,070	82	RA ZONING D SOIL
	1,207,838	57	Weighted Average
	1,155,978		Pervious Area
	51,860		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	598	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.6	697	0.0400	4.43	12.72	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 3.5 '/' Top.W=7.50' n= 0.035 Earth, dense weeds
1.1	161	0.0100	2.45	11.05	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
2.1	545	0.0300	4.25	19.13	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.1	74	0.0700	23.95	117.56	**Circular Channel (pipe), F-G** Diam= 30.0" Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.012
0.9	305	0.0500	5.57	30.64	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.035 Earth, dense weeds
0.1	163	0.0900	37.15	466.84	**Circular Channel (pipe), H-I** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.012
17.4	2,643	Total			

Subcatchment 6S: PROPOSED TO BASIN 2



Summary for Subcatchment 7S: PROPOSED TO BASIN 3

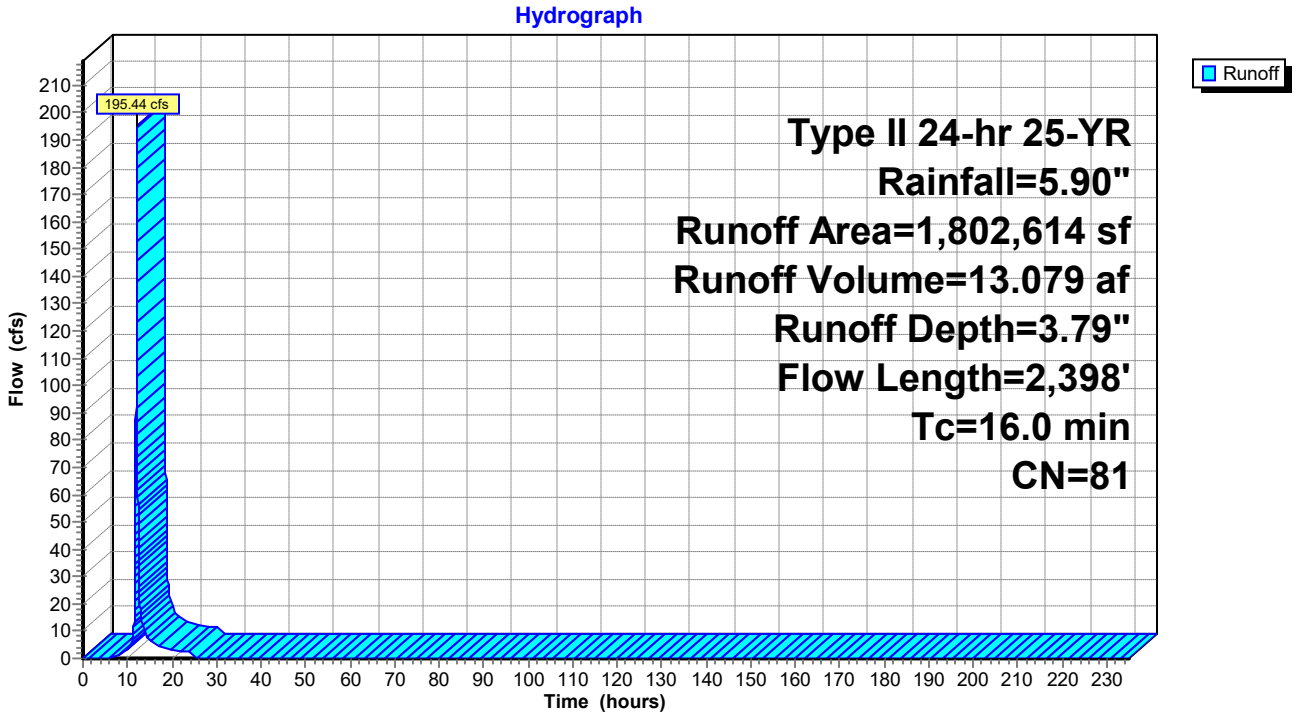
Runoff = 195.44 cfs @ 12.08 hrs, Volume= 13.079 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	68,751	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	252,304	80	>75% Grass cover, Good, HSG D (ONSITE C)
	29,508	80	>75% Grass cover, Good, HSG D
*	9,226	98	Paved parking & roofs (ONSITE A)
*	110,479	98	Paved parking & roofs (ONSITE C)
*	19,790	98	Paved parking & roofs (ONSITE D)
*	1,312,556	80	CAP
	1,802,614	81	Weighted Average
	1,663,119		Pervious Area
	139,495		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	33	0.5000	0.49		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
14.9	2,274	0.0100	2.54	19.03	**Trap/Vee/Rect Channel Flow, B-C** Bot.W=14.00' D=0.50' Z= 2.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
0.0	91	0.0600	35.20	691.11	**Circular Channel (pipe), C-D** Diam= 60.0" Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012
16.0	2,398	Total			

Subcatchment 7S: PROPOSED TO BASIN 3



Summary for Subcatchment 8S: PROPOSED TO BASIN 4

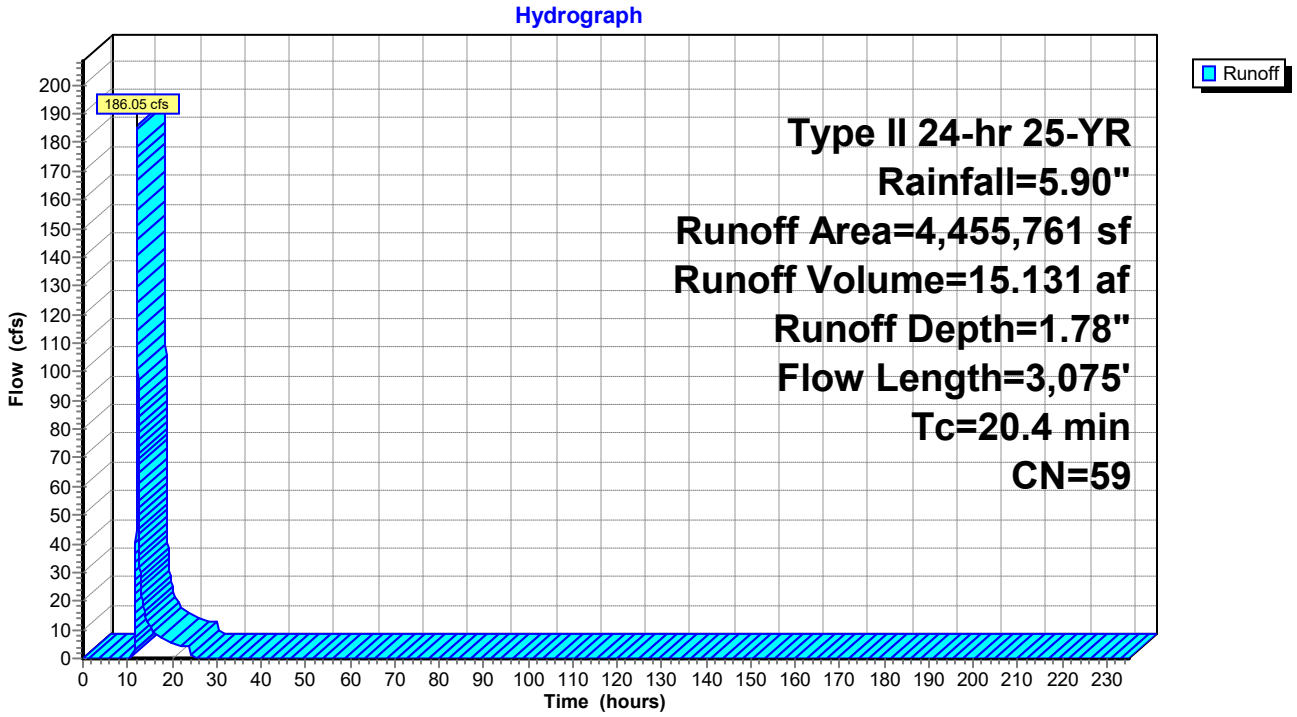
Runoff = 186.05 cfs @ 12.15 hrs, Volume= 15.131 af, Depth= 1.78"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	395,927	30	Woods, Good, HSG A (ONSITE)
*	5,767	55	Woods, Good, HSG B (ONSITE)
*	404,259	70	Woods, Good, HSG C (ONSITE)
*	35,334	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	18,850	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	198,718	80	>75% Grass cover, Good, HSG D (ONSITE C)
	50,619	80	>75% Grass cover, Good, HSG D
*	7,436	98	Paved parking & roofs (ONSITE A)
*	16,314	98	Paved parking & roofs (ONSITE B)
*	18,955	98	Paved parking & roofs (ONSITE C)
*	6,703	98	Paved parking & roofs (ONSITE D)
*	1,043,104	42	RA ZONING A SOILS
*	281,741	64	RA ZONING B SOILS
*	75,531	76	RA ZONING C SOILS
*	692,547	50	R-2 ZONING A SOILS
*	599,476	70	R-2 ZONING B SOILS
*	322,638	80	R-2 ZONING C SOILS
*	281,842	85	R-2 ZONING D SOILS
	4,455,761	59	Weighted Average
	4,406,353		Pervious Area
	49,408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.5	141	0.1000	5.09		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	190	0.0700	6.14	23.43	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=6.00' D=0.50' Z= 2.0 & 4.5 '/' Top.W=9.25' n= 0.035 Earth, dense weeds
2.8	653	0.0600	3.94		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.9	274	0.0500	5.01	15.67	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
8.8	1,671	0.0200	3.17	9.91	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
0.1	46	0.1800	9.91	27.26	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=4.50' D=0.50' Z= 2.0 '/' Top.W=6.50' n= 0.035 Earth, dense weeds
20.4	3,075	Total			

Subcatchment 8S: PROPOSED TO BASIN 4



Summary for Subcatchment 15S: PROPOSED TO WQv FACILITY

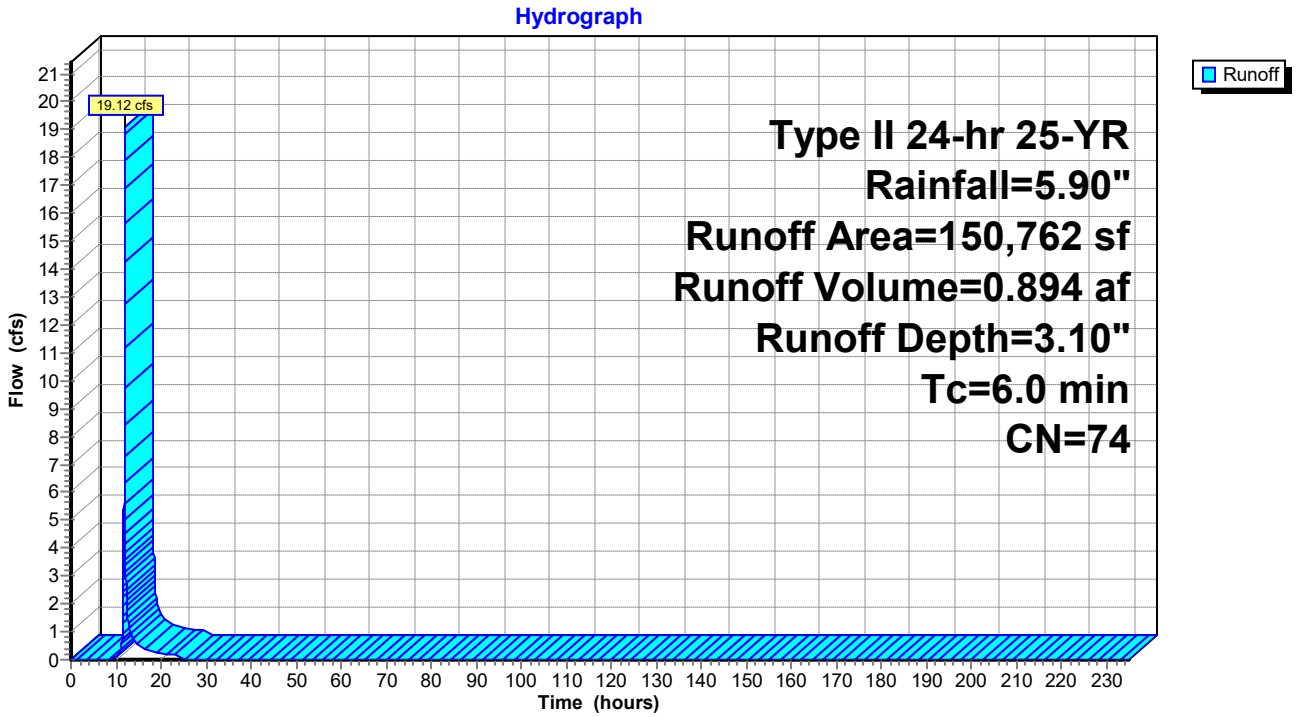
Runoff = 19.12 cfs @ 11.97 hrs, Volume= 0.894 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	9,235	55	Woods, Good, HSG B
	6,229	70	Woods, Good, HSG C
*	20,647	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	16,945	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	8,756	98	Paved parking & roofs (ONSITE B)
*	4,487	98	Paved parking & roofs (ONSITE C)
*	65,732	70	R-2 ZONING B SOILS
*	18,731	80	R-2 ZONING C SOILS
	150,762	74	Weighted Average
	137,519		Pervious Area
	13,243		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 15S: PROPOSED TO WQv FACILITY



Summary for Subcatchment 19S: DRAINAGE AREA TO CULVERT 3

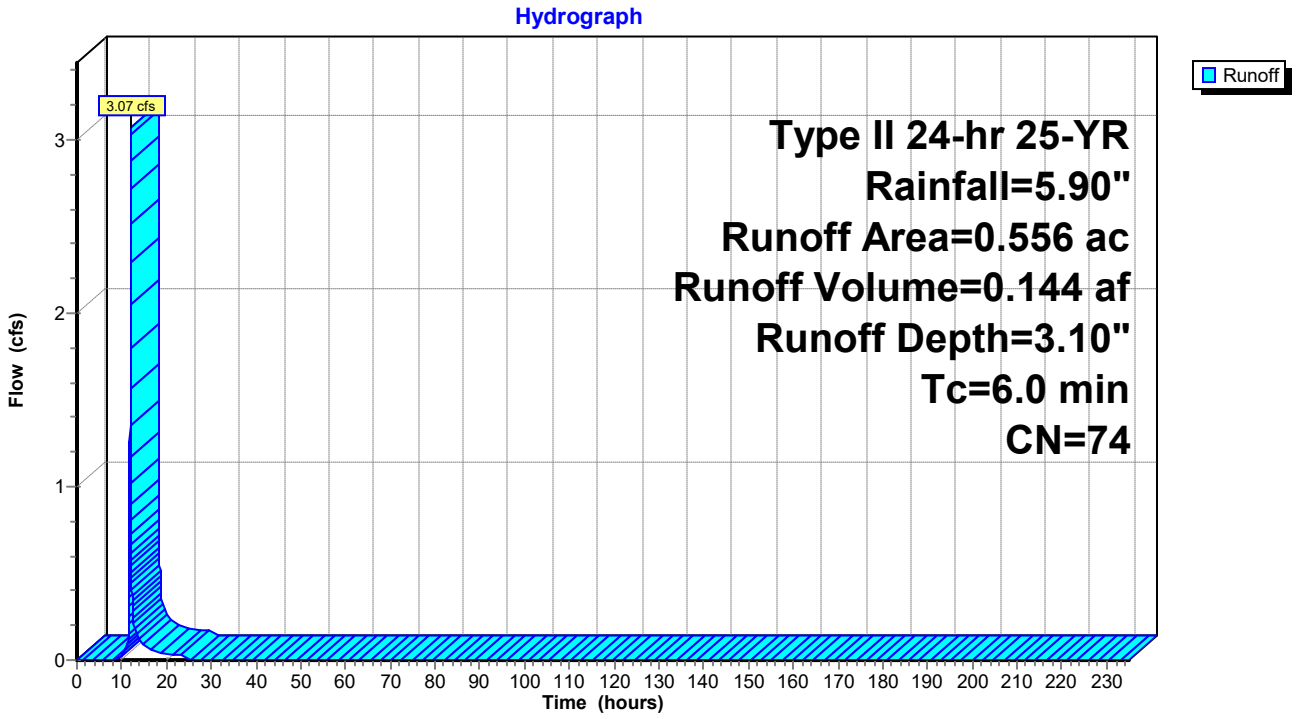
Runoff = 3.07 cfs @ 11.97 hrs, Volume= 0.144 af, Depth= 3.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.150	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.013	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.008	98	Paved parking & roofs B SOILS
*	0.042	98	Paved parking & roofs C SOILS
*	0.343	70	R-2 ZONING B SOILS
	0.556	74	Weighted Average
	0.506		Pervious Area
	0.050		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 19S: DRAINAGE AREA TO CULVERT 3



Summary for Subcatchment 20S: DRAINAGE AREA TO CULVERT 4

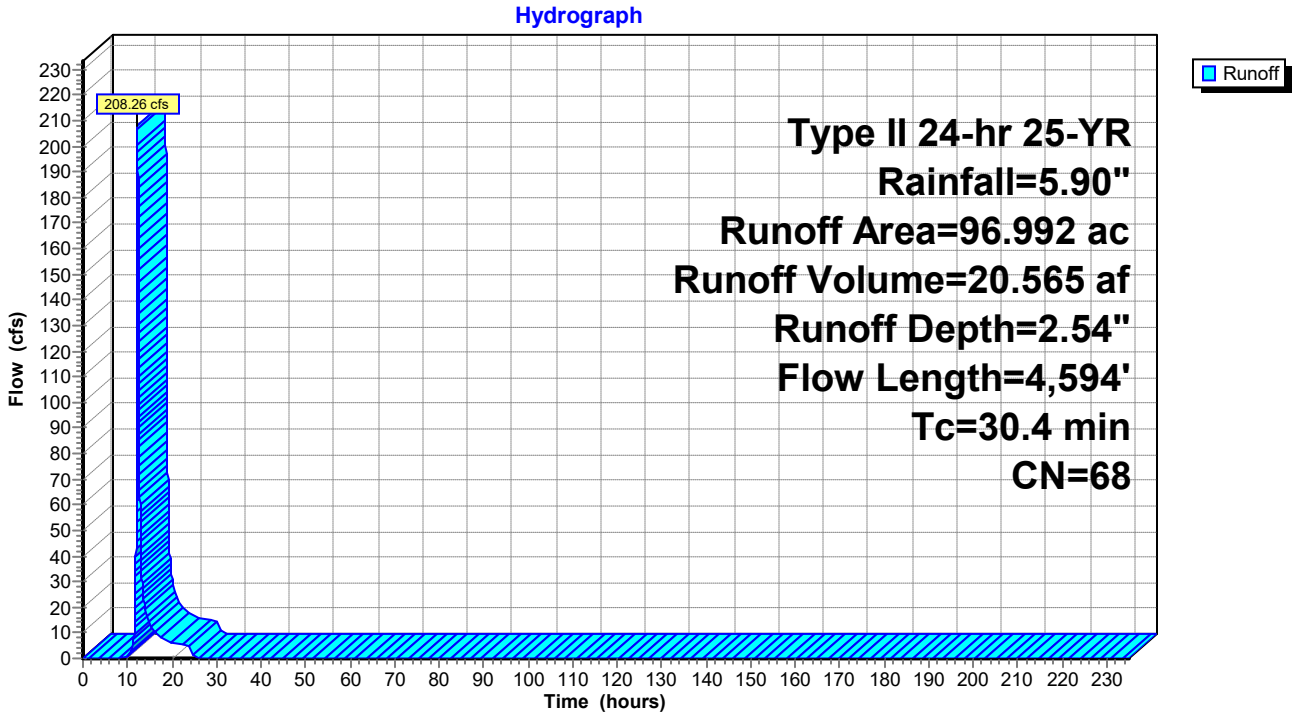
Runoff = 208.26 cfs @ 12.26 hrs, Volume= 20.565 af, Depth= 2.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.193	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.776	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.003	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	0.228	80	>75% Grass cover, Good, HSG D
*	0.050	98	Paved parking & roofs A SOILS
*	0.073	98	Paved parking & roofs B SOILS
*	0.008	98	Paved parking & roofs C SOILS
*	0.028	98	Paved parking & roofs D SOILS
*	33.640	50	R-2 ZONING A SOILS
*	27.405	70	R-2 ZONING B SOILS
*	19.119	80	R-2 ZONING C SOILS
*	15.469	85	R-2 ZONING D SOILS
	96.992	68	Weighted Average
	96.833		Pervious Area
	0.159		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.8	468	0.0100	1.61		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	83	0.1500	6.24		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.7	3,415	0.0300	3.88	13.59	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
3.9	528	0.0100	2.24	7.85	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
30.4	4,594	Total			

Subcatchment 20S: DRAINAGE AREA TO CULVERT 4



Summary for Subcatchment 21S: DRAINAGE AREA TO CULVERT 5

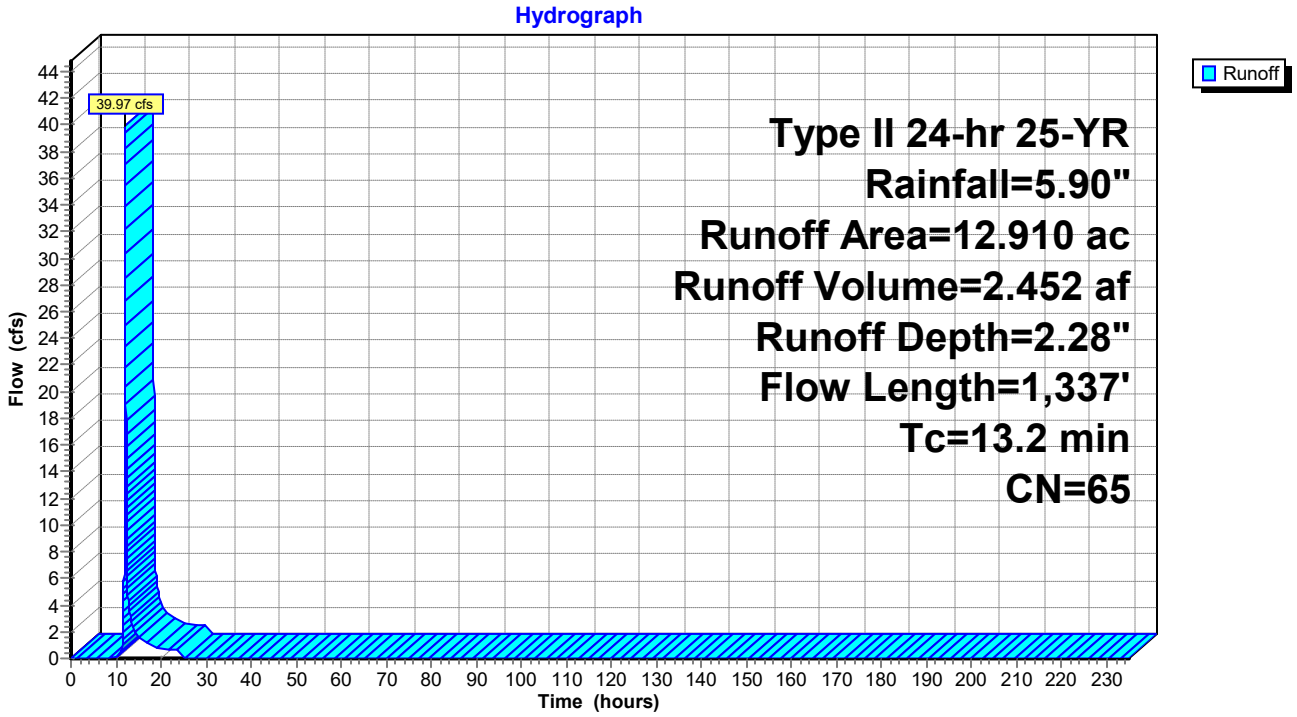
Runoff = 39.97 cfs @ 12.06 hrs, Volume= 2.452 af, Depth= 2.28"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.467	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.546	74	>75% Grass cover, Good, HSG C (DISTURBED B)
	0.197	98	Paved parking & roofs
	0.052	98	Paved parking & roofs
*	3.819	50	R-2 ZONING A SOILS
*	6.875	70	R-2 ZONING B SOILS
*	0.954	80	R-2 ZONING C SOILS
	12.910	65	Weighted Average
	12.661		Pervious Area
	0.249		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	428	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.0	10	0.6000	12.47		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
2.7	799	0.0200	4.96	13.30	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=10.00' D=0.25' Z= 1.7 & 4.0 '/' Top.W=11.43' n= 0.016 Asphalt, rough
13.2	1,337	Total			

Subcatchment 21S: DRAINAGE AREA TO CULVERT 5



Summary for Subcatchment 22S: DRAINAGE AREA TO CULVERT 6

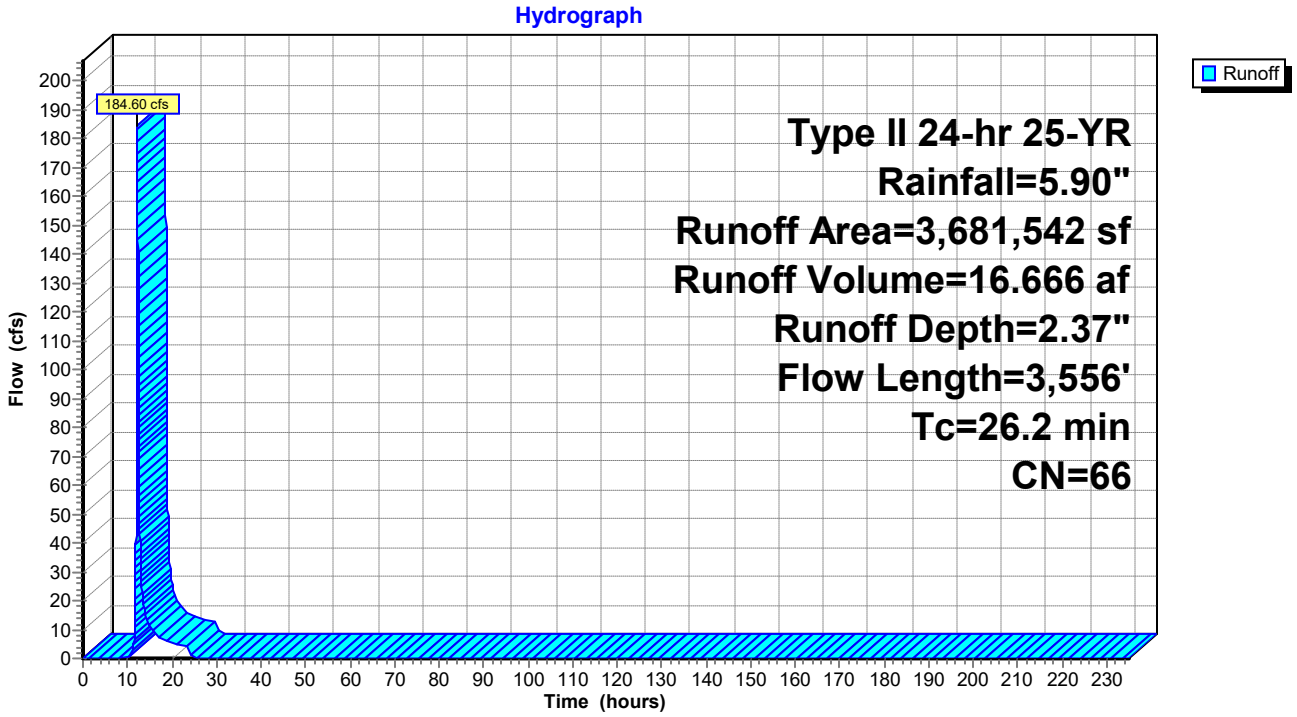
Runoff = 184.60 cfs @ 12.20 hrs, Volume= 16.666 af, Depth= 2.37"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	9,867	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	3,623	98	Paved parking & roofs
*	1,329,281	50	R-2 ZONING A SOILS
*	1,059,738	70	R-2 ZONING B SOILS
*	1,279,033	80	R-2 ZONING C SOILS
	3,681,542	66	Weighted Average
	3,677,919		Pervious Area
	3,623		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
2.6	700	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.8	728	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
5.9	574	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.1	53	0.2600	8.21		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
3.9	850	0.0300	3.60	19.81	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
3.1	551	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
26.2	3,556	Total			

Subcatchment 22S: DRAINAGE AREA TO CULVERT 6



Summary for Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)

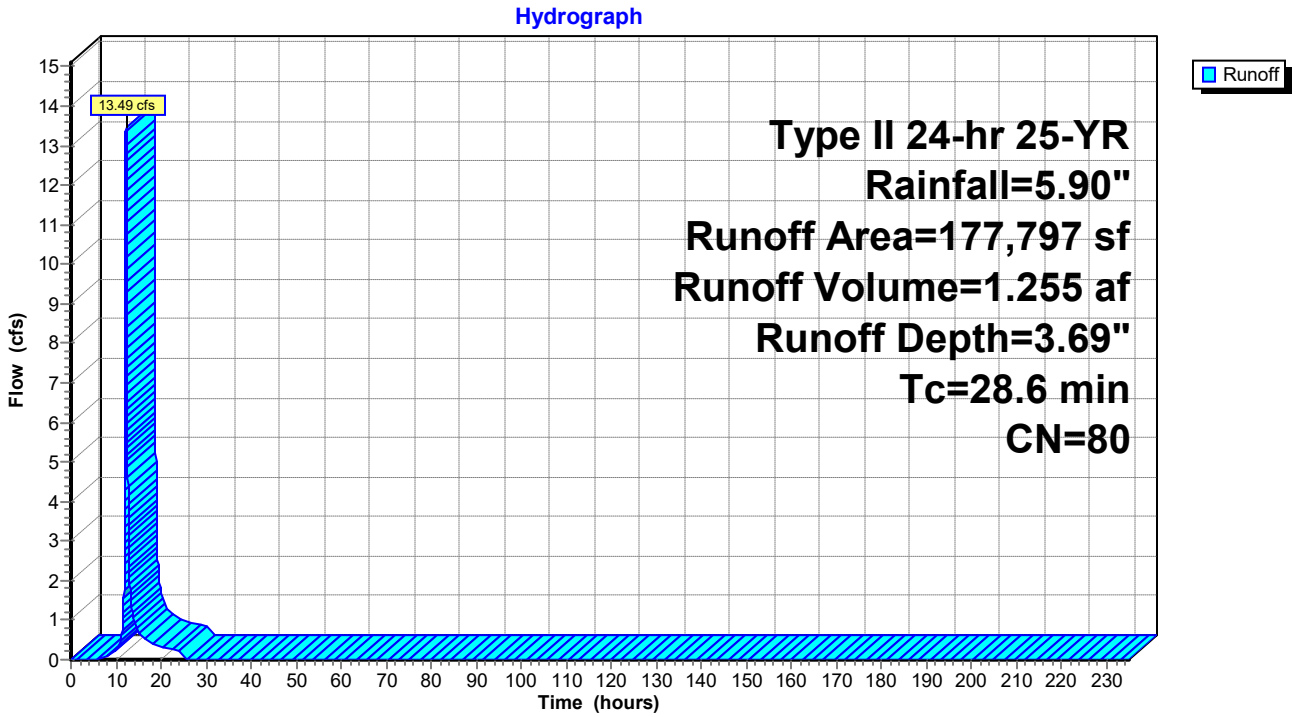
Runoff = 13.49 cfs @ 12.23 hrs, Volume= 1.255 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	40,015	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	9,812	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	68,391	80	>75% Grass cover, Good, HSG D (ONSITE C)
	16,061	80	>75% Grass cover, Good, HSG D
*	12,080	98	Paved parking & roofs (ONSITE A)
*	3,237	98	Paved parking & roofs (ONSITE B)
*	24,939	98	Paved parking & roofs (ONSITE C)
*	3,262	98	Paved parking & roofs (ONSITE D)
	177,797	80	Weighted Average
	134,279		Pervious Area
	43,518		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6					**Direct Entry, SEE Tc CALC FOR AREA TO CULVERT 6**

Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)



Summary for Subcatchment 52S: DRAINAGE AREA TO CULVERT 7

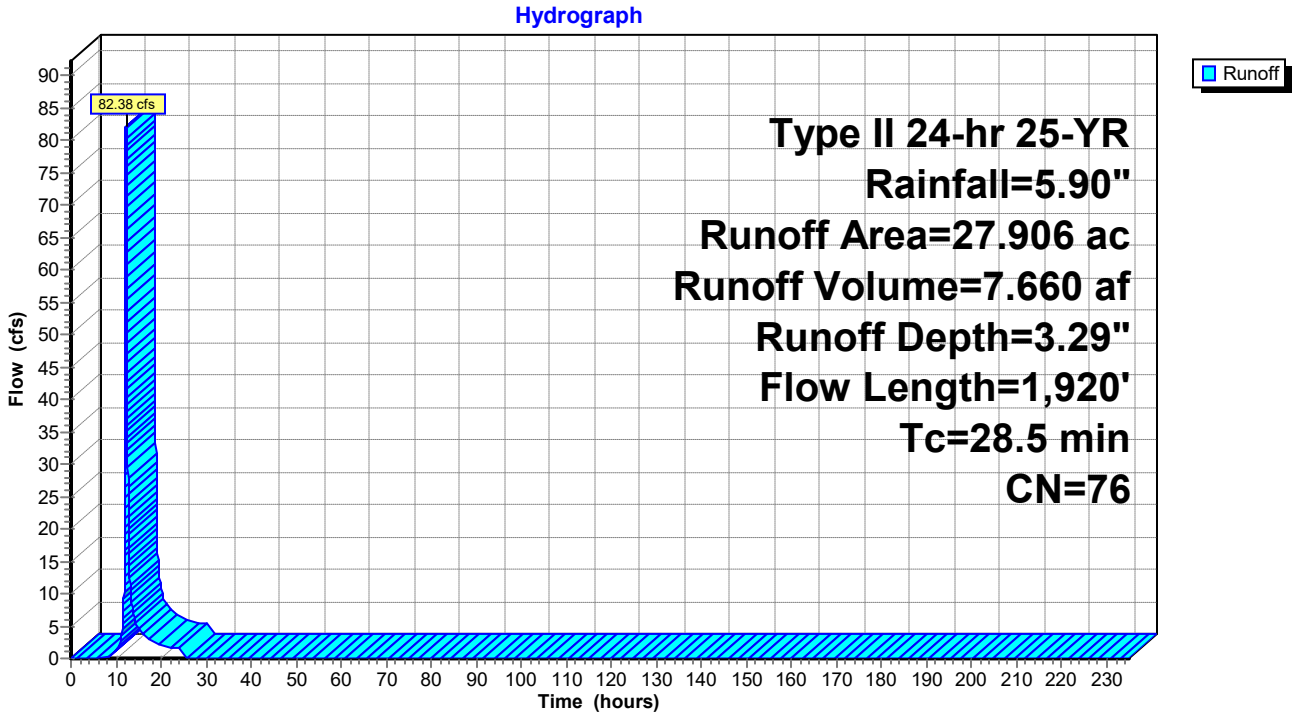
Runoff = 82.38 cfs @ 12.22 hrs, Volume= 7.660 af, Depth= 3.29"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	1.525	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.201	80	>75% Grass cover, Good, HSG D (DISTURBED D)
*	0.303	98	Paved parking & roofs C SOILS
*	0.052	98	Paved parking & roofs D SOILS
*	3.110	50	R-2 ZONING A SOILS
*	4.062	70	R-2 ZONING B SOILS
*	13.425	80	R-2 ZONING C SOILS
*	5.228	85	R-2 ZONING D SOILS
	27.906	76	Weighted Average
	27.551		Pervious Area
	0.355		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	145	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.9	986	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
7.1	689	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
28.5	1,920	Total			

Subcatchment 52S: DRAINAGE AREA TO CULVERT 7



Summary for Subcatchment 55S: UNMANAGED P 2

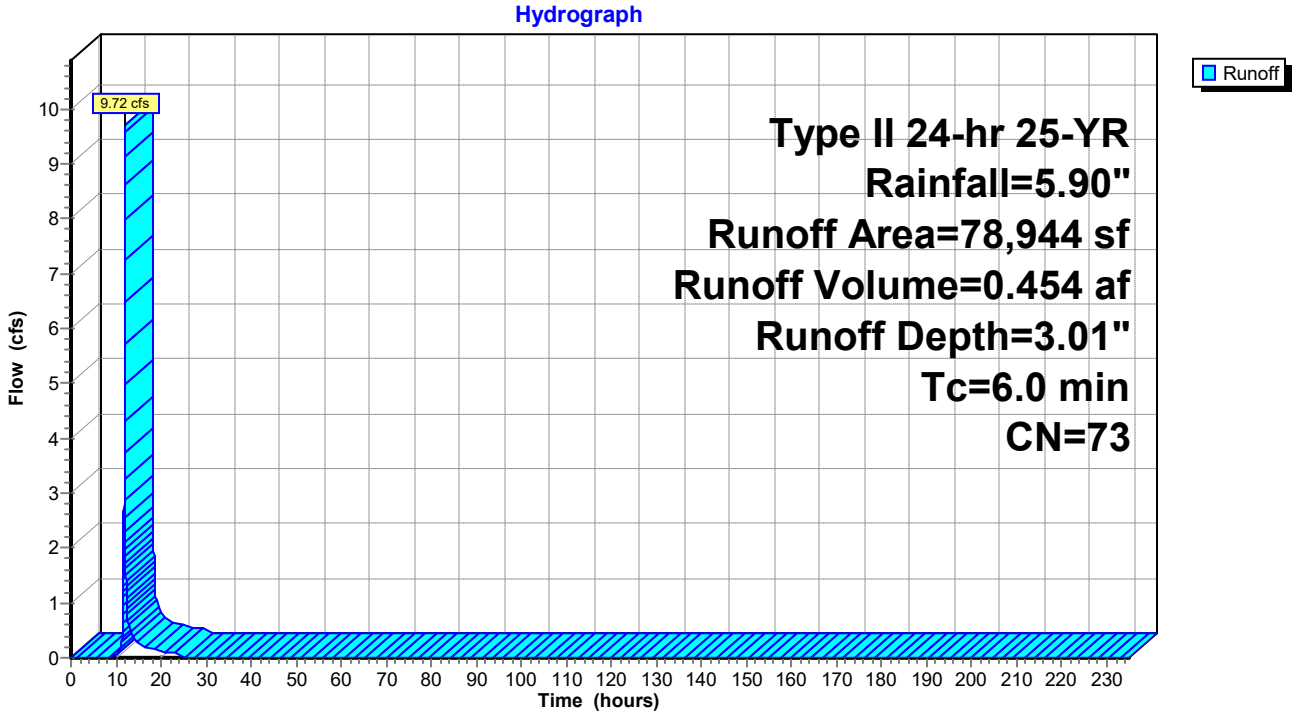
Runoff = 9.72 cfs @ 11.97 hrs, Volume= 0.454 af, Depth= 3.01"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	7,354	70	Woods, Good, HSG C
	7,236	77	Woods, Good, HSG D
*	24,838	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	25,224	80	>75% Grass cover, Good, HSG D (ONSITE C)
	14,292	80	>75% Grass cover, Good, HSG D
	78,944	73	Weighted Average
	78,944		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 55S: UNMANAGED P 2



Summary for Subcatchment 56S: UNMANAGED P 1

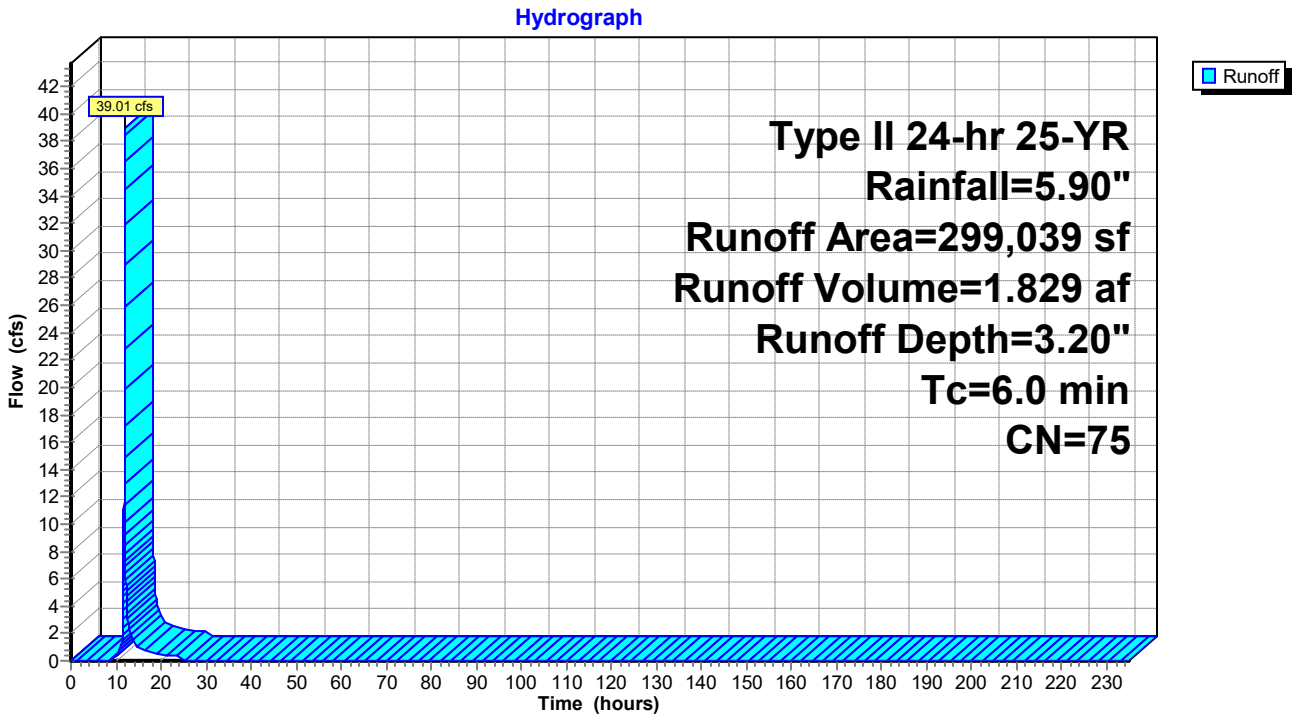
Runoff = 39.01 cfs @ 11.97 hrs, Volume= 1.829 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	4,400	30	Woods, Good, HSG A
	86,031	70	Woods, Good, HSG C
	184,912	77	Woods, Good, HSG D
*	2,047	80	>75% Grass cover, Good, HSG D (ONSITE C)
	21,649	80	>75% Grass cover, Good, HSG D
	299,039	75	Weighted Average
	299,039		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 56S: UNMANAGED P 1



Summary for Subcatchment 57S: UNMANAGED P 3

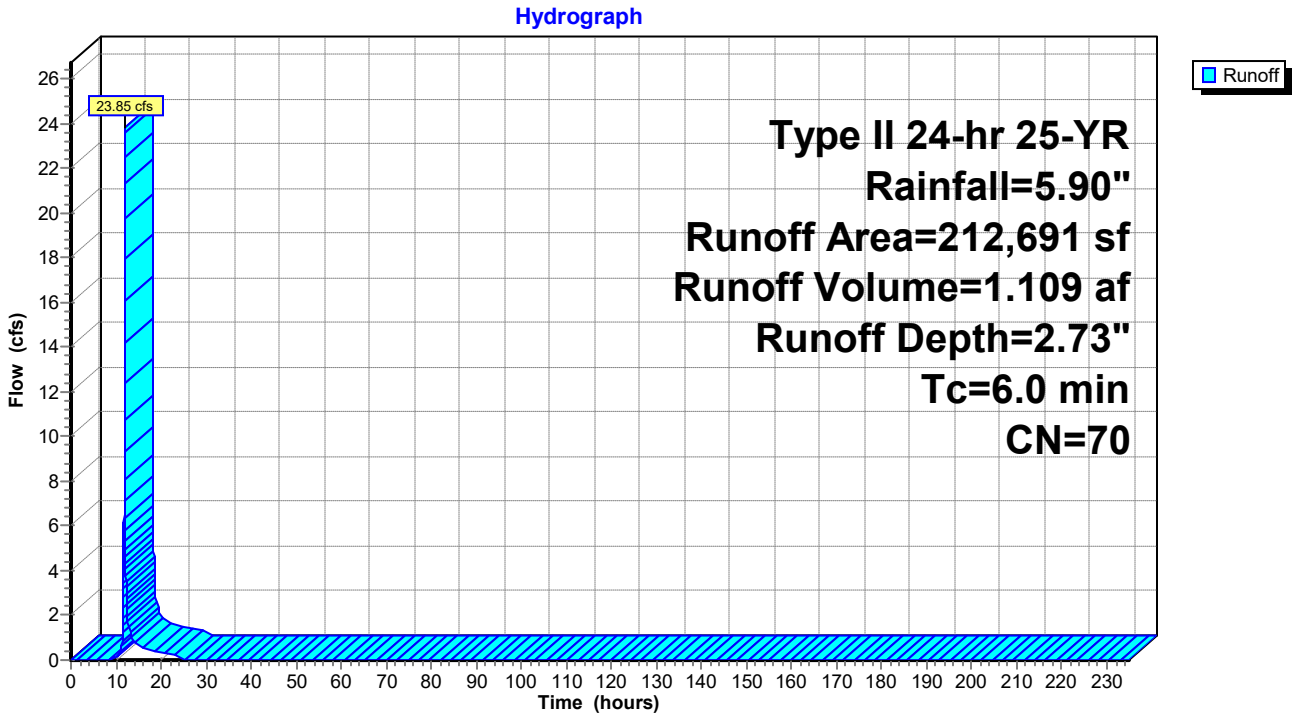
Runoff = 23.85 cfs @ 11.98 hrs, Volume= 1.109 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	25,681	30	Woods, Good, HSG A
	11,227	70	Woods, Good, HSG C
	20,676	77	Woods, Good, HSG D
*	37,410	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	32,984	80	>75% Grass cover, Good, HSG D (ONSITE C)
	84,713	80	>75% Grass cover, Good, HSG D
	212,691	70	Weighted Average
	212,691		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 57S: UNMANAGED P 3



Summary for Subcatchment 58S: UNMANAGED P 4

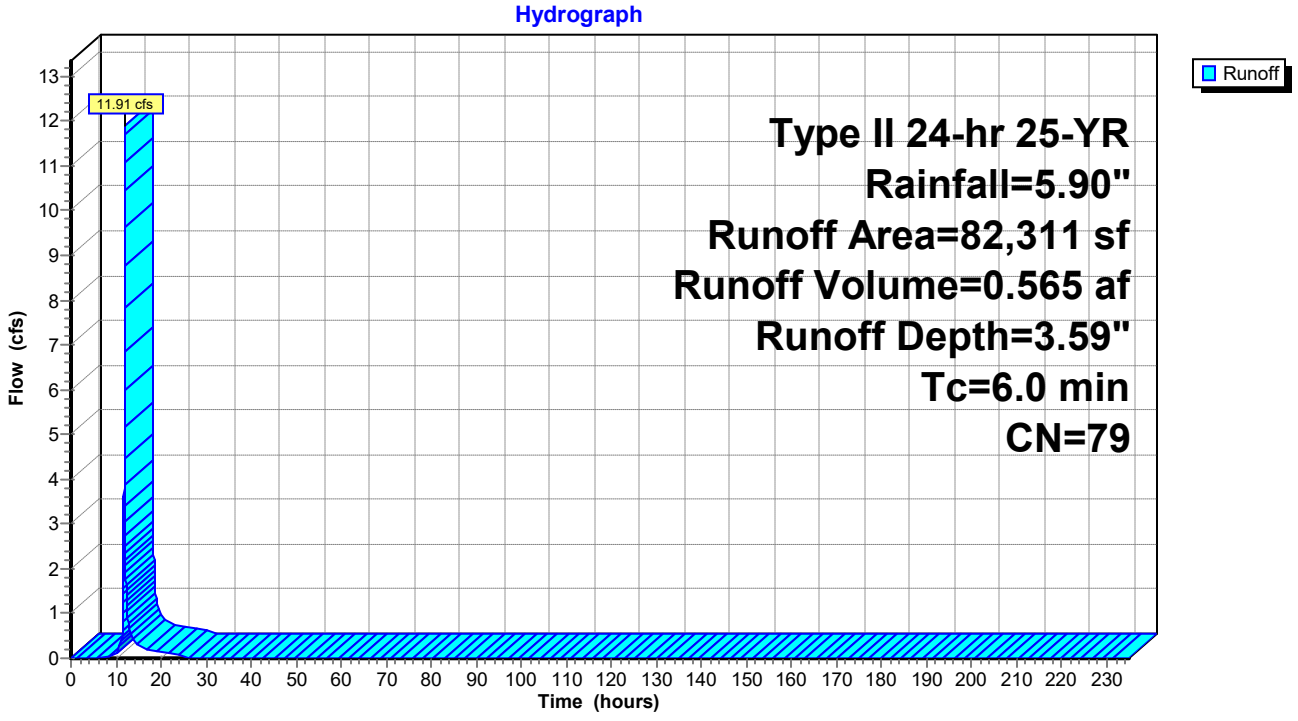
Runoff = 11.91 cfs @ 11.97 hrs, Volume= 0.565 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	3,590	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	5,089	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	14,725	80	>75% Grass cover, Good, HSG D (ONSITE C)
	58,907	80	>75% Grass cover, Good, HSG D
	82,311	79	Weighted Average
	82,311		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 58S: UNMANAGED P 4



Summary for Pond 9P: BASIN 1

Inflow Area = 154.439 ac, 4.15% Impervious, Inflow Depth = 3.10" for 25-YR event
Inflow = 386.46 cfs @ 12.28 hrs, Volume= 39.909 af
Outflow = 140.81 cfs @ 12.77 hrs, Volume= 39.794 af, Atten= 64%, Lag= 29.1 min
Primary = 140.81 cfs @ 12.77 hrs, Volume= 39.794 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 86.60' @ 12.77 hrs Surf.Area= 143,047 sf Storage= 718,710 cf

Plug-Flow detention time= 588.1 min calculated for 39.794 af (100% of inflow)
Center-of-Mass det. time= 586.2 min (1,438.0 - 851.7)

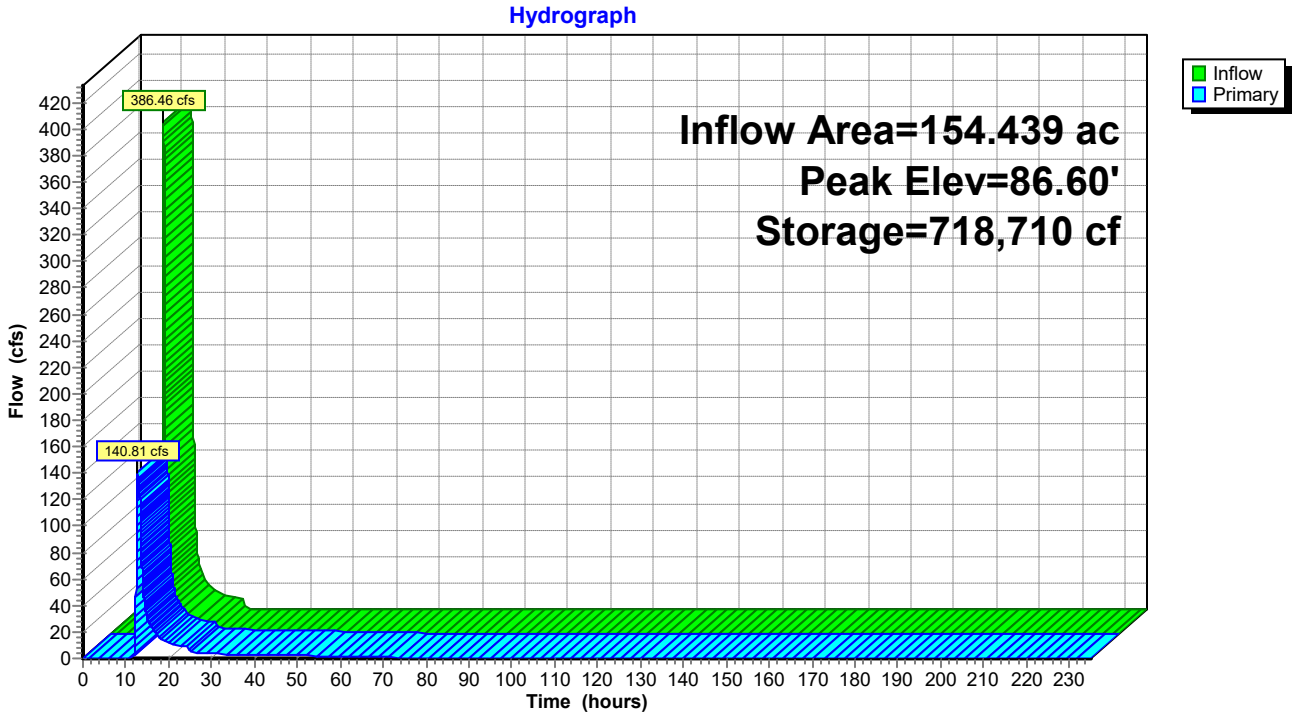
Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,573,213 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	110,353	0	0
82.00	113,238	111,796	111,796
82.50	114,690	56,982	168,778
83.00	128,912	60,901	229,678
87.00	144,633	547,090	776,768
89.00	157,733	302,366	1,079,134
91.00	167,296	325,029	1,404,163
92.00	170,803	169,050	1,573,213

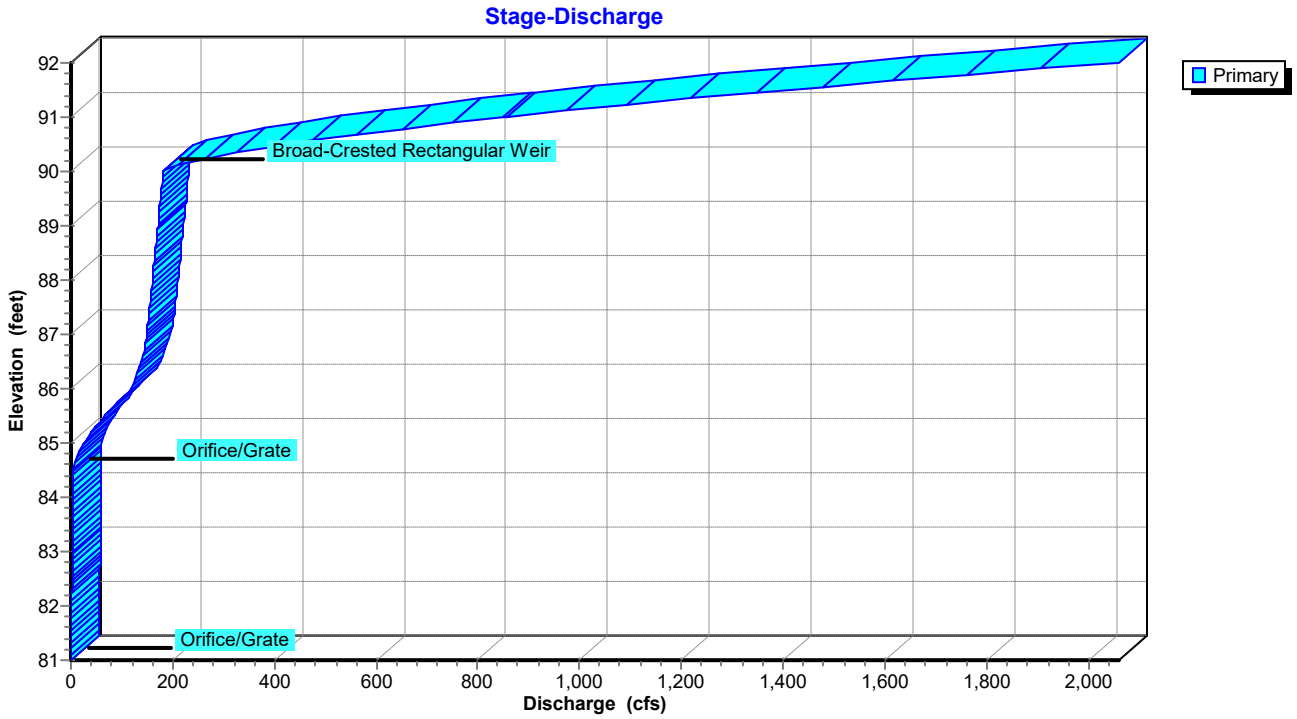
Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**48.0" x 70.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 78.66' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	81.00'	**9.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	84.50'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.00'	**250.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=140.80 cfs @ 12.77 hrs HW=86.60' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 140.80 cfs of 143.14 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 4.86 cfs @ 11.00 fps)
  - **3=Orifice/Grate** (Orifice Controls 135.94 cfs @ 6.97 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

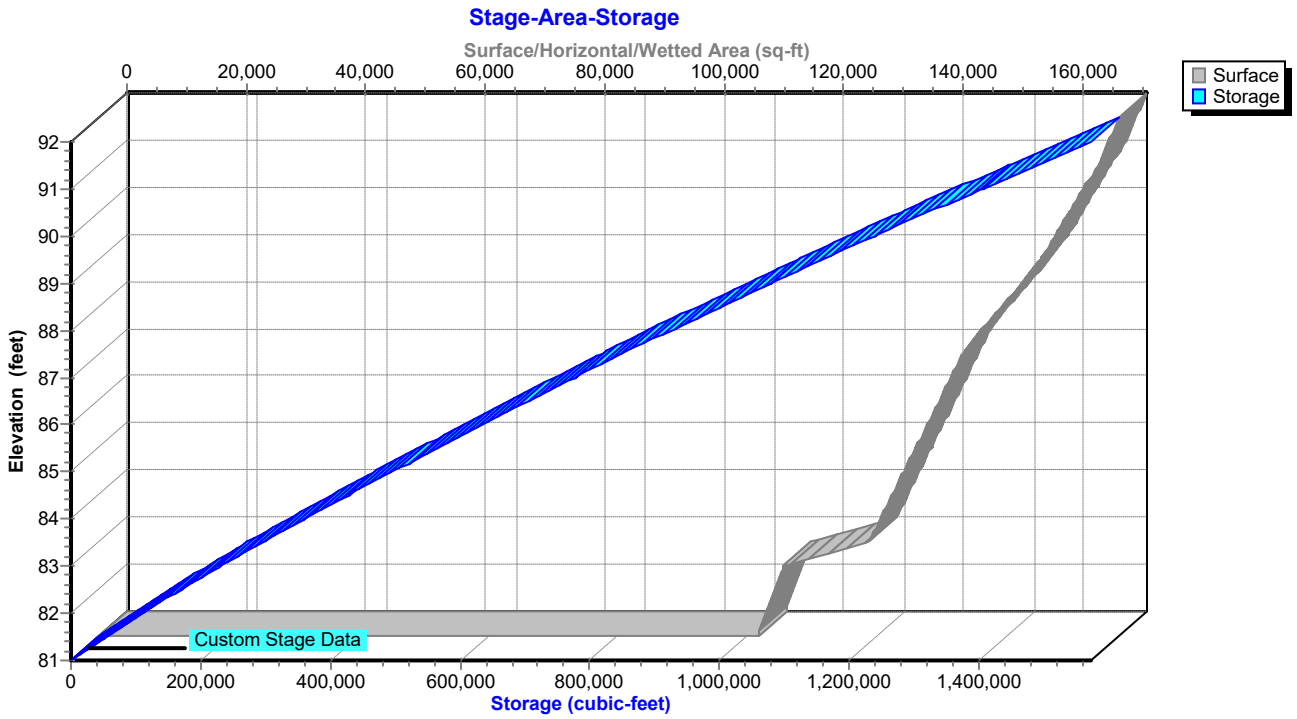
Pond 9P: BASIN 1



Pond 9P: BASIN 1



Pond 9P: BASIN 1



Stage-Discharge for Pond 9P: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
81.00	0.00	84.12	3.52	87.24	151.15	90.36	330.70
81.06	0.01	84.18	3.56	87.30	151.87	90.42	369.44
81.12	0.05	84.24	3.60	87.36	152.59	90.48	410.77
81.18	0.12	84.30	3.64	87.42	153.31	90.54	454.74
81.24	0.20	84.36	3.68	87.48	154.03	90.60	501.19
81.30	0.31	84.42	3.71	87.54	154.74	90.66	547.57
81.36	0.43	84.48	3.75	87.60	155.44	90.72	595.53
81.42	0.56	84.54	4.28	87.66	156.15	90.78	644.92
81.48	0.70	84.60	5.78	87.72	156.85	90.84	697.53
81.54	0.85	84.66	7.83	87.78	157.55	90.90	752.83
81.60	1.00	84.72	10.30	87.84	158.25	90.96	809.87
81.66	1.14	84.78	13.13	87.90	158.94	91.02	869.11
81.72	1.26	84.84	16.28	87.96	159.63	91.08	931.18
81.78	1.35	84.90	19.71	88.02	160.31	91.14	995.10
81.84	1.45	84.96	23.41	88.08	161.00	91.20	1,060.84
81.90	1.54	85.02	27.36	88.14	161.68	91.26	1,127.28
81.96	1.63	85.08	31.54	88.20	162.36	91.32	1,195.31
82.02	1.71	85.14	35.94	88.26	163.03	91.38	1,264.89
82.08	1.79	85.20	40.55	88.32	163.70	91.44	1,335.12
82.14	1.86	85.26	45.36	88.38	164.37	91.50	1,406.27
82.20	1.93	85.32	50.36	88.44	165.04	91.56	1,478.70
82.26	2.00	85.38	55.55	88.50	165.70	91.62	1,552.90
82.32	2.07	85.44	60.91	88.56	166.37	91.68	1,629.46
82.38	2.13	85.50	66.45	88.62	167.03	91.74	1,707.40
82.44	2.20	85.56	72.16	88.68	167.68	91.80	1,786.68
82.50	2.26	85.62	78.03	88.74	168.34	91.86	1,867.28
82.56	2.32	85.68	84.05	88.80	168.99	91.92	1,949.18
82.62	2.37	85.74	90.23	88.86	169.63	91.98	**2,032.36**
82.68	2.43	85.80	96.57	88.92	170.28		
82.74	2.49	85.86	103.04	88.98	170.92		
82.80	2.54	85.92	109.67	89.04	171.57		
82.86	2.59	85.98	116.43	89.10	172.21		
82.92	2.64	86.04	121.11	89.16	172.84		
82.98	2.69	86.10	123.39	89.22	173.48		
83.04	2.74	86.16	125.62	89.28	174.11		
83.10	2.79	86.22	127.82	89.34	174.74		
83.16	2.84	86.28	129.98	89.40	175.37		
83.22	2.89	86.34	132.10	89.46	175.99		
83.28	2.94	86.40	134.19	89.52	176.61		
83.34	2.98	86.46	136.25	89.58	177.23		
83.40	3.03	86.52	138.27	89.64	177.85		
83.46	3.07	86.58	140.27	89.70	178.47		
83.52	3.12	86.64	142.23	89.76	179.08		
83.58	3.16	86.70	144.17	89.82	179.70		
83.64	3.20	86.76	145.22	89.88	180.31		
83.70	3.24	86.82	145.97	89.94	180.91		
83.76	3.29	86.88	146.72	90.00	181.52		
83.82	3.33	86.94	147.47	90.06	191.97		
83.88	3.37	87.00	148.21	90.12	210.58		
83.94	3.41	87.06	148.95	90.18	234.49		
84.00	3.45	87.12	149.69	90.24	262.82		
84.06	3.49	87.18	150.42	90.30	295.02		

Stage-Area-Storage for Pond 9P: BASIN 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
81.00	110,353	0
81.15	110,786	16,585
81.30	111,218	33,236
81.45	111,651	49,951
81.60	112,084	66,731
81.75	112,517	83,576
81.90	112,950	100,486
82.05	113,383	117,461
82.20	113,819	134,501
82.35	114,254	151,607
82.50	114,690	168,778
82.65	118,957	186,301
82.80	123,223	204,464
82.95	127,490	223,268
83.10	129,305	242,589
83.25	129,895	262,029
83.40	130,484	281,557
83.55	131,074	301,174
83.70	131,663	320,879
83.85	132,253	340,673
84.00	132,842	360,555
84.15	133,432	380,526
84.30	134,021	400,585
84.45	134,611	420,732
84.60	135,200	440,968
84.75	135,790	461,292
84.90	136,379	481,705
85.05	136,969	502,206
85.20	137,559	522,796
85.35	138,148	543,474
85.50	138,738	564,240
85.65	139,327	585,095
85.80	139,917	606,038
85.95	140,506	627,070
86.10	141,096	648,190
86.25	141,685	669,399
86.40	142,275	690,696
86.55	142,864	712,081
86.70	143,454	733,555
86.85	144,043	755,117
87.00	144,633	776,768
87.15	145,616	798,537
87.30	146,598	820,453
87.45	147,581	842,516
87.60	148,563	864,727
87.75	149,546	887,085
87.90	150,528	909,590
88.05	151,510	932,243
88.20	152,493	955,044
88.35	153,475	977,991
88.50	154,458	1,001,086
88.65	155,441	1,024,329
88.80	156,423	1,047,718
88.95	157,406	1,071,256
89.10	158,211	1,094,931
89.25	158,928	1,118,717
89.40	159,646	1,142,610
89.55	160,363	1,166,610
89.70	161,080	1,190,719
89.85	161,797	1,214,934
90.00	162,515	1,239,258
90.15	163,232	1,263,689
90.30	163,949	1,288,227
90.45	164,666	1,312,873
90.60	165,383	1,337,627
90.75	166,101	1,362,488
90.90	166,818	1,387,457
91.05	167,471	1,412,532
91.20	167,997	1,437,692
91.35	168,523	1,462,931
91.50	169,050	1,488,249
91.65	169,576	1,513,646
91.80	170,102	1,539,122
91.95	**170,628**	**1,564,677**

Summary for Pond 10P: BASIN 2

Inflow Area = 27.728 ac, 4.29% Impervious, Inflow Depth = 1.62" for 25-YR event
Inflow = 49.60 cfs @ 12.12 hrs, Volume= 3.733 af
Outflow = 3.75 cfs @ 13.90 hrs, Volume= 3.729 af, Atten= 92%, Lag= 106.8 min
Primary = 3.75 cfs @ 13.90 hrs, Volume= 3.729 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 77.06' @ 13.90 hrs Surf.Area= 32,285 sf Storage= 79,209 cf

Plug-Flow detention time= 404.9 min calculated for 3.729 af (100% of inflow)
Center-of-Mass det. time= 404.3 min (1,284.0 - 879.7)

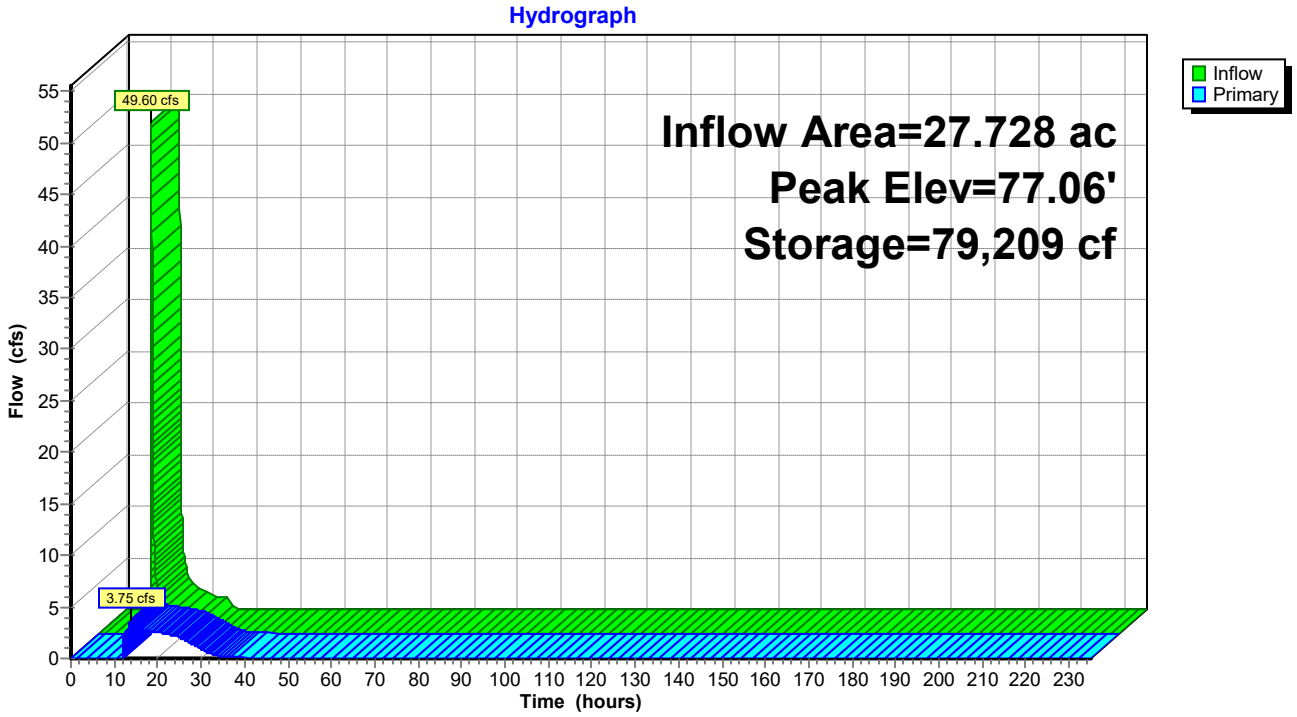
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	183,706 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	21,185	0	0
75.00	22,367	21,776	21,776
75.50	22,967	11,334	33,110
76.00	29,696	13,166	46,275
78.00	34,569	64,265	110,540
80.00	38,597	73,166	183,706

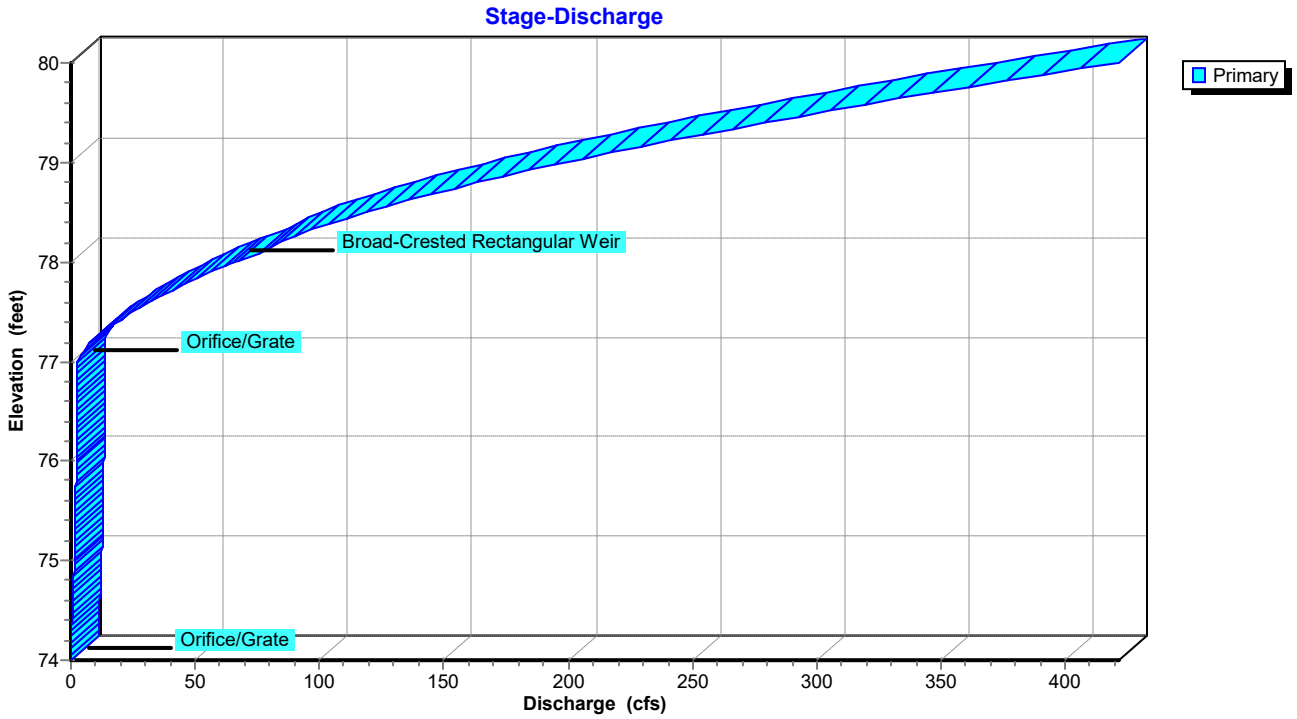
Device	Routing	Invert	Outlet Devices
#1	Primary	72.00'	**36.0" x 51.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 71.75' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.00'	**45.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=3.75 cfs @ 13.90 hrs HW=77.06' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 3.75 cfs of 64.02 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.78 cfs @ 7.95 fps)
  - **3=Orifice/Grate** (Weir Controls 0.98 cfs @ 0.82 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

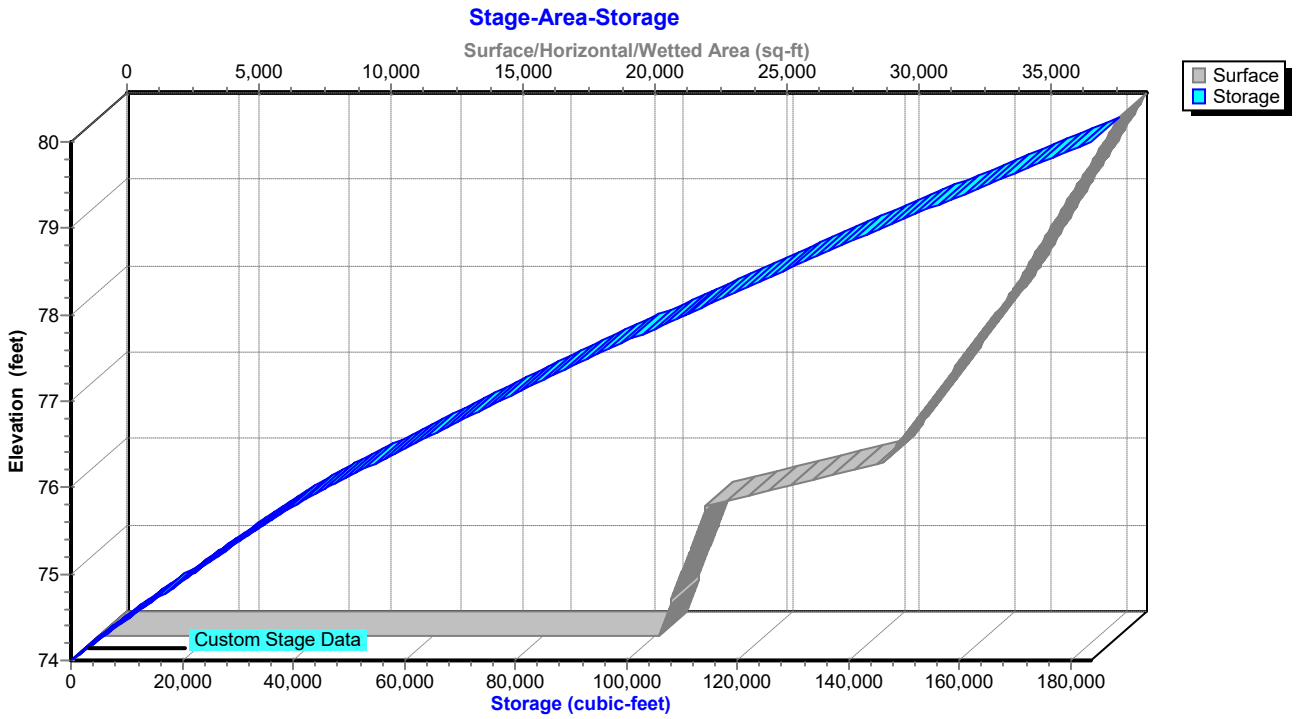
Pond 10P: BASIN 2



Pond 10P: BASIN 2



Pond 10P: BASIN 2



Stage-Discharge for Pond 10P: BASIN 2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	2.22	78.16	81.19
74.04	0.01	76.12	2.25	78.20	84.57
74.08	0.02	76.16	2.27	78.24	88.30
74.12	0.05	76.20	2.30	78.28	92.33
74.16	0.09	76.24	2.32	78.32	96.65
74.20	0.13	76.28	2.35	78.36	101.24
74.24	0.19	76.32	2.37	78.40	106.08
74.28	0.25	76.36	2.39	78.44	111.11
74.32	0.32	76.40	2.42	78.48	116.36
74.36	0.39	76.44	2.44	78.52	121.82
74.40	0.47	76.48	2.46	78.56	127.48
74.44	0.55	76.52	2.49	78.60	133.33
74.48	0.63	76.56	2.51	78.64	139.09
74.52	0.72	76.60	2.53	78.68	144.99
74.56	0.80	76.64	2.55	78.72	151.00
74.60	0.87	76.68	2.57	78.76	157.13
74.64	0.94	76.72	2.60	78.80	163.36
74.68	0.99	76.76	2.62	78.84	170.04
74.72	1.05	76.80	2.64	78.88	176.87
74.76	1.10	76.84	2.66	78.92	183.83
74.80	1.15	76.88	2.68	78.96	190.93
74.84	1.20	76.92	2.70	79.00	198.17
74.88	1.24	76.96	2.72	79.04	205.73
74.92	1.29	77.00	2.74	79.08	213.43
74.96	1.33	77.04	3.26	79.12	221.29
75.00	1.37	77.08	4.19	79.16	229.28
75.04	1.41	77.12	5.39	79.20	237.42
75.08	1.45	77.16	6.80	79.24	245.58
75.12	1.49	77.20	8.40	79.28	253.87
75.16	1.53	77.24	10.17	79.32	262.28
75.20	1.56	77.28	12.09	79.36	270.81
75.24	1.60	77.32	14.15	79.40	279.46
75.28	1.64	77.36	16.34	79.44	288.08
75.32	1.67	77.40	18.66	79.48	296.80
75.36	1.70	77.44	21.10	79.52	305.63
75.40	1.74	77.48	23.64	79.56	314.56
75.44	1.77	77.52	26.30	79.60	323.58
75.48	1.80	77.56	29.06	79.64	332.90
75.52	1.83	77.60	31.91	79.68	342.32
75.56	1.86	77.64	34.87	79.72	351.85
75.60	1.89	77.68	37.91	79.76	361.49
75.64	1.92	77.72	41.05	79.80	371.24
75.68	1.95	77.76	44.28	79.84	381.09
75.72	1.98	77.80	47.59	79.88	391.04
75.76	2.01	77.84	50.98	79.92	401.10
75.80	2.04	77.88	54.45	79.96	411.26
75.84	2.06	77.92	58.01	80.00	**421.52**
75.88	2.09	77.96	61.64		
75.92	2.12	78.00	65.35		
75.96	2.14	78.04	70.10		
76.00	2.17	78.08	75.57		
76.04	2.20	78.12	78.17		

Stage-Area-Storage for Pond 10P: BASIN 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	21,185	0
74.10	21,303	2,124
74.20	21,421	4,261
74.30	21,540	6,409
74.40	21,658	8,569
74.50	21,776	10,740
74.60	21,894	12,924
74.70	22,012	15,119
74.80	22,131	17,326
74.90	22,249	19,545
75.00	22,367	21,776
75.10	22,487	24,019
75.20	22,607	26,273
75.30	22,727	28,540
75.40	22,847	30,819
75.50	22,967	33,110
75.60	24,313	35,473
75.70	25,659	37,972
75.80	27,004	40,605
75.90	28,350	43,373
76.00	29,696	46,275
76.10	29,940	49,257
76.20	30,183	52,263
76.30	30,427	55,294
76.40	30,671	58,349
76.50	30,914	61,428
76.60	31,158	64,531
76.70	31,402	67,659
76.80	31,645	70,812
76.90	31,889	73,988
77.00	32,133	77,190
77.10	32,376	80,415
77.20	32,620	83,665
77.30	32,863	86,939
77.40	33,107	90,237
77.50	33,351	93,560
77.60	33,594	96,908
77.70	33,838	100,279
77.80	34,082	103,675
77.90	34,325	107,096
78.00	34,569	110,540
78.10	34,770	114,007
78.20	34,972	117,494
78.30	35,173	121,002
78.40	35,375	124,529
78.50	35,576	128,077
78.60	35,777	131,644
78.70	35,979	135,232
78.80	36,180	138,840
78.90	36,382	142,468
79.00	36,583	146,116
79.10	36,784	149,785
79.20	36,986	153,473
79.30	37,187	157,182
79.40	37,389	160,911
79.50	37,590	164,660
79.60	37,791	168,429
79.70	37,993	172,218
79.80	38,194	176,027
79.90	38,396	179,857
80.00	**38,597**	**183,706**

Summary for Pond 11P: BASIN 3

Inflow Area = 41.382 ac, 7.74% Impervious, Inflow Depth = 3.79" for 25-YR event
Inflow = 195.44 cfs @ 12.08 hrs, Volume= 13.079 af
Outflow = 54.16 cfs @ 12.37 hrs, Volume= 13.036 af, Atten= 72%, Lag= 17.7 min
Primary = 54.16 cfs @ 12.37 hrs, Volume= 13.036 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 77.89' @ 12.37 hrs Surf.Area= 83,655 sf Storage= 277,110 cf

Plug-Flow detention time= 865.5 min calculated for 13.036 af (100% of inflow)
Center-of-Mass det. time= 863.5 min (1,681.9 - 818.4)

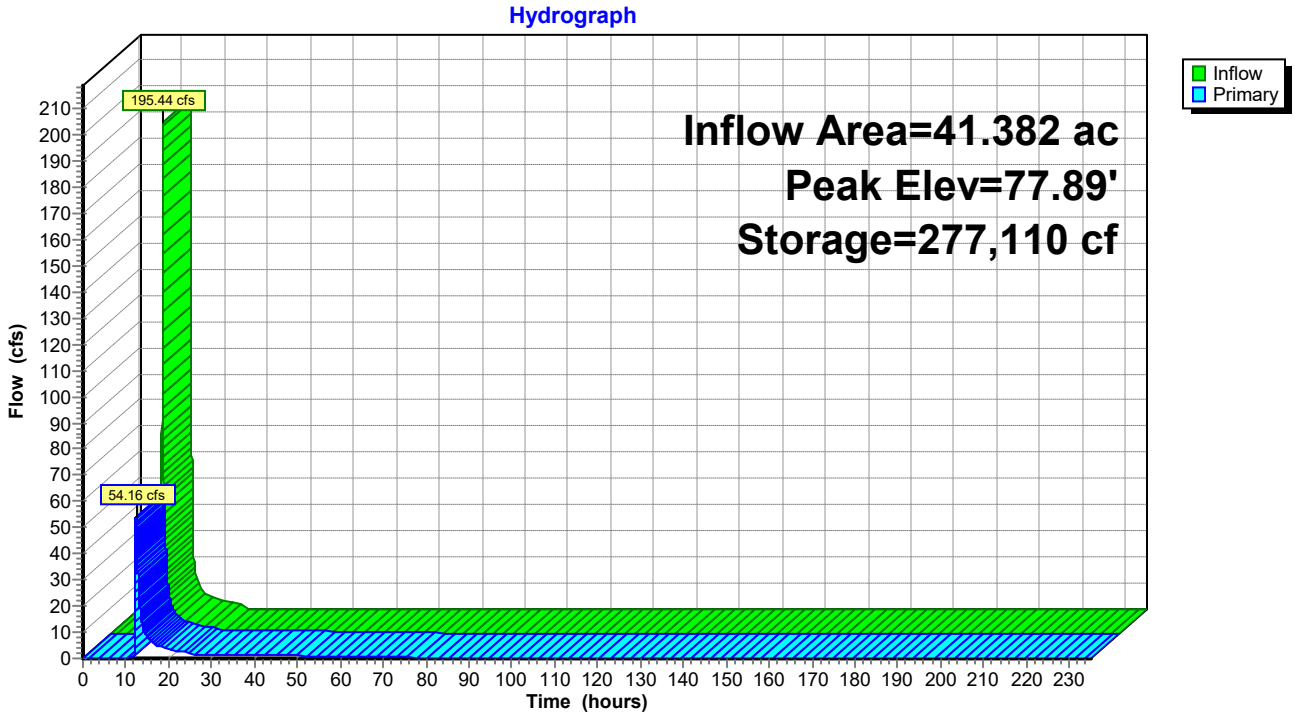
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	461,645 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	59,381	0	0
75.00	61,618	60,500	60,500
75.50	62,746	31,091	91,591
76.00	75,824	34,643	126,233
78.00	84,101	159,925	286,158
80.00	91,386	175,487	461,645

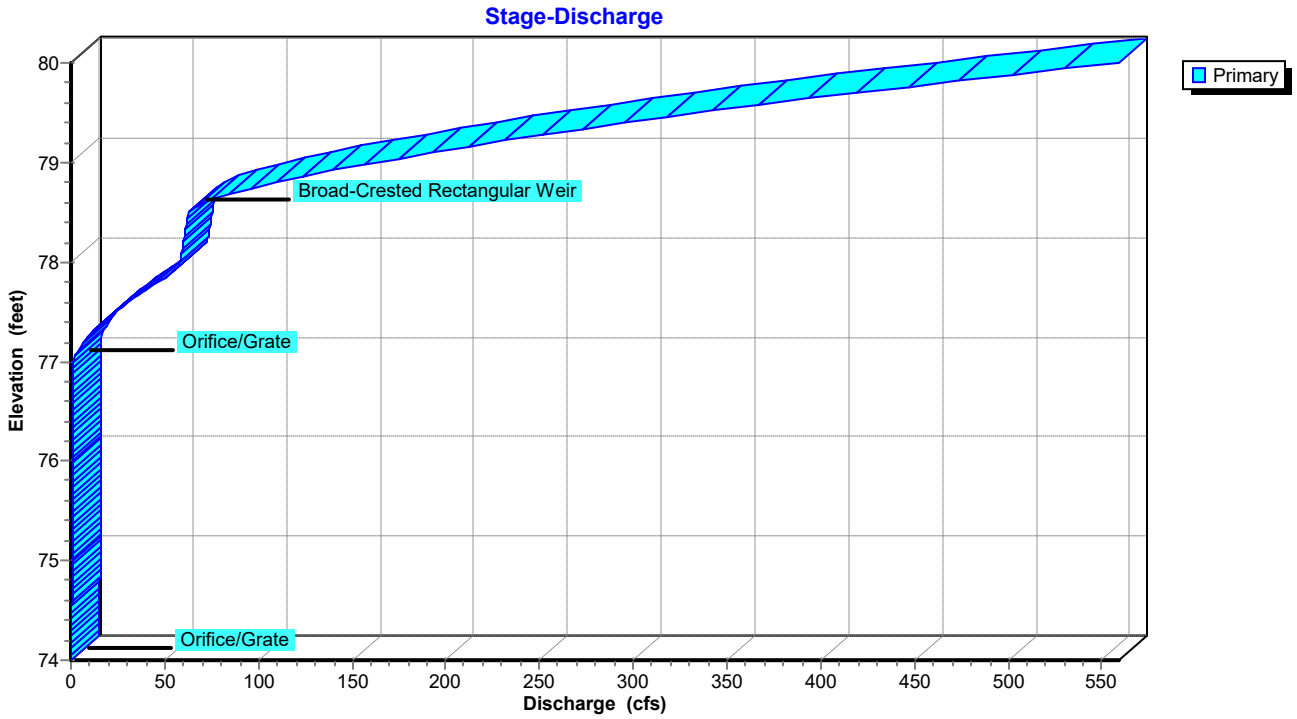
Device	Routing	Invert	Outlet Devices
#1	Primary	73.10'	**36.0" x 220.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 72.00' S= 0.0050 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.50'	**100.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=54.15 cfs @ 12.37 hrs HW=77.89' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 54.15 cfs of 57.03 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 1.80 cfs @ 9.19 fps)
  - **3=Orifice/Grate** (Weir Controls 52.35 cfs @ 3.09 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

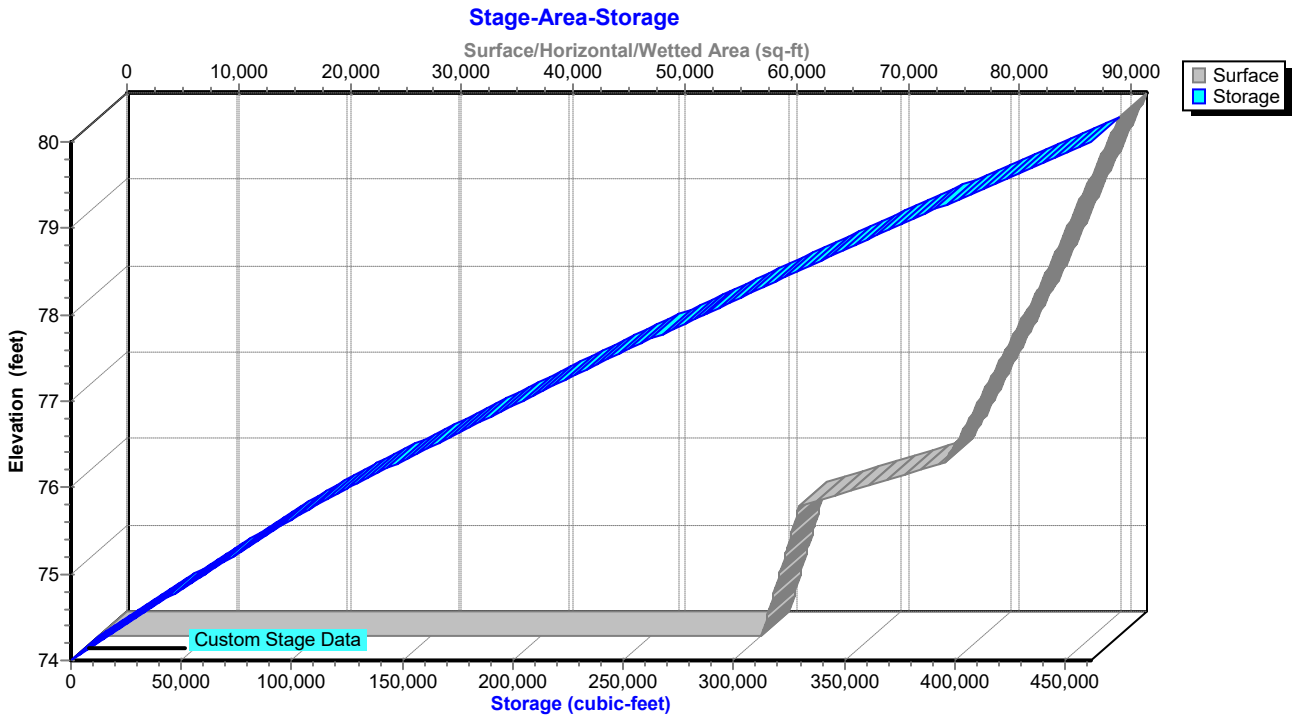
Pond 11P: BASIN 3



Pond 11P: BASIN 3



Pond 11P: BASIN 3



Stage-Discharge for Pond 11P: BASIN 3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	1.28	78.16	59.62
74.04	0.01	76.12	1.29	78.20	59.99
74.08	0.02	76.16	1.31	78.24	60.37
74.12	0.04	76.20	1.32	78.28	60.74
74.16	0.07	76.24	1.33	78.32	61.11
74.20	0.11	76.28	1.35	78.36	61.48
74.24	0.16	76.32	1.36	78.40	61.84
74.28	0.20	76.36	1.37	78.44	62.20
74.32	0.26	76.40	1.39	78.48	62.56
74.36	0.31	76.44	1.40	78.52	63.68
74.40	0.36	76.48	1.41	78.56	67.22
74.44	0.41	76.52	1.42	78.60	72.11
74.48	0.46	76.56	1.44	78.64	78.02
74.52	0.49	76.60	1.45	78.68	84.80
74.56	0.53	76.64	1.46	78.72	92.36
74.60	0.56	76.68	1.47	78.76	100.64
74.64	0.59	76.72	1.49	78.80	109.58
74.68	0.62	76.76	1.50	78.84	119.13
74.72	0.65	76.80	1.51	78.88	129.26
74.76	0.68	76.84	1.52	78.92	139.89
74.80	0.70	76.88	1.53	78.96	150.98
74.84	0.73	76.92	1.54	79.00	162.53
74.88	0.75	76.96	1.56	79.04	174.55
74.92	0.77	77.00	1.57	79.08	187.01
74.96	0.80	77.04	2.08	79.12	199.59
75.00	0.82	77.08	3.00	79.16	212.21
75.04	0.84	77.12	4.18	79.20	225.10
75.08	0.86	77.16	5.59	79.24	238.26
75.12	0.88	77.20	7.18	79.28	251.66
75.16	0.90	77.24	8.94	79.32	265.66
75.20	0.92	77.28	10.85	79.36	280.34
75.24	0.94	77.32	12.90	79.40	295.33
75.28	0.96	77.36	15.09	79.44	310.63
75.32	0.98	77.40	17.40	79.48	326.23
75.36	1.00	77.44	19.82	79.52	342.33
75.40	1.01	77.48	22.36	79.56	358.97
75.44	1.03	77.52	25.01	79.60	375.93
75.48	1.05	77.56	27.76	79.64	393.21
75.52	1.07	77.60	30.61	79.68	410.82
75.56	1.08	77.64	33.55	79.72	428.61
75.60	1.10	77.68	36.59	79.76	446.56
75.64	1.11	77.72	39.72	79.80	464.79
75.68	1.13	77.76	42.94	79.84	483.29
75.72	1.15	77.80	46.24	79.88	502.07
75.76	1.16	77.84	49.62	79.92	520.94
75.80	1.18	77.88	53.09	79.96	539.89
75.84	1.19	77.92	56.64	80.00	**559.07**
75.88	1.21	77.96	57.70		
75.92	1.22	78.00	58.09		
75.96	1.24	78.04	58.47		
76.00	1.25	78.08	58.86		
76.04	1.26	78.12	59.24		

Stage-Area-Storage for Pond 11P: BASIN 3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	59,381	0
74.10	59,605	5,949
74.20	59,828	11,921
74.30	60,052	17,915
74.40	60,276	23,931
74.50	60,500	29,970
74.60	60,723	36,031
74.70	60,947	42,115
74.80	61,171	48,221
74.90	61,394	54,349
75.00	61,618	60,500
75.10	61,844	66,673
75.20	62,069	72,868
75.30	62,295	79,086
75.40	62,520	85,327
75.50	62,746	91,591
75.60	65,362	97,996
75.70	67,977	104,663
75.80	70,593	111,591
75.90	73,208	118,781
76.00	75,824	126,233
76.10	76,238	133,836
76.20	76,652	141,481
76.30	77,066	149,166
76.40	77,479	156,894
76.50	77,893	164,662
76.60	78,307	172,472
76.70	78,721	180,324
76.80	79,135	188,217
76.90	79,549	196,151
77.00	79,963	204,126
77.10	80,376	212,143
77.20	80,790	220,202
77.30	81,204	228,301
77.40	81,618	236,442
77.50	82,032	244,625
77.60	82,446	252,849
77.70	82,859	261,114
77.80	83,273	269,421
77.90	83,687	277,769
78.00	84,101	286,158
78.10	84,465	294,586
78.20	84,830	303,051
78.30	85,194	311,552
78.40	85,558	320,090
78.50	85,922	328,664
78.60	86,286	337,274
78.70	86,651	345,921
78.80	87,015	354,604
78.90	87,379	363,324
79.00	87,744	372,080
79.10	88,108	380,873
79.20	88,472	389,702
79.30	88,836	398,567
79.40	89,201	407,469
79.50	89,565	416,407
79.60	89,929	425,382
79.70	90,293	434,393
79.80	90,657	443,441
79.90	91,022	452,525
80.00	**91,386**	**461,645**

Summary for Pond 12P: BASIN 4

Inflow Area = 102.290 ac, 1.11% Impervious, Inflow Depth = 1.78" for 25-YR event
Inflow = 186.05 cfs @ 12.15 hrs, Volume= 15.131 af
Outflow = 95.11 cfs @ 12.37 hrs, Volume= 15.125 af, Atten= 49%, Lag= 13.1 min
Primary = 95.11 cfs @ 12.37 hrs, Volume= 15.125 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 84.49' @ 12.37 hrs Surf.Area= 42,508 sf Storage= 200,499 cf

Plug-Flow detention time= 416.5 min calculated for 15.125 af (100% of inflow)
Center-of-Mass det. time= 416.2 min (1,292.9 - 876.7)

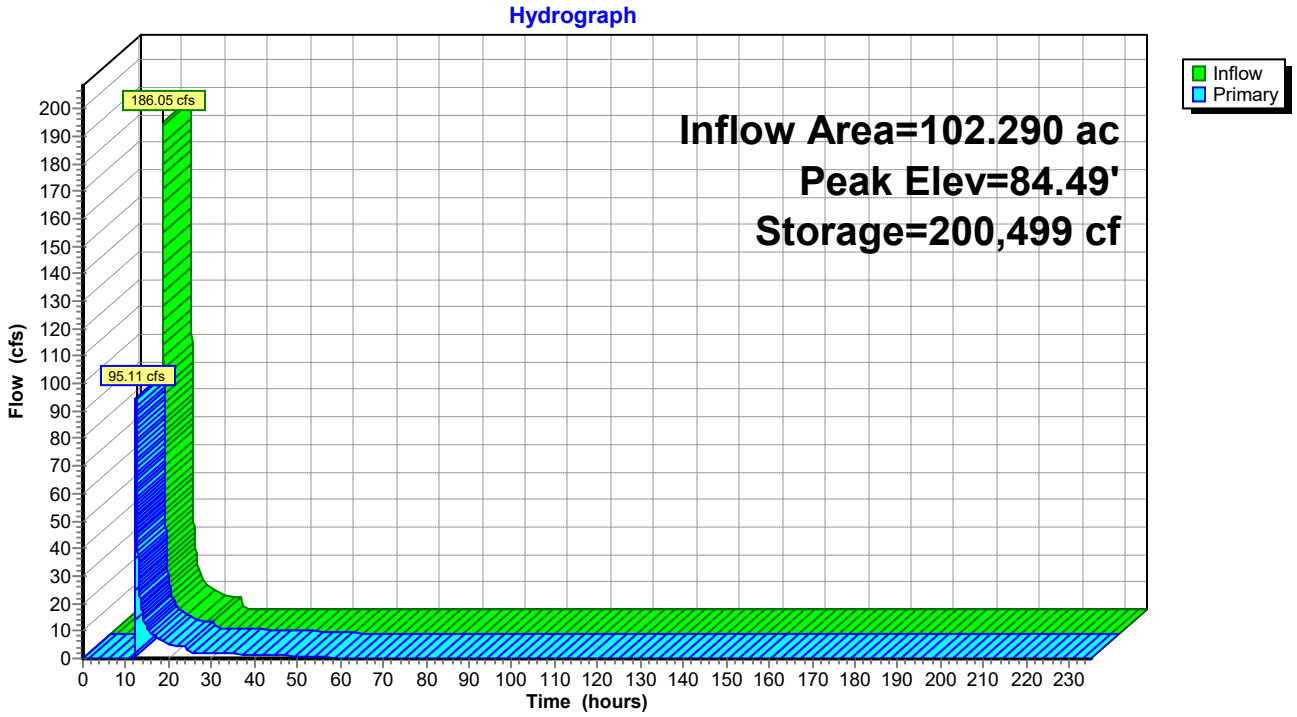
Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	420,819 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.50	23,525	0	0
79.50	24,819	24,172	24,172
80.00	30,634	13,863	38,035
82.00	35,056	65,690	103,725
84.00	41,314	76,370	180,095
86.00	46,221	87,535	267,630
88.00	50,842	97,063	364,693
89.00	61,410	56,126	420,819

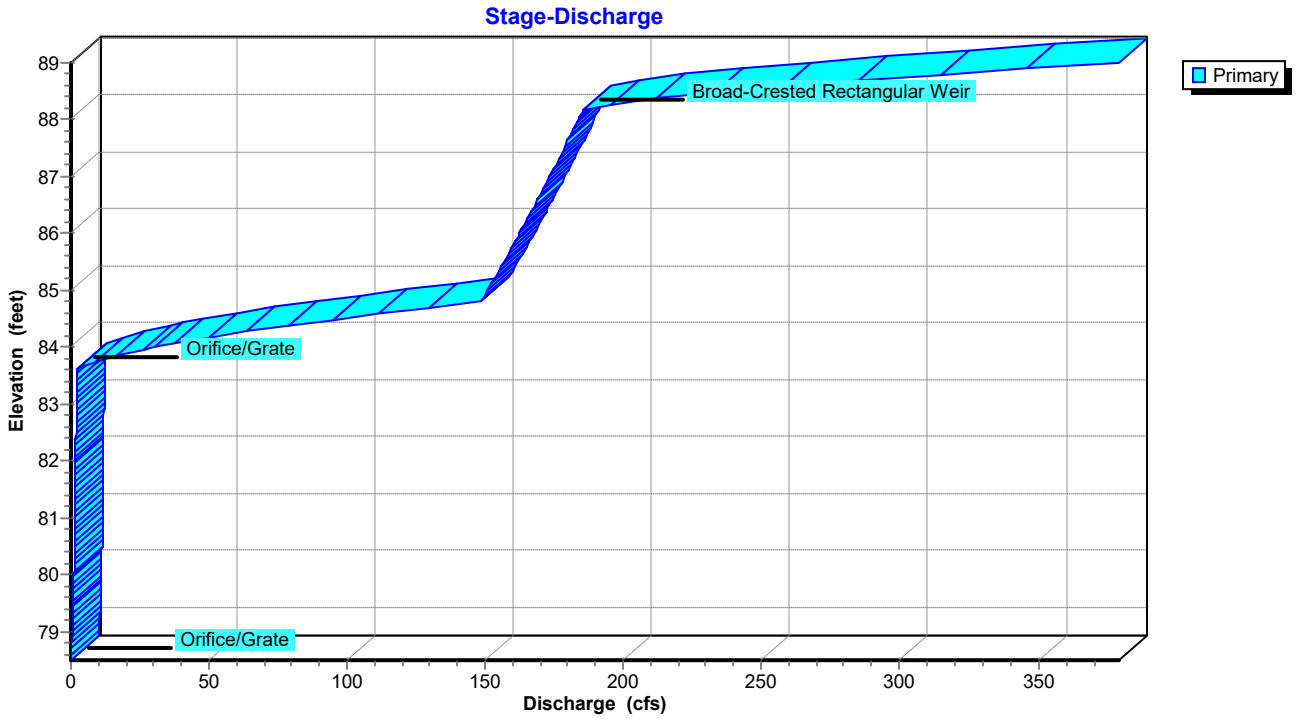
Device	Routing	Invert	Outlet Devices
#1	Primary	76.80'	**48.0" x 161.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 76.00' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	78.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	83.60'	**7.00' x 10.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	88.15'	**90.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=95.06 cfs @ 12.37 hrs HW=84.49' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 95.06 cfs of 144.29 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 2.26 cfs @ 11.53 fps)
  - **3=Orifice/Grate** (Weir Controls 92.80 cfs @ 3.08 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

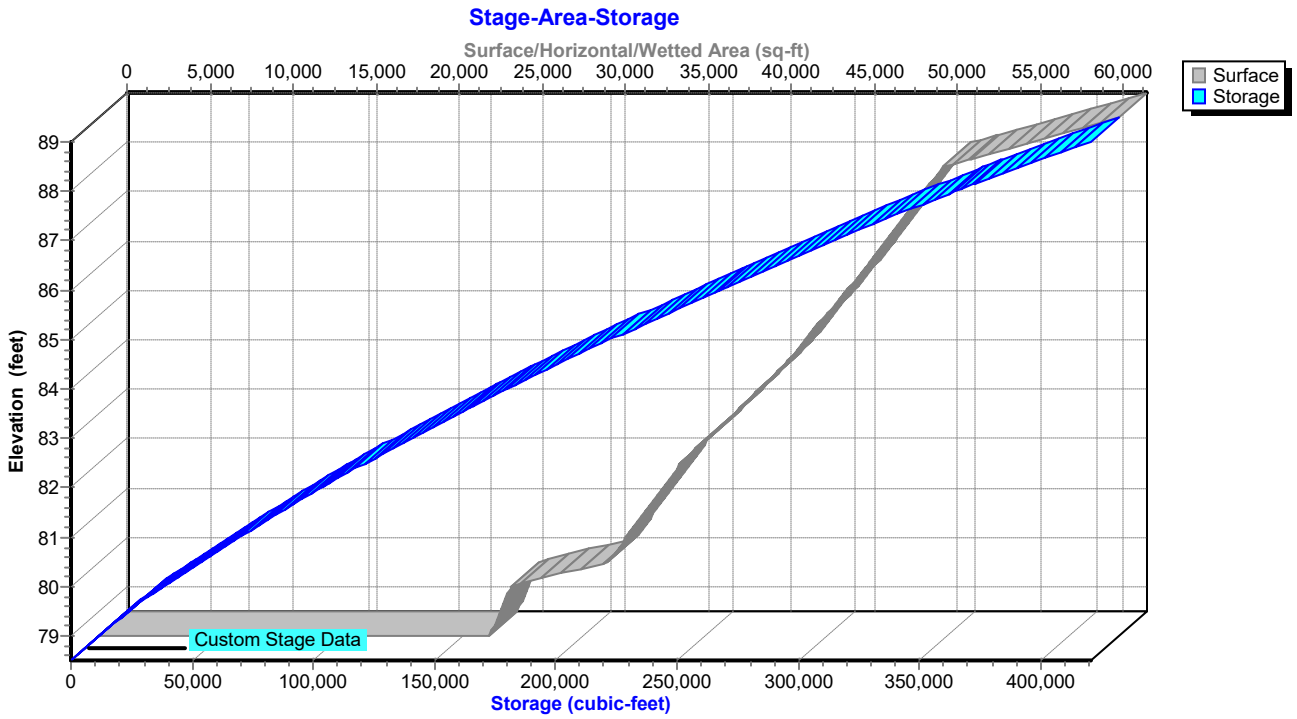
Pond 12P: BASIN 4



Pond 12P: BASIN 4



Pond 12P: BASIN 4



Stage-Discharge for Pond 12P: BASIN 4

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
78.50	0.00	81.62	1.60	84.74	137.64	87.86	182.12
78.56	0.01	81.68	1.62	84.80	148.21	87.92	182.73
78.62	0.04	81.74	1.63	84.86	148.95	87.98	183.33
78.68	0.09	81.80	1.65	84.92	149.69	88.04	183.92
78.74	0.16	81.86	1.67	84.98	150.42	88.10	184.52
78.80	0.23	81.92	1.68	85.04	151.15	88.16	185.36
78.86	0.31	81.98	1.70	85.10	151.87	88.22	190.17
78.92	0.39	82.04	1.71	85.16	152.59	88.28	197.60
78.98	0.46	82.10	1.73	85.22	153.31	88.34	206.86
79.04	0.51	82.16	1.75	85.28	154.03	88.40	217.68
79.10	0.56	82.22	1.76	85.34	154.74	88.46	229.86
79.16	0.61	82.28	1.78	85.40	155.44	88.52	243.27
79.22	0.65	82.34	1.79	85.46	156.15	88.58	257.74
79.28	0.69	82.40	1.81	85.52	156.85	88.64	273.15
79.34	0.73	82.46	1.82	85.58	157.55	88.70	289.50
79.40	0.76	82.52	1.84	85.64	158.25	88.76	306.60
79.46	0.80	82.58	1.85	85.70	158.94	88.82	323.76
79.52	0.83	82.64	1.86	85.76	159.63	88.88	341.48
79.58	0.86	82.70	1.88	85.82	160.31	88.94	359.70
79.64	0.89	82.76	1.89	85.88	161.00	89.00	**379.26**
79.70	0.92	82.82	1.91	85.94	161.68		
79.76	0.95	82.88	1.92	86.00	162.36		
79.82	0.98	82.94	1.94	86.06	163.03		
79.88	1.00	83.00	1.95	86.12	163.70		
79.94	1.03	83.06	1.96	86.18	164.37		
80.00	1.06	83.12	1.98	86.24	165.04		
80.06	1.08	83.18	1.99	86.30	165.70		
80.12	1.11	83.24	2.00	86.36	166.37		
80.18	1.13	83.30	2.02	86.42	167.03		
80.24	1.15	83.36	2.03	86.48	167.68		
80.30	1.18	83.42	2.04	86.54	168.34		
80.36	1.20	83.48	2.06	86.60	168.99		
80.42	1.22	83.54	2.07	86.66	169.63		
80.48	1.24	83.60	2.08	86.72	170.28		
80.54	1.26	83.66	3.73	86.78	170.92		
80.60	1.29	83.72	6.73	86.84	171.57		
80.66	1.31	83.78	10.61	86.90	172.21		
80.72	1.33	83.84	15.21	86.96	172.84		
80.78	1.35	83.90	20.41	87.02	173.48		
80.84	1.37	83.96	26.17	87.08	174.11		
80.90	1.39	84.02	32.43	87.14	174.74		
80.96	1.41	84.08	39.16	87.20	175.37		
81.02	1.42	84.14	46.31	87.26	175.99		
81.08	1.44	84.20	53.88	87.32	176.61		
81.14	1.46	84.26	61.83	87.38	177.23		
81.20	1.48	84.32	70.16	87.44	177.85		
81.26	1.50	84.38	78.83	87.50	178.47		
81.32	1.52	84.44	87.85	87.56	179.08		
81.38	1.53	84.50	97.19	87.62	179.70		
81.44	1.55	84.56	106.86	87.68	180.31		
81.50	1.57	84.62	116.82	87.74	180.91		
81.56	1.58	84.68	127.09	87.80	181.52		

Stage-Area-Storage for Pond 12P: BASIN 4

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
78.50	23,525	0
78.65	23,719	3,543
78.80	23,913	7,116
78.95	24,107	10,717
79.10	24,301	14,348
79.25	24,496	18,008
79.40	24,690	21,697
79.55	25,400	25,427
79.70	27,145	29,368
79.85	28,889	33,571
80.00	30,634	38,035
80.15	30,966	42,655
80.30	31,297	47,325
80.45	31,629	52,044
80.60	31,961	56,814
80.75	32,292	61,633
80.90	32,624	66,501
81.05	32,956	71,420
81.20	33,287	76,388
81.35	33,619	81,406
81.50	33,951	86,474
81.65	34,282	91,591
81.80	34,614	96,758
81.95	34,945	101,975
82.10	35,369	107,246
82.25	35,838	112,587
82.40	36,308	117,998
82.55	36,777	123,479
82.70	37,246	129,031
82.85	37,716	134,653
83.00	38,185	140,346
83.15	38,654	146,109
83.30	39,124	151,942
83.45	39,593	157,846
83.60	40,062	163,820
83.75	40,532	169,865
83.90	41,001	175,979
84.05	41,437	182,164
84.20	41,805	188,407
84.35	42,173	194,705
84.50	42,541	201,059
84.65	42,909	207,468
84.80	43,277	213,932
84.95	43,645	220,451
85.10	44,013	227,025
85.25	44,381	233,655
85.40	44,749	240,339
85.55	45,117	247,079
85.70	45,485	253,874
85.85	45,853	260,725
86.00	46,221	267,630
86.15	46,568	274,589
86.30	46,914	281,601
86.45	47,261	288,664
86.60	47,607	295,779
86.75	47,954	302,946
86.90	48,300	310,165
87.05	48,647	317,436
87.20	48,994	324,759
87.35	49,340	332,134
87.50	49,687	339,561
87.65	50,033	347,040
87.80	50,380	354,571
87.95	50,726	362,154
88.10	51,899	369,830
88.25	53,484	377,734
88.40	55,069	385,875
88.55	56,654	394,255
88.70	58,240	402,872
88.85	59,825	411,727
89.00	**61,410**	**420,819**

Summary for Pond 16P: WQv FACILITY

Inflow Area = 3.461 ac, 8.78% Impervious, Inflow Depth = 3.10" for 25-YR event
Inflow = 19.12 cfs @ 11.97 hrs, Volume= 0.894 af
Outflow = 15.60 cfs @ 12.02 hrs, Volume= 0.894 af, Atten= 18%, Lag= 2.8 min
Primary = 15.60 cfs @ 12.02 hrs, Volume= 0.894 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 90.11' @ 12.02 hrs Surf.Area= 4,271 sf Storage= 7,923 cf

Plug-Flow detention time= 134.0 min calculated for 0.894 af (100% of inflow)
Center-of-Mass det. time= 134.4 min (960.8 - 826.4)

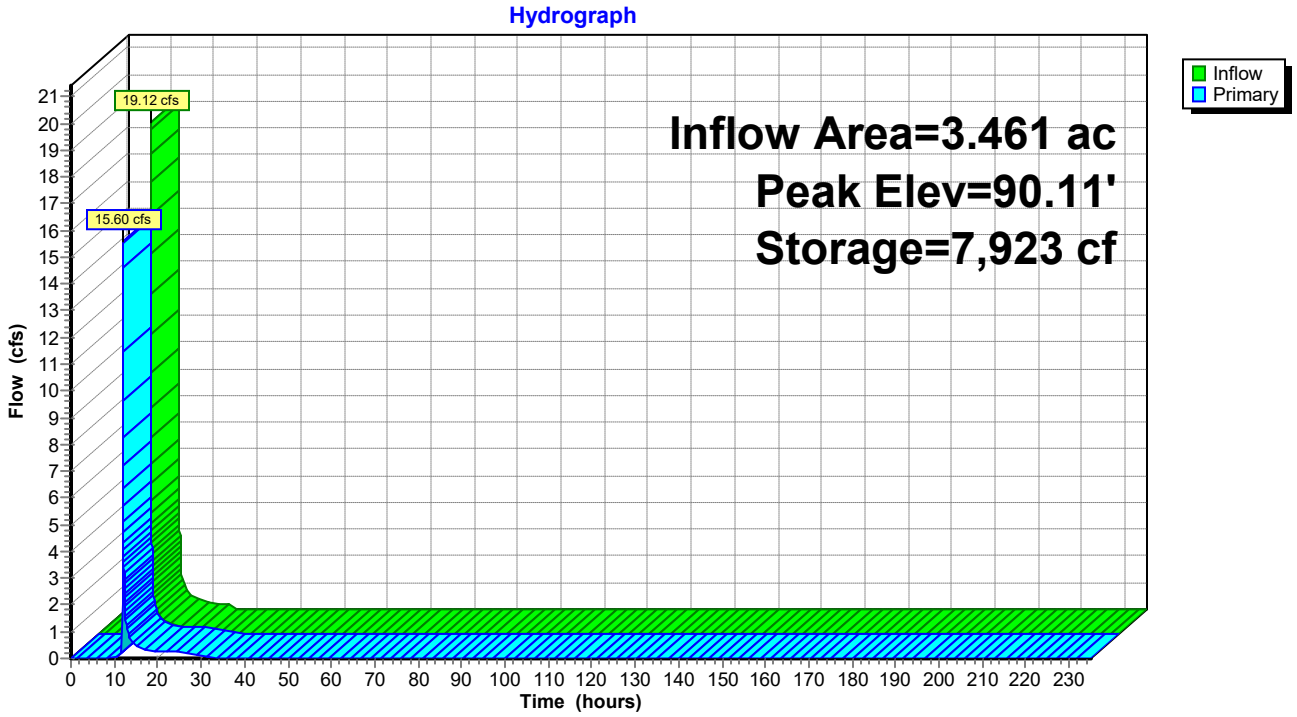
Volume	Invert	Avail.Storage	Storage Description
#1	88.00'	16,930 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
88.00	3,242	0	0
89.50	3,958	5,400	5,400
90.00	4,210	2,042	7,442
92.00	5,278	9,488	16,930

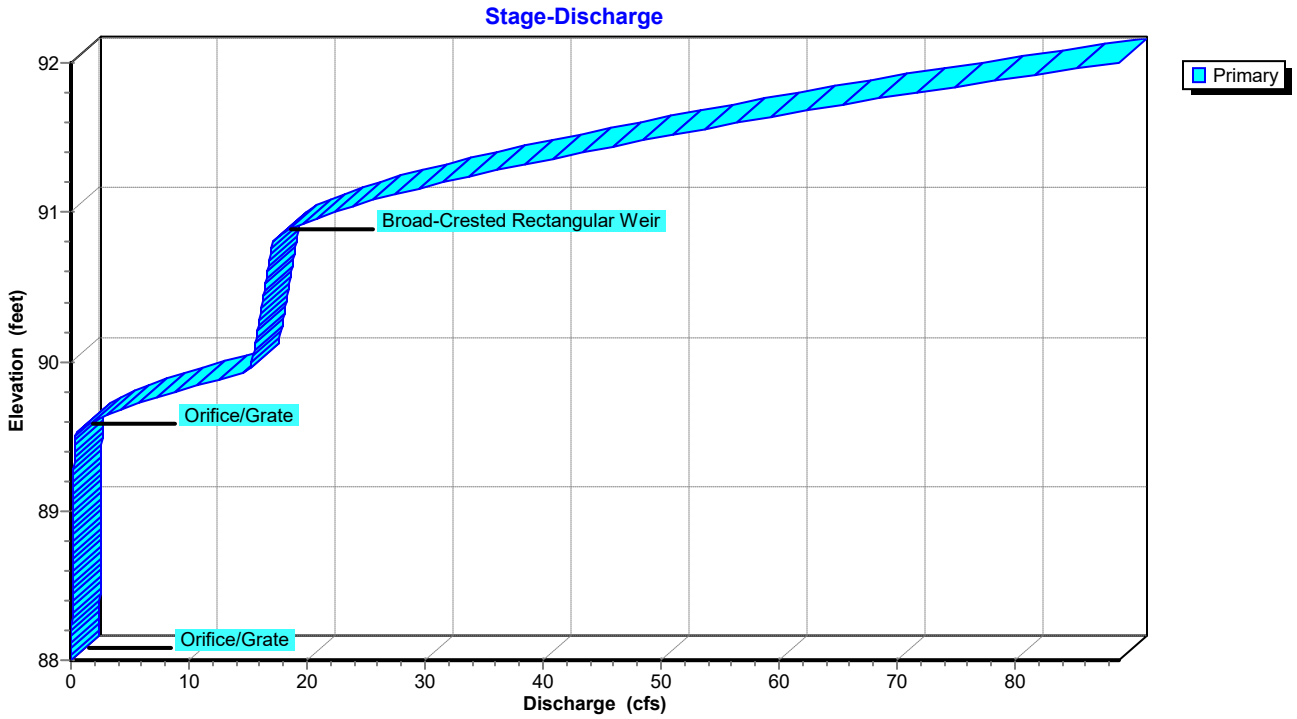
Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" x 44.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 82.00' S= 0.0909 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	88.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	89.50'	**4.00' x 4.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=15.60 cfs @ 12.02 hrs HW=90.11' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 15.60 cfs @ 8.83 fps)
  - **2=Orifice/Grate** (Passes < 0.33 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 25.13 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

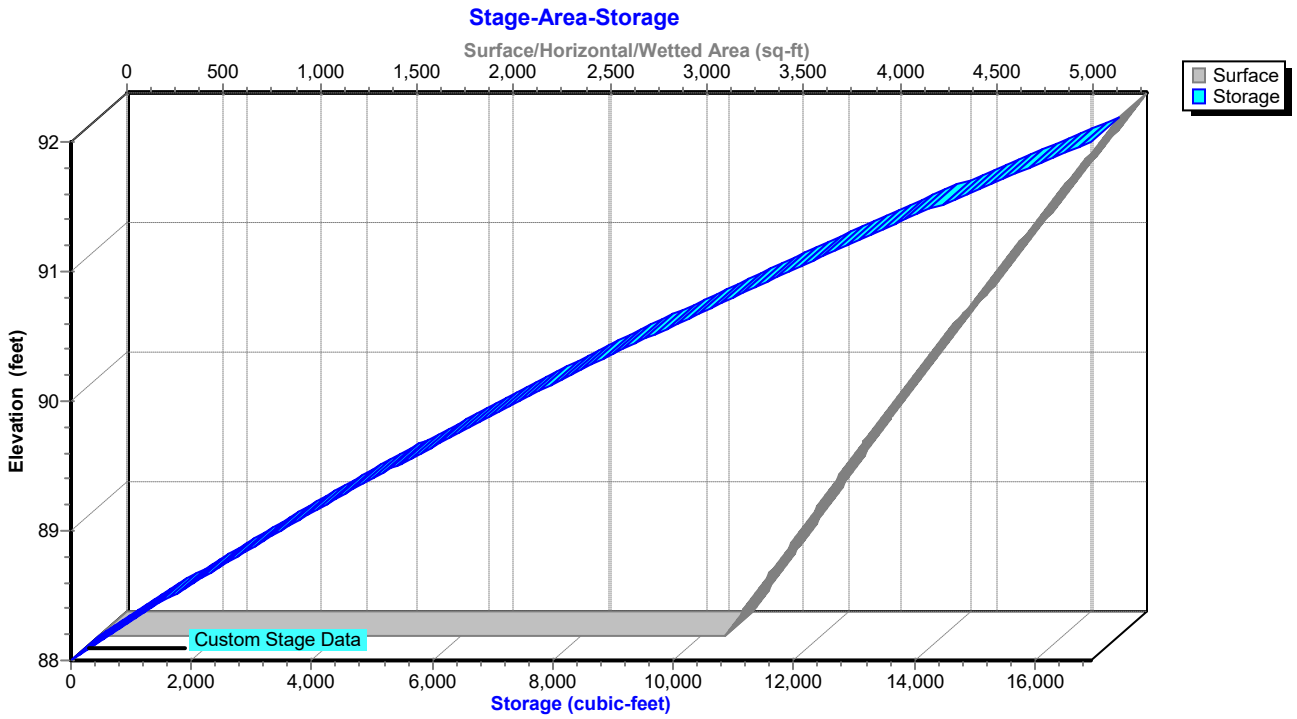
Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Stage-Discharge for Pond 16P: WQv FACILITY

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
88.00	0.00	89.04	0.23	90.08	15.53	91.12	27.53
88.02	0.00	89.06	0.23	90.10	15.57	91.14	28.51
88.04	0.00	89.08	0.23	90.12	15.62	91.16	29.52
88.06	0.01	89.10	0.23	90.14	15.67	91.18	30.55
88.08	0.01	89.12	0.24	90.16	15.71	91.20	31.61
88.10	0.02	89.14	0.24	90.18	15.76	91.22	32.69
88.12	0.03	89.16	0.24	90.20	15.80	91.24	33.79
88.14	0.04	89.18	0.24	90.22	15.85	91.26	34.92
88.16	0.05	89.20	0.25	90.24	15.90	91.28	36.07
88.18	0.05	89.22	0.25	90.26	15.94	91.30	37.24
88.20	0.06	89.24	0.25	90.28	15.99	91.32	38.44
88.22	0.07	89.26	0.25	90.30	16.03	91.34	39.66
88.24	0.08	89.28	0.25	90.32	16.08	91.36	40.90
88.26	0.09	89.30	0.26	90.34	16.12	91.38	42.16
88.28	0.09	89.32	0.26	90.36	16.17	91.40	43.45
88.30	0.10	89.34	0.26	90.38	16.21	91.42	44.69
88.32	0.10	89.36	0.26	90.40	16.26	91.44	45.95
88.34	0.11	89.38	0.26	90.42	16.30	91.46	47.23
88.36	0.11	89.40	0.27	90.44	16.34	91.48	48.52
88.38	0.12	89.42	0.27	90.46	16.39	91.50	49.82
88.40	0.12	89.44	0.27	90.48	16.43	91.52	51.13
88.42	0.13	89.46	0.27	90.50	16.48	91.54	52.46
88.44	0.13	89.48	0.28	90.52	16.52	91.56	53.80
88.46	0.14	89.50	0.28	90.54	16.56	91.58	55.16
88.48	0.14	89.52	0.43	90.56	16.61	91.60	56.52
88.50	0.14	89.54	0.70	90.58	16.65	91.62	57.97
88.52	0.15	89.56	1.05	90.60	16.70	91.64	59.43
88.54	0.15	89.58	1.47	90.62	16.74	91.66	60.92
88.56	0.16	89.60	1.94	90.64	16.78	91.68	62.41
88.58	0.16	89.62	2.46	90.66	16.82	91.70	63.93
88.60	0.16	89.64	3.03	90.68	16.87	91.72	65.46
88.62	0.17	89.66	3.64	90.70	16.91	91.74	67.00
88.64	0.17	89.68	4.29	90.72	16.95	91.76	68.56
88.66	0.17	89.70	4.98	90.74	17.00	91.78	70.13
88.68	0.18	89.72	5.70	90.76	17.04	91.80	71.72
88.70	0.18	89.74	6.45	90.78	17.08	91.82	73.37
88.72	0.18	89.76	7.24	90.80	17.12	91.84	75.03
88.74	0.19	89.78	8.06	90.82	17.32	91.86	76.70
88.76	0.19	89.80	8.90	90.84	17.64	91.88	78.40
88.78	0.19	89.82	9.78	90.86	18.04	91.90	80.11
88.80	0.19	89.84	10.68	90.88	18.50	91.92	81.84
88.82	0.20	89.86	11.61	90.90	19.03	91.94	83.58
88.84	0.20	89.88	12.57	90.92	19.60	91.96	85.34
88.86	0.20	89.90	13.55	90.94	20.22	91.98	87.11
88.88	0.21	89.92	14.56	90.96	20.89	92.00	**88.90**
88.90	0.21	89.94	15.20	90.98	21.59		
88.92	0.21	89.96	15.24	91.00	22.34		
88.94	0.21	89.98	15.29	91.02	23.12		
88.96	0.22	90.00	15.34	91.04	23.94		
88.98	0.22	90.02	15.39	91.06	24.79		
89.00	0.22	90.04	15.43	91.08	25.67		
89.02	0.22	90.06	15.48	91.10	26.59		

Stage-Area-Storage for Pond 16P: WQv FACILITY

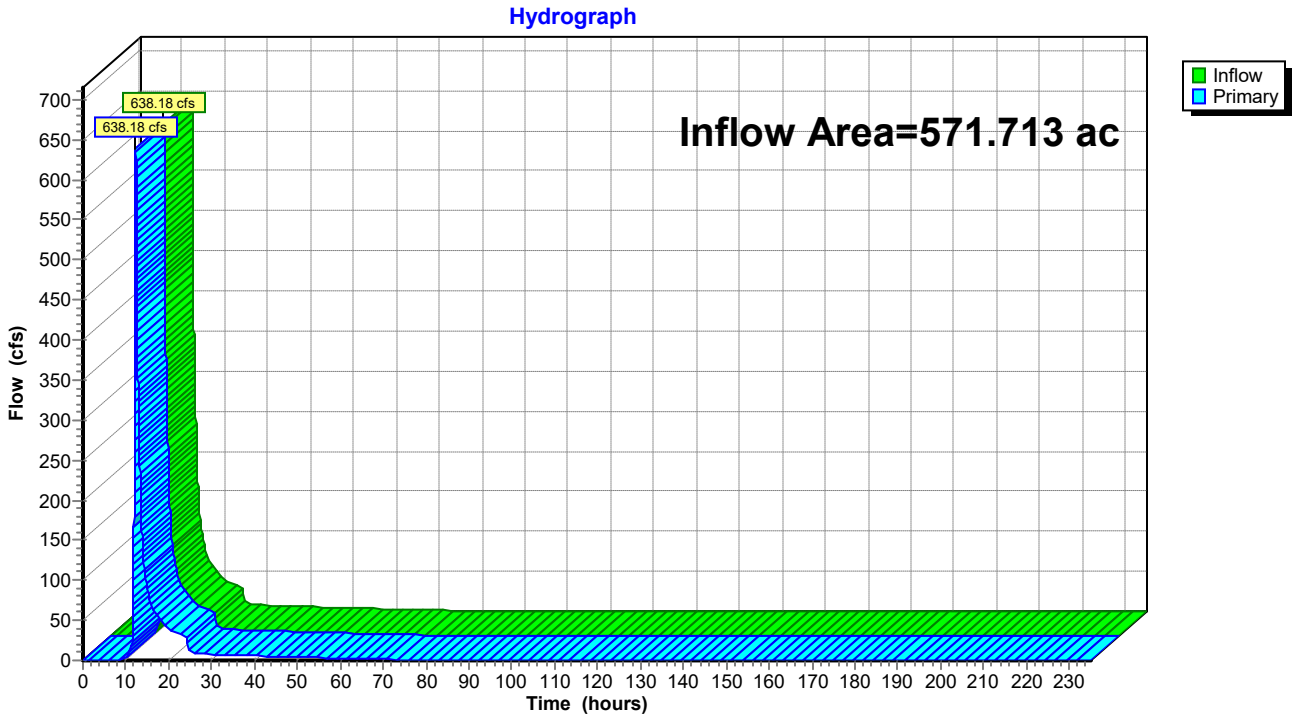
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
88.00	3,242	0
88.05	3,266	163
88.10	3,290	327
88.15	3,314	492
88.20	3,337	658
88.25	3,361	825
88.30	3,385	994
88.35	3,409	1,164
88.40	3,433	1,335
88.45	3,457	1,507
88.50	3,481	1,681
88.55	3,505	1,855
88.60	3,528	2,031
88.65	3,552	2,208
88.70	3,576	2,386
88.75	3,600	2,566
88.80	3,624	2,746
88.85	3,648	2,928
88.90	3,672	3,111
88.95	3,695	3,295
89.00	3,719	3,481
89.05	3,743	3,667
89.10	3,767	3,855
89.15	3,791	4,044
89.20	3,815	4,234
89.25	3,839	4,425
89.30	3,863	4,618
89.35	3,886	4,812
89.40	3,910	5,007
89.45	3,934	5,203
89.50	3,958	5,400
89.55	3,983	5,599
89.60	4,008	5,798
89.65	4,034	5,999
89.70	4,059	6,202
89.75	4,084	6,405
89.80	4,109	6,610
89.85	4,134	6,816
89.90	4,160	7,024
89.95	4,185	7,232
90.00	4,210	7,442
90.05	4,237	7,653
90.10	4,263	7,866
90.15	4,290	8,080
90.20	4,317	8,295
90.25	4,344	8,511
90.30	4,370	8,729
90.35	4,397	8,948
90.40	4,424	9,169
90.45	4,450	9,391
90.50	4,477	9,614
90.55	4,504	9,838
90.60	4,530	10,064
90.65	4,557	10,291
90.70	4,584	10,520
90.75	4,611	10,750
90.80	4,637	10,981
90.85	4,664	11,213
90.90	4,691	11,447
90.95	4,717	11,682
91.00	4,744	11,919
91.05	4,771	12,157
91.10	4,797	12,396
91.15	4,824	12,637
91.20	4,851	12,878
91.25	4,878	13,122
91.30	4,904	13,366
91.35	4,931	13,612
91.40	4,958	13,859
91.45	4,984	14,108
91.50	5,011	14,358
91.55	5,038	14,609
91.60	5,064	14,862
91.65	5,091	15,115
91.70	5,118	15,371
91.75	5,145	15,627
91.80	5,171	15,885
91.85	5,198	16,144
91.90	5,225	16,405
91.95	5,251	16,667
92.00	**5,278**	**16,930**

Summary for Link 14L: TOTAL PROPOSED

Inflow Area = 571.713 ac, 2.47% Impervious, Inflow Depth = 2.63" for 25-YR event
Inflow = 638.18 cfs @ 12.33 hrs, Volume= 125.279 af
Primary = 638.18 cfs @ 12.33 hrs, Volume= 125.279 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 14L: TOTAL PROPOSED

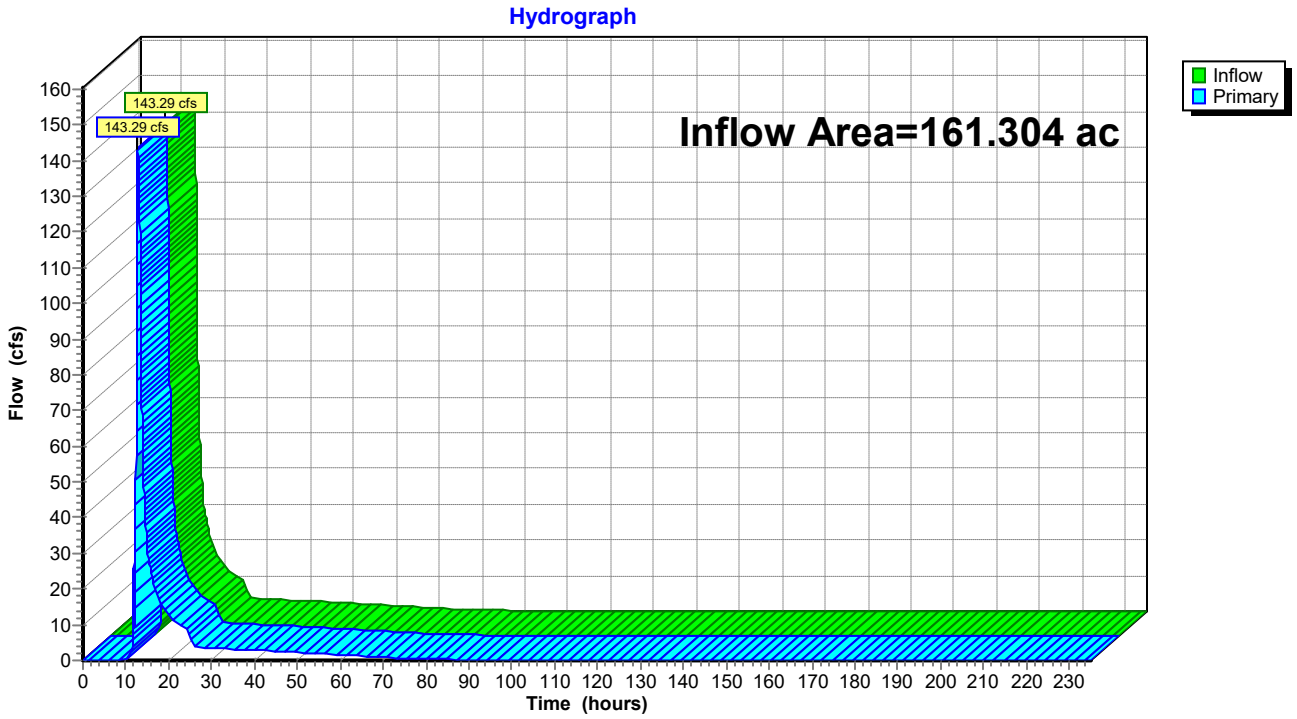


Summary for Link 59L: Discharge Pt 1

Inflow Area = 161.304 ac, 3.97% Impervious, Inflow Depth = 3.10" for 25-YR event
Inflow = 143.29 cfs @ 12.76 hrs, Volume= 41.622 af
Primary = 143.29 cfs @ 12.76 hrs, Volume= 41.622 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: Discharge Pt 1

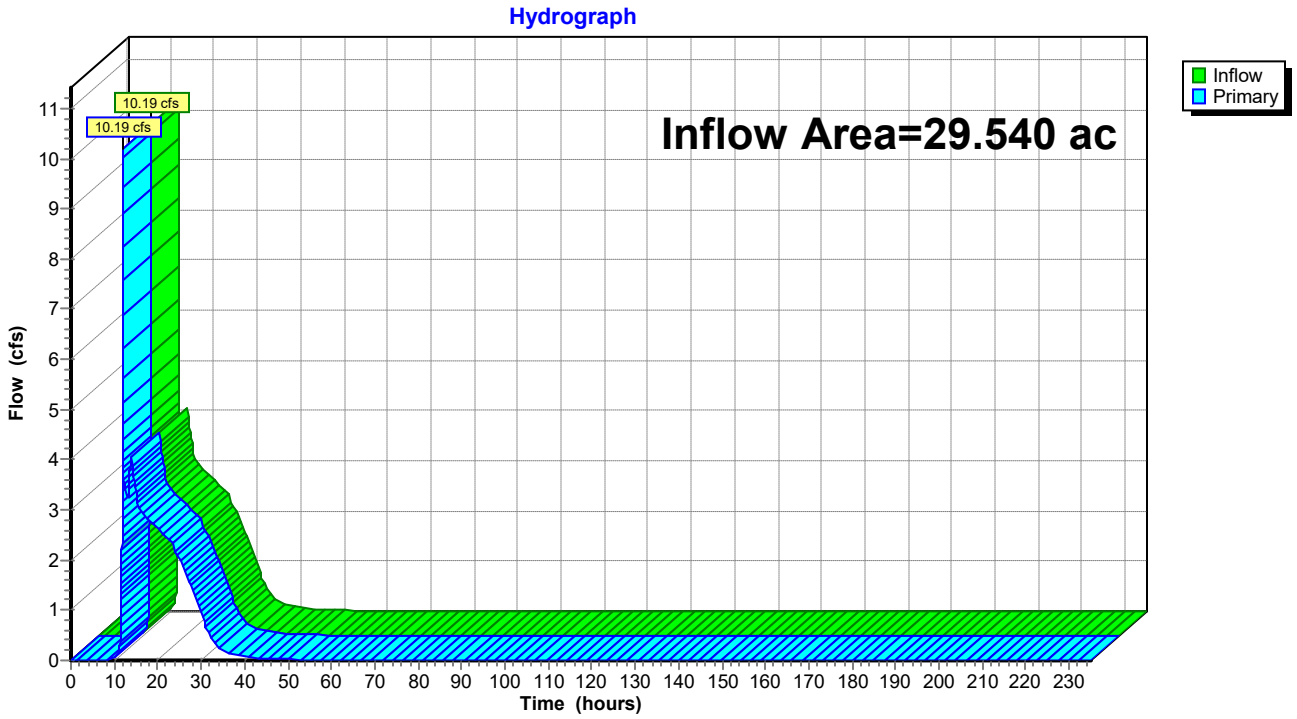


Summary for Link 60L: Discharge Pt 2

Inflow Area = 29.540 ac, 4.03% Impervious, Inflow Depth = 1.70" for 25-YR event
Inflow = 10.19 cfs @ 11.98 hrs, Volume= 4.183 af
Primary = 10.19 cfs @ 11.98 hrs, Volume= 4.183 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: Discharge Pt 2

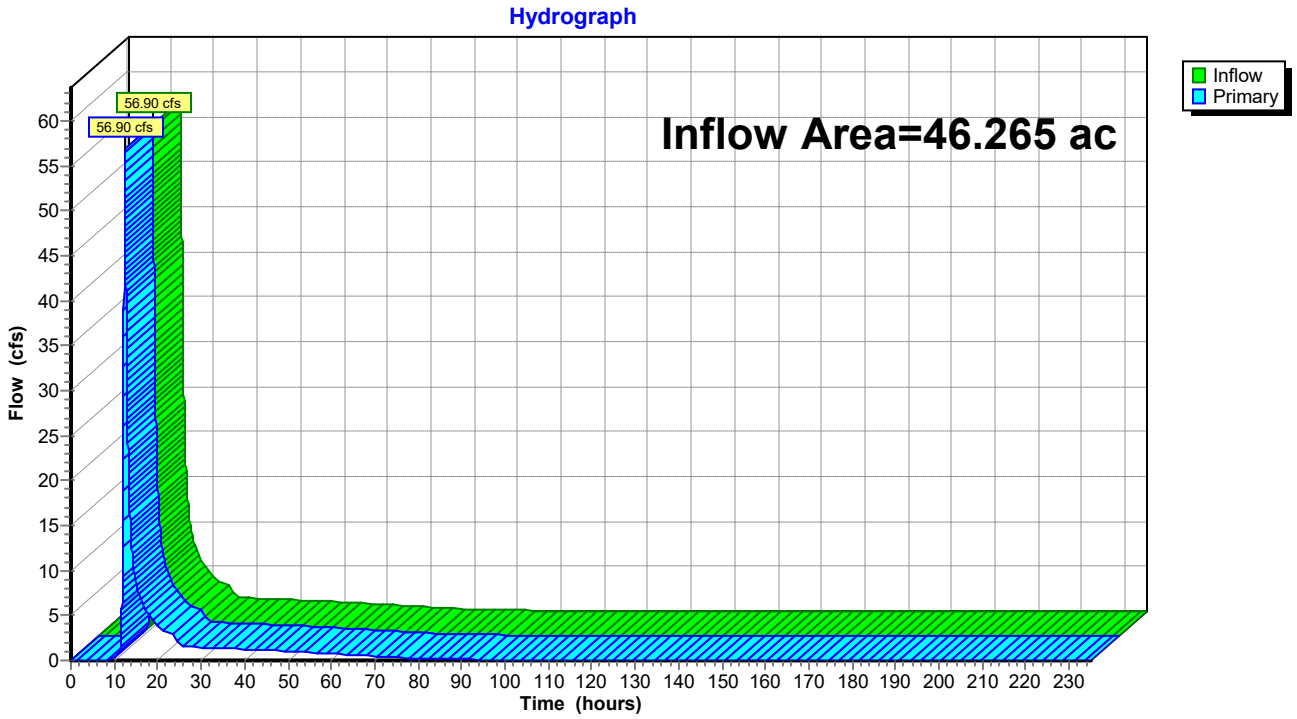


Summary for Link 61L: Discharge Pt 3

Inflow Area = 46.265 ac, 6.92% Impervious, Inflow Depth = 3.67" for 25-YR event
Inflow = 56.90 cfs @ 12.37 hrs, Volume= 14.146 af
Primary = 56.90 cfs @ 12.37 hrs, Volume= 14.146 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: Discharge Pt 3

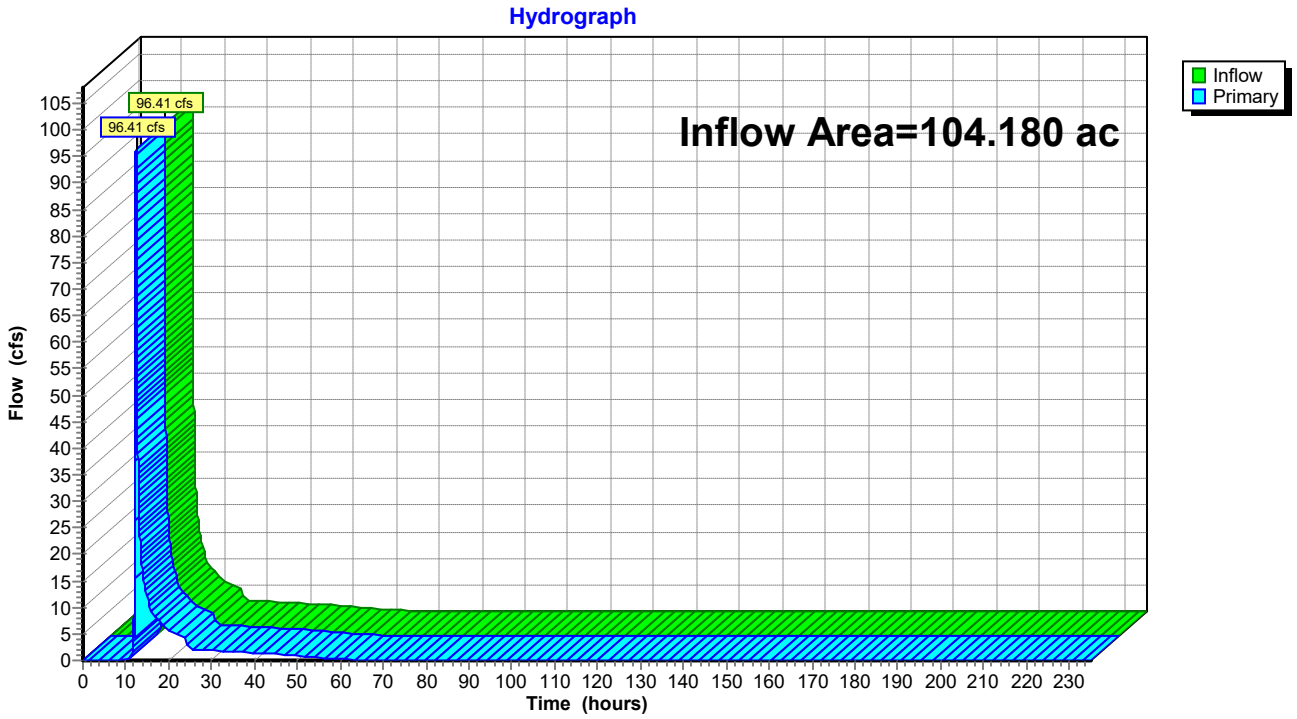


Summary for Link 62L: Discharge Pt 4

Inflow Area = 104.180 ac, 1.09% Impervious, Inflow Depth = 1.81" for 25-YR event
Inflow = 96.41 cfs @ 12.36 hrs, Volume= 15.691 af
Primary = 96.41 cfs @ 12.36 hrs, Volume= 15.691 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: Discharge Pt 4

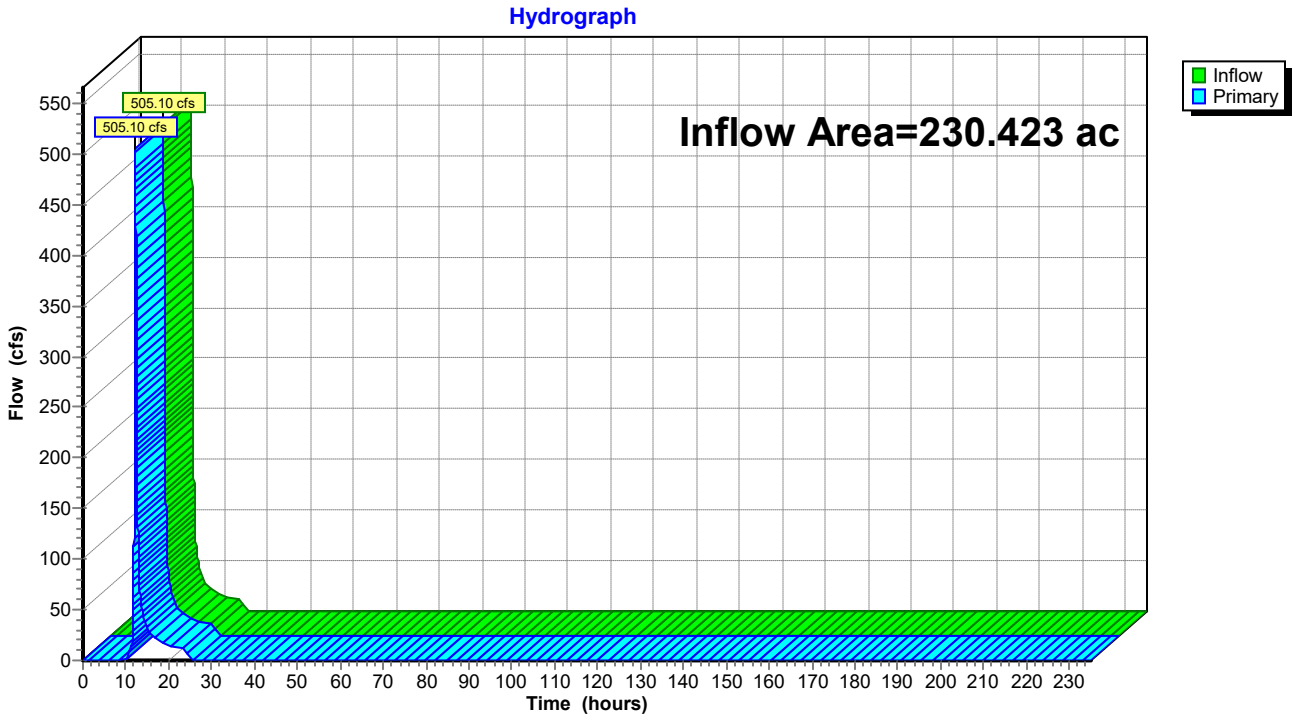


Summary for Link 63L: P 5

Inflow Area = 230.423 ac, 0.95% Impervious, Inflow Depth = 2.58" for 25-YR event
Inflow = 505.10 cfs @ 12.22 hrs, Volume= 49.637 af
Primary = 505.10 cfs @ 12.22 hrs, Volume= 49.637 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: P 5



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 5S: PROPOSED TO BASIN Runoff Area=154.439 ac 4.15% Impervious Runoff Depth=5.38"
Flow Length=5,552' Tc=33.3 min CN=74 Runoff=672.36 cfs 69.178 af

Subcatchment 6S: PROPOSED TO Runoff Area=1,207,838 sf 4.29% Impervious Runoff Depth=3.36"
Flow Length=2,643' Tc=17.4 min CN=57 Runoff=110.04 cfs 7.770 af

Subcatchment 7S: PROPOSED TO Runoff Area=1,802,614 sf 7.74% Impervious Runoff Depth=6.22"
Flow Length=2,398' Tc=16.0 min CN=81 Runoff=314.99 cfs 21.434 af

Subcatchment 8S: PROPOSED TO Runoff Area=4,455,761 sf 1.11% Impervious Runoff Depth=3.60"
Flow Length=3,075' Tc=20.4 min CN=59 Runoff=399.01 cfs 30.651 af

Subcatchment 15S: PROPOSED TO WQv Runoff Area=150,762 sf 8.78% Impervious Runoff Depth=5.38"
Tc=6.0 min CN=74 Runoff=32.48 cfs 1.550 af

Subcatchment 19S: DRAINAGE AREA TO Runoff Area=0.556 ac 8.99% Impervious Runoff Depth=5.38"
Tc=6.0 min CN=74 Runoff=5.22 cfs 0.249 af

Subcatchment 20S: DRAINAGE AREA TO Runoff Area=96.992 ac 0.16% Impervious Runoff Depth=4.66"
Flow Length=4,594' Tc=30.4 min CN=68 Runoff=388.58 cfs 37.654 af

Subcatchment 21S: DRAINAGE AREA TO Runoff Area=12.910 ac 1.93% Impervious Runoff Depth=4.30"
Flow Length=1,337' Tc=13.2 min CN=65 Runoff=76.44 cfs 4.629 af

Subcatchment 22S: DRAINAGE AREA TO Runoff Area=3,681,542 sf 0.10% Impervious Runoff Depth=4.42"
Flow Length=3,556' Tc=26.2 min CN=66 Runoff=353.81 cfs 31.136 af

Subcatchment 51S: ONSITE ACCESS Runoff Area=177,797 sf 24.48% Impervious Runoff Depth=6.10"
Tc=28.6 min CN=80 Runoff=22.03 cfs 2.073 af

Subcatchment 52S: DRAINAGE AREA TO Runoff Area=27.906 ac 1.27% Impervious Runoff Depth=5.61"
Flow Length=1,920' Tc=28.5 min CN=76 Runoff=140.08 cfs 13.058 af

Subcatchment 55S: UNMANAGED P 2 Runoff Area=78,944 sf 0.00% Impervious Runoff Depth=5.26"
Tc=6.0 min CN=73 Runoff=16.69 cfs 0.794 af

Subcatchment 56S: UNMANAGED P 1 Runoff Area=299,039 sf 0.00% Impervious Runoff Depth=5.50"
Tc=6.0 min CN=75 Runoff=65.63 cfs 3.144 af

Subcatchment 57S: UNMANAGED P 3 Runoff Area=212,691 sf 0.00% Impervious Runoff Depth=4.90"
Tc=6.0 min CN=70 Runoff=42.26 cfs 1.993 af

Subcatchment 58S: UNMANAGED P 4 Runoff Area=82,311 sf 0.00% Impervious Runoff Depth=5.98"
Tc=6.0 min CN=79 Runoff=19.32 cfs 0.941 af

Pond 9P: BASIN 1 Peak Elev=90.22' Storage=1,275,872 cf Inflow=672.36 cfs 69.178 af
Outflow=255.13 cfs 69.062 af

Pond 10P: BASIN 2 Peak Elev=77.93' Storage=107,974 cf Inflow=110.04 cfs 7.770 af
Outflow=58.51 cfs 7.766 af

Pond 11P: BASIN 3 Peak Elev=79.10' Storage=380,892 cf Inflow=314.99 cfs 21.434 af
Outflow=193.46 cfs 21.391 af

Pond 12P: BASIN 4 Peak Elev=88.13' Storage=371,527 cf Inflow=399.01 cfs 30.651 af
Outflow=184.84 cfs 30.645 af

Pond 16P: WQv FACILITY Peak Elev=91.10' Storage=12,385 cf Inflow=32.48 cfs 1.550 af
Outflow=26.48 cfs 1.550 af

Link 14L: TOTAL PROPOSED Inflow=1,520.29 cfs 226.084 af
Primary=1,520.29 cfs 226.084 af

Link 59L: Discharge Pt 1 Inflow=259.19 cfs 72.206 af
Primary=259.19 cfs 72.206 af

Link 60L: Discharge Pt 2 Inflow=60.56 cfs 8.560 af
Primary=60.56 cfs 8.560 af

Link 61L: Discharge Pt 3 Inflow=199.52 cfs 23.384 af
Primary=199.52 cfs 23.384 af

Link 62L: Discharge Pt 4 Inflow=186.83 cfs 31.586 af
Primary=186.83 cfs 31.586 af

Link 63L: P 5 Inflow=946.15 cfs 90.348 af
Primary=946.15 cfs 90.348 af

Total Runoff Area = 571.713 ac Runoff Volume = 226.253 af Average Runoff Depth = 4.75"
97.53% Pervious = 557.579 ac 2.47% Impervious = 14.133 ac

Summary for Subcatchment 5S: PROPOSED TO BASIN 1

Runoff = 672.36 cfs @ 12.28 hrs, Volume= 69.178 af, Depth= 5.38"

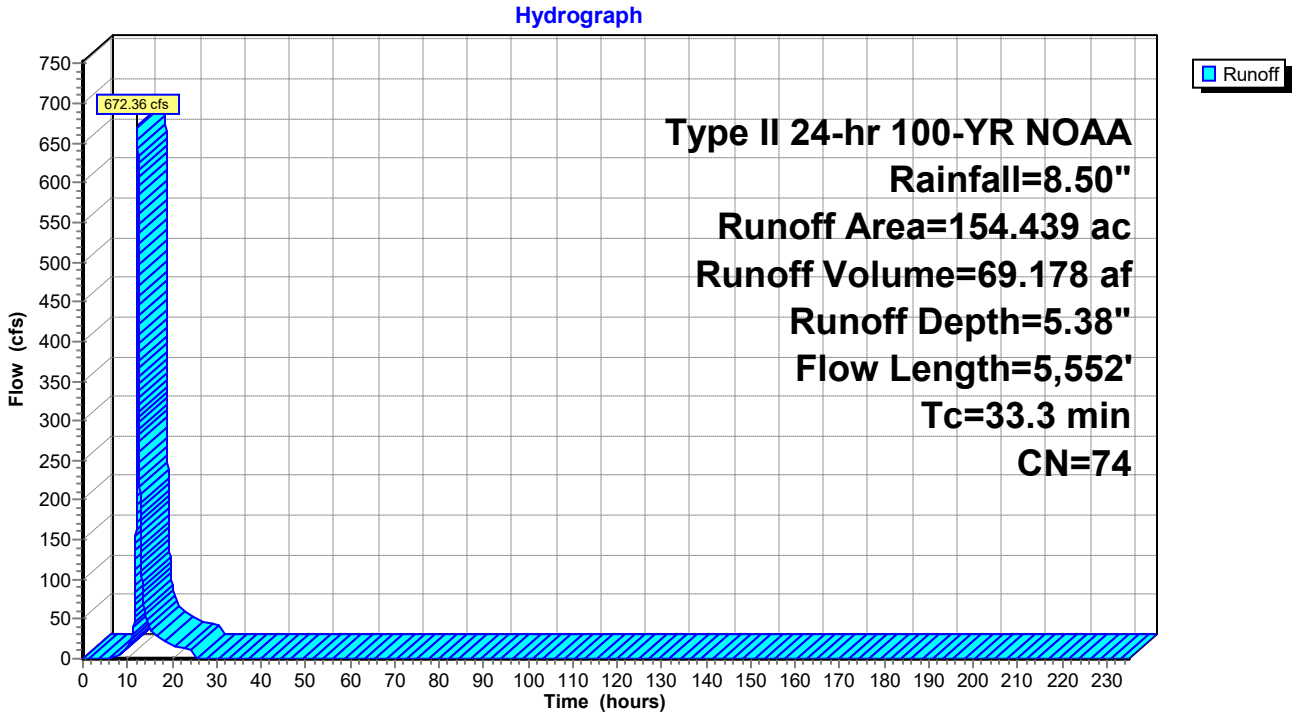
Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	7.630	30	Woods, Good, HSG A (ONSITE)
*	3.008	70	Woods, Good, HSG C (ONSITE)
*	0.597	77	Woods, Good, HSG D (ONSITE)
*	9.439	61	>75% Grass cover, Good, HSG B (ONSITE A SOILS)
*	15.374	80	>75% Grass cover, Good, HSG D (ONSITE C SOILS)
*	6.297	80	>75% Grass cover, Good, HSG D (ONSITE D SOILS)
*	1.702	98	Paved parking & roofs A ONSITE
*	3.969	98	Paved parking & roofs C ONSITE
*	0.736	98	Paved parking & roofs D ONSITE
*	85.888	80	CAP AREA
*	0.772	30	Woods, Good, HSG A OFFSITE
*	1.183	70	Woods, Good, HSG C OFFSITE
*	9.257	42	RA ZONING A SOIL
*	2.379	64	RA ZONING B SOIL
*	4.931	76	RA ZONING C SOIL
*	1.277	82	RA ZONING D SOIL
	154.439	74	Weighted Average
	148.032		Pervious Area
	6.407		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.3	100	0.0600	0.26		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
1.2	295	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
1.3	272	0.0200	3.44	32.28	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=16.00' D=0.50' Z= 6.0 & 5.0 '/' Top.W=21.50' n= 0.035 Earth, dense weeds
6.5	1,025	0.0100	2.64	73.81	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
9.4	2,107	0.0200	3.73	104.38	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=55.00' D=0.50' Z= 2.0 '/' Top.W=57.00' n= 0.035 Earth, dense weeds
0.3	165	0.0050	7.89	55.74	**Circular Channel (pipe), F-G** Diam= 36.0" Area= 7.1 sf Perim= 9.4' r= 0.75' n= 0.011 Concrete pipe, straight & clean
1.1	380	0.0600	5.78	17.35	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
5.1	724	0.0100	2.36	7.08	**Trap/Vee/Rect Channel Flow, H-I** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00'

n= 0.035 Earth, dense weeds					
1.9	376	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, I-J** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
0.2	108	0.0050	10.33	164.33	**Circular Channel (pipe), J-K** Diam= 54.0" Area= 15.9 sf Perim= 14.1' r= 1.13' n= 0.011 Concrete pipe, straight & clean
33.3	5,552	Total			

Subcatchment 5S: PROPOSED TO BASIN 1



Summary for Subcatchment 6S: PROPOSED TO BASIN 2

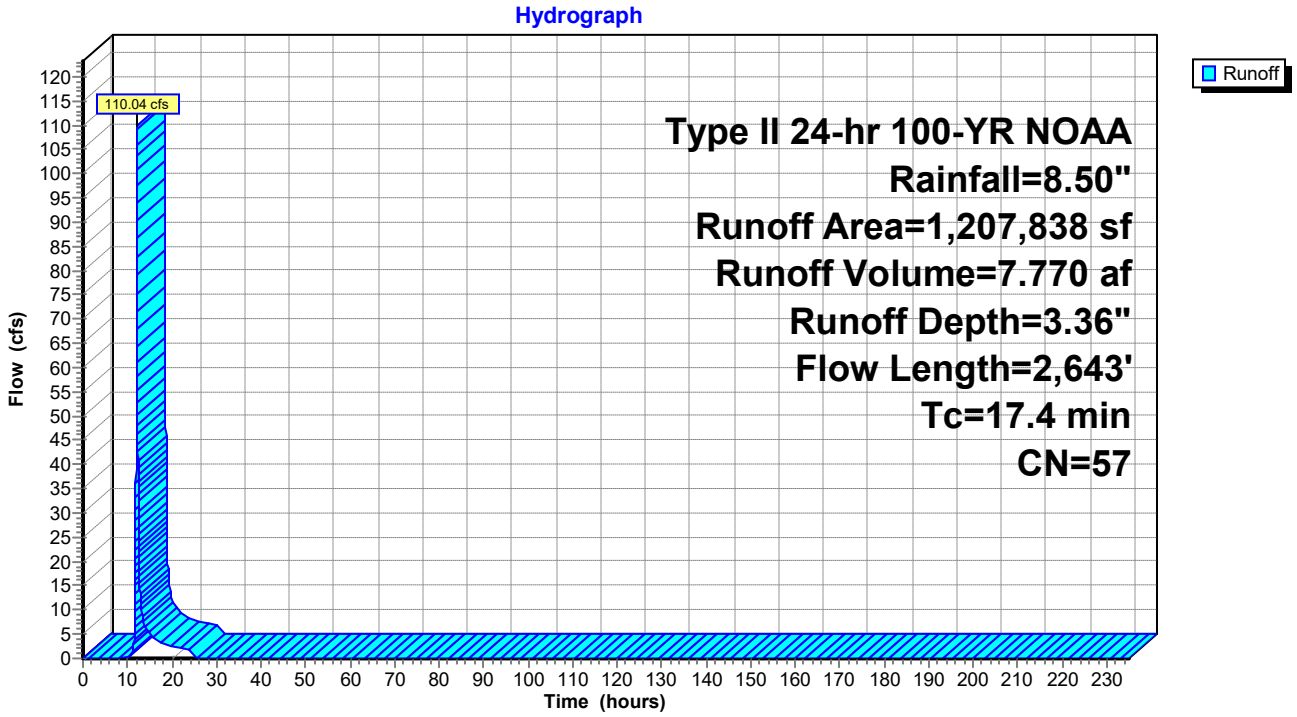
Runoff = 110.04 cfs @ 12.10 hrs, Volume= 7.770 af, Depth= 3.36"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	122,667	30	Woods, Good, HSG A (ONSITE)
*	43,308	70	Woods, Good, HSG C (ONSITE)
*	3,323	77	Woods, Good, HSG D (ONSITE)
*	75,069	61	>75% Grass cover, Good, HSG B (ONSITE A SOIL)
*	193,145	80	>75% Grass cover, Good, HSG D (ONSITE C SOIL)
*	12,756	98	Paved parking & roofs (ONSITE A)
*	39,104	98	Paved parking & roofs (ONSITE C)
*	42,617	80	CAP
*	547,893	42	RA ZONING A SOIL
*	9,866	64	RA ZONING B SOIL
*	81,020	76	RA ZONING C SOIL
*	37,070	82	RA ZONING D SOIL
	1,207,838	57	Weighted Average
	1,155,978		Pervious Area
	51,860		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	598	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
2.6	697	0.0400	4.43	12.72	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=4.00' D=0.50' Z= 3.5 '/' Top.W=7.50' n= 0.035 Earth, dense weeds
1.1	161	0.0100	2.45	11.05	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
2.1	545	0.0300	4.25	19.13	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=8.00' D=0.50' Z= 2.0 '/' Top.W=10.00' n= 0.035 Earth, dense weeds
0.1	74	0.0700	23.95	117.56	**Circular Channel (pipe), F-G** Diam= 30.0" Area= 4.9 sf Perim= 7.9' r= 0.63' n= 0.012
0.9	305	0.0500	5.57	30.64	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=10.00' D=0.50' Z= 2.0 '/' Top.W=12.00' n= 0.035 Earth, dense weeds
0.1	163	0.0900	37.15	466.84	**Circular Channel (pipe), H-I** Diam= 48.0" Area= 12.6 sf Perim= 12.6' r= 1.00' n= 0.012
17.4	2,643	Total			

Subcatchment 6S: PROPOSED TO BASIN 2



Summary for Subcatchment 7S: PROPOSED TO BASIN 3

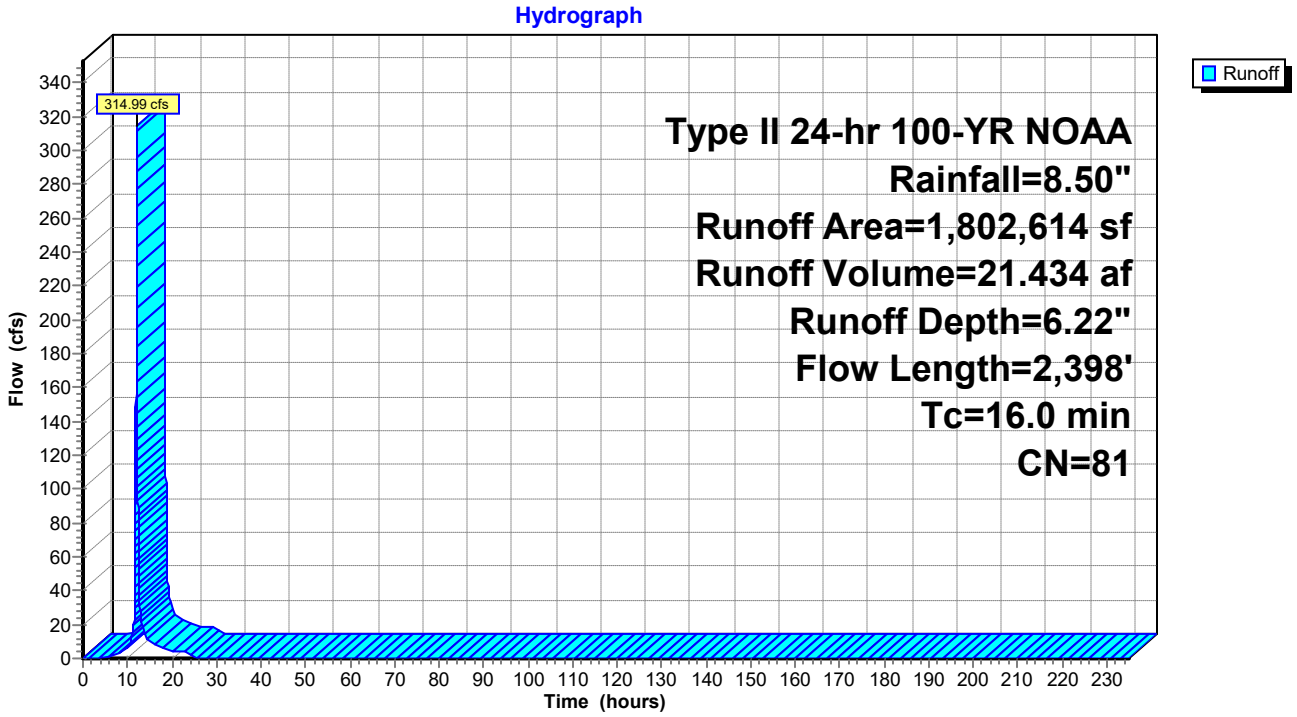
Runoff = 314.99 cfs @ 12.07 hrs, Volume= 21.434 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	68,751	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	252,304	80	>75% Grass cover, Good, HSG D (ONSITE C)
	29,508	80	>75% Grass cover, Good, HSG D
*	9,226	98	Paved parking & roofs (ONSITE A)
*	110,479	98	Paved parking & roofs (ONSITE C)
*	19,790	98	Paved parking & roofs (ONSITE D)
*	1,312,556	80	CAP
	1,802,614	81	Weighted Average
	1,663,119		Pervious Area
	139,495		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
1.1	33	0.5000	0.49		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
14.9	2,274	0.0100	2.54	19.03	**Trap/Vee/Rect Channel Flow, B-C** Bot.W=14.00' D=0.50' Z= 2.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
0.0	91	0.0600	35.20	691.11	**Circular Channel (pipe), C-D** Diam= 60.0" Area= 19.6 sf Perim= 15.7' r= 1.25' n= 0.012
16.0	2,398	Total			

Subcatchment 7S: PROPOSED TO BASIN 3



Summary for Subcatchment 8S: PROPOSED TO BASIN 4

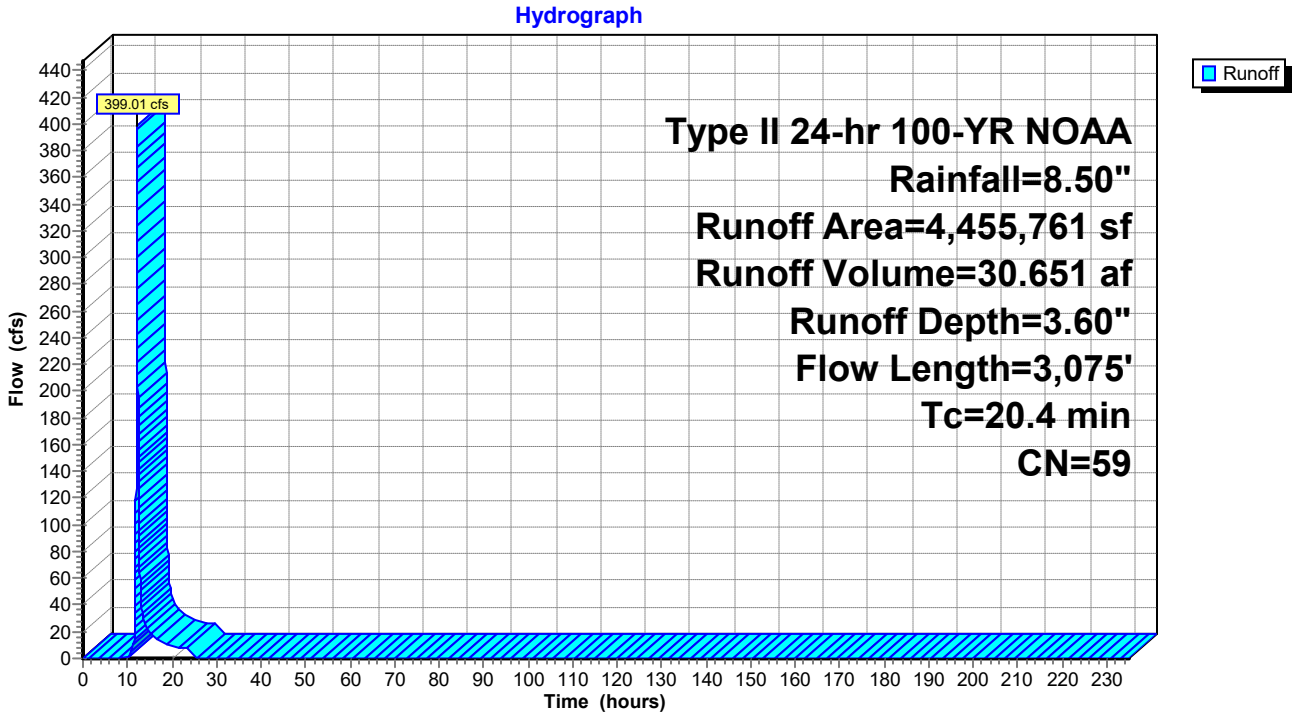
Runoff = 399.01 cfs @ 12.13 hrs, Volume= 30.651 af, Depth= 3.60"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	395,927	30	Woods, Good, HSG A (ONSITE)
*	5,767	55	Woods, Good, HSG B (ONSITE)
*	404,259	70	Woods, Good, HSG C (ONSITE)
*	35,334	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	18,850	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	198,718	80	>75% Grass cover, Good, HSG D (ONSITE C)
	50,619	80	>75% Grass cover, Good, HSG D
*	7,436	98	Paved parking & roofs (ONSITE A)
*	16,314	98	Paved parking & roofs (ONSITE B)
*	18,955	98	Paved parking & roofs (ONSITE C)
*	6,703	98	Paved parking & roofs (ONSITE D)
*	1,043,104	42	RA ZONING A SOILS
*	281,741	64	RA ZONING B SOILS
*	75,531	76	RA ZONING C SOILS
*	692,547	50	R-2 ZONING A SOILS
*	599,476	70	R-2 ZONING B SOILS
*	322,638	80	R-2 ZONING C SOILS
*	281,842	85	R-2 ZONING D SOILS
	4,455,761	59	Weighted Average
	4,406,353		Pervious Area
	49,408		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.5	141	0.1000	5.09		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.5	190	0.0700	6.14	23.43	**Trap/Vee/Rect Channel Flow, C-D** Bot.W=6.00' D=0.50' Z= 2.0 & 4.5 '/' Top.W=9.25' n= 0.035 Earth, dense weeds
2.8	653	0.0600	3.94		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.9	274	0.0500	5.01	15.67	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
8.8	1,671	0.0200	3.17	9.91	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=4.50' D=0.50' Z= 3.5 '/' Top.W=8.00' n= 0.035 Earth, dense weeds
0.1	46	0.1800	9.91	27.26	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=4.50' D=0.50' Z= 2.0 '/' Top.W=6.50' n= 0.035 Earth, dense weeds
20.4	3,075	Total			

Subcatchment 8S: PROPOSED TO BASIN 4



Summary for Subcatchment 15S: PROPOSED TO WQv FACILITY

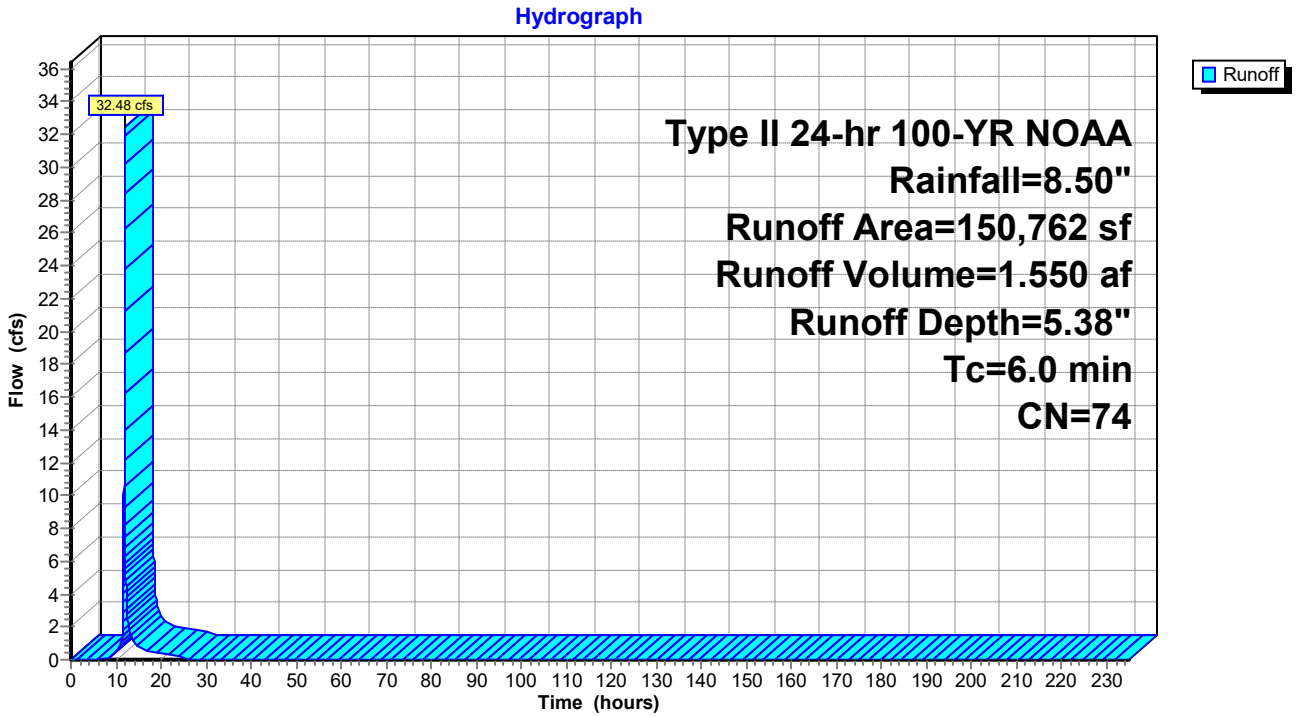
Runoff = 32.48 cfs @ 11.97 hrs, Volume= 1.550 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	9,235	55	Woods, Good, HSG B
	6,229	70	Woods, Good, HSG C
*	20,647	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	16,945	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	8,756	98	Paved parking & roofs (ONSITE B)
*	4,487	98	Paved parking & roofs (ONSITE C)
*	65,732	70	R-2 ZONING B SOILS
*	18,731	80	R-2 ZONING C SOILS
	150,762	74	Weighted Average
	137,519		Pervious Area
	13,243		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 15S: PROPOSED TO WQv FACILITY



Summary for Subcatchment 19S: DRAINAGE AREA TO CULVERT 3

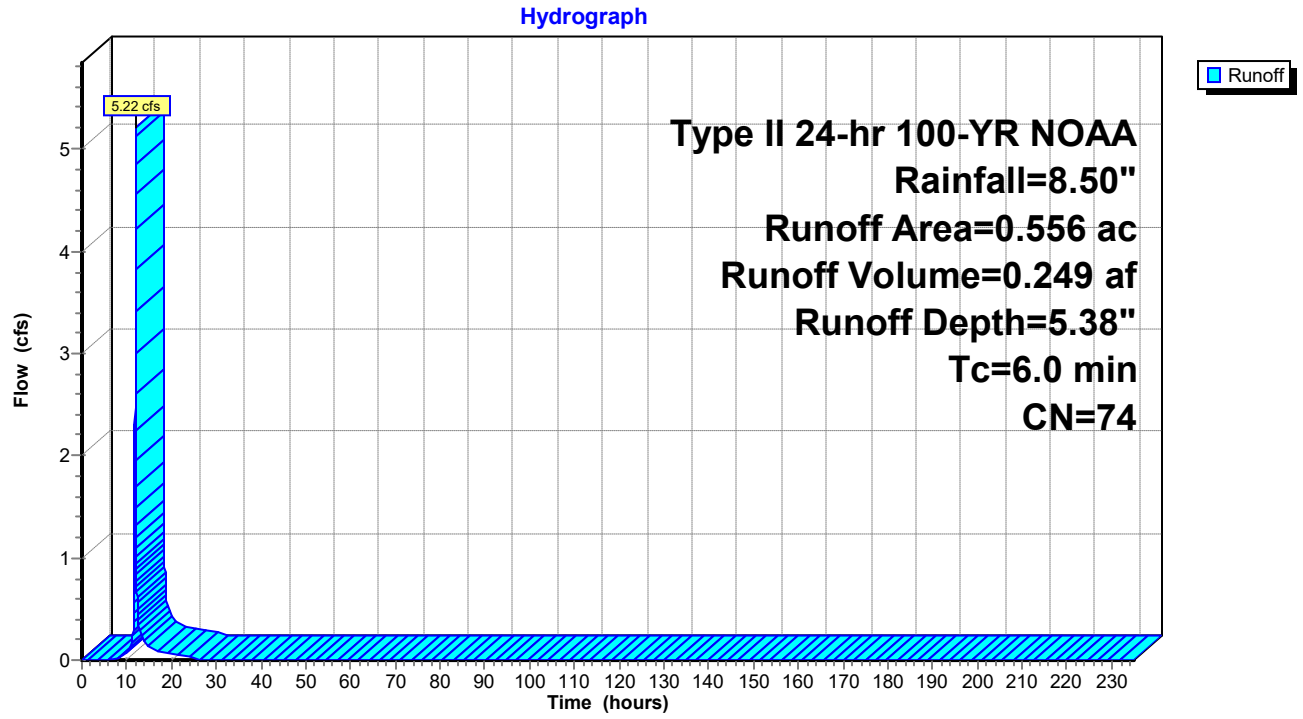
Runoff = 5.22 cfs @ 11.97 hrs, Volume= 0.249 af, Depth= 5.38"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.150	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.013	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.008	98	Paved parking & roofs B SOILS
*	0.042	98	Paved parking & roofs C SOILS
*	0.343	70	R-2 ZONING B SOILS
	0.556	74	Weighted Average
	0.506		Pervious Area
	0.050		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 19S: DRAINAGE AREA TO CULVERT 3



Summary for Subcatchment 20S: DRAINAGE AREA TO CULVERT 4

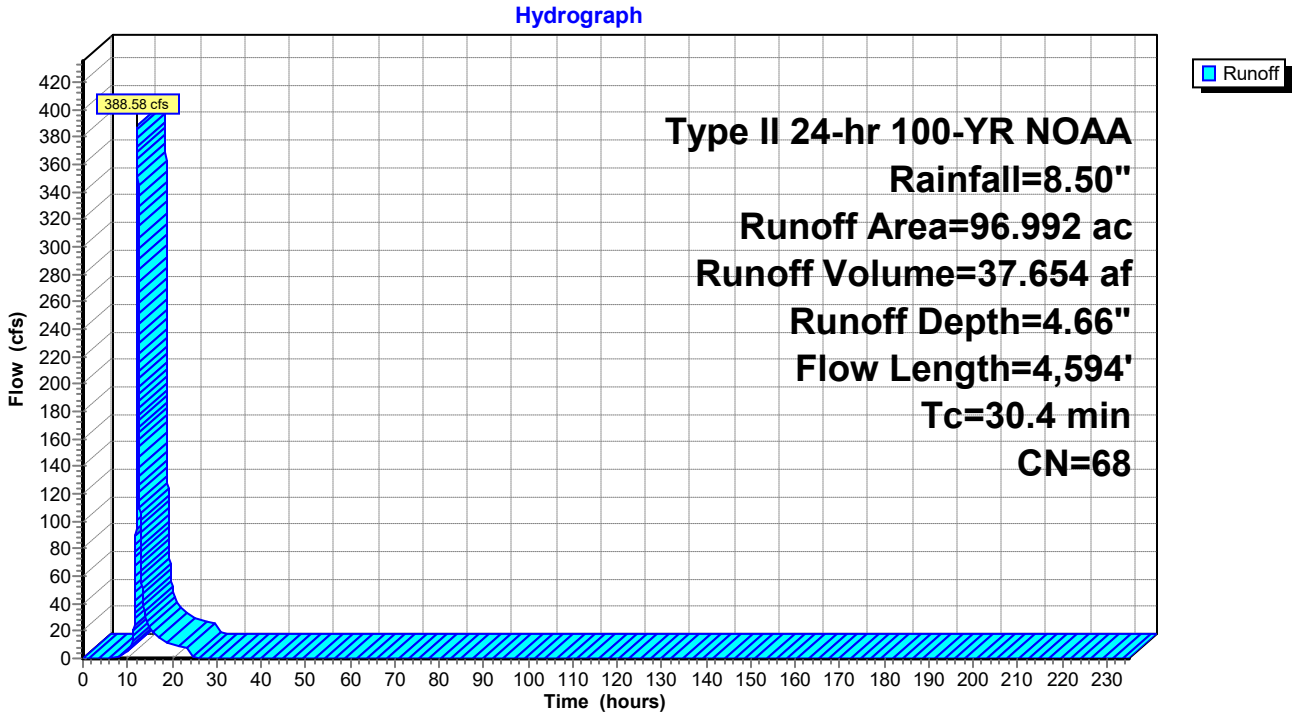
Runoff = 388.58 cfs @ 12.26 hrs, Volume= 37.654 af, Depth= 4.66"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.193	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.776	74	>75% Grass cover, Good, HSG C (DISTURBED B)
*	0.003	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	0.228	80	>75% Grass cover, Good, HSG D
*	0.050	98	Paved parking & roofs A SOILS
*	0.073	98	Paved parking & roofs B SOILS
*	0.008	98	Paved parking & roofs C SOILS
*	0.028	98	Paved parking & roofs D SOILS
*	33.640	50	R-2 ZONING A SOILS
*	27.405	70	R-2 ZONING B SOILS
*	19.119	80	R-2 ZONING C SOILS
*	15.469	85	R-2 ZONING D SOILS
	96.992	68	Weighted Average
	96.833		Pervious Area
	0.159		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
4.8	468	0.0100	1.61		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.2	83	0.1500	6.24		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
14.7	3,415	0.0300	3.88	13.59	**Trap/Vee/Rect Channel Flow, D-E** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
3.9	528	0.0100	2.24	7.85	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=5.00' D=0.50' Z= 4.0 '/' Top.W=9.00' n= 0.035 Earth, dense weeds
30.4	4,594	Total			

Subcatchment 20S: DRAINAGE AREA TO CULVERT 4



Summary for Subcatchment 21S: DRAINAGE AREA TO CULVERT 5

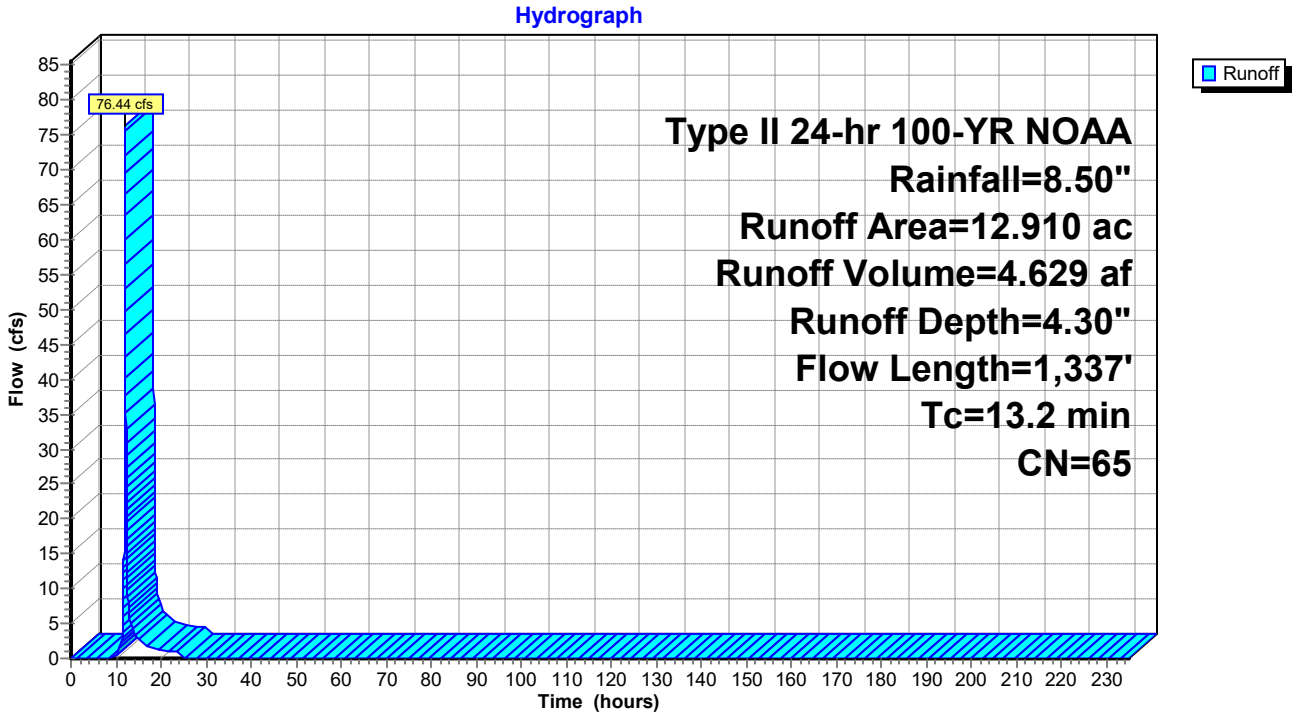
Runoff = 76.44 cfs @ 12.05 hrs, Volume= 4.629 af, Depth= 4.30"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.467	61	>75% Grass cover, Good, HSG B (DISTURBED A)
*	0.546	74	>75% Grass cover, Good, HSG C (DISTURBED B)
	0.197	98	Paved parking & roofs
	0.052	98	Paved parking & roofs
*	3.819	50	R-2 ZONING A SOILS
*	6.875	70	R-2 ZONING B SOILS
*	0.954	80	R-2 ZONING C SOILS
	12.910	65	Weighted Average
	12.661		Pervious Area
	0.249		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
7.4	100	0.0400	0.22		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
3.1	428	0.0200	2.28		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.0	10	0.6000	12.47		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
2.7	799	0.0200	4.96	13.30	**Trap/Vee/Rect Channel Flow, E-F** Bot.W=10.00' D=0.25' Z= 1.7 & 4.0 '/' Top.W=11.43' n= 0.016 Asphalt, rough
13.2	1,337	Total			

Subcatchment 21S: DRAINAGE AREA TO CULVERT 5



Summary for Subcatchment 22S: DRAINAGE AREA TO CULVERT 6

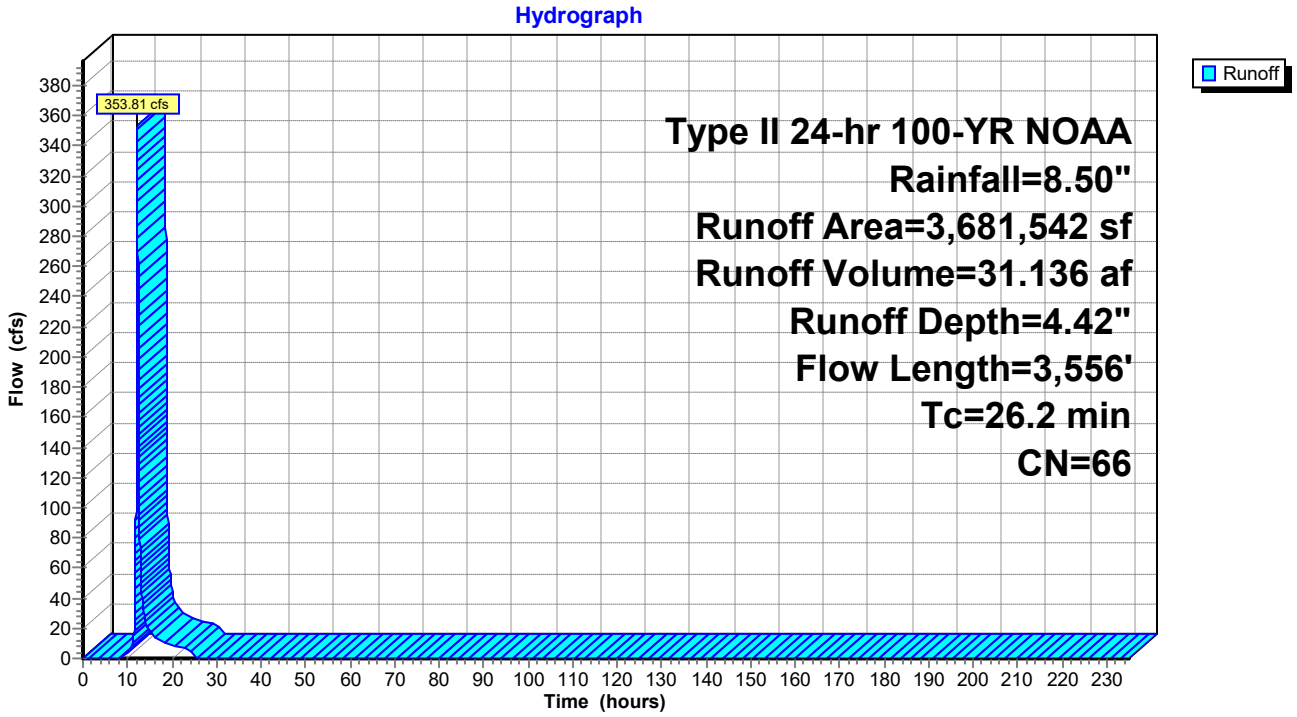
Runoff = 353.81 cfs @ 12.20 hrs, Volume= 31.136 af, Depth= 4.42"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	9,867	80	>75% Grass cover, Good, HSG D (DISTURBED C)
	3,623	98	Paved parking & roofs
*	1,329,281	50	R-2 ZONING A SOILS
*	1,059,738	70	R-2 ZONING B SOILS
*	1,279,033	80	R-2 ZONING C SOILS
	3,681,542	66	Weighted Average
	3,677,919		Pervious Area
	3,623		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
2.6	700	0.0800	4.55		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
3.8	728	0.0400	3.22		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
5.9	574	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
0.1	53	0.2600	8.21		**Shallow Concentrated Flow, E-F** Unpaved Kv= 16.1 fps
3.9	850	0.0300	3.60	19.81	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
3.1	551	0.0200	2.94	16.17	**Trap/Vee/Rect Channel Flow, G-H** Bot.W=6.00' D=0.50' Z= 10.0 '/' Top.W=16.00' n= 0.035 Earth, dense weeds
26.2	3,556	Total			

Subcatchment 22S: DRAINAGE AREA TO CULVERT 6



Summary for Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)

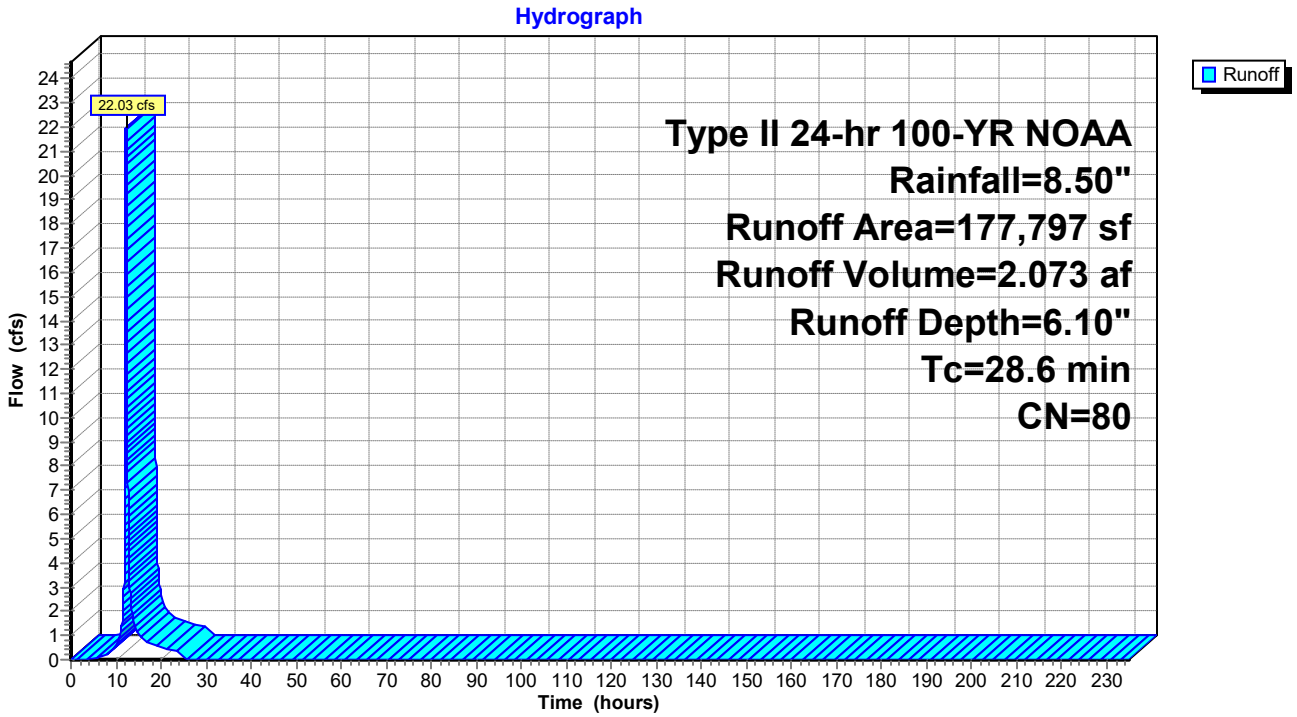
Runoff = 22.03 cfs @ 12.23 hrs, Volume= 2.073 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	40,015	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	9,812	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	68,391	80	>75% Grass cover, Good, HSG D (ONSITE C)
	16,061	80	>75% Grass cover, Good, HSG D
*	12,080	98	Paved parking & roofs (ONSITE A)
*	3,237	98	Paved parking & roofs (ONSITE B)
*	24,939	98	Paved parking & roofs (ONSITE C)
*	3,262	98	Paved parking & roofs (ONSITE D)
	177,797	80	Weighted Average
	134,279		Pervious Area
	43,518		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.6					**Direct Entry, SEE Tc CALC FOR AREA TO CULVERT 6**

Subcatchment 51S: ONSITE ACCESS ROAD (UNMANAGED)



Summary for Subcatchment 52S: DRAINAGE AREA TO CULVERT 7

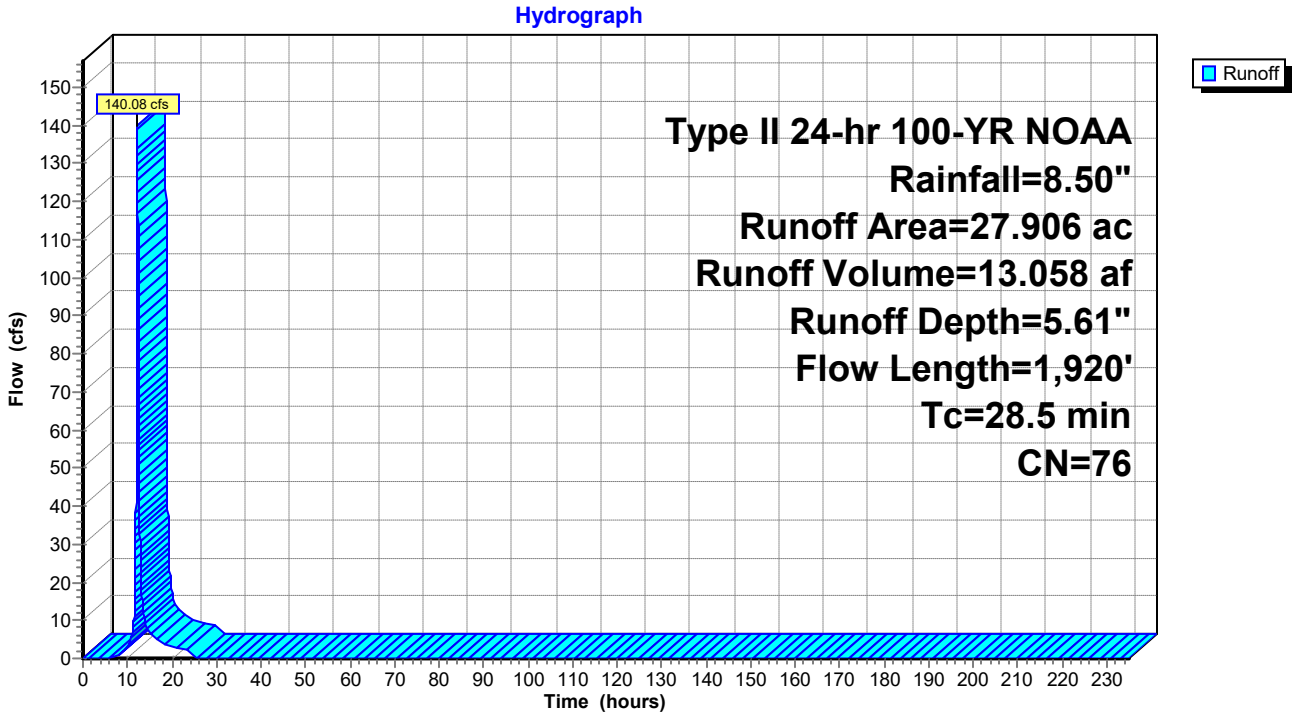
Runoff = 140.08 cfs @ 12.22 hrs, Volume= 13.058 af, Depth= 5.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	1.525	80	>75% Grass cover, Good, HSG D (DISTURBED C)
*	0.201	80	>75% Grass cover, Good, HSG D (DISTURBED D)
*	0.303	98	Paved parking & roofs C SOILS
*	0.052	98	Paved parking & roofs D SOILS
*	3.110	50	R-2 ZONING A SOILS
*	4.062	70	R-2 ZONING B SOILS
*	13.425	80	R-2 ZONING C SOILS
*	5.228	85	R-2 ZONING D SOILS
	27.906	76	Weighted Average
	27.551		Pervious Area
	0.355		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.9	100	0.0500	0.11		**Sheet Flow, A-B** Woods: Light underbrush n= 0.400 P2= 3.20"
0.6	145	0.0700	4.26		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
5.9	986	0.0300	2.79		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
7.1	689	0.0100	1.61		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
28.5	1,920	Total			

Subcatchment 52S: DRAINAGE AREA TO CULVERT 7



Summary for Subcatchment 55S: UNMANAGED P 2

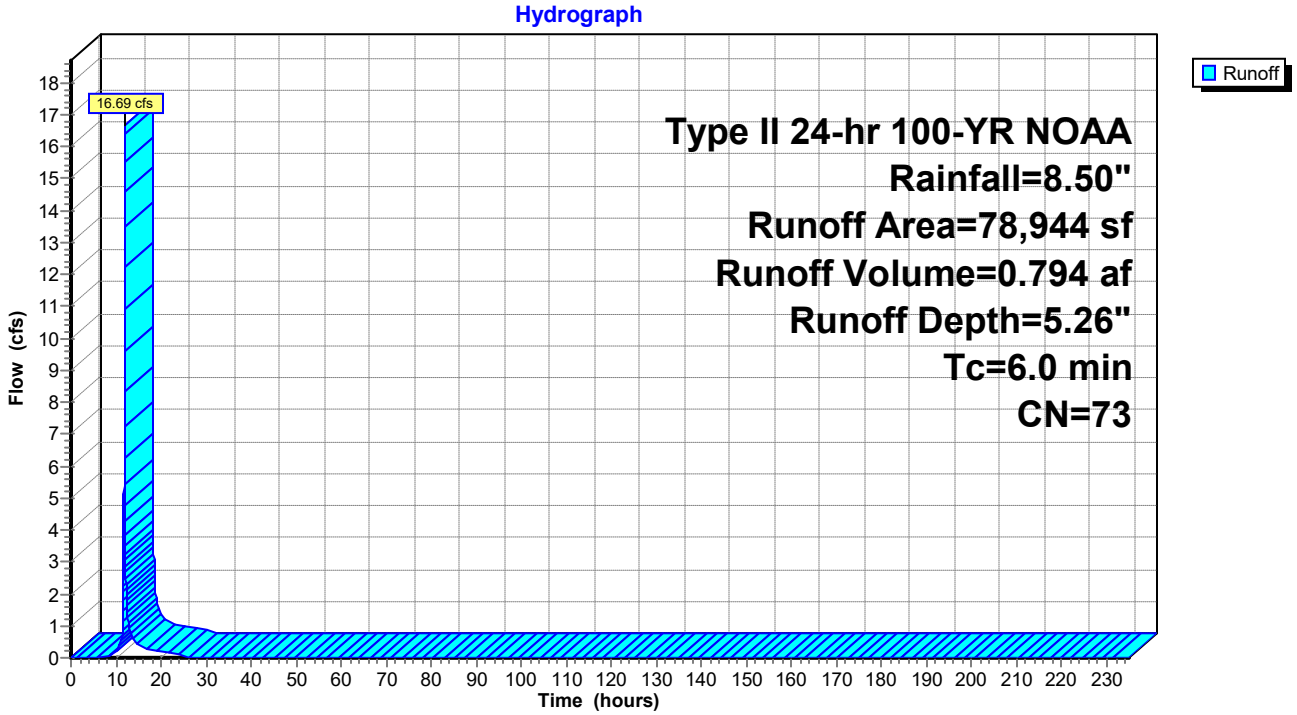
Runoff = 16.69 cfs @ 11.97 hrs, Volume= 0.794 af, Depth= 5.26"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	7,354	70	Woods, Good, HSG C
	7,236	77	Woods, Good, HSG D
*	24,838	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	25,224	80	>75% Grass cover, Good, HSG D (ONSITE C)
	14,292	80	>75% Grass cover, Good, HSG D
	78,944	73	Weighted Average
	78,944		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 55S: UNMANAGED P 2



Summary for Subcatchment 56S: UNMANAGED P 1

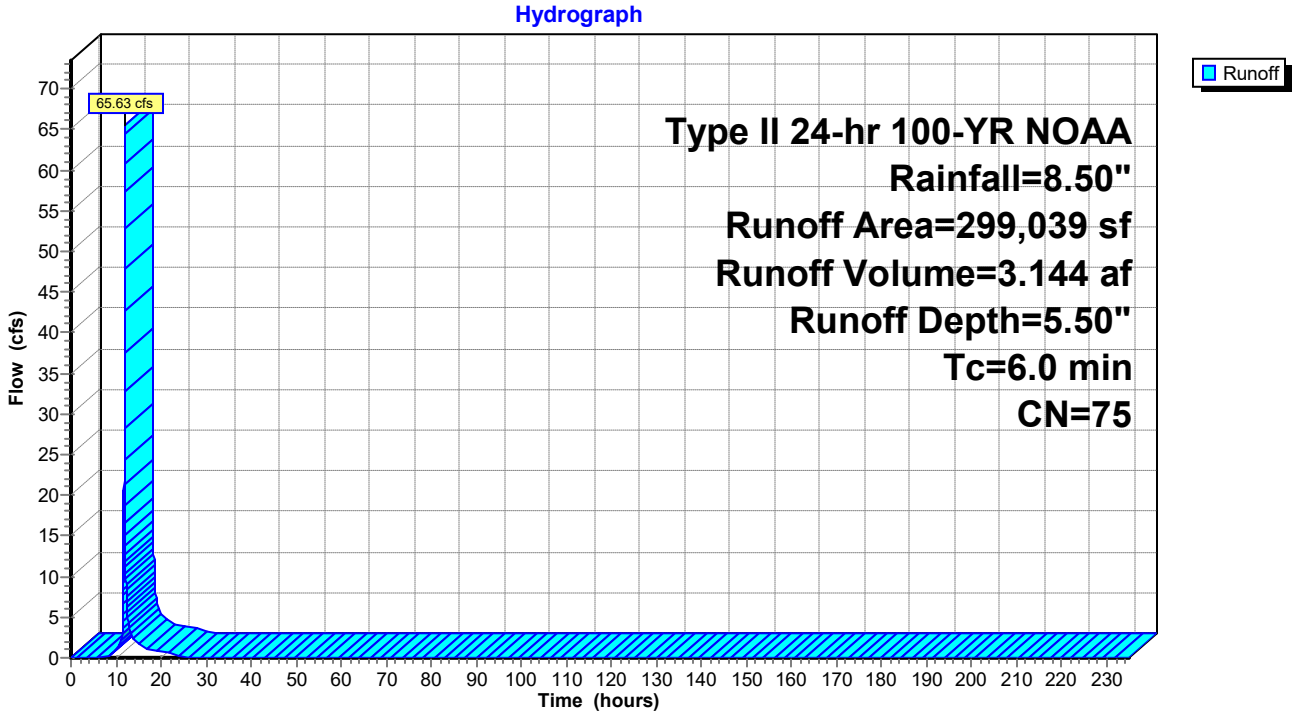
Runoff = 65.63 cfs @ 11.97 hrs, Volume= 3.144 af, Depth= 5.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	4,400	30	Woods, Good, HSG A
	86,031	70	Woods, Good, HSG C
	184,912	77	Woods, Good, HSG D
*	2,047	80	>75% Grass cover, Good, HSG D (ONSITE C)
	21,649	80	>75% Grass cover, Good, HSG D
	299,039	75	Weighted Average
	299,039		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 56S: UNMANAGED P 1



Summary for Subcatchment 57S: UNMANAGED P 3

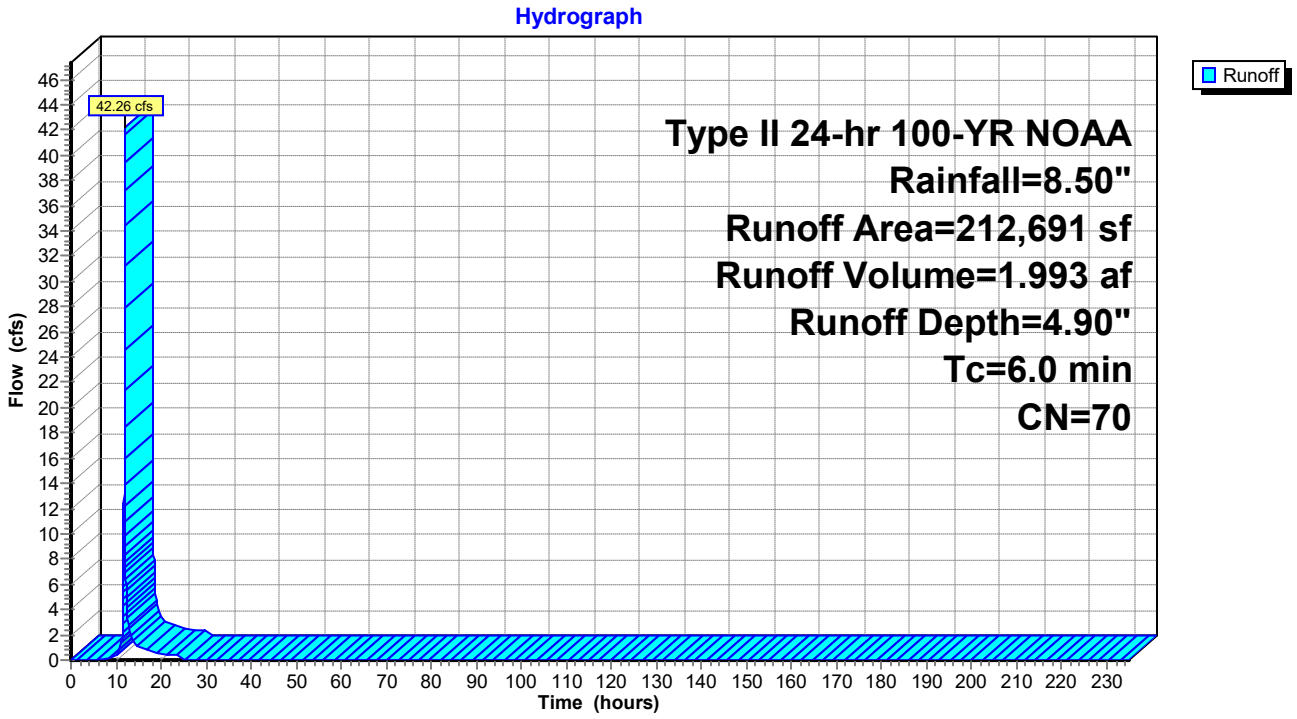
Runoff = 42.26 cfs @ 11.97 hrs, Volume= 1.993 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	25,681	30	Woods, Good, HSG A
	11,227	70	Woods, Good, HSG C
	20,676	77	Woods, Good, HSG D
*	37,410	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	32,984	80	>75% Grass cover, Good, HSG D (ONSITE C)
	84,713	80	>75% Grass cover, Good, HSG D
	212,691	70	Weighted Average
	212,691		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 57S: UNMANAGED P 3



Summary for Subcatchment 58S: UNMANAGED P 4

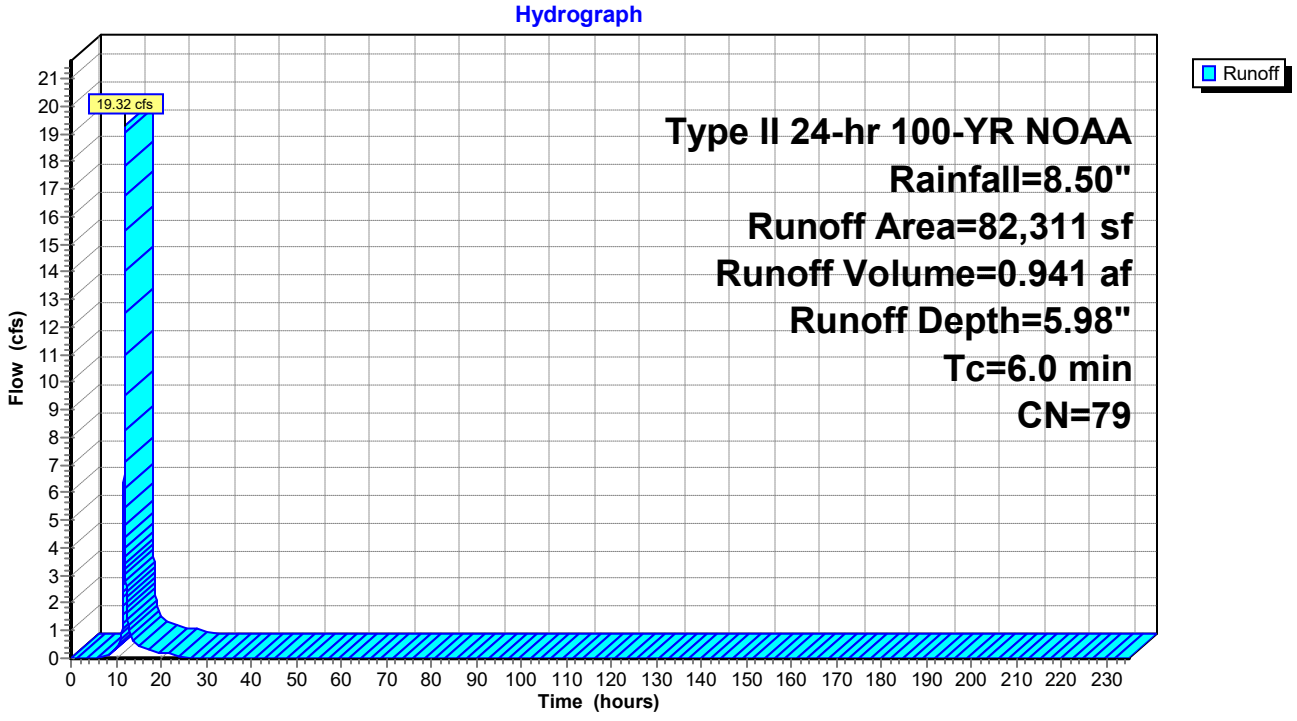
Runoff = 19.32 cfs @ 11.97 hrs, Volume= 0.941 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	3,590	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	5,089	74	>75% Grass cover, Good, HSG C (ONSITE B)
*	14,725	80	>75% Grass cover, Good, HSG D (ONSITE C)
	58,907	80	>75% Grass cover, Good, HSG D
	82,311	79	Weighted Average
	82,311		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0					**Direct Entry, ASSUMED Tc**

Subcatchment 58S: UNMANAGED P 4



Summary for Pond 9P: BASIN 1

Inflow Area = 154.439 ac, 4.15% Impervious, Inflow Depth = 5.38" for 100-YR NOAA event
Inflow = 672.36 cfs @ 12.28 hrs, Volume= 69.178 af
Outflow = 255.13 cfs @ 12.73 hrs, Volume= 69.062 af, Atten= 62%, Lag= 27.2 min
Primary = 255.13 cfs @ 12.73 hrs, Volume= 69.062 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 90.22' @ 12.73 hrs Surf.Area= 163,588 sf Storage= 1,275,872 cf

Plug-Flow detention time= 374.2 min calculated for 69.060 af (100% of inflow)
Center-of-Mass det. time= 373.6 min (1,209.7 - 836.0)

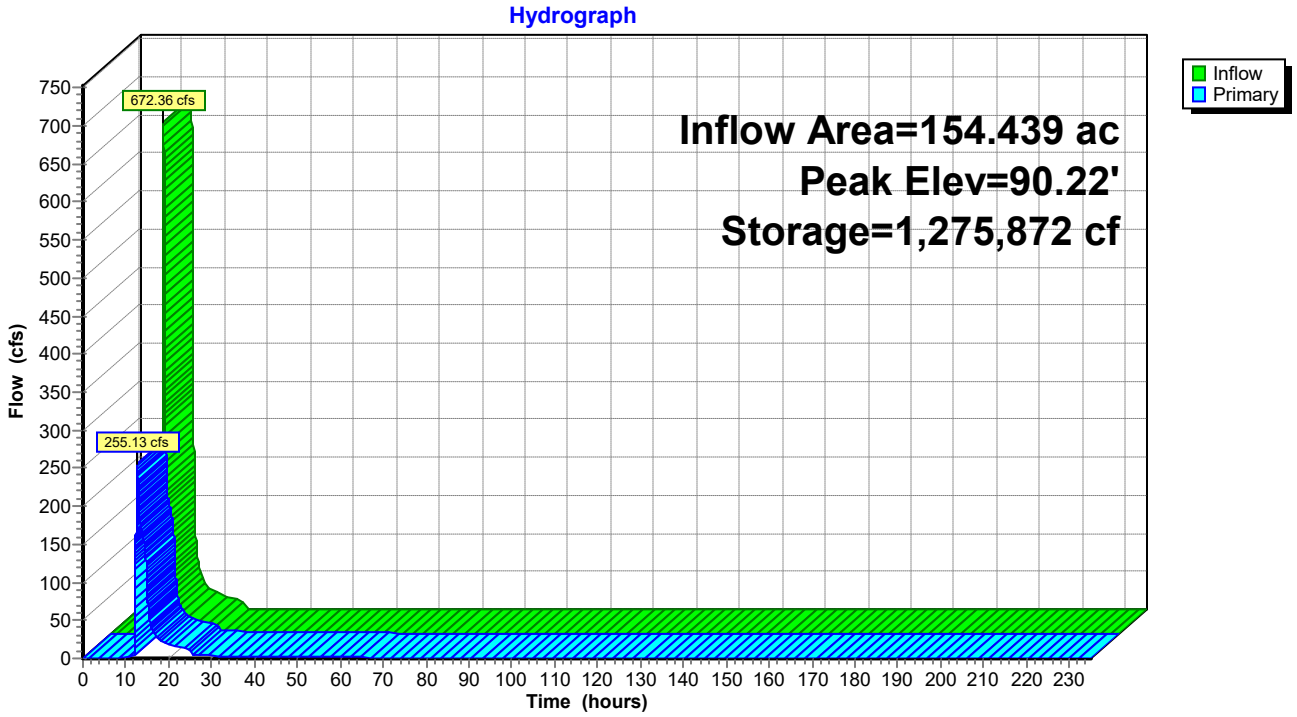
Volume	Invert	Avail.Storage	Storage Description
#1	81.00'	1,573,213 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
81.00	110,353	0	0
82.00	113,238	111,796	111,796
82.50	114,690	56,982	168,778
83.00	128,912	60,901	229,678
87.00	144,633	547,090	776,768
89.00	157,733	302,366	1,079,134
91.00	167,296	325,029	1,404,163
92.00	170,803	169,050	1,573,213

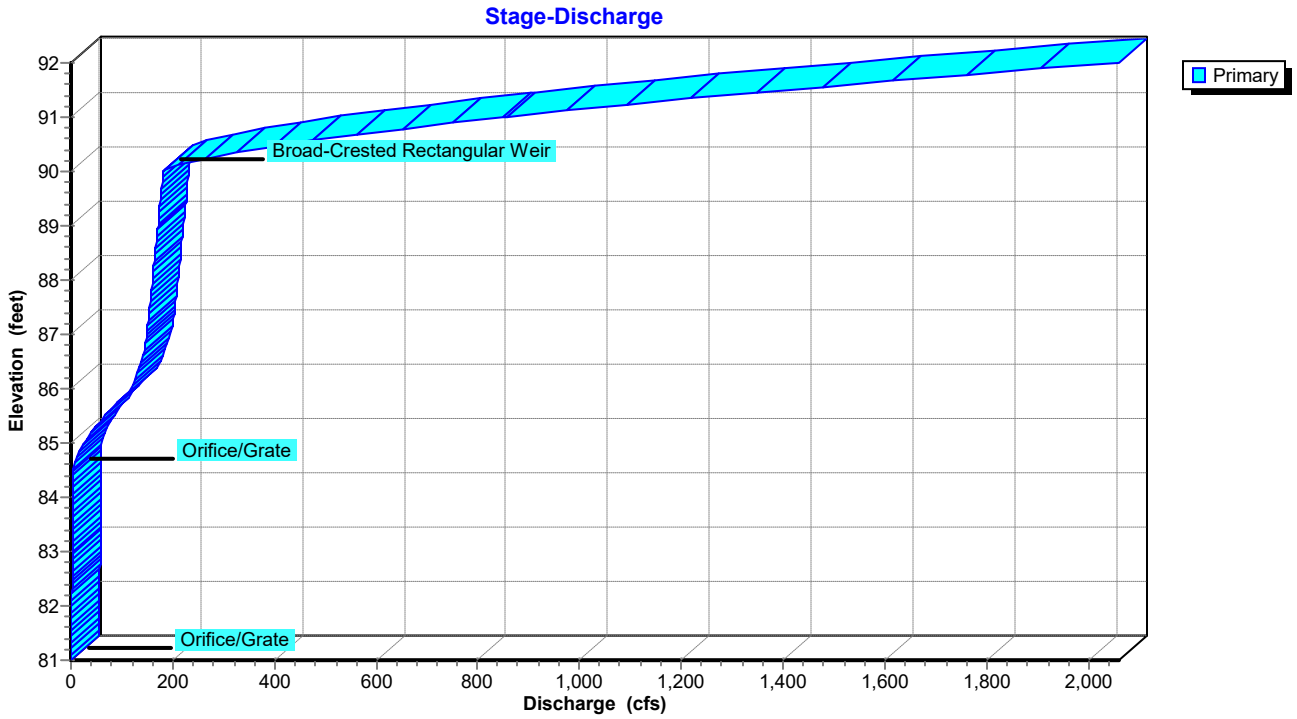
Device	Routing	Invert	Outlet Devices
#1	Primary	79.00'	**48.0" x 70.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 78.66' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	81.00'	**9.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	84.50'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.00'	**250.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=255.06 cfs @ 12.73 hrs HW=90.22' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 183.77 cfs @ 14.62 fps)
  - **2=Orifice/Grate** (Passes < 6.33 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 224.64 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 71.29 cfs @ 1.27 fps)

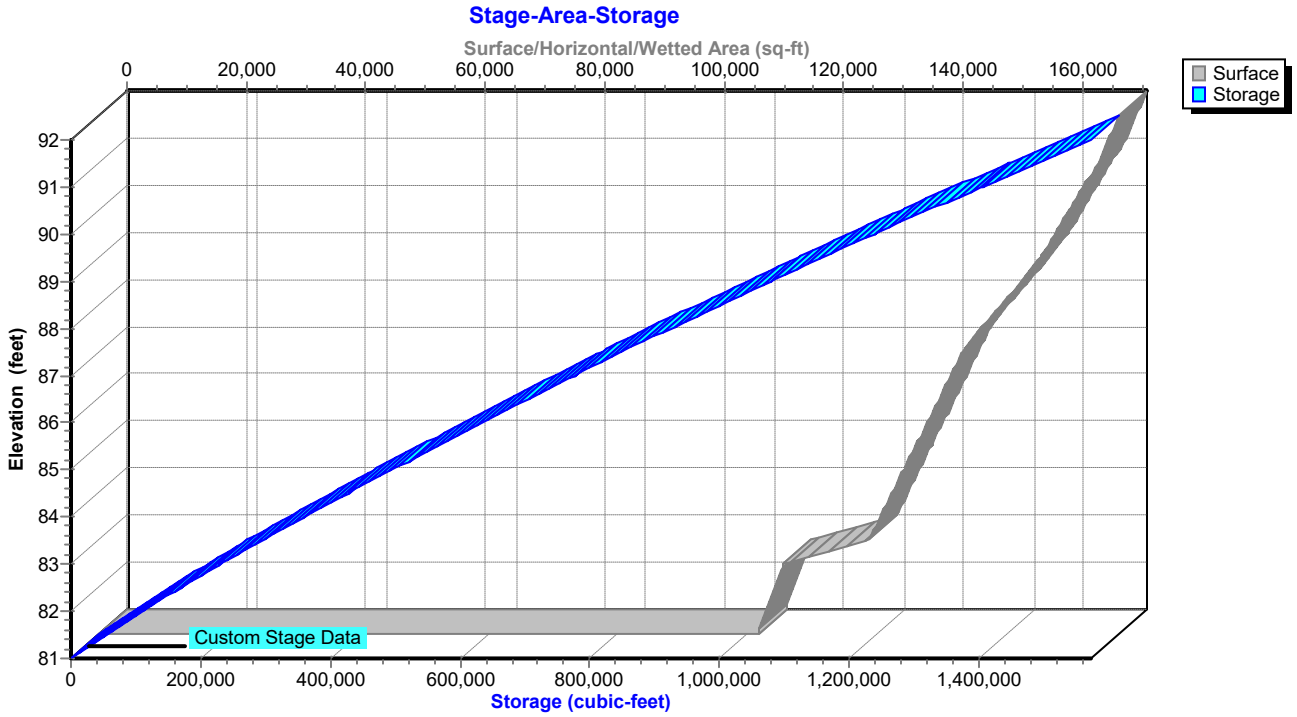
Pond 9P: BASIN 1



Pond 9P: BASIN 1



Pond 9P: BASIN 1



Stage-Discharge for Pond 9P: BASIN 1

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
81.00	0.00	84.12	3.52	87.24	151.15	90.36	330.70
81.06	0.01	84.18	3.56	87.30	151.87	90.42	369.44
81.12	0.05	84.24	3.60	87.36	152.59	90.48	410.77
81.18	0.12	84.30	3.64	87.42	153.31	90.54	454.74
81.24	0.20	84.36	3.68	87.48	154.03	90.60	501.19
81.30	0.31	84.42	3.71	87.54	154.74	90.66	547.57
81.36	0.43	84.48	3.75	87.60	155.44	90.72	595.53
81.42	0.56	84.54	4.28	87.66	156.15	90.78	644.92
81.48	0.70	84.60	5.78	87.72	156.85	90.84	697.53
81.54	0.85	84.66	7.83	87.78	157.55	90.90	752.83
81.60	1.00	84.72	10.30	87.84	158.25	90.96	809.87
81.66	1.14	84.78	13.13	87.90	158.94	91.02	869.11
81.72	1.26	84.84	16.28	87.96	159.63	91.08	931.18
81.78	1.35	84.90	19.71	88.02	160.31	91.14	995.10
81.84	1.45	84.96	23.41	88.08	161.00	91.20	1,060.84
81.90	1.54	85.02	27.36	88.14	161.68	91.26	1,127.28
81.96	1.63	85.08	31.54	88.20	162.36	91.32	1,195.31
82.02	1.71	85.14	35.94	88.26	163.03	91.38	1,264.89
82.08	1.79	85.20	40.55	88.32	163.70	91.44	1,335.12
82.14	1.86	85.26	45.36	88.38	164.37	91.50	1,406.27
82.20	1.93	85.32	50.36	88.44	165.04	91.56	1,478.70
82.26	2.00	85.38	55.55	88.50	165.70	91.62	1,552.90
82.32	2.07	85.44	60.91	88.56	166.37	91.68	1,629.46
82.38	2.13	85.50	66.45	88.62	167.03	91.74	1,707.40
82.44	2.20	85.56	72.16	88.68	167.68	91.80	1,786.68
82.50	2.26	85.62	78.03	88.74	168.34	91.86	1,867.28
82.56	2.32	85.68	84.05	88.80	168.99	91.92	1,949.18
82.62	2.37	85.74	90.23	88.86	169.63	91.98	**2,032.36**
82.68	2.43	85.80	96.57	88.92	170.28		
82.74	2.49	85.86	103.04	88.98	170.92		
82.80	2.54	85.92	109.67	89.04	171.57		
82.86	2.59	85.98	116.43	89.10	172.21		
82.92	2.64	86.04	121.11	89.16	172.84		
82.98	2.69	86.10	123.39	89.22	173.48		
83.04	2.74	86.16	125.62	89.28	174.11		
83.10	2.79	86.22	127.82	89.34	174.74		
83.16	2.84	86.28	129.98	89.40	175.37		
83.22	2.89	86.34	132.10	89.46	175.99		
83.28	2.94	86.40	134.19	89.52	176.61		
83.34	2.98	86.46	136.25	89.58	177.23		
83.40	3.03	86.52	138.27	89.64	177.85		
83.46	3.07	86.58	140.27	89.70	178.47		
83.52	3.12	86.64	142.23	89.76	179.08		
83.58	3.16	86.70	144.17	89.82	179.70		
83.64	3.20	86.76	145.22	89.88	180.31		
83.70	3.24	86.82	145.97	89.94	180.91		
83.76	3.29	86.88	146.72	90.00	181.52		
83.82	3.33	86.94	147.47	90.06	191.97		
83.88	3.37	87.00	148.21	90.12	210.58		
83.94	3.41	87.06	148.95	90.18	234.49		
84.00	3.45	87.12	149.69	90.24	262.82		
84.06	3.49	87.18	150.42	90.30	295.02		

Stage-Area-Storage for Pond 9P: BASIN 1

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
81.00	110,353	0
81.15	110,786	16,585
81.30	111,218	33,236
81.45	111,651	49,951
81.60	112,084	66,731
81.75	112,517	83,576
81.90	112,950	100,486
82.05	113,383	117,461
82.20	113,819	134,501
82.35	114,254	151,607
82.50	114,690	168,778
82.65	118,957	186,301
82.80	123,223	204,464
82.95	127,490	223,268
83.10	129,305	242,589
83.25	129,895	262,029
83.40	130,484	281,557
83.55	131,074	301,174
83.70	131,663	320,879
83.85	132,253	340,673
84.00	132,842	360,555
84.15	133,432	380,526
84.30	134,021	400,585
84.45	134,611	420,732
84.60	135,200	440,968
84.75	135,790	461,292
84.90	136,379	481,705
85.05	136,969	502,206
85.20	137,559	522,796
85.35	138,148	543,474
85.50	138,738	564,240
85.65	139,327	585,095
85.80	139,917	606,038
85.95	140,506	627,070
86.10	141,096	648,190
86.25	141,685	669,399
86.40	142,275	690,696
86.55	142,864	712,081
86.70	143,454	733,555
86.85	144,043	755,117
87.00	144,633	776,768
87.15	145,616	798,537
87.30	146,598	820,453
87.45	147,581	842,516
87.60	148,563	864,727
87.75	149,546	887,085
87.90	150,528	909,590
88.05	151,510	932,243
88.20	152,493	955,044
88.35	153,475	977,991
88.50	154,458	1,001,086
88.65	155,441	1,024,329
88.80	156,423	1,047,718
88.95	157,406	1,071,256
89.10	158,211	1,094,931
89.25	158,928	1,118,717
89.40	159,646	1,142,610
89.55	160,363	1,166,610
89.70	161,080	1,190,719
89.85	161,797	1,214,934
90.00	162,515	1,239,258
90.15	163,232	1,263,689
90.30	163,949	1,288,227
90.45	164,666	1,312,873
90.60	165,383	1,337,627
90.75	166,101	1,362,488
90.90	166,818	1,387,457
91.05	167,471	1,412,532
91.20	167,997	1,437,692
91.35	168,523	1,462,931
91.50	169,050	1,488,249
91.65	169,576	1,513,646
91.80	170,102	1,539,122
91.95	**170,628**	**1,564,677**

Summary for Pond 10P: BASIN 2

Inflow Area = 27.728 ac, 4.29% Impervious, Inflow Depth = 3.36" for 100-YR NOAA event
Inflow = 110.04 cfs @ 12.10 hrs, Volume= 7.770 af
Outflow = 58.51 cfs @ 12.28 hrs, Volume= 7.766 af, Atten= 47%, Lag= 10.5 min
Primary = 58.51 cfs @ 12.28 hrs, Volume= 7.766 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 77.93' @ 12.28 hrs Surf.Area= 34,388 sf Storage= 107,974 cf

Plug-Flow detention time= 248.0 min calculated for 7.766 af (100% of inflow)
Center-of-Mass det. time= 248.2 min (1,105.0 - 856.8)

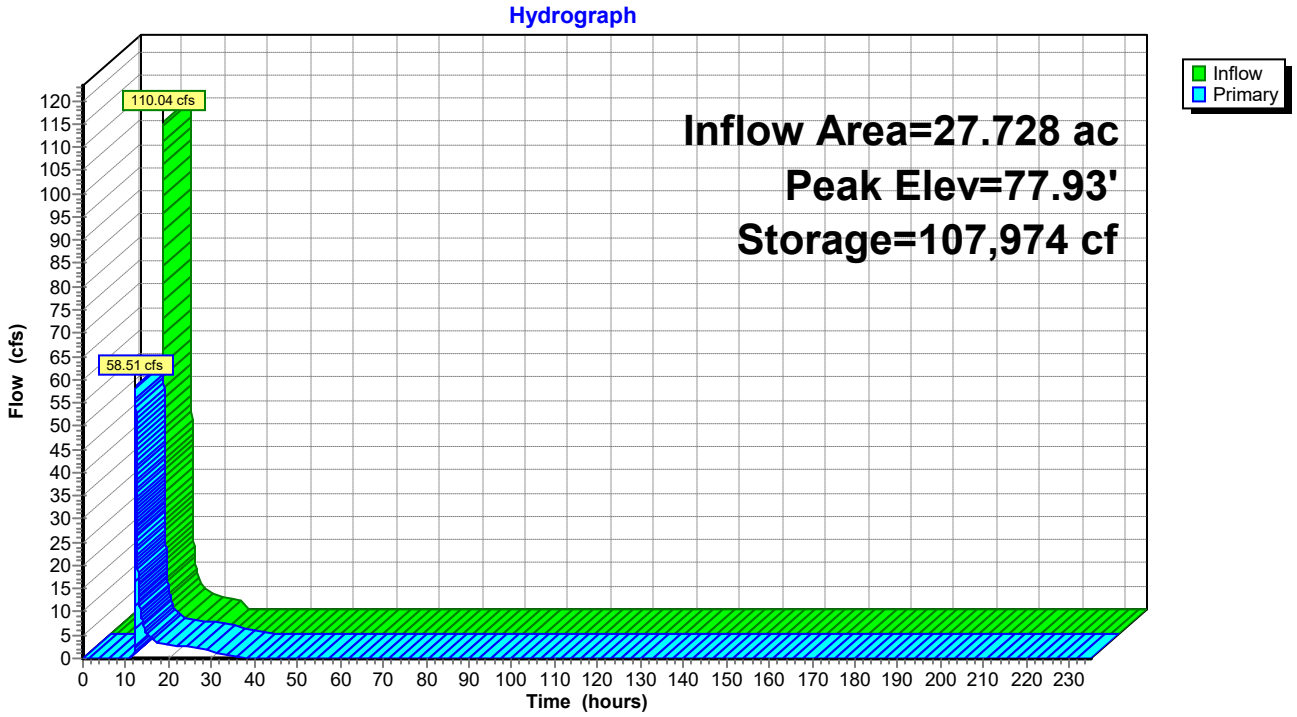
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	183,706 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	21,185	0	0
75.00	22,367	21,776	21,776
75.50	22,967	11,334	33,110
76.00	29,696	13,166	46,275
78.00	34,569	64,265	110,540
80.00	38,597	73,166	183,706

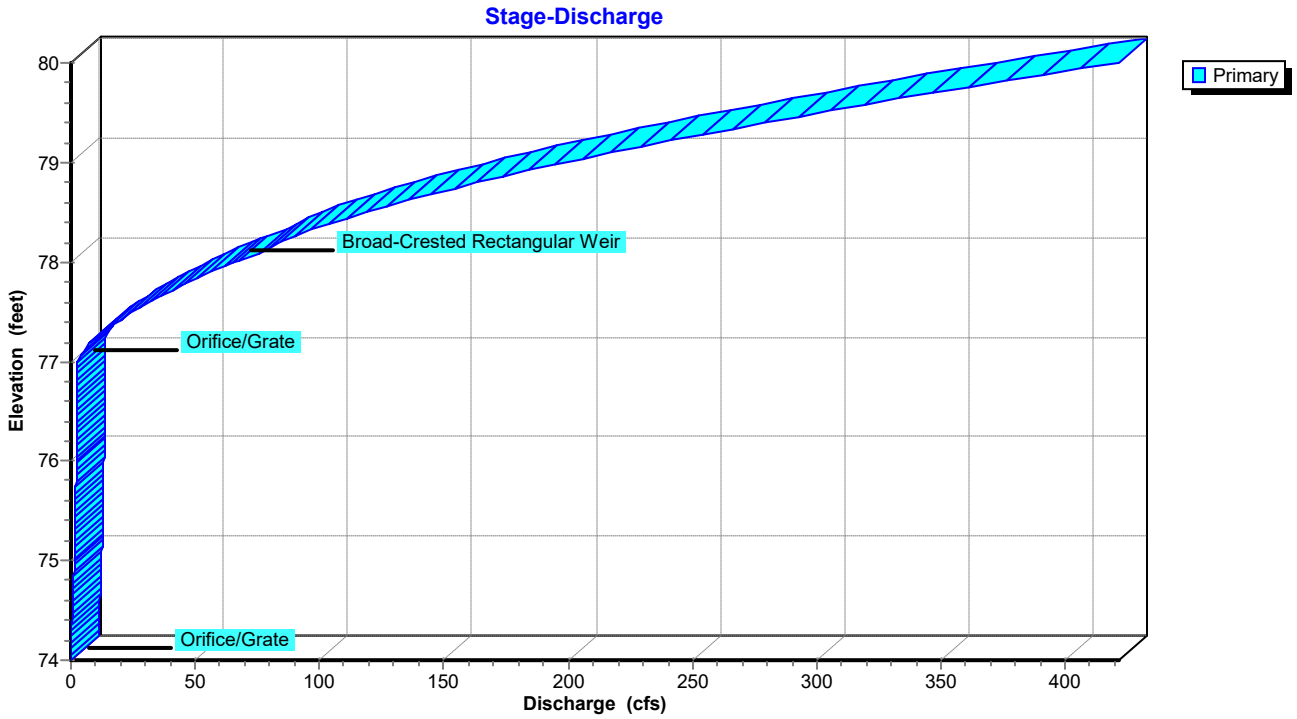
Device	Routing	Invert	Outlet Devices
#1	Primary	72.00'	**36.0" x 51.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 71.75' S= 0.0049 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**8.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.00'	**45.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=58.50 cfs @ 12.28 hrs HW=77.93' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Passes 58.50 cfs of 71.60 cfs potential flow)
  - **2=Orifice/Grate** (Orifice Controls 3.19 cfs @ 9.13 fps)
  - **3=Orifice/Grate** (Weir Controls 55.32 cfs @ 3.15 fps)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

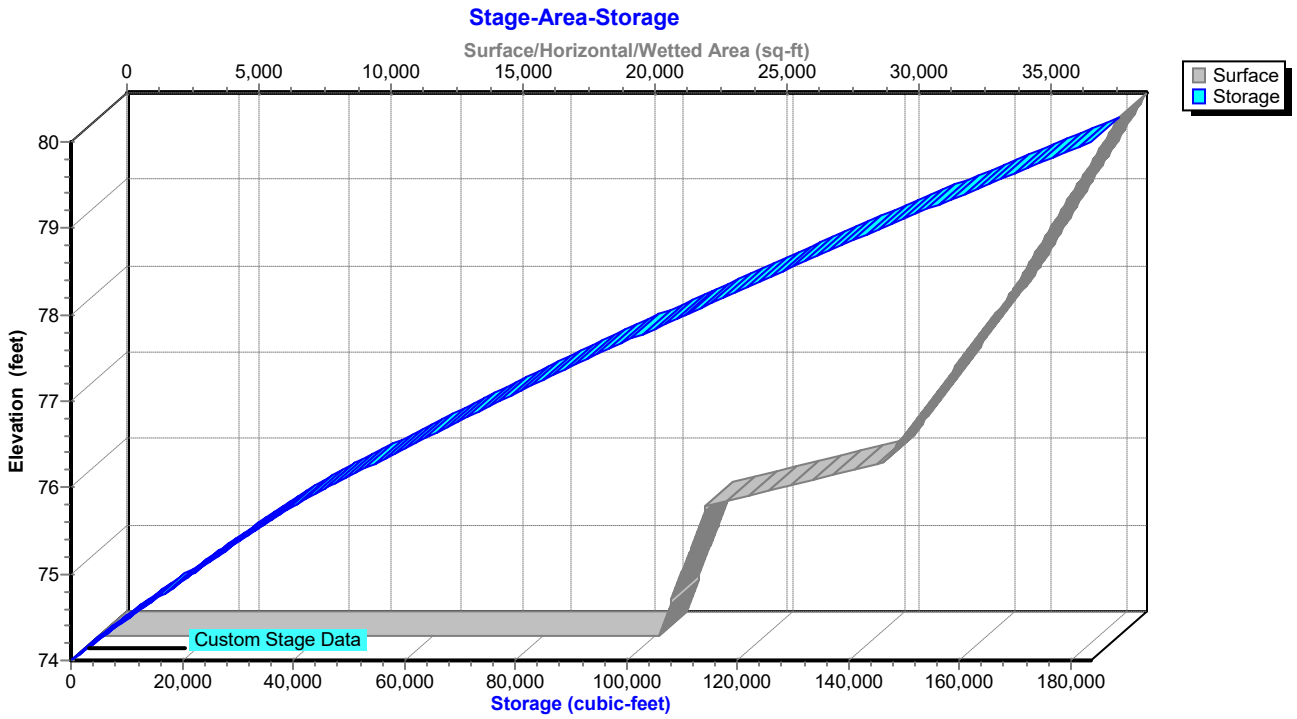
Pond 10P: BASIN 2



Pond 10P: BASIN 2



Pond 10P: BASIN 2



Stage-Discharge for Pond 10P: BASIN 2

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	2.22	78.16	81.19
74.04	0.01	76.12	2.25	78.20	84.57
74.08	0.02	76.16	2.27	78.24	88.30
74.12	0.05	76.20	2.30	78.28	92.33
74.16	0.09	76.24	2.32	78.32	96.65
74.20	0.13	76.28	2.35	78.36	101.24
74.24	0.19	76.32	2.37	78.40	106.08
74.28	0.25	76.36	2.39	78.44	111.11
74.32	0.32	76.40	2.42	78.48	116.36
74.36	0.39	76.44	2.44	78.52	121.82
74.40	0.47	76.48	2.46	78.56	127.48
74.44	0.55	76.52	2.49	78.60	133.33
74.48	0.63	76.56	2.51	78.64	139.09
74.52	0.72	76.60	2.53	78.68	144.99
74.56	0.80	76.64	2.55	78.72	151.00
74.60	0.87	76.68	2.57	78.76	157.13
74.64	0.94	76.72	2.60	78.80	163.36
74.68	0.99	76.76	2.62	78.84	170.04
74.72	1.05	76.80	2.64	78.88	176.87
74.76	1.10	76.84	2.66	78.92	183.83
74.80	1.15	76.88	2.68	78.96	190.93
74.84	1.20	76.92	2.70	79.00	198.17
74.88	1.24	76.96	2.72	79.04	205.73
74.92	1.29	77.00	2.74	79.08	213.43
74.96	1.33	77.04	3.26	79.12	221.29
75.00	1.37	77.08	4.19	79.16	229.28
75.04	1.41	77.12	5.39	79.20	237.42
75.08	1.45	77.16	6.80	79.24	245.58
75.12	1.49	77.20	8.40	79.28	253.87
75.16	1.53	77.24	10.17	79.32	262.28
75.20	1.56	77.28	12.09	79.36	270.81
75.24	1.60	77.32	14.15	79.40	279.46
75.28	1.64	77.36	16.34	79.44	288.08
75.32	1.67	77.40	18.66	79.48	296.80
75.36	1.70	77.44	21.10	79.52	305.63
75.40	1.74	77.48	23.64	79.56	314.56
75.44	1.77	77.52	26.30	79.60	323.58
75.48	1.80	77.56	29.06	79.64	332.90
75.52	1.83	77.60	31.91	79.68	342.32
75.56	1.86	77.64	34.87	79.72	351.85
75.60	1.89	77.68	37.91	79.76	361.49
75.64	1.92	77.72	41.05	79.80	371.24
75.68	1.95	77.76	44.28	79.84	381.09
75.72	1.98	77.80	47.59	79.88	391.04
75.76	2.01	77.84	50.98	79.92	401.10
75.80	2.04	77.88	54.45	79.96	411.26
75.84	2.06	77.92	58.01	80.00	**421.52**
75.88	2.09	77.96	61.64		
75.92	2.12	78.00	65.35		
75.96	2.14	78.04	70.10		
76.00	2.17	78.08	75.57		
76.04	2.20	78.12	78.17		

Stage-Area-Storage for Pond 10P: BASIN 2

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	21,185	0
74.10	21,303	2,124
74.20	21,421	4,261
74.30	21,540	6,409
74.40	21,658	8,569
74.50	21,776	10,740
74.60	21,894	12,924
74.70	22,012	15,119
74.80	22,131	17,326
74.90	22,249	19,545
75.00	22,367	21,776
75.10	22,487	24,019
75.20	22,607	26,273
75.30	22,727	28,540
75.40	22,847	30,819
75.50	22,967	33,110
75.60	24,313	35,473
75.70	25,659	37,972
75.80	27,004	40,605
75.90	28,350	43,373
76.00	29,696	46,275
76.10	29,940	49,257
76.20	30,183	52,263
76.30	30,427	55,294
76.40	30,671	58,349
76.50	30,914	61,428
76.60	31,158	64,531
76.70	31,402	67,659
76.80	31,645	70,812
76.90	31,889	73,988
77.00	32,133	77,190
77.10	32,376	80,415
77.20	32,620	83,665
77.30	32,863	86,939
77.40	33,107	90,237
77.50	33,351	93,560
77.60	33,594	96,908
77.70	33,838	100,279
77.80	34,082	103,675
77.90	34,325	107,096
78.00	34,569	110,540
78.10	34,770	114,007
78.20	34,972	117,494
78.30	35,173	121,002
78.40	35,375	124,529
78.50	35,576	128,077
78.60	35,777	131,644
78.70	35,979	135,232
78.80	36,180	138,840
78.90	36,382	142,468
79.00	36,583	146,116
79.10	36,784	149,785
79.20	36,986	153,473
79.30	37,187	157,182
79.40	37,389	160,911
79.50	37,590	164,660
79.60	37,791	168,429
79.70	37,993	172,218
79.80	38,194	176,027
79.90	38,396	179,857
80.00	**38,597**	**183,706**

Summary for Pond 11P: BASIN 3

Inflow Area = 41.382 ac, 7.74% Impervious, Inflow Depth = 6.22" for 100-YR NOAA event
Inflow = 314.99 cfs @ 12.07 hrs, Volume= 21.434 af
Outflow = 193.46 cfs @ 12.21 hrs, Volume= 21.391 af, Atten= 39%, Lag= 8.3 min
Primary = 193.46 cfs @ 12.21 hrs, Volume= 21.391 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 79.10' @ 12.21 hrs Surf.Area= 88,109 sf Storage= 380,892 cf

Plug-Flow detention time= 550.2 min calculated for 21.390 af (100% of inflow)
Center-of-Mass det. time= 549.4 min (1,353.9 - 804.4)

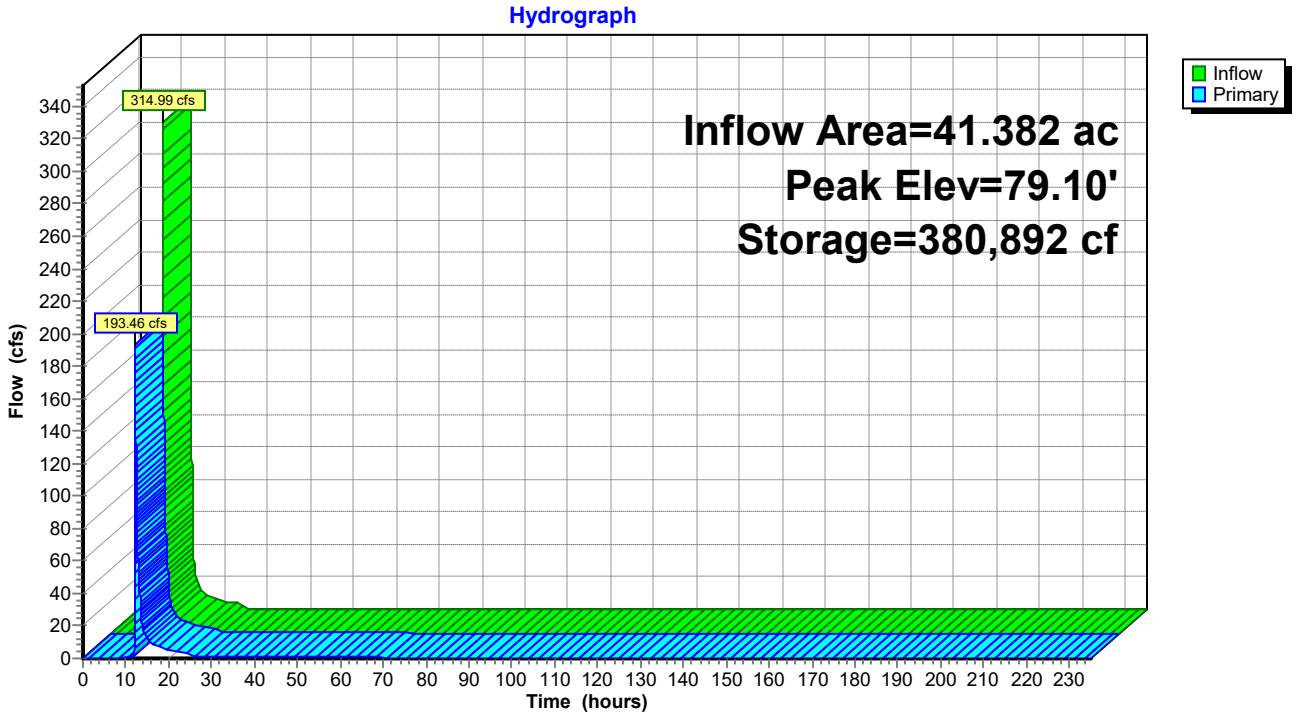
Volume	Invert	Avail.Storage	Storage Description
#1	74.00'	461,645 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
74.00	59,381	0	0
75.00	61,618	60,500	60,500
75.50	62,746	31,091	91,591
76.00	75,824	34,643	126,233
78.00	84,101	159,925	286,158
80.00	91,386	175,487	461,645

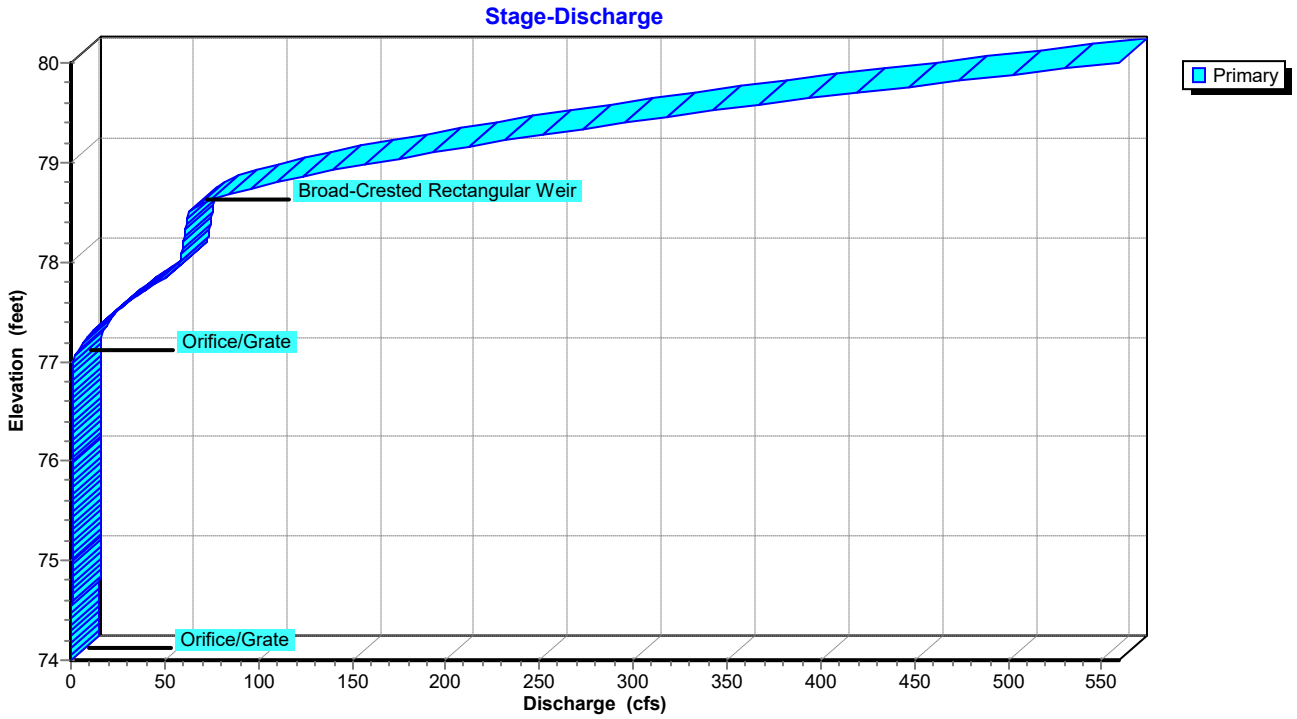
Device	Routing	Invert	Outlet Devices
#1	Primary	73.10'	**36.0" x 220.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 72.00' S= 0.0050 '/' Cc= 0.900 n= 0.012
#2	Device 1	74.00'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	77.00'	**3.00' x 6.50' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	78.50'	**100.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=193.35 cfs @ 12.21 hrs HW=79.10' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Barrel Controls 67.91 cfs @ 9.61 fps)
  - **2=Orifice/Grate** (Passes < 2.08 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 136.06 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 125.44 cfs @ 2.09 fps)

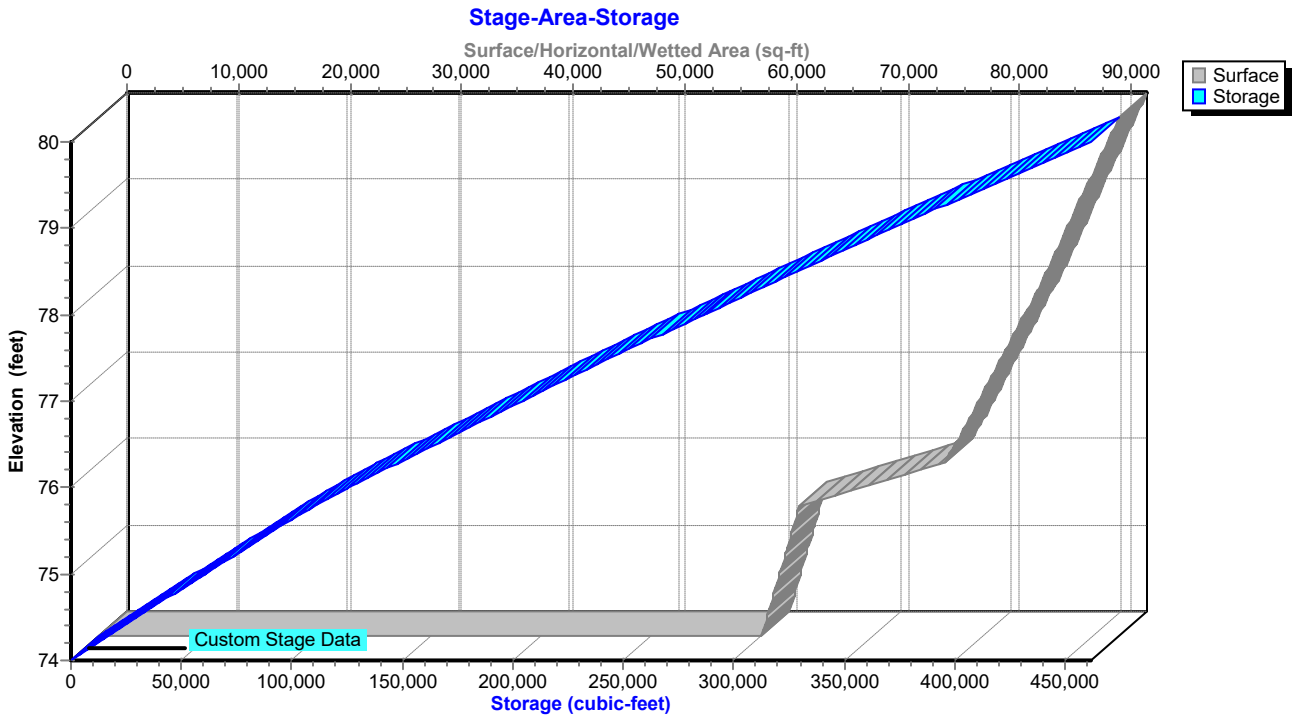
Pond 11P: BASIN 3



Pond 11P: BASIN 3



Pond 11P: BASIN 3



Stage-Discharge for Pond 11P: BASIN 3

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
74.00	0.00	76.08	1.28	78.16	59.62
74.04	0.01	76.12	1.29	78.20	59.99
74.08	0.02	76.16	1.31	78.24	60.37
74.12	0.04	76.20	1.32	78.28	60.74
74.16	0.07	76.24	1.33	78.32	61.11
74.20	0.11	76.28	1.35	78.36	61.48
74.24	0.16	76.32	1.36	78.40	61.84
74.28	0.20	76.36	1.37	78.44	62.20
74.32	0.26	76.40	1.39	78.48	62.56
74.36	0.31	76.44	1.40	78.52	63.68
74.40	0.36	76.48	1.41	78.56	67.22
74.44	0.41	76.52	1.42	78.60	72.11
74.48	0.46	76.56	1.44	78.64	78.02
74.52	0.49	76.60	1.45	78.68	84.80
74.56	0.53	76.64	1.46	78.72	92.36
74.60	0.56	76.68	1.47	78.76	100.64
74.64	0.59	76.72	1.49	78.80	109.58
74.68	0.62	76.76	1.50	78.84	119.13
74.72	0.65	76.80	1.51	78.88	129.26
74.76	0.68	76.84	1.52	78.92	139.89
74.80	0.70	76.88	1.53	78.96	150.98
74.84	0.73	76.92	1.54	79.00	162.53
74.88	0.75	76.96	1.56	79.04	174.55
74.92	0.77	77.00	1.57	79.08	187.01
74.96	0.80	77.04	2.08	79.12	199.59
75.00	0.82	77.08	3.00	79.16	212.21
75.04	0.84	77.12	4.18	79.20	225.10
75.08	0.86	77.16	5.59	79.24	238.26
75.12	0.88	77.20	7.18	79.28	251.66
75.16	0.90	77.24	8.94	79.32	265.66
75.20	0.92	77.28	10.85	79.36	280.34
75.24	0.94	77.32	12.90	79.40	295.33
75.28	0.96	77.36	15.09	79.44	310.63
75.32	0.98	77.40	17.40	79.48	326.23
75.36	1.00	77.44	19.82	79.52	342.33
75.40	1.01	77.48	22.36	79.56	358.97
75.44	1.03	77.52	25.01	79.60	375.93
75.48	1.05	77.56	27.76	79.64	393.21
75.52	1.07	77.60	30.61	79.68	410.82
75.56	1.08	77.64	33.55	79.72	428.61
75.60	1.10	77.68	36.59	79.76	446.56
75.64	1.11	77.72	39.72	79.80	464.79
75.68	1.13	77.76	42.94	79.84	483.29
75.72	1.15	77.80	46.24	79.88	502.07
75.76	1.16	77.84	49.62	79.92	520.94
75.80	1.18	77.88	53.09	79.96	539.89
75.84	1.19	77.92	56.64	80.00	**559.07**
75.88	1.21	77.96	57.70		
75.92	1.22	78.00	58.09		
75.96	1.24	78.04	58.47		
76.00	1.25	78.08	58.86		
76.04	1.26	78.12	59.24		

Stage-Area-Storage for Pond 11P: BASIN 3

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
74.00	59,381	0
74.10	59,605	5,949
74.20	59,828	11,921
74.30	60,052	17,915
74.40	60,276	23,931
74.50	60,500	29,970
74.60	60,723	36,031
74.70	60,947	42,115
74.80	61,171	48,221
74.90	61,394	54,349
75.00	61,618	60,500
75.10	61,844	66,673
75.20	62,069	72,868
75.30	62,295	79,086
75.40	62,520	85,327
75.50	62,746	91,591
75.60	65,362	97,996
75.70	67,977	104,663
75.80	70,593	111,591
75.90	73,208	118,781
76.00	75,824	126,233
76.10	76,238	133,836
76.20	76,652	141,481
76.30	77,066	149,166
76.40	77,479	156,894
76.50	77,893	164,662
76.60	78,307	172,472
76.70	78,721	180,324
76.80	79,135	188,217
76.90	79,549	196,151
77.00	79,963	204,126
77.10	80,376	212,143
77.20	80,790	220,202
77.30	81,204	228,301
77.40	81,618	236,442
77.50	82,032	244,625
77.60	82,446	252,849
77.70	82,859	261,114
77.80	83,273	269,421
77.90	83,687	277,769
78.00	84,101	286,158
78.10	84,465	294,586
78.20	84,830	303,051
78.30	85,194	311,552
78.40	85,558	320,090
78.50	85,922	328,664
78.60	86,286	337,274
78.70	86,651	345,921
78.80	87,015	354,604
78.90	87,379	363,324
79.00	87,744	372,080
79.10	88,108	380,873
79.20	88,472	389,702
79.30	88,836	398,567
79.40	89,201	407,469
79.50	89,565	416,407
79.60	89,929	425,382
79.70	90,293	434,393
79.80	90,657	443,441
79.90	91,022	452,525
80.00	**91,386**	**461,645**

Summary for Pond 12P: BASIN 4

Inflow Area = 102.290 ac, 1.11% Impervious, Inflow Depth = 3.60" for 100-YR NOAA event
Inflow = 399.01 cfs @ 12.13 hrs, Volume= 30.651 af
Outflow = 184.84 cfs @ 12.37 hrs, Volume= 30.645 af, Atten= 54%, Lag= 14.5 min
Primary = 184.84 cfs @ 12.37 hrs, Volume= 30.645 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 88.13' @ 12.37 hrs Surf.Area= 52,243 sf Storage= 371,527 cf

Plug-Flow detention time= 215.0 min calculated for 30.644 af (100% of inflow)
Center-of-Mass det. time= 215.4 min (1,070.6 - 855.2)

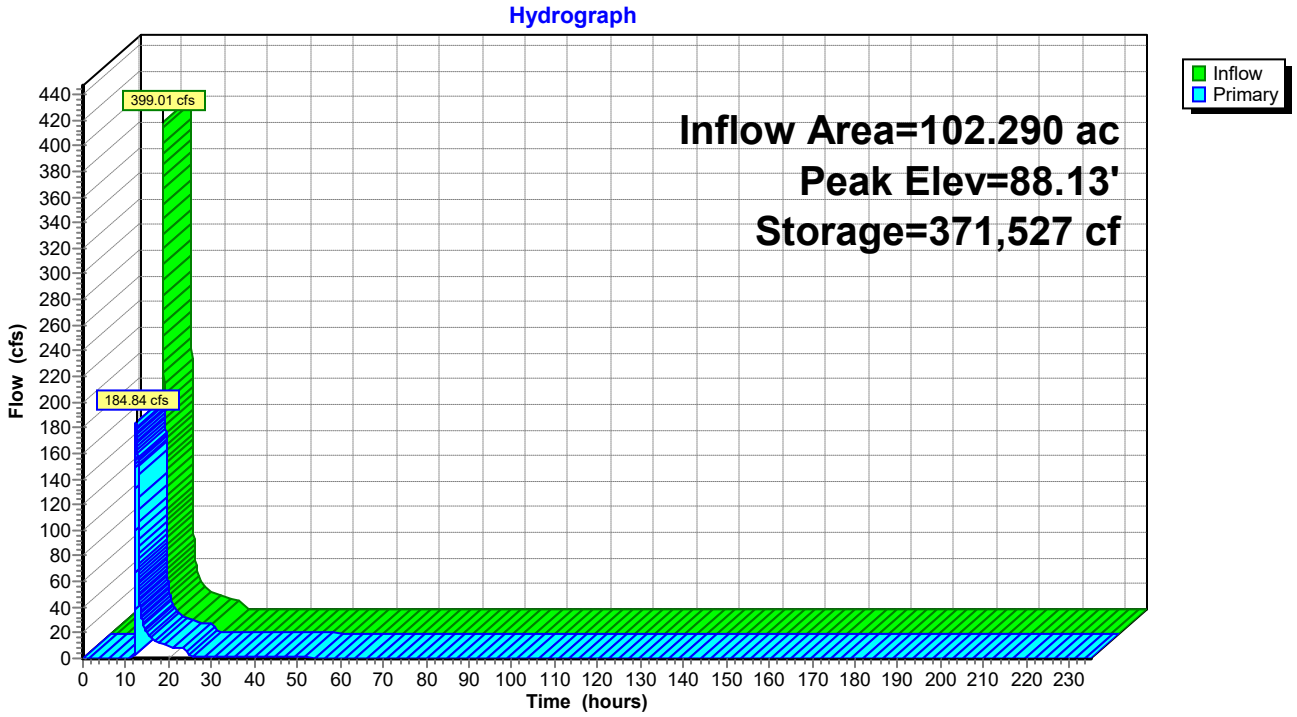
Volume	Invert	Avail.Storage	Storage Description
#1	78.50'	420,819 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
78.50	23,525	0	0
79.50	24,819	24,172	24,172
80.00	30,634	13,863	38,035
82.00	35,056	65,690	103,725
84.00	41,314	76,370	180,095
86.00	46,221	87,535	267,630
88.00	50,842	97,063	364,693
89.00	61,410	56,126	420,819

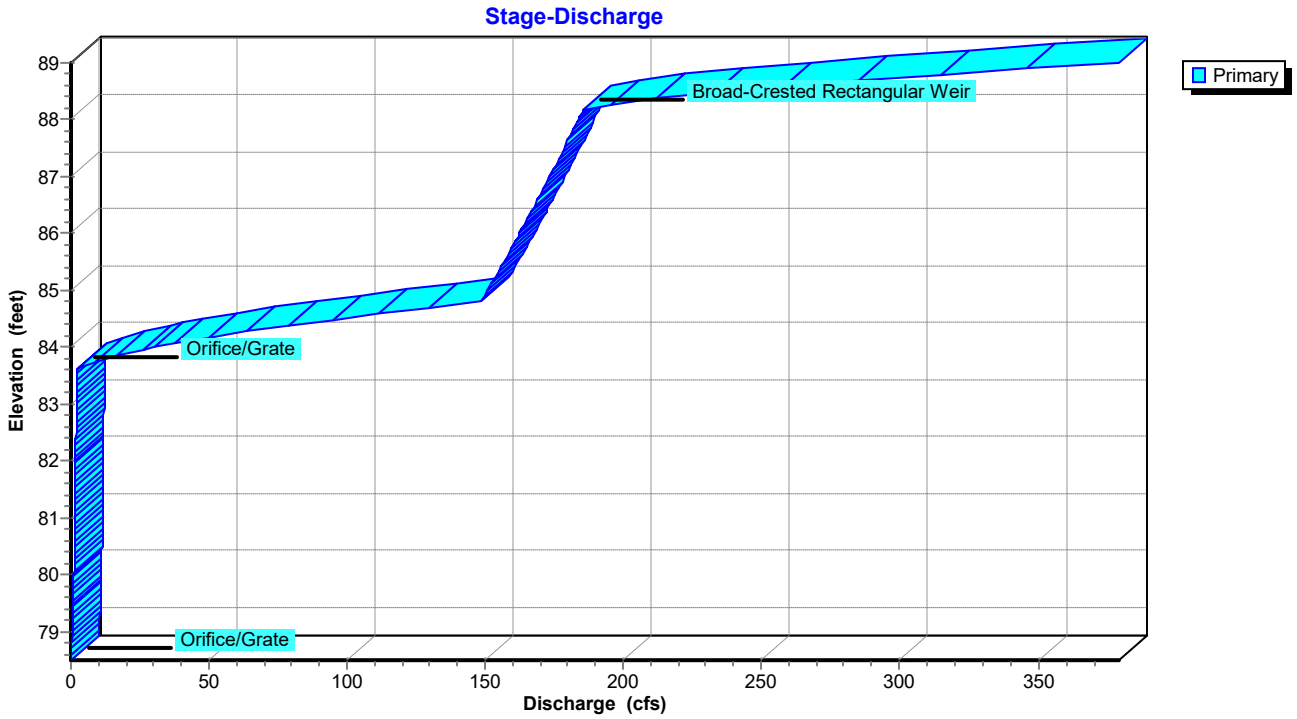
Device	Routing	Invert	Outlet Devices
#1	Primary	76.80'	**48.0" x 161.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 76.00' S= 0.0050 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	78.50'	**6.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	83.60'	**7.00' x 10.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	88.15'	**90.0' long x 25.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=184.84 cfs @ 12.37 hrs HW=88.13' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 184.84 cfs @ 14.71 fps)
  - **2=Orifice/Grate** (Passes < 2.90 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 717.52 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

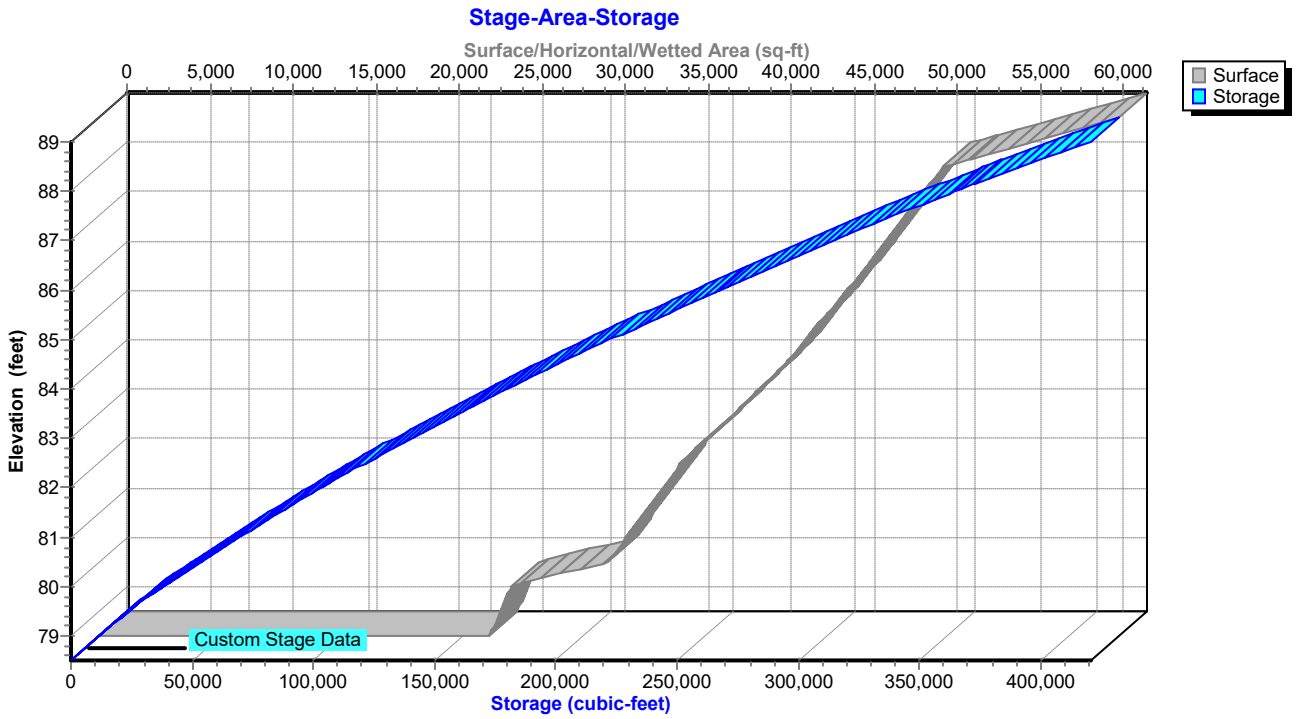
Pond 12P: BASIN 4



Pond 12P: BASIN 4



Pond 12P: BASIN 4



Stage-Discharge for Pond 12P: BASIN 4

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
78.50	0.00	81.62	1.60	84.74	137.64	87.86	182.12
78.56	0.01	81.68	1.62	84.80	148.21	87.92	182.73
78.62	0.04	81.74	1.63	84.86	148.95	87.98	183.33
78.68	0.09	81.80	1.65	84.92	149.69	88.04	183.92
78.74	0.16	81.86	1.67	84.98	150.42	88.10	184.52
78.80	0.23	81.92	1.68	85.04	151.15	88.16	185.36
78.86	0.31	81.98	1.70	85.10	151.87	88.22	190.17
78.92	0.39	82.04	1.71	85.16	152.59	88.28	197.60
78.98	0.46	82.10	1.73	85.22	153.31	88.34	206.86
79.04	0.51	82.16	1.75	85.28	154.03	88.40	217.68
79.10	0.56	82.22	1.76	85.34	154.74	88.46	229.86
79.16	0.61	82.28	1.78	85.40	155.44	88.52	243.27
79.22	0.65	82.34	1.79	85.46	156.15	88.58	257.74
79.28	0.69	82.40	1.81	85.52	156.85	88.64	273.15
79.34	0.73	82.46	1.82	85.58	157.55	88.70	289.50
79.40	0.76	82.52	1.84	85.64	158.25	88.76	306.60
79.46	0.80	82.58	1.85	85.70	158.94	88.82	323.76
79.52	0.83	82.64	1.86	85.76	159.63	88.88	341.48
79.58	0.86	82.70	1.88	85.82	160.31	88.94	359.70
79.64	0.89	82.76	1.89	85.88	161.00	89.00	**379.26**
79.70	0.92	82.82	1.91	85.94	161.68		
79.76	0.95	82.88	1.92	86.00	162.36		
79.82	0.98	82.94	1.94	86.06	163.03		
79.88	1.00	83.00	1.95	86.12	163.70		
79.94	1.03	83.06	1.96	86.18	164.37		
80.00	1.06	83.12	1.98	86.24	165.04		
80.06	1.08	83.18	1.99	86.30	165.70		
80.12	1.11	83.24	2.00	86.36	166.37		
80.18	1.13	83.30	2.02	86.42	167.03		
80.24	1.15	83.36	2.03	86.48	167.68		
80.30	1.18	83.42	2.04	86.54	168.34		
80.36	1.20	83.48	2.06	86.60	168.99		
80.42	1.22	83.54	2.07	86.66	169.63		
80.48	1.24	83.60	2.08	86.72	170.28		
80.54	1.26	83.66	3.73	86.78	170.92		
80.60	1.29	83.72	6.73	86.84	171.57		
80.66	1.31	83.78	10.61	86.90	172.21		
80.72	1.33	83.84	15.21	86.96	172.84		
80.78	1.35	83.90	20.41	87.02	173.48		
80.84	1.37	83.96	26.17	87.08	174.11		
80.90	1.39	84.02	32.43	87.14	174.74		
80.96	1.41	84.08	39.16	87.20	175.37		
81.02	1.42	84.14	46.31	87.26	175.99		
81.08	1.44	84.20	53.88	87.32	176.61		
81.14	1.46	84.26	61.83	87.38	177.23		
81.20	1.48	84.32	70.16	87.44	177.85		
81.26	1.50	84.38	78.83	87.50	178.47		
81.32	1.52	84.44	87.85	87.56	179.08		
81.38	1.53	84.50	97.19	87.62	179.70		
81.44	1.55	84.56	106.86	87.68	180.31		
81.50	1.57	84.62	116.82	87.74	180.91		
81.56	1.58	84.68	127.09	87.80	181.52		

Stage-Area-Storage for Pond 12P: BASIN 4

Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
78.50	23,525	0
78.65	23,719	3,543
78.80	23,913	7,116
78.95	24,107	10,717
79.10	24,301	14,348
79.25	24,496	18,008
79.40	24,690	21,697
79.55	25,400	25,427
79.70	27,145	29,368
79.85	28,889	33,571
80.00	30,634	38,035
80.15	30,966	42,655
80.30	31,297	47,325
80.45	31,629	52,044
80.60	31,961	56,814
80.75	32,292	61,633
80.90	32,624	66,501
81.05	32,956	71,420
81.20	33,287	76,388
81.35	33,619	81,406
81.50	33,951	86,474
81.65	34,282	91,591
81.80	34,614	96,758
81.95	34,945	101,975
82.10	35,369	107,246
82.25	35,838	112,587
82.40	36,308	117,998
82.55	36,777	123,479
82.70	37,246	129,031
82.85	37,716	134,653
83.00	38,185	140,346
83.15	38,654	146,109
83.30	39,124	151,942
83.45	39,593	157,846
83.60	40,062	163,820
83.75	40,532	169,865
83.90	41,001	175,979
84.05	41,437	182,164
84.20	41,805	188,407
84.35	42,173	194,705
84.50	42,541	201,059
84.65	42,909	207,468
84.80	43,277	213,932
84.95	43,645	220,451
85.10	44,013	227,025
85.25	44,381	233,655
85.40	44,749	240,339
85.55	45,117	247,079
85.70	45,485	253,874
85.85	45,853	260,725
86.00	46,221	267,630
86.15	46,568	274,589
86.30	46,914	281,601
86.45	47,261	288,664
86.60	47,607	295,779
86.75	47,954	302,946
86.90	48,300	310,165
87.05	48,647	317,436
87.20	48,994	324,759
87.35	49,340	332,134
87.50	49,687	339,561
87.65	50,033	347,040
87.80	50,380	354,571
87.95	50,726	362,154
88.10	51,899	369,830
88.25	53,484	377,734
88.40	55,069	385,875
88.55	56,654	394,255
88.70	58,240	402,872
88.85	59,825	411,727
89.00	**61,410**	**420,819**

Summary for Pond 16P: WQv FACILITY

Inflow Area = 3.461 ac, 8.78% Impervious, Inflow Depth = 5.38" for 100-YR NOAA event
Inflow = 32.48 cfs @ 11.97 hrs, Volume= 1.550 af
Outflow = 26.48 cfs @ 12.02 hrs, Volume= 1.550 af, Atten= 18%, Lag= 2.9 min
Primary = 26.48 cfs @ 12.02 hrs, Volume= 1.550 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Peak Elev= 91.10' @ 12.02 hrs Surf.Area= 4,796 sf Storage= 12,385 cf

Plug-Flow detention time= 89.7 min calculated for 1.550 af (100% of inflow)
Center-of-Mass det. time= 90.1 min (900.9 - 810.7)

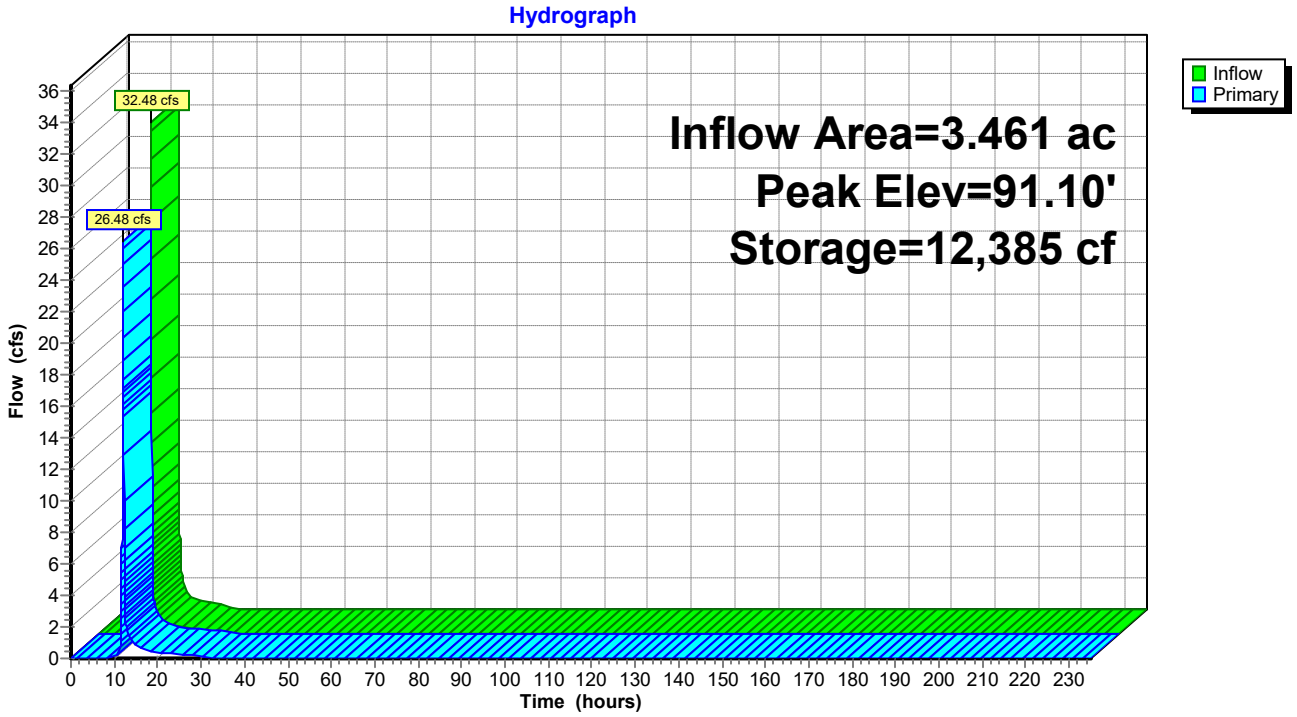
Volume	Invert	Avail.Storage	Storage Description
#1	88.00'	16,930 cf	**Custom Stage Data (Prismatic)** Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
88.00	3,242	0	0
89.50	3,958	5,400	5,400
90.00	4,210	2,042	7,442
92.00	5,278	9,488	16,930

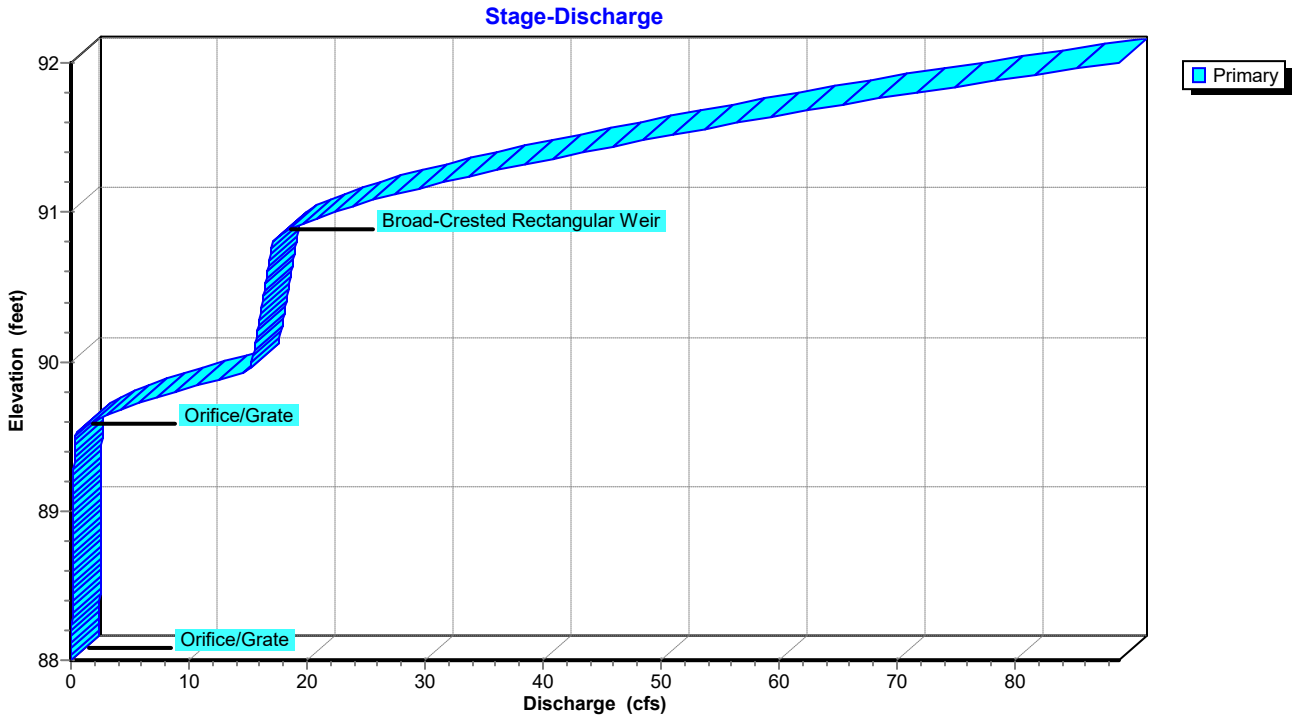
Device	Routing	Invert	Outlet Devices
#1	Primary	86.00'	**18.0" x 44.0' long Culvert** RCP, sq.cut end projecting, Ke= 0.500 Outlet Invert= 82.00' S= 0.0909 '/' Cc= 0.900 n= 0.011 Concrete pipe, straight & clean
#2	Device 1	88.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#3	Device 1	89.50'	**4.00' x 4.00' Horiz. Orifice/Grate** Limited to weir flow C= 0.600
#4	Primary	90.80'	**20.0' long x 20.0' breadth Broad-Crested Rectangular Weir** Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 Coef. (English) 2.68 2.70 2.70 2.64 2.63 2.64 2.64 2.63

Primary OutFlow Max=26.46 cfs @ 12.02 hrs HW=91.10' TW=0.00' (Dynamic Tailwater)
- **1=Culvert** (Inlet Controls 17.74 cfs @ 10.04 fps)
  - **2=Orifice/Grate** (Passes < 0.41 cfs potential flow)
  - **3=Orifice/Grate** (Passes < 97.36 cfs potential flow)
- **4=Broad-Crested Rectangular Weir** (Weir Controls 8.72 cfs @ 1.47 fps)

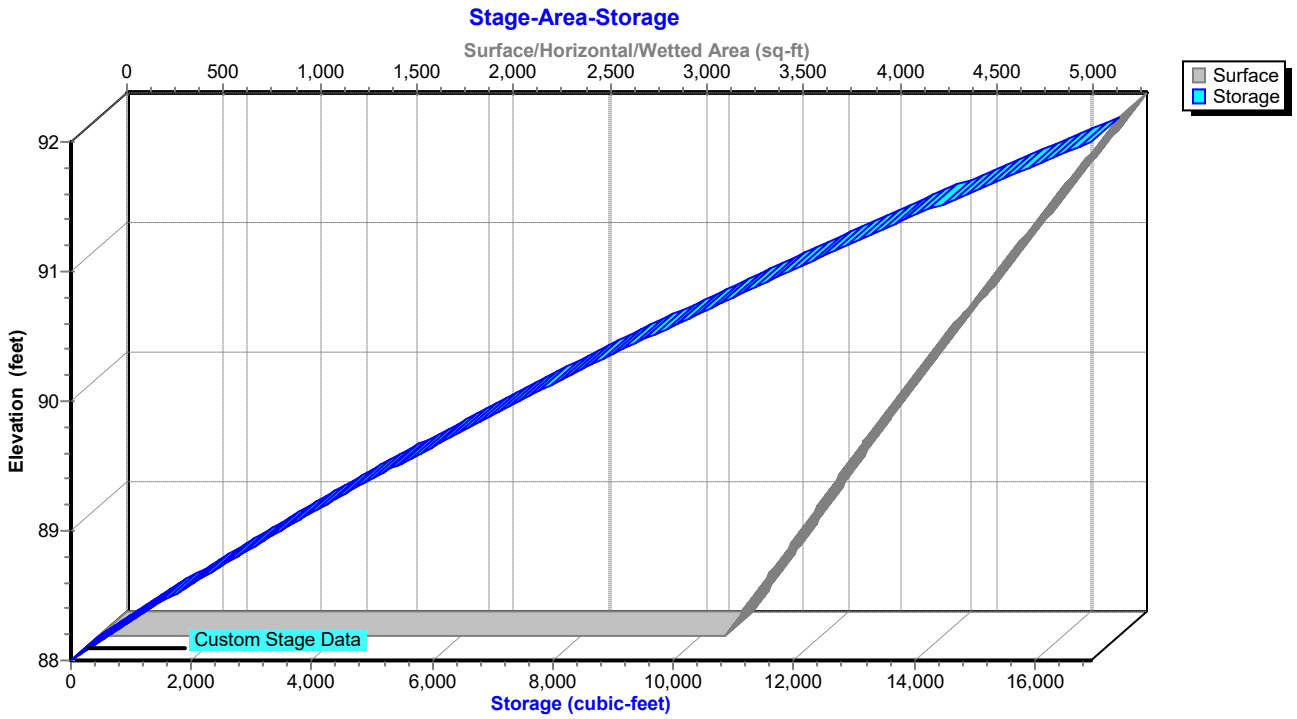
Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Pond 16P: WQv FACILITY



Stage-Discharge for Pond 16P: WQv FACILITY

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
88.00	0.00	89.04	0.23	90.08	15.53	91.12	27.53
88.02	0.00	89.06	0.23	90.10	15.57	91.14	28.51
88.04	0.00	89.08	0.23	90.12	15.62	91.16	29.52
88.06	0.01	89.10	0.23	90.14	15.67	91.18	30.55
88.08	0.01	89.12	0.24	90.16	15.71	91.20	31.61
88.10	0.02	89.14	0.24	90.18	15.76	91.22	32.69
88.12	0.03	89.16	0.24	90.20	15.80	91.24	33.79
88.14	0.04	89.18	0.24	90.22	15.85	91.26	34.92
88.16	0.05	89.20	0.25	90.24	15.90	91.28	36.07
88.18	0.05	89.22	0.25	90.26	15.94	91.30	37.24
88.20	0.06	89.24	0.25	90.28	15.99	91.32	38.44
88.22	0.07	89.26	0.25	90.30	16.03	91.34	39.66
88.24	0.08	89.28	0.25	90.32	16.08	91.36	40.90
88.26	0.09	89.30	0.26	90.34	16.12	91.38	42.16
88.28	0.09	89.32	0.26	90.36	16.17	91.40	43.45
88.30	0.10	89.34	0.26	90.38	16.21	91.42	44.69
88.32	0.10	89.36	0.26	90.40	16.26	91.44	45.95
88.34	0.11	89.38	0.26	90.42	16.30	91.46	47.23
88.36	0.11	89.40	0.27	90.44	16.34	91.48	48.52
88.38	0.12	89.42	0.27	90.46	16.39	91.50	49.82
88.40	0.12	89.44	0.27	90.48	16.43	91.52	51.13
88.42	0.13	89.46	0.27	90.50	16.48	91.54	52.46
88.44	0.13	89.48	0.28	90.52	16.52	91.56	53.80
88.46	0.14	89.50	0.28	90.54	16.56	91.58	55.16
88.48	0.14	89.52	0.43	90.56	16.61	91.60	56.52
88.50	0.14	89.54	0.70	90.58	16.65	91.62	57.97
88.52	0.15	89.56	1.05	90.60	16.70	91.64	59.43
88.54	0.15	89.58	1.47	90.62	16.74	91.66	60.92
88.56	0.16	89.60	1.94	90.64	16.78	91.68	62.41
88.58	0.16	89.62	2.46	90.66	16.82	91.70	63.93
88.60	0.16	89.64	3.03	90.68	16.87	91.72	65.46
88.62	0.17	89.66	3.64	90.70	16.91	91.74	67.00
88.64	0.17	89.68	4.29	90.72	16.95	91.76	68.56
88.66	0.17	89.70	4.98	90.74	17.00	91.78	70.13
88.68	0.18	89.72	5.70	90.76	17.04	91.80	71.72
88.70	0.18	89.74	6.45	90.78	17.08	91.82	73.37
88.72	0.18	89.76	7.24	90.80	17.12	91.84	75.03
88.74	0.19	89.78	8.06	90.82	17.32	91.86	76.70
88.76	0.19	89.80	8.90	90.84	17.64	91.88	78.40
88.78	0.19	89.82	9.78	90.86	18.04	91.90	80.11
88.80	0.19	89.84	10.68	90.88	18.50	91.92	81.84
88.82	0.20	89.86	11.61	90.90	19.03	91.94	83.58
88.84	0.20	89.88	12.57	90.92	19.60	91.96	85.34
88.86	0.20	89.90	13.55	90.94	20.22	91.98	87.11
88.88	0.21	89.92	14.56	90.96	20.89	92.00	**88.90**
88.90	0.21	89.94	15.20	90.98	21.59		
88.92	0.21	89.96	15.24	91.00	22.34		
88.94	0.21	89.98	15.29	91.02	23.12		
88.96	0.22	90.00	15.34	91.04	23.94		
88.98	0.22	90.02	15.39	91.06	24.79		
89.00	0.22	90.04	15.43	91.08	25.67		
89.02	0.22	90.06	15.48	91.10	26.59		

Stage-Area-Storage for Pond 16P: WQv FACILITY

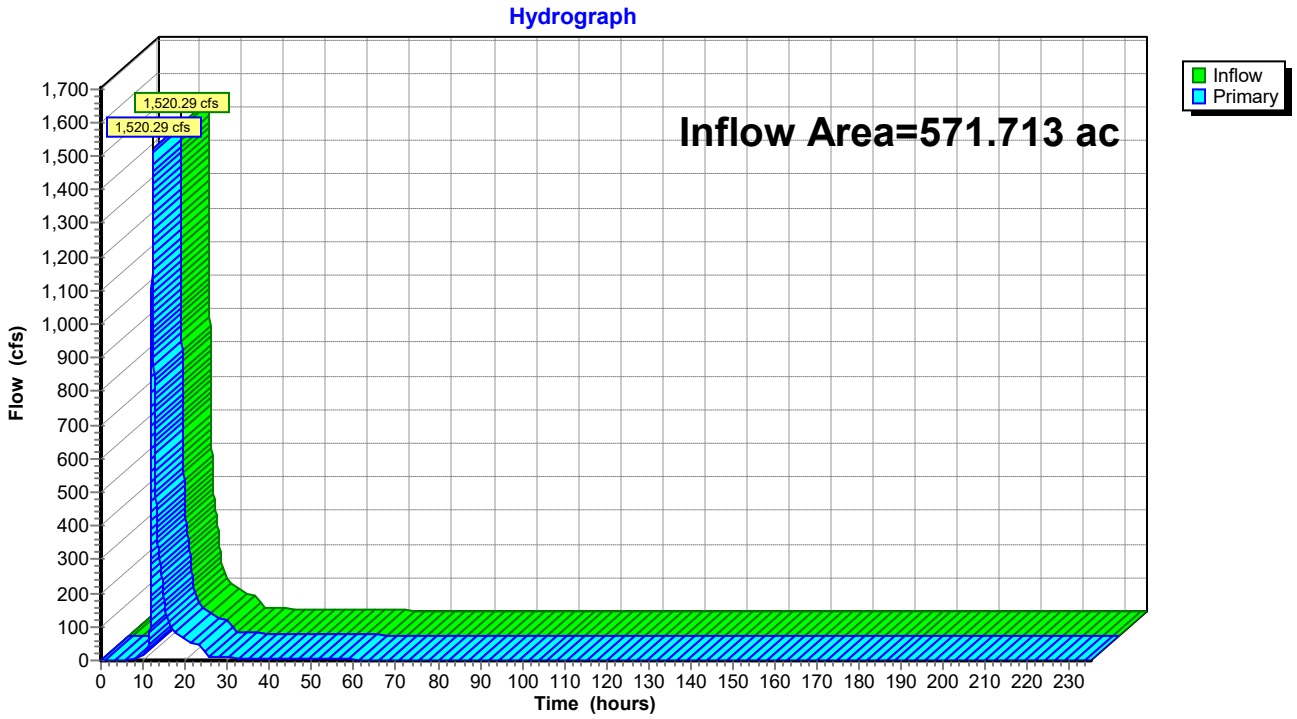
Elevation (feet)	Surface (sq-ft)	Storage (cubic-feet)
88.00	3,242	0
88.05	3,266	163
88.10	3,290	327
88.15	3,314	492
88.20	3,337	658
88.25	3,361	825
88.30	3,385	994
88.35	3,409	1,164
88.40	3,433	1,335
88.45	3,457	1,507
88.50	3,481	1,681
88.55	3,505	1,855
88.60	3,528	2,031
88.65	3,552	2,208
88.70	3,576	2,386
88.75	3,600	2,566
88.80	3,624	2,746
88.85	3,648	2,928
88.90	3,672	3,111
88.95	3,695	3,295
89.00	3,719	3,481
89.05	3,743	3,667
89.10	3,767	3,855
89.15	3,791	4,044
89.20	3,815	4,234
89.25	3,839	4,425
89.30	3,863	4,618
89.35	3,886	4,812
89.40	3,910	5,007
89.45	3,934	5,203
89.50	3,958	5,400
89.55	3,983	5,599
89.60	4,008	5,798
89.65	4,034	5,999
89.70	4,059	6,202
89.75	4,084	6,405
89.80	4,109	6,610
89.85	4,134	6,816
89.90	4,160	7,024
89.95	4,185	7,232
90.00	4,210	7,442
90.05	4,237	7,653
90.10	4,263	7,866
90.15	4,290	8,080
90.20	4,317	8,295
90.25	4,344	8,511
90.30	4,370	8,729
90.35	4,397	8,948
90.40	4,424	9,169
90.45	4,450	9,391
90.50	4,477	9,614
90.55	4,504	9,838
90.60	4,530	10,064
90.65	4,557	10,291
90.70	4,584	10,520
90.75	4,611	10,750
90.80	4,637	10,981
90.85	4,664	11,213
90.90	4,691	11,447
90.95	4,717	11,682
91.00	4,744	11,919
91.05	4,771	12,157
91.10	4,797	12,396
91.15	4,824	12,637
91.20	4,851	12,878
91.25	4,878	13,122
91.30	4,904	13,366
91.35	4,931	13,612
91.40	4,958	13,859
91.45	4,984	14,108
91.50	5,011	14,358
91.55	5,038	14,609
91.60	5,064	14,862
91.65	5,091	15,115
91.70	5,118	15,371
91.75	5,145	15,627
91.80	5,171	15,885
91.85	5,198	16,144
91.90	5,225	16,405
91.95	5,251	16,667
92.00	**5,278**	**16,930**

Summary for Link 14L: TOTAL PROPOSED

Inflow Area = 571.713 ac, 2.47% Impervious, Inflow Depth = 4.75" for 100-YR NOAA event
Inflow = 1,520.29 cfs @ 12.23 hrs, Volume= 226.084 af
Primary = 1,520.29 cfs @ 12.23 hrs, Volume= 226.084 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 14L: TOTAL PROPOSED

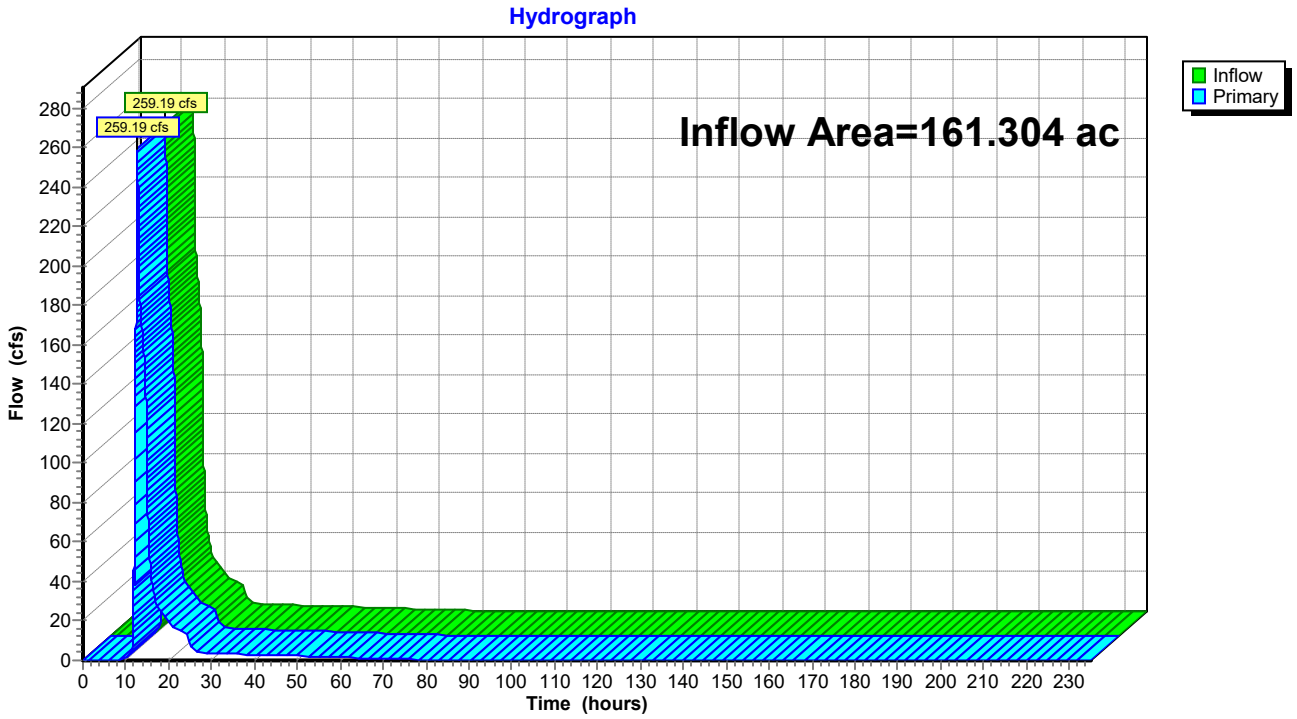


Summary for Link 59L: Discharge Pt 1

Inflow Area = 161.304 ac, 3.97% Impervious, Inflow Depth = 5.37" for 100-YR NOAA event
Inflow = 259.19 cfs @ 12.73 hrs, Volume= 72.206 af
Primary = 259.19 cfs @ 12.73 hrs, Volume= 72.206 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: Discharge Pt 1

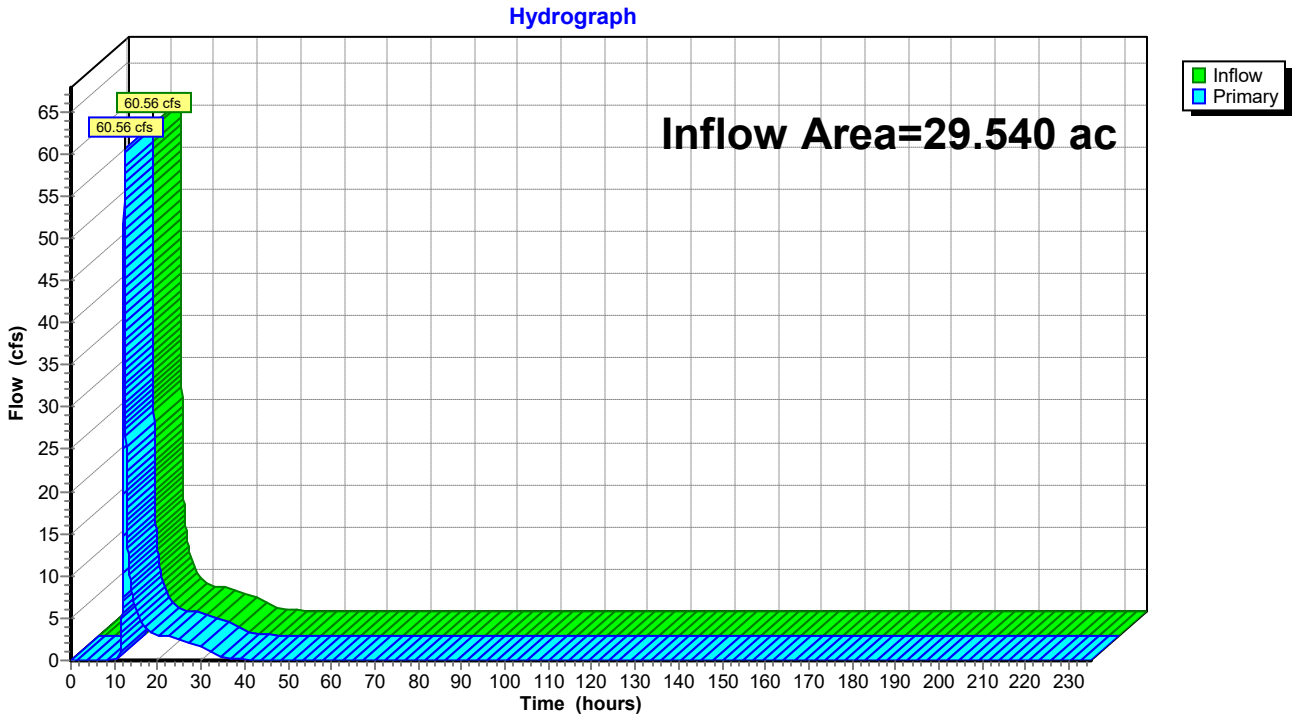


Summary for Link 60L: Discharge Pt 2

Inflow Area = 29.540 ac, 4.03% Impervious, Inflow Depth = 3.48" for 100-YR NOAA event
Inflow = 60.56 cfs @ 12.28 hrs, Volume= 8.560 af
Primary = 60.56 cfs @ 12.28 hrs, Volume= 8.560 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: Discharge Pt 2

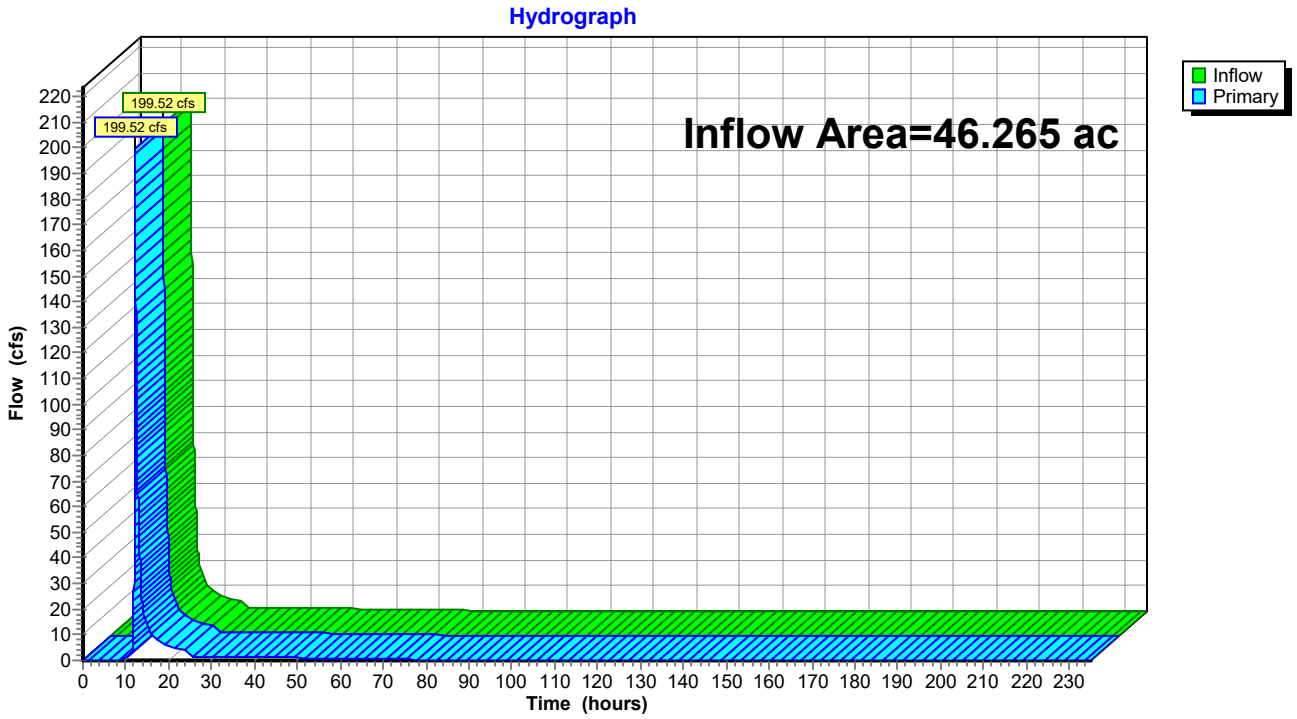


Summary for Link 61L: Discharge Pt 3

Inflow Area = 46.265 ac, 6.92% Impervious, Inflow Depth = 6.07" for 100-YR NOAA event
Inflow = 199.52 cfs @ 12.21 hrs, Volume= 23.384 af
Primary = 199.52 cfs @ 12.21 hrs, Volume= 23.384 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: Discharge Pt 3

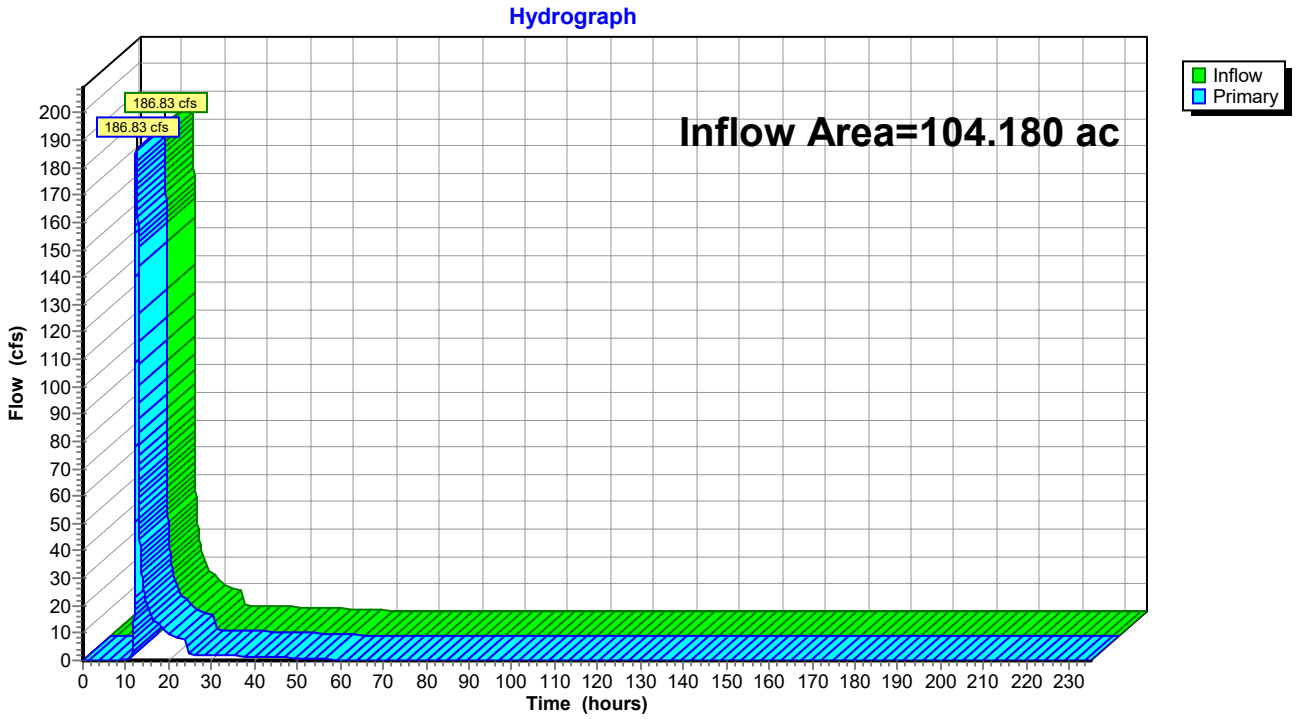


Summary for Link 62L: Discharge Pt 4

Inflow Area = 104.180 ac, 1.09% Impervious, Inflow Depth = 3.64" for 100-YR NOAA event
Inflow = 186.83 cfs @ 12.37 hrs, Volume= 31.586 af
Primary = 186.83 cfs @ 12.37 hrs, Volume= 31.586 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: Discharge Pt 4

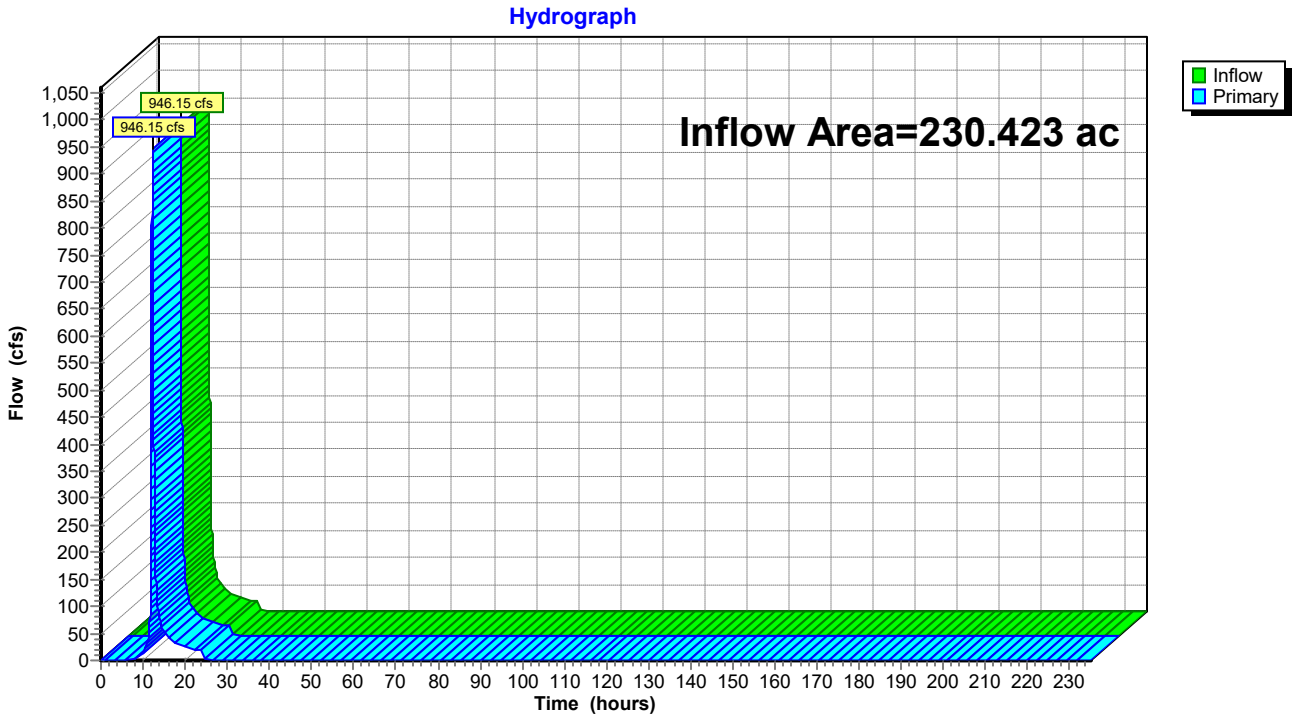


Summary for Link 63L: P 5

Inflow Area = 230.423 ac, 0.95% Impervious, Inflow Depth = 4.71" for 100-YR NOAA event
Inflow = 946.15 cfs @ 12.20 hrs, Volume= 90.348 af
Primary = 946.15 cfs @ 12.20 hrs, Volume= 90.348 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: P 5



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ATTACHMENT 17D

Proposed Channel Flows

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 3

Revised by PGS 08/21/2021

Objective: The objective of this analysis is to estimate the flow in the proposed stormwater management channels under the design storms being considered.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) Drainage areas – determine the contributing drainage area to the discharge location based upon the topographic data of the area. Use the "area" function in AutoCAD to find the area of the drainage area boundary.
2) Based on the soils types and the vegetative cover, determine the areas of multiple soil types and cover conditions in each drainage area. Calculate a "weighed" curve number. HydroCAD actually does this calculation based upon data entry.
3) Determine the time of concentration for water to flow from the longest distance (in time) from the outlet. Measure the length and slope of the tc flow path and the surface condition.
4) Although the site is ~~location~~ located along the eastern seaboard, this is a Type II storm event because the DelMarVa peninsula shields it from the affects of the ocean.
5) Determine the peak flows for the 25-year, 24 hour (5.9 inches of rain) and 100 year, 24 hour (8.5 inches of rain) storm events.
6) The HydroCad models allows calculating the peak flows without conducting a full-~~sledged~~ fledged hydraulic routing.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater management – Existing Conditions," dated July 15, 2020.

Revised by PGS 08/21/2021

Conclusions:

A summary of the inflow and the proposed channel flows are provided in the table below.

Channel ID	25 year, 24 hour storm event Qout (cfs)	100 year, 24 hour storm event Qout (cfs)
West Section (Cells 1-10)		
Downchute 1 (DC-1)	60.95	94.79
Downchute 2 (DC-2)	54.36	85.88
Downchute 3 (DC-3)	70.96	113.02
Downchute 4 (DC-4)	49.88	80.10
Downchute 5 (DC-5)	51.59	82.86
Downchute 6 (DC-6)	68.55	107.42
Downchute 7 (DC-7)	65.04	103.58
Downchute 8 (DC-8)	59.62	100.17
Downchute 9 (DC-9)	47.30	74.71
Downchute 10 (DC-10)	58.89	93.03
Perimeter Channel 2	31.83	57.96
Perimeter Channel 3A	15.97	24.83
Perimeter Channel 3B	80.84	128.22
Perimeter Channel 3C	140.25	228.15
Perimeter Channel 3D	197.64	319.29
Perimeter Channel 3E	282.93	455.14
Perimeter Channel 4A	40.72	63.32
Perimeter Channel 4B	109.16	170.64
Perimeter Channel 4C	160.59	253.31
Perimeter Channel 4D	210.30	333.21
Perimeter Channel 4E	281.05	445.99
Perimeter Channel 4F	~~347.91~~ 391.91*	~~552.08~~ 653.38*
Perimeter Channel 5	81.01	126.24
Leachate Storage Facility No. 1		
Perimeter Channel 1	64.62	158.72
Perimeter Channel 6	24.00	65.73
Perimeter Channel 7	17.34	26.77
Perimeter Channel 10	68.46	164.87

*Proposed channel flows were increased by 44.0 cfs and 101.3 cfs for the 25 year and 100 year storm events to include inflow from Culvert #6. Added peak to peak without routing to be conservative.

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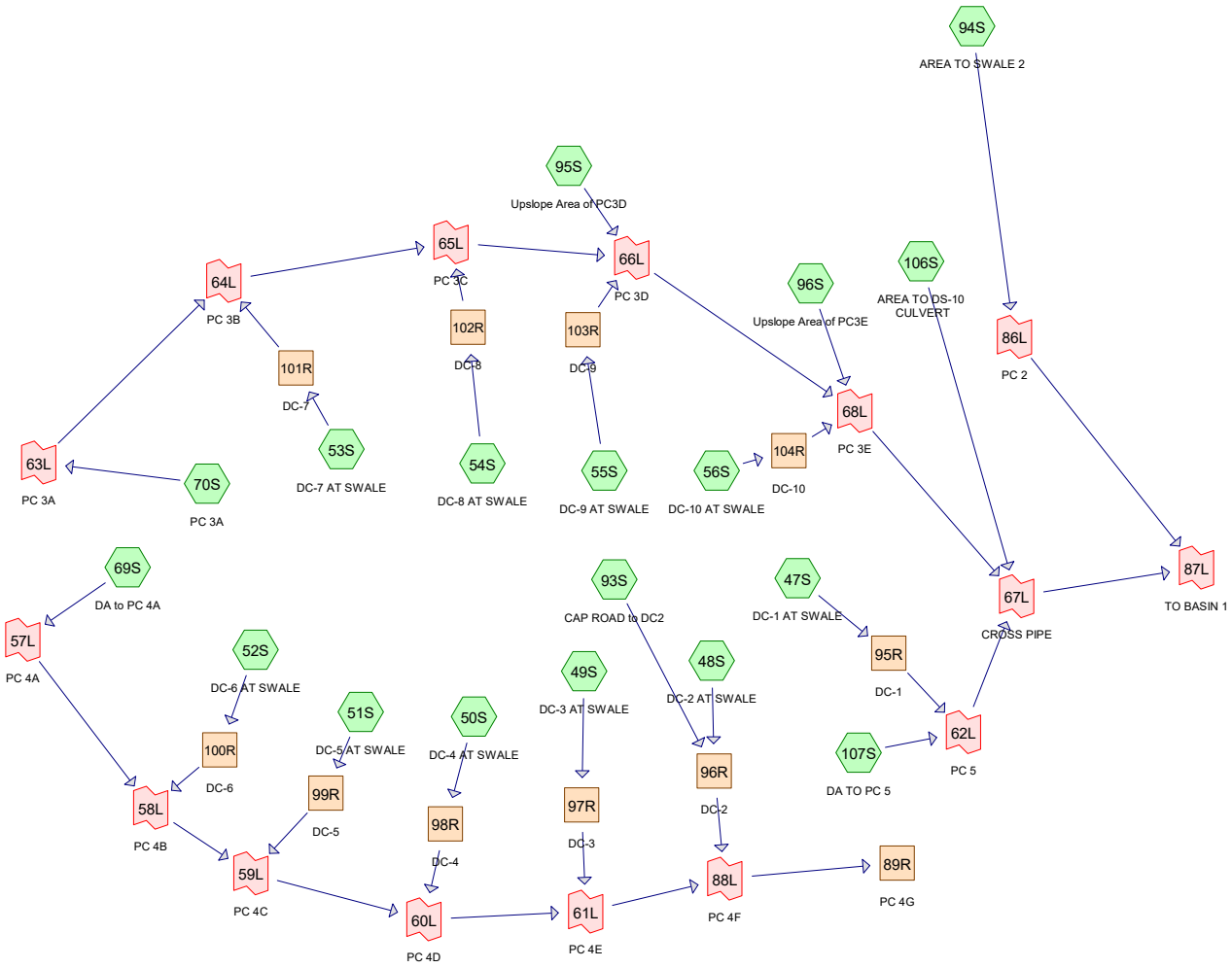
Channel ID	25 year, 24 hour storm event Qout (cfs)	100 year, 24 hour storm event Qout (cfs)
East Section (Cells 11-16)		
Downchute 20 (DC-20)	35.77	57.44
Downchute 21 (DC-21)	53.31	85.62
Downchute 22 (DC-22)	29.30	47.05
Downchute 23 (DC-23)	42.90	68.89
Perimeter Channel 8A	36.51	57.29
Perimeter Channel 8B	113.80	180.49
Perimeter Channel 8C	279.88	444.63
Perimeter Channel 9A	48.18	76.42
Perimeter Channel 9B	91.08	145.31
Perimeter Channel 9C	122.84	195.09

The 25 year, 24 hour storm event flow rates will be used to determine the size of the channels and select channel lining. These flow rates will also be used to size culverts.

The selected channels will be checked for overtopping under 100 year, 24 hour flow conditions.

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West Section (Cells 1-10)



Subcat 92S
Drainage from PC 1
to PC 4F(88L)
(enters 88L through Culvert #6. Included in SWM
add flows peak to peak for channel design flow)

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Subcat Reach Pond Link

Drainage Diagram for PC AND DOWNCHUTES_07152020
Prepared by {enter your company name here}, Printed 7/18/2020
HydroCAD® 8.50 s/n 005690 © 2007 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
1.317	30	Woods, Good, HSG A (94S)
2.613	61	>75% Grass cover, Good, HSG B (ONSITE A) (94S)
0.669	70	Woods, Good, HSG C (94S)
14.090	74	>75% Grass cover, Good, HSG C (54S,95S,96S)
1.448	74	FROM APPROVED CALCS (93S)
1.462	76	RA ZONING C SOILS (94S)
0.732	77	Woods, Good, HSG D (94S)
84.159	80	>75% Grass cover, Good, HSG D (47S,48S,49S,50S,51S,52S,53S,55S,56S,69S,70S,106S,107
6.261	80	>75% Grass cover, Good, HSG D (ONSITE C) (94S)
0.279	80	>75% Grass cover, Good, HSG D (ONSITE D) (94S)
0.539	98	CAP ACCESS (47S)
0.225	98	CAP ROAD (48S)
2.511	98	PERIMETER ROAD (47S,48S,107S)
7.462	98	Paved parking & roofs (49S,50S,51S,52S,53S,54S,55S,56S,69S,70S,95S,96S)
0.472	98	Paved roads w/curbs & sewers (93S)
124.239		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
1.317	HSG A	94S
2.613	HSG B	94S
14.759	HSG C	54S, 94S, 95S, 96S
91.431	HSG D	47S, 48S, 49S, 50S, 51S, 52S, 53S, 55S, 56S, 69S, 70S, 94S, 106S, 107S
14.119	Other	47S, 48S, 49S, 50S, 51S, 52S, 53S, 54S, 55S, 56S, 69S, 70S, 93S, 94S, 95S, 96S, 107S
124.239		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 47S: DC-1 AT SWALE Runoff Area=8.371 ac 21.28% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=60.95 cfs 2.862 af

Subcatchment 48S: DC-2 AT SWALE Runoff Area=7.779 ac 11.04% Impervious Runoff Depth=3.90"
Tc=5.0 min CN=82 Runoff=54.36 cfs 2.525 af

Subcatchment 49S: DC-3 AT SWALE Runoff Area=10.378 ac 4.90% Impervious Runoff Depth=3.79"
Tc=5.0 min CN=81 Runoff=70.96 cfs 3.280 af

Subcatchment 50S: DC-4 AT SWALE Runoff Area=325,003 sf 2.45% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=49.88 cfs 2.295 af

Subcatchment 51S: DC-5 AT SWALE Runoff Area=336,190 sf 2.47% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=51.59 cfs 2.374 af

Subcatchment 52S: DC-6 AT SWALE Runoff Area=9.605 ac 13.94% Impervious Runoff Depth=4.00"
Tc=5.0 min CN=83 Runoff=68.55 cfs 3.201 af

Subcatchment 53S: DC-7 AT SWALE Runoff Area=414,298 sf 5.16% Impervious Runoff Depth=3.79"
Tc=5.0 min CN=81 Runoff=65.04 cfs 3.006 af

Subcatchment 54S: DC-8 AT SWALE Runoff Area=440,848 sf 5.29% Impervious Runoff Depth=3.20"
Tc=5.0 min CN=75 Runoff=59.62 cfs 2.696 af

Subcatchment 55S: DC-9 AT SWALE Runoff Area=294,805 sf 9.96% Impervious Runoff Depth=3.90"
Tc=5.0 min CN=82 Runoff=47.30 cfs 2.197 af

Subcatchment 56S: DC-10 AT SWALE Runoff Area=8.427 ac 8.39% Impervious Runoff Depth=3.90"
Tc=5.0 min CN=82 Runoff=58.89 cfs 2.735 af

Subcatchment 69S: DA to PC 4A Runoff Area=243,601 sf 21.90% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=40.72 cfs 1.912 af

Subcatchment 70S: PC 3A Runoff Area=95,531 sf 21.86% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=15.97 cfs 0.750 af

Subcatchment 93S: CAP ROAD to DC2 Runoff Area=83,627 sf 24.59% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=12.83 cfs 0.591 af

Subcatchment 94S: AREA TO SWALE 2 Runoff Area=580,809 sf 0.00% Impervious Runoff Depth=2.73"
Flow Length=4,507' Tc=29.0 min CN=70 Runoff=31.83 cfs 3.029 af

Subcatchment 95S: Upslope Area of PC3D Runoff Area=1.573 ac 21.17% Impervious Runoff Depth=3.59"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=10.27 cfs 0.471 af

Subcatchment 96S: Upslope Area of PC3E Runoff Area=4.062 ac 19.62% Impervious Runoff Depth=3.59"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=26.52 cfs 1.215 af

Subcatchment 106S: AREA TO DS-10 Runoff Area=286,585 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=43.98 cfs 2.024 af

Subcatchment 107S: DA TO PC 5 Runoff Area=124,070 sf 22.29% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=20.74 cfs 0.974 af

391.91
Reach 89R: PC 4G Avg. Depth=1.59' Max Vel=11.82 fps Inflow=~~347.91~~ cfs ~~16.177~~ af
n=0.015 L=1,000.0' S=0.0100 '/' Capacity=1,809.44 cfs Outflow=~~340.56~~ cfs ~~16.177~~ af
Inflow/Outflow still <<capacity 391.91

Reach 95R: DC-1 Avg. Depth=0.40' Max Vel=14.60 fps Inflow=60.95 cfs 2.862 af
n=0.025 L=800.0' S=0.2325 '/' Capacity=292.29 cfs Outflow=60.41 cfs 2.862 af
Q=120.4 cfs across bench at full depth

Reach 96R: DC-2 Avg. Depth=0.40' Max Vel=16.19 fps Inflow=67.20 cfs 3.116 af
n=0.025 L=600.0' S=0.2867 '/' Capacity=324.56 cfs Outflow=66.91 cfs 3.116 af
Q=120.4 cfs across bench at full depth

Reach 97R: DC-3 Avg. Depth=0.41' Max Vel=16.55 fps Inflow=70.96 cfs 3.280 af
n=0.025 L=465.0' S=0.2882 '/' Capacity=325.41 cfs Outflow=70.77 cfs 3.280 af
Q=120.4 cfs across bench at full depth

Reach 98R: DC-4 Avg. Depth=0.33' Max Vel=14.56 fps Inflow=49.88 cfs 2.295 af
n=0.025 L=415.0' S=0.2892 '/' Capacity=325.96 cfs Outflow=49.75 cfs 2.295 af
Q=120.4 cfs across bench at full depth

Reach 99R: DC-5 Avg. Depth=0.34' Max Vel=14.84 fps Inflow=51.59 cfs 2.374 af
n=0.025 L=390.0' S=0.2949 '/' Capacity=329.17 cfs Outflow=51.47 cfs 2.374 af
Q=120.4 cfs across bench at full depth

Reach 100R: DC-6 Avg. Depth=0.41' Max Vel=16.05 fps Inflow=68.55 cfs 3.201 af
n=0.025 L=280.0' S=0.2714 '/' Capacity=315.81 cfs Outflow=68.47 cfs 3.201 af
Q=120.4 cfs across bench at full depth

Reach 101R: DC-7 Avg. Depth=0.39' Max Vel=15.84 fps Inflow=65.04 cfs 3.006 af
n=0.025 L=390.0' S=0.2769 '/' Capacity=318.99 cfs Outflow=64.90 cfs 3.006 af
Q=120.4 cfs across bench at full depth

Reach 102R: DC-8 Avg. Depth=0.37' Max Vel=15.34 fps Inflow=59.62 cfs 2.696 af
n=0.025 L=430.0' S=0.2767 '/' Capacity=318.89 cfs Outflow=59.47 cfs 2.696 af
Q=120.4 cfs across bench at full depth

Reach 103R: DC-9 Avg. Depth=0.33' Max Vel=13.99 fps Inflow=47.30 cfs 2.197 af
n=0.025 L=450.0' S=0.2711 '/' Capacity=315.63 cfs Outflow=47.14 cfs 2.197 af
Q=120.4 cfs across bench at full depth

Reach 104R: DC-10 Avg. Depth=0.37' Max Vel=15.46 fps Inflow=58.89 cfs 2.735 af
n=0.025 L=320.0' S=0.2875 '/' Capacity=325.03 cfs Outflow=58.81 cfs 2.735 af
Q=120.4 cfs across bench at full depth

Link 57L: PC 4A Inflow=40.72 cfs 1.912 af
Primary=40.72 cfs 1.912 af

Link 58L: PC 4B Inflow=109.16 cfs 5.113 af
Primary=109.16 cfs 5.113 af

Link 59L: PC 4C Inflow=160.59 cfs 7.487 af
Primary=160.59 cfs 7.487 af

Link 60L: PC 4D Inflow=210.30 cfs 9.782 af
Primary=210.30 cfs 9.782 af

Back calculated capacity for downchute at 7% slope across bench, with 1 ft flow depth Q= 120.4 cfs, V=13.4 fps

Link 61L: PC 4E
Inflow=281.05 cfs 13.062 af
Primary=281.05 cfs 13.062 af

Link 62L: PC 5
Inflow=81.01 cfs 3.836 af
Primary=81.01 cfs 3.836 af

Link 63L: PC 3A
Inflow=15.97 cfs 0.750 af
Primary=15.97 cfs 0.750 af

Link 64L: PC 3B
Inflow=80.84 cfs 3.756 af
Primary=80.84 cfs 3.756 af

Link 65L: PC 3C
Inflow=140.25 cfs 6.452 af
Primary=140.25 cfs 6.452 af

Link 66L: PC 3D
Inflow=197.64 cfs 9.120 af
Primary=197.64 cfs 9.120 af

Link 67L: CROSS PIPE
Inflow=407.82 cfs 18.930 af
Primary=407.82 cfs 18.930 af

Link 68L: PC 3E
Inflow=282.93 cfs 13.070 af
Primary=282.93 cfs 13.070 af

Link 86L: PC 2
Inflow=31.83 cfs 3.029 af
Primary=31.83 cfs 3.029 af

Link 87L: TO BASIN 1
Inflow=418.56 cfs 21.959 af
Primary=418.56 cfs 21.959 af

391.91 cfs
Link 88L: PC 4F Add flows from 92S to include Culvert #6 flow
Inflow=~~347.91~~ cfs ~~16.177~~ af
Primary=~~347.91~~ cfs ~~16.177~~ af
391.91 cfs

Total Runoff Area = ~~124.239~~ ac Runoff Volume = ~~38.137~~ af Average Runoff Depth = 3.68"
90.98% Pervious = 113.030 ac 9.02% Impervious = 11.209 ac

Summary for Subcatchment 47S: DC-1 AT SWALE

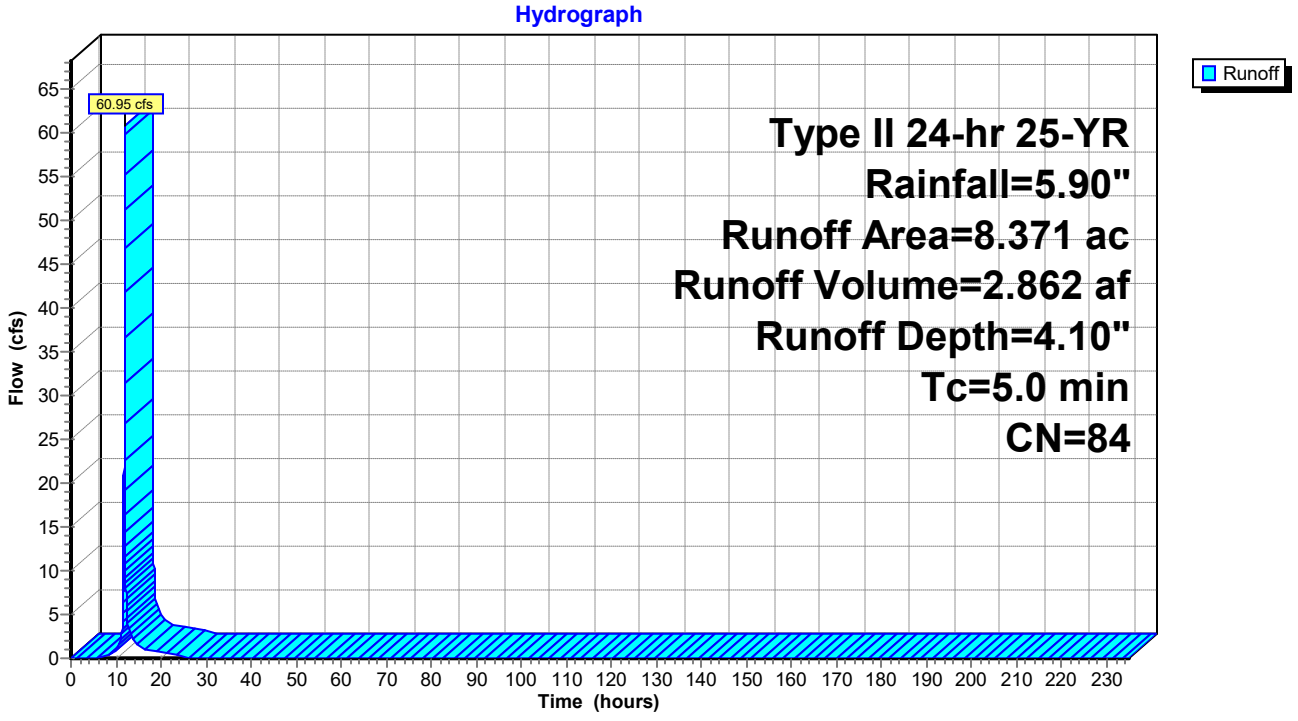
Runoff = 60.95 cfs @ 11.96 hrs, Volume= 2.862 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	1.242	98	PERIMETER ROAD
	6.590	80	>75% Grass cover, Good, HSG D
*	0.539	98	CAP ACCESS
	8.371	84	Weighted Average
	6.590		Pervious Area
	1.781		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 47S: DC-1 AT SWALE



Summary for Subcatchment 48S: DC-2 AT SWALE

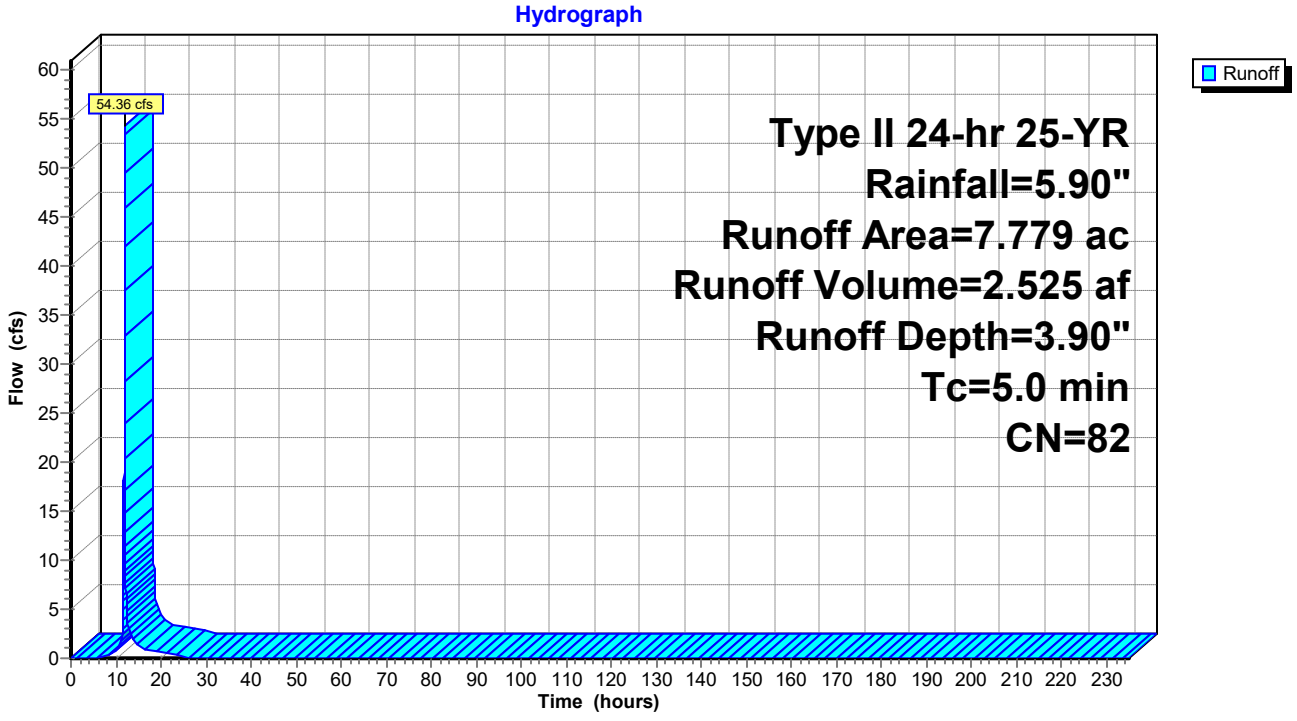
Runoff = 54.36 cfs @ 11.96 hrs, Volume= 2.525 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (ac)	CN	Description
*	0.634	98	PERIMETER ROAD
	6.920	80	>75% Grass cover, Good, HSG D
*	0.225	98	CAP ROAD
	7.779	82	Weighted Average
	6.920		Pervious Area
	0.859		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 48S: DC-2 AT SWALE



Summary for Subcatchment 49S: DC-3 AT SWALE

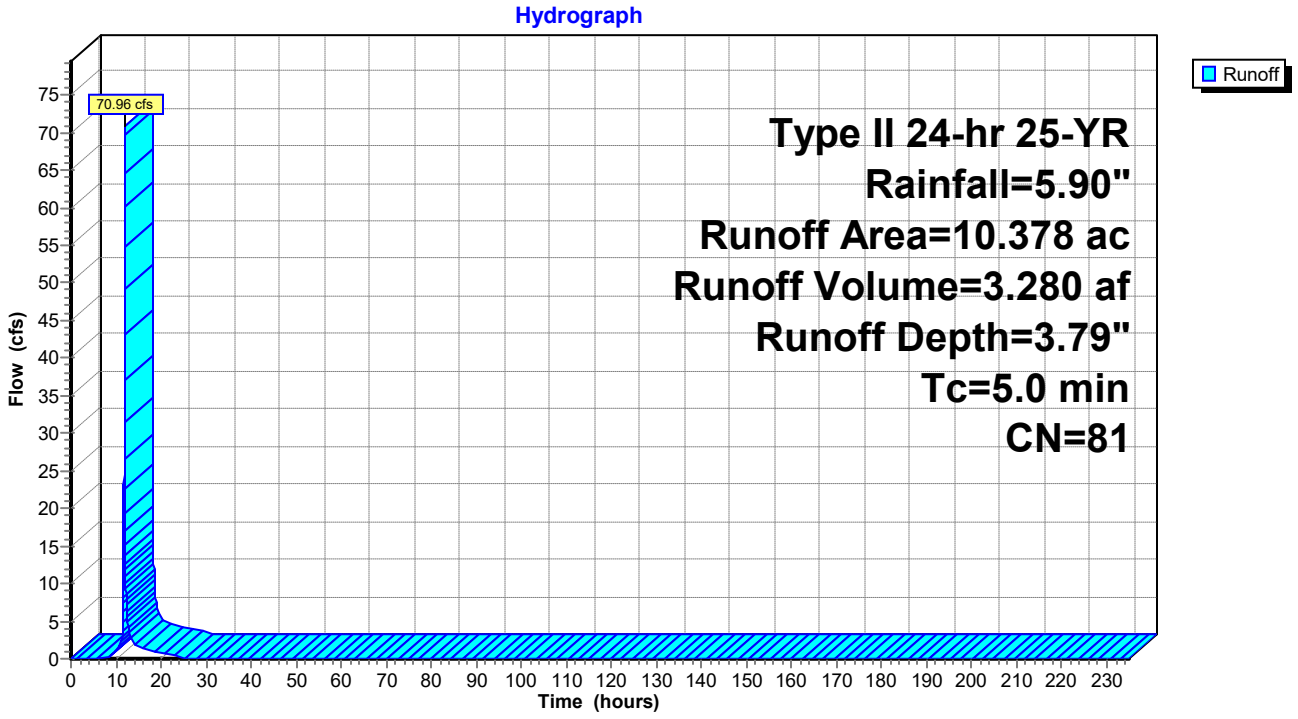
Runoff = 70.96 cfs @ 11.96 hrs, Volume= 3.280 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
0.509	98	Paved parking & roofs
9.869	80	>75% Grass cover, Good, HSG D
10.378	81	Weighted Average
9.869		Pervious Area
0.509		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 49S: DC-3 AT SWALE



Summary for Subcatchment 50S: DC-4 AT SWALE

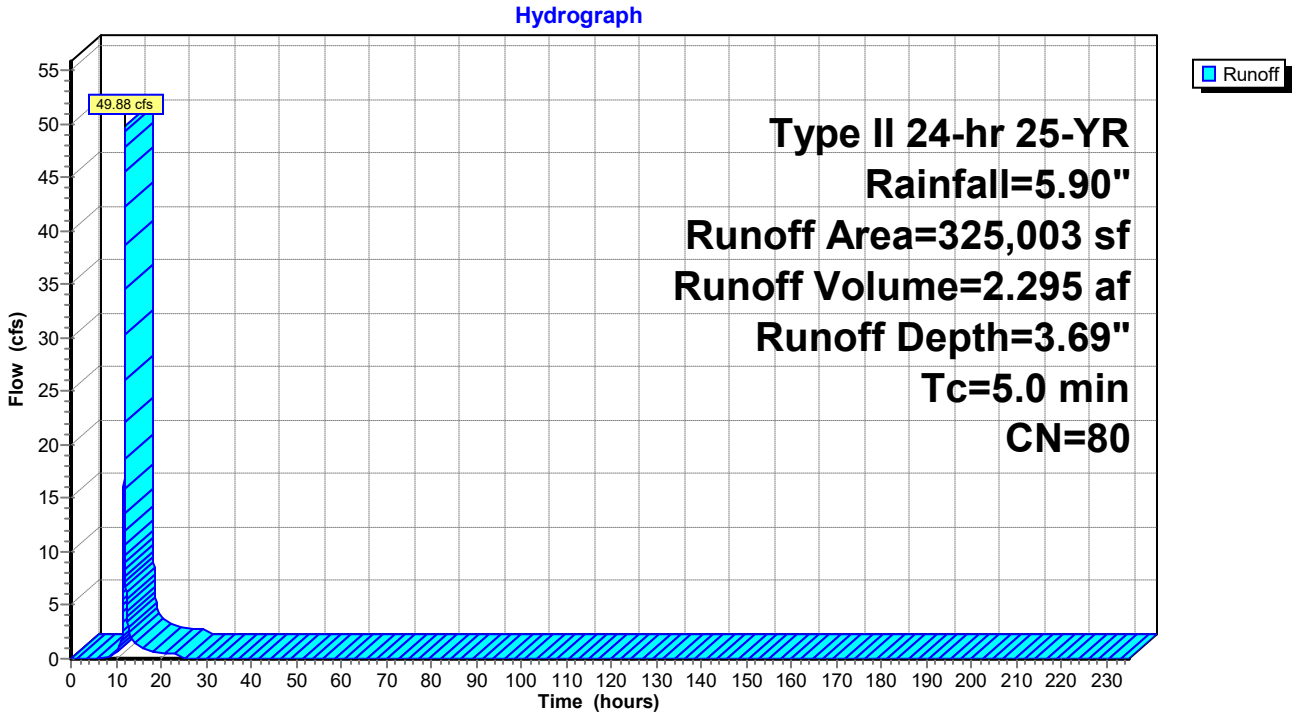
Runoff = 49.88 cfs @ 11.96 hrs, Volume= 2.295 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
7,956	98	Paved parking & roofs
317,047	80	>75% Grass cover, Good, HSG D
325,003	80	Weighted Average
317,047		Pervious Area
7,956		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 50S: DC-4 AT SWALE



Summary for Subcatchment 51S: DC-5 AT SWALE

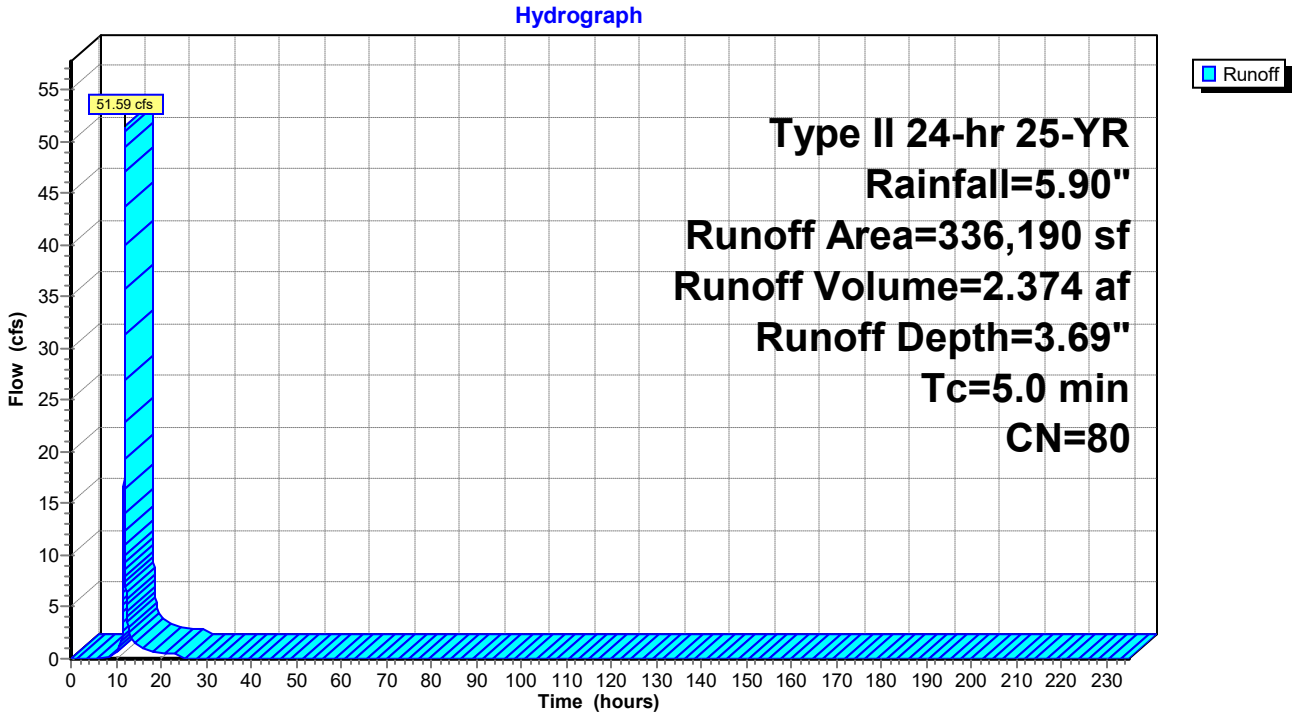
Runoff = 51.59 cfs @ 11.96 hrs, Volume= 2.374 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
8,293	98	Paved parking & roofs
327,897	80	>75% Grass cover, Good, HSG D
336,190	80	Weighted Average
327,897		Pervious Area
8,293		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 51S: DC-5 AT SWALE



Summary for Subcatchment 52S: DC-6 AT SWALE

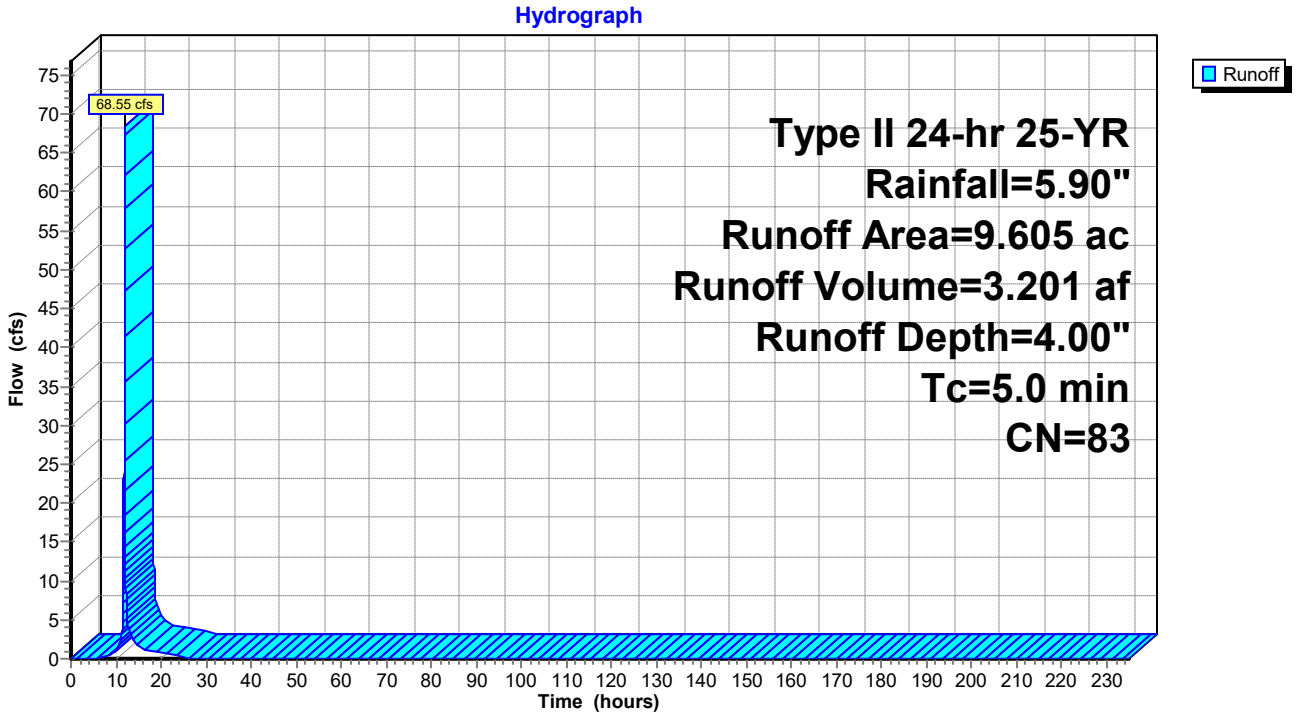
Runoff = 68.55 cfs @ 11.96 hrs, Volume= 3.201 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
1.339	98	Paved parking & roofs
8.266	80	>75% Grass cover, Good, HSG D
9.605	83	Weighted Average
8.266		Pervious Area
1.339		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 52S: DC-6 AT SWALE



Summary for Subcatchment 53S: DC-7 AT SWALE

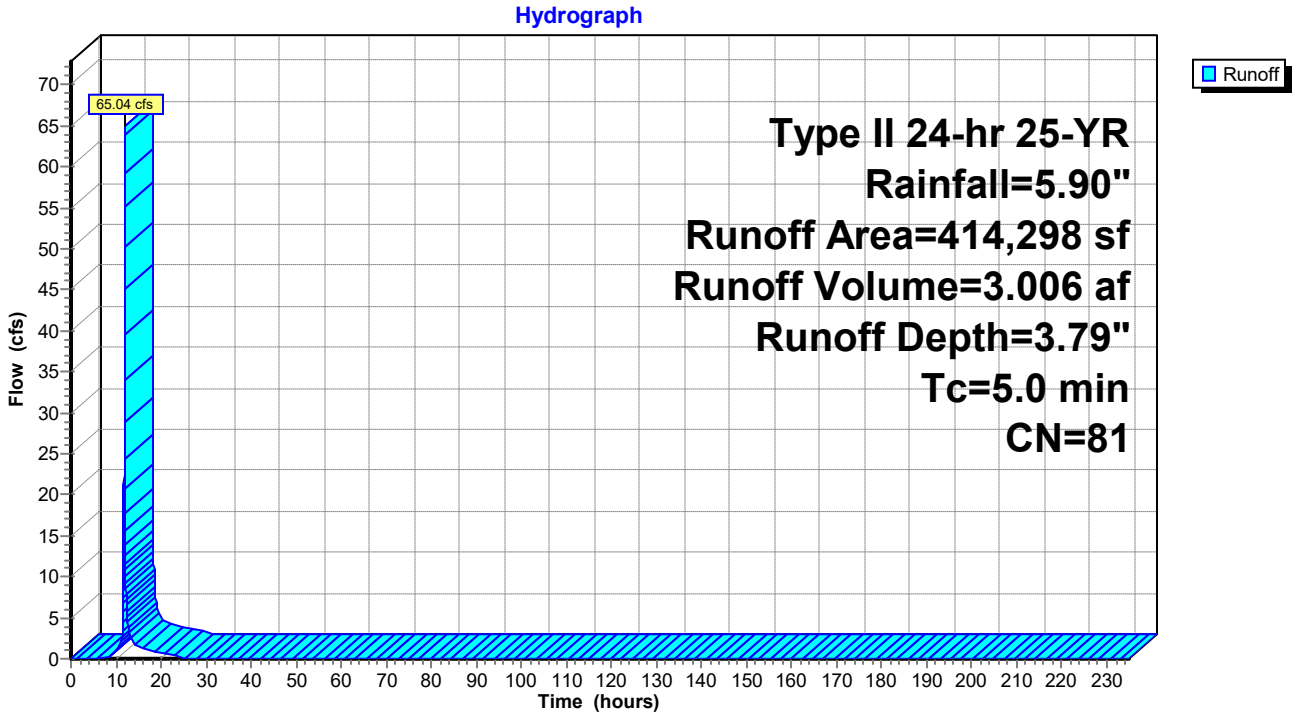
Runoff = 65.04 cfs @ 11.96 hrs, Volume= 3.006 af, Depth= 3.79"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
21,376	98	Paved parking & roofs
392,922	80	>75% Grass cover, Good, HSG D
414,298	81	Weighted Average
392,922		Pervious Area
21,376		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 53S: DC-7 AT SWALE



Summary for Subcatchment 54S: DC-8 AT SWALE

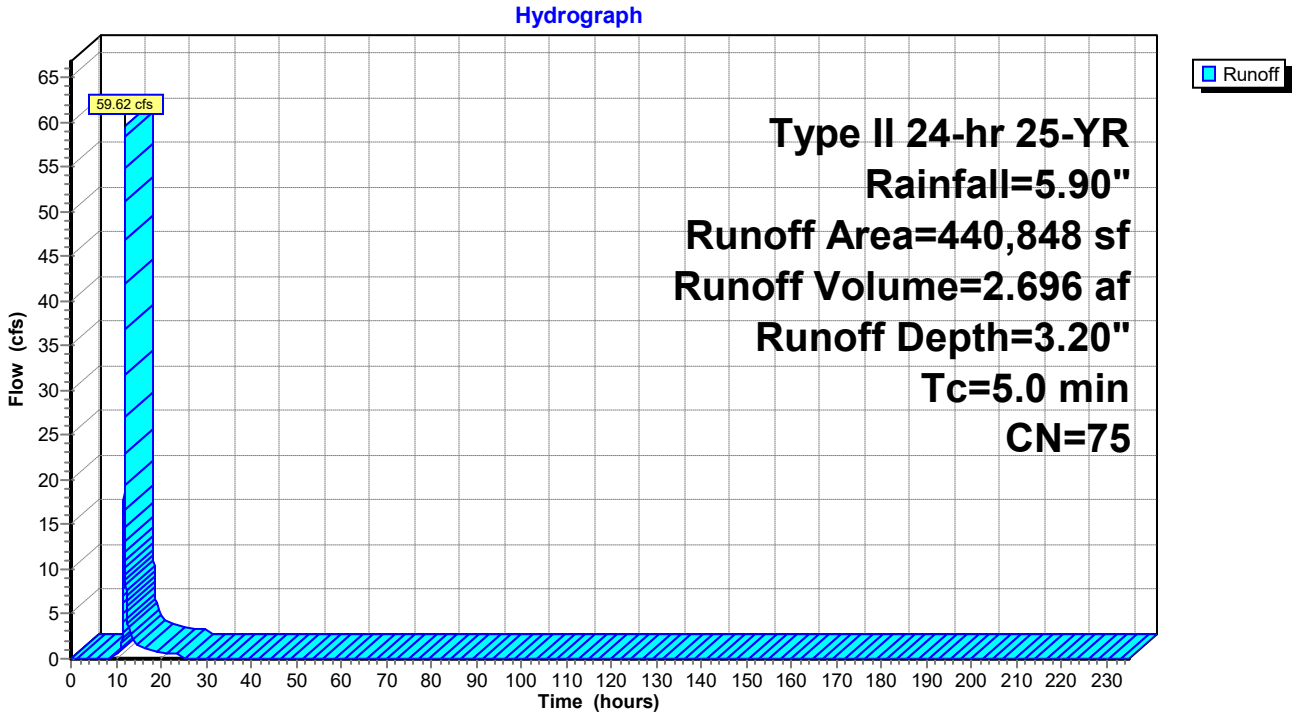
Runoff = 59.62 cfs @ 11.96 hrs, Volume= 2.696 af, Depth= 3.20"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
23,312	98	Paved parking & roofs
417,536	74	>75% Grass cover, Good, HSG C
440,848	75	Weighted Average
417,536		Pervious Area
23,312		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 54S: DC-8 AT SWALE



Summary for Subcatchment 55S: DC-9 AT SWALE

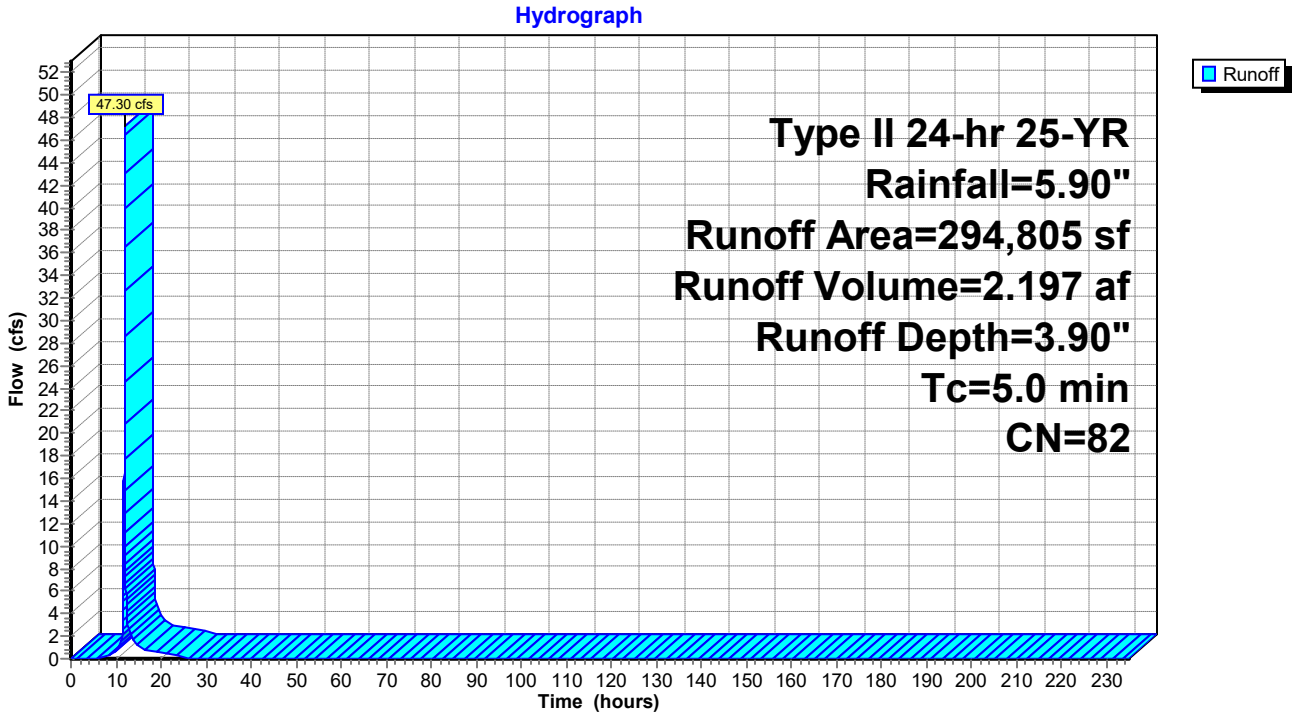
Runoff = 47.30 cfs @ 11.96 hrs, Volume= 2.197 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
29,366	98	Paved parking & roofs
265,439	80	>75% Grass cover, Good, HSG D
294,805	82	Weighted Average
265,439		Pervious Area
29,366		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 55S: DC-9 AT SWALE



Summary for Subcatchment 56S: DC-10 AT SWALE

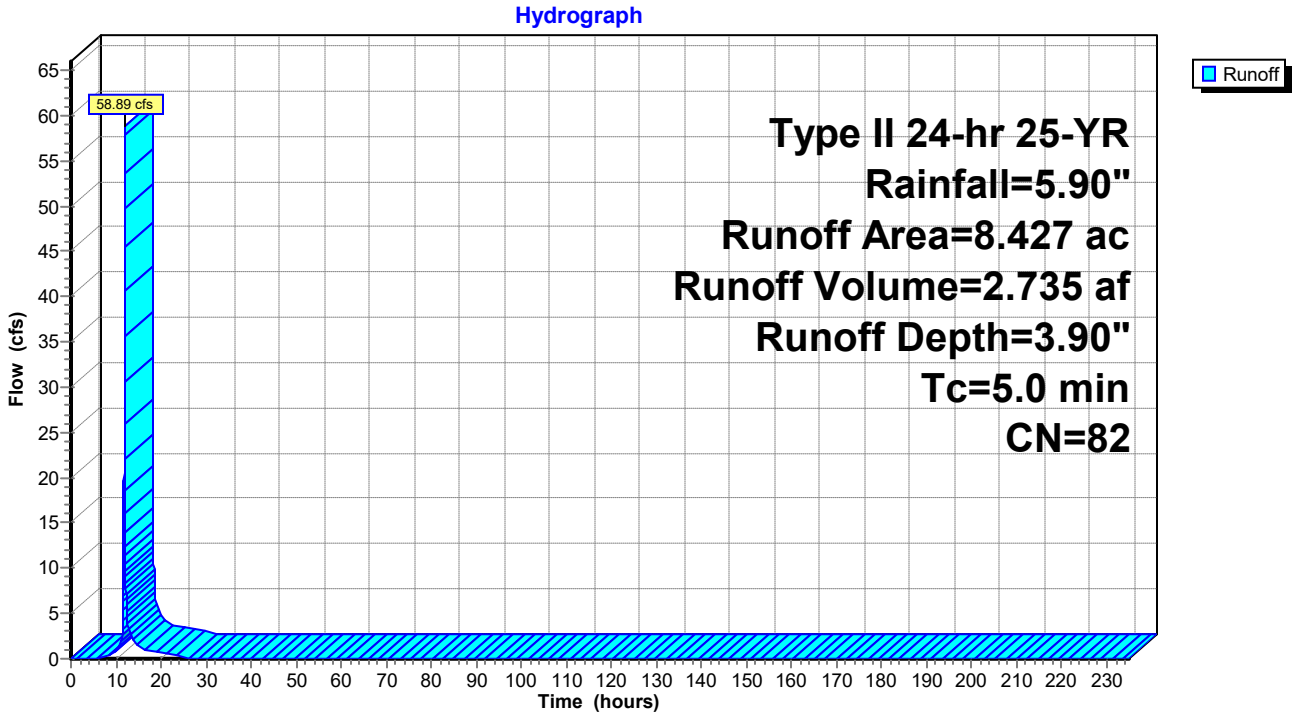
Runoff = 58.89 cfs @ 11.96 hrs, Volume= 2.735 af, Depth= 3.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
0.707	98	Paved parking & roofs
7.720	80	>75% Grass cover, Good, HSG D
8.427	82	Weighted Average
7.720		Pervious Area
0.707		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 56S: DC-10 AT SWALE



Summary for Subcatchment 69S: DA to PC 4A

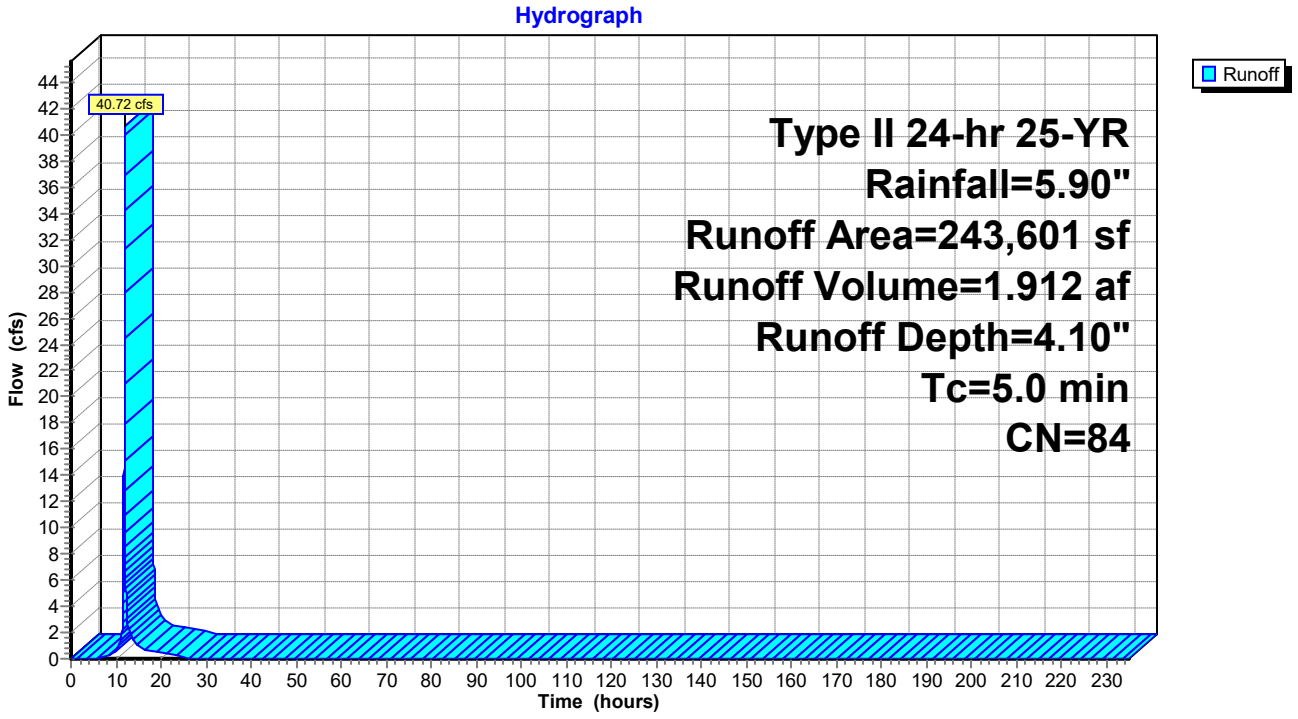
Runoff = 40.72 cfs @ 11.96 hrs, Volume= 1.912 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
53,337	98	Paved parking & roofs
190,264	80	>75% Grass cover, Good, HSG D
243,601	84	Weighted Average
190,264		Pervious Area
53,337		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 69S: DA to PC 4A



Summary for Subcatchment 70S: PC 3A

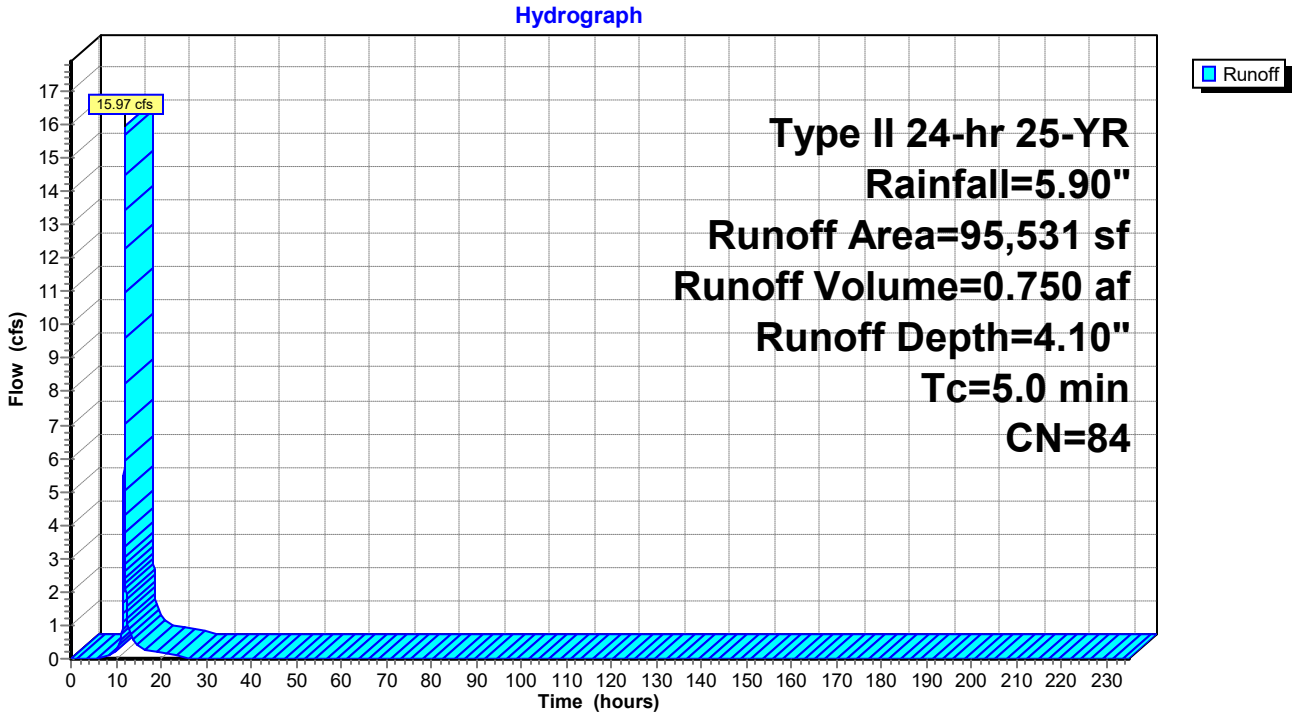
Runoff = 15.97 cfs @ 11.96 hrs, Volume= 0.750 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
20,880	98	Paved parking & roofs
74,651	80	>75% Grass cover, Good, HSG D
95,531	84	Weighted Average
74,651		Pervious Area
20,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 70S: PC 3A



Summary for Subcatchment 93S: CAP ROAD to DC2

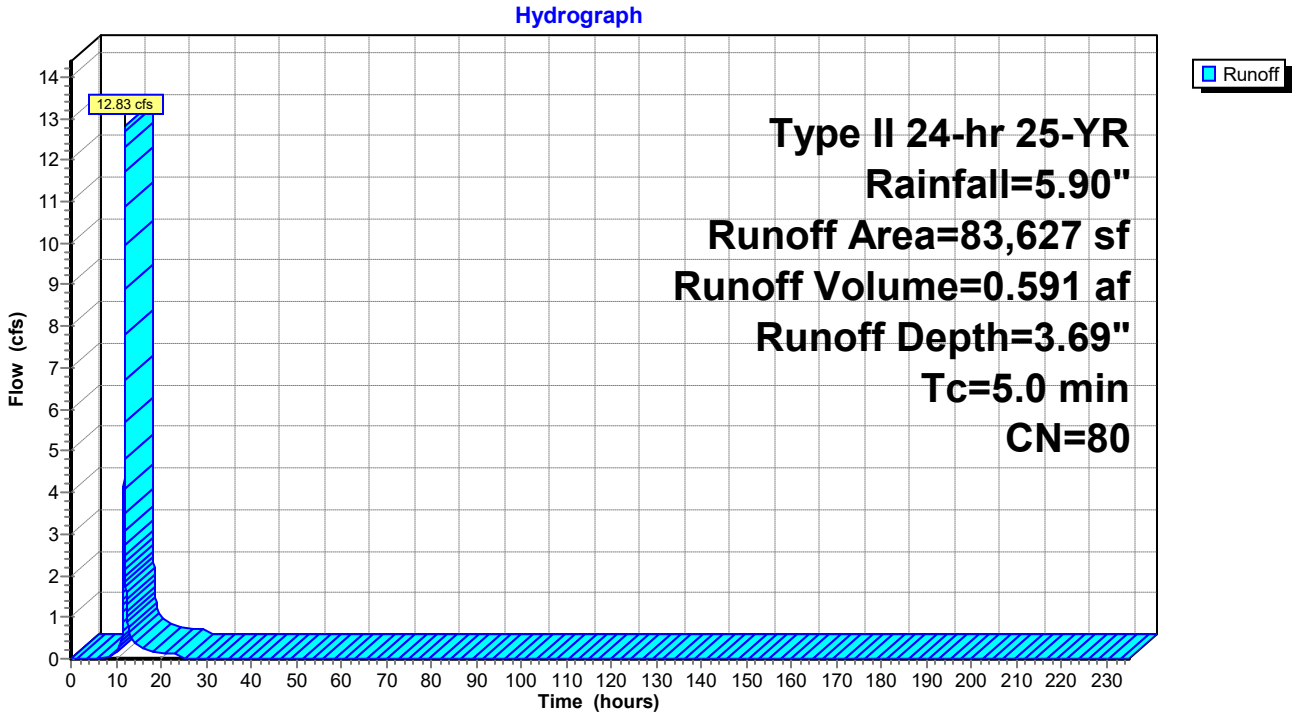
Runoff = 12.83 cfs @ 11.96 hrs, Volume= 0.591 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	63,066	74	FROM APPROVED CALCS
	20,561	98	Paved roads w/curbs & sewers
	83,627	80	Weighted Average
	63,066		Pervious Area
	20,561		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 93S: CAP ROAD to DC2



Summary for Subcatchment 94S: AREA TO SWALE 2

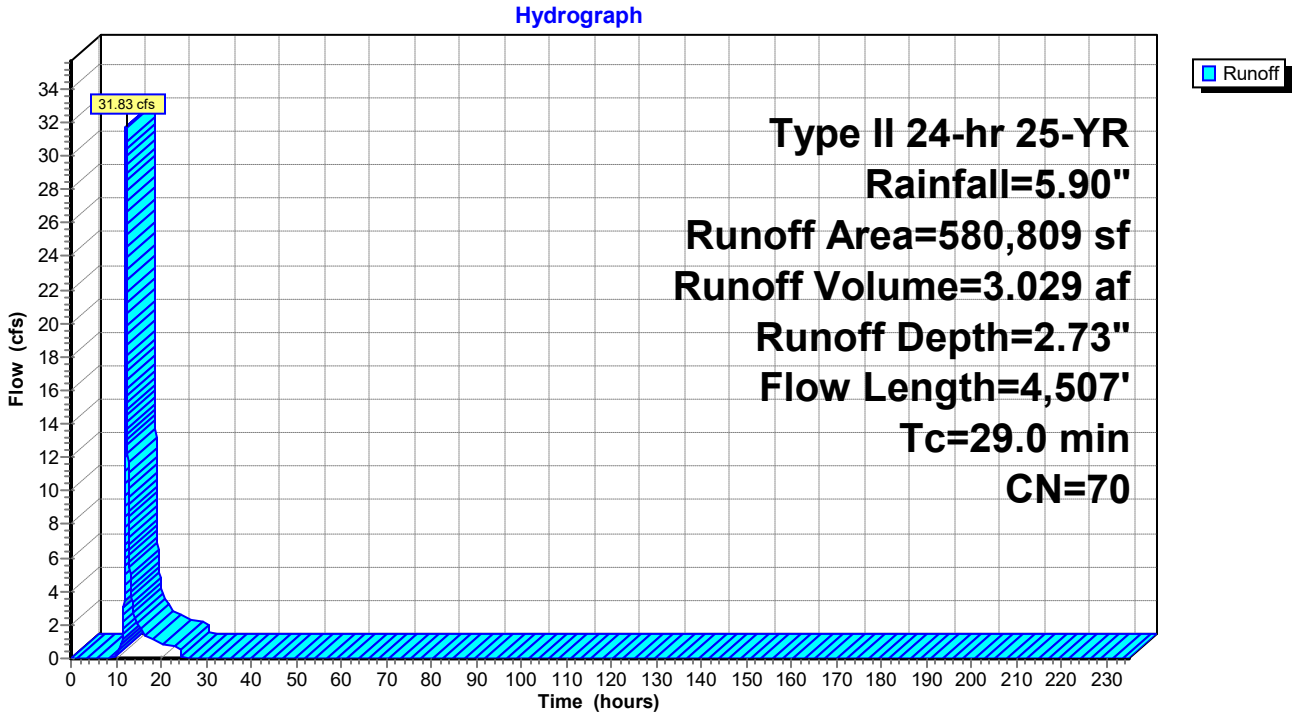
Runoff = 31.83 cfs @ 12.24 hrs, Volume= 3.029 af, Depth= 2.73"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	23,760	30	Woods, Good, HSG A
	29,120	70	Woods, Good, HSG C
*	113,835	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	272,732	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	12,155	80	>75% Grass cover, Good, HSG D (ONSITE D)
	33,629	30	Woods, Good, HSG A
	31,887	77	Woods, Good, HSG D
*	63,691	76	RA ZONING C SOILS
	580,809	70	Weighted Average
	580,809		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.6	120	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	27	0.3000	8.82		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	250	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
20.0	4,010	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
29.0	4,507	Total			

Subcatchment 94S: AREA TO SWALE 2



Summary for Subcatchment 95S: Upslope Area of PC3D

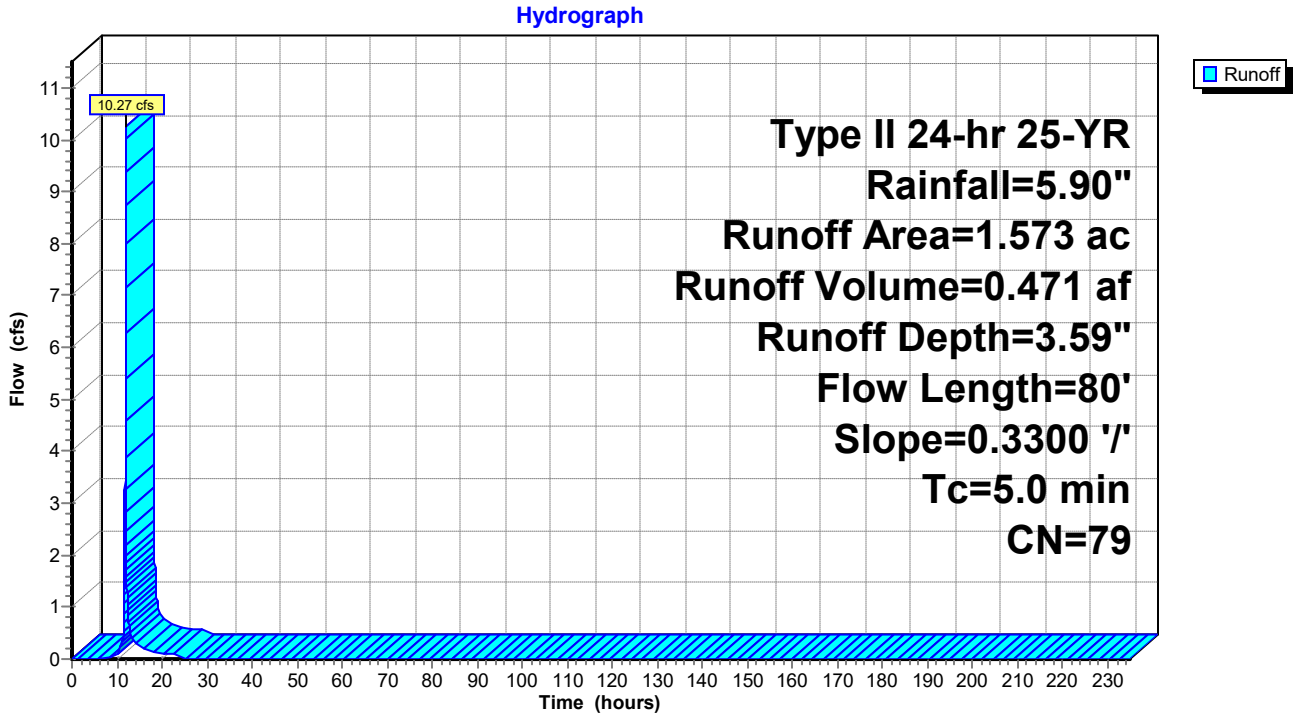
Runoff = 10.27 cfs @ 11.96 hrs, Volume= 0.471 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
1.240	74	>75% Grass cover, Good, HSG C
0.333	98	Paved parking & roofs
1.573	79	Weighted Average
1.240		Pervious Area
0.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, PErimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 95S: Upslope Area of PC3D



Summary for Subcatchment 96S: Upslope Area of PC3E

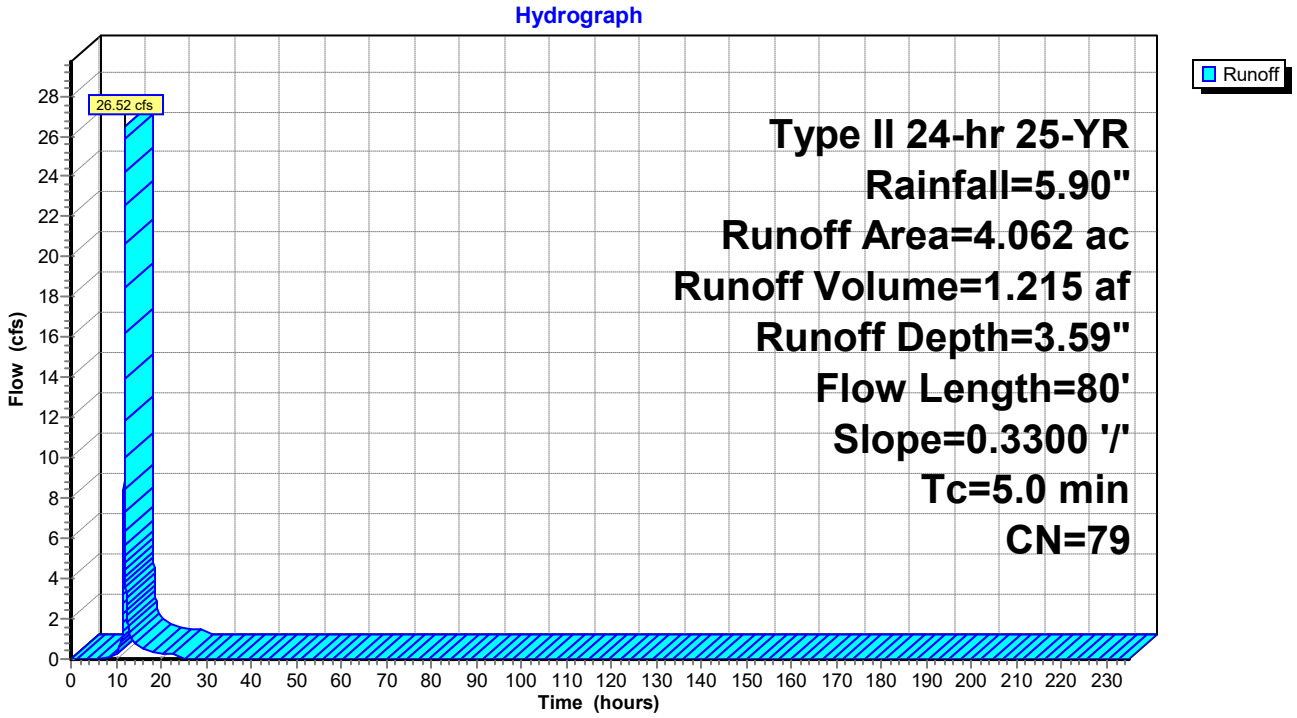
Runoff = 26.52 cfs @ 11.96 hrs, Volume= 1.215 af, Depth= 3.59"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
3.265	74	>75% Grass cover, Good, HSG C
0.797	98	Paved parking & roofs
4.062	79	Weighted Average
3.265		Pervious Area
0.797		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, Perimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 96S: Upslope Area of PC3E



Summary for Subcatchment 106S: AREA TO DS-10 CULVERT

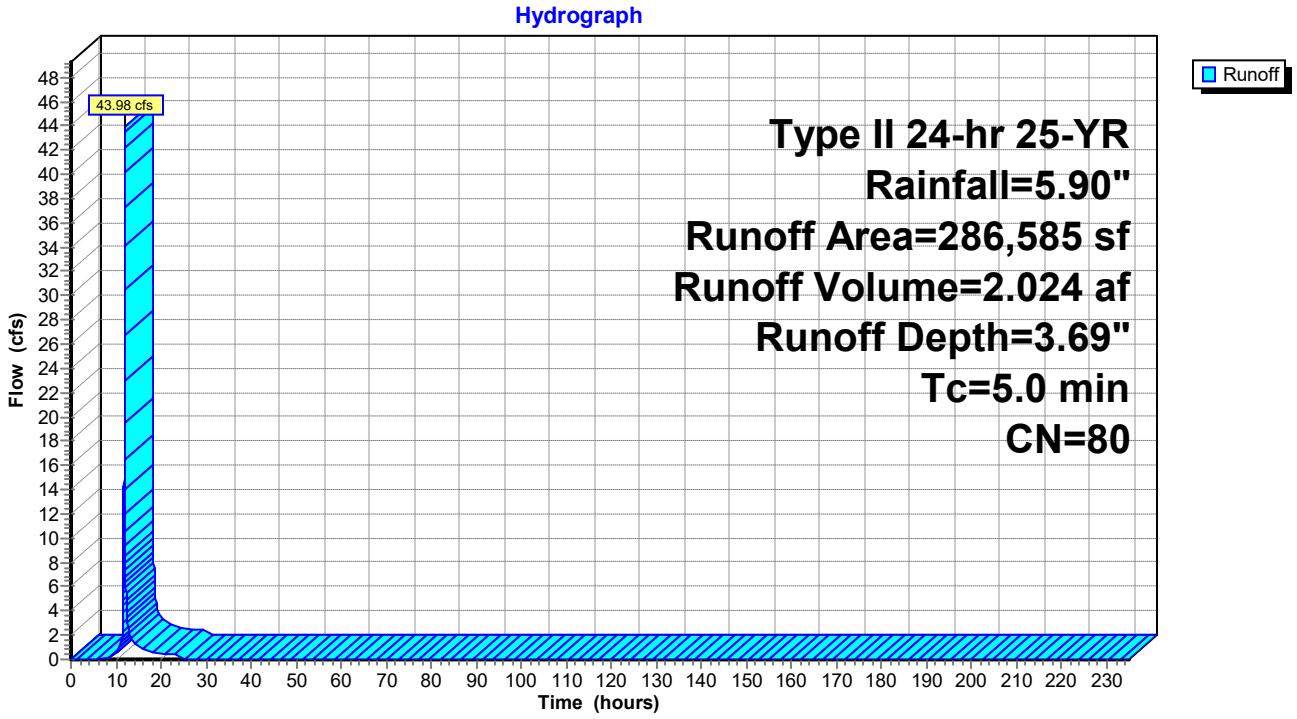
Runoff = 43.98 cfs @ 11.96 hrs, Volume= 2.024 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
286,585	80	>75% Grass cover, Good, HSG D
286,585		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 106S: AREA TO DS-10 CULVERT



Summary for Subcatchment 107S: DA TO PC 5

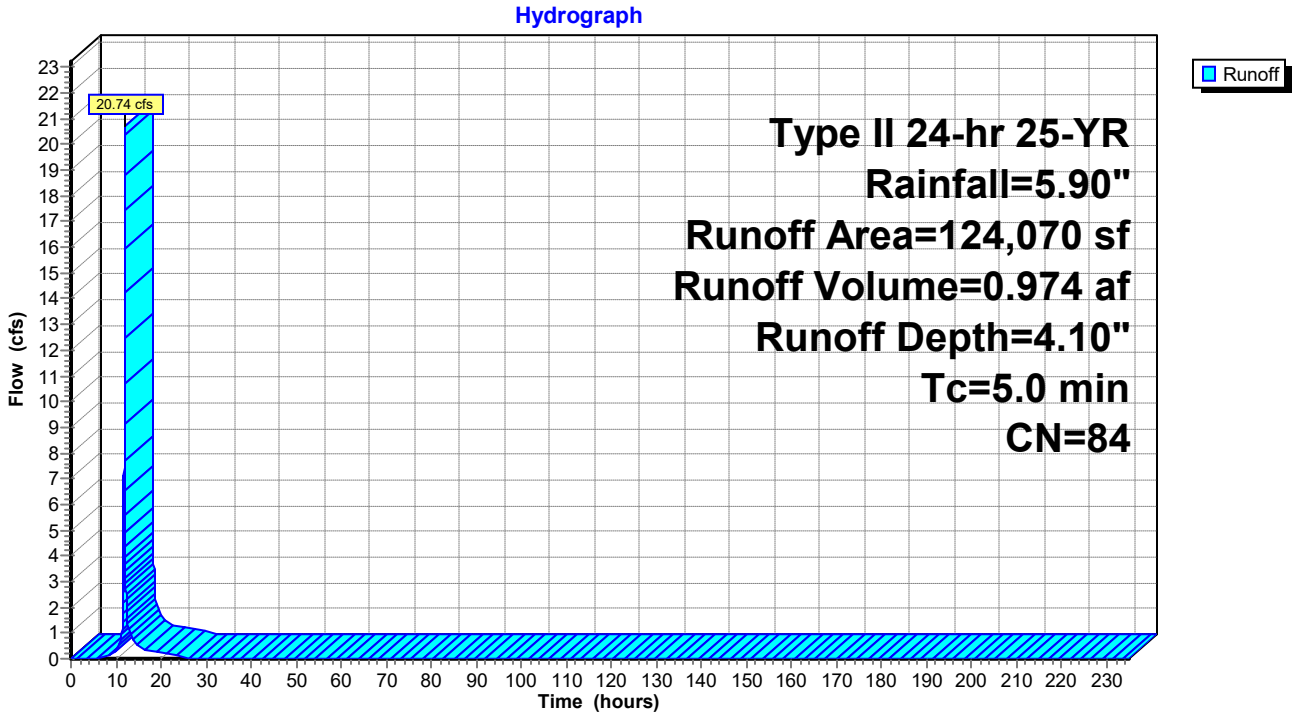
Runoff = 20.74 cfs @ 11.96 hrs, Volume= 0.974 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	27,657	98	PERIMETER ROAD
	96,413	80	>75% Grass cover, Good, HSG D
	124,070	84	Weighted Average
	96,413		Pervious Area
	27,657		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 107S: DA TO PC 5

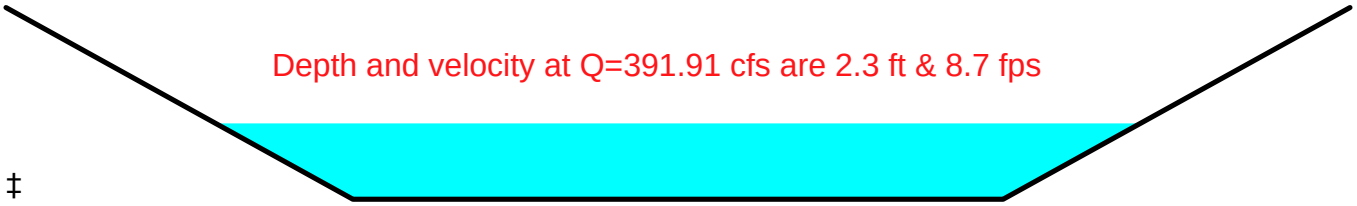


Summary for Reach 89R: PC 4G

Inflow Area = 50.453 ac, 9.47% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = ~~347.91~~ cfs @ 11.96 hrs, Volume= 16.177 af
Outflow = ~~340.56~~ cfs @ 11.98 hrs, Volume= 16.177 af, Atten= 2%, Lag= 0.9 min
391.1 (assume no attenuation)
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 11.82 fps, Min. Travel Time= 1.4 min
Avg. Velocity = 2.47 fps, Avg. Travel Time= 6.7 min

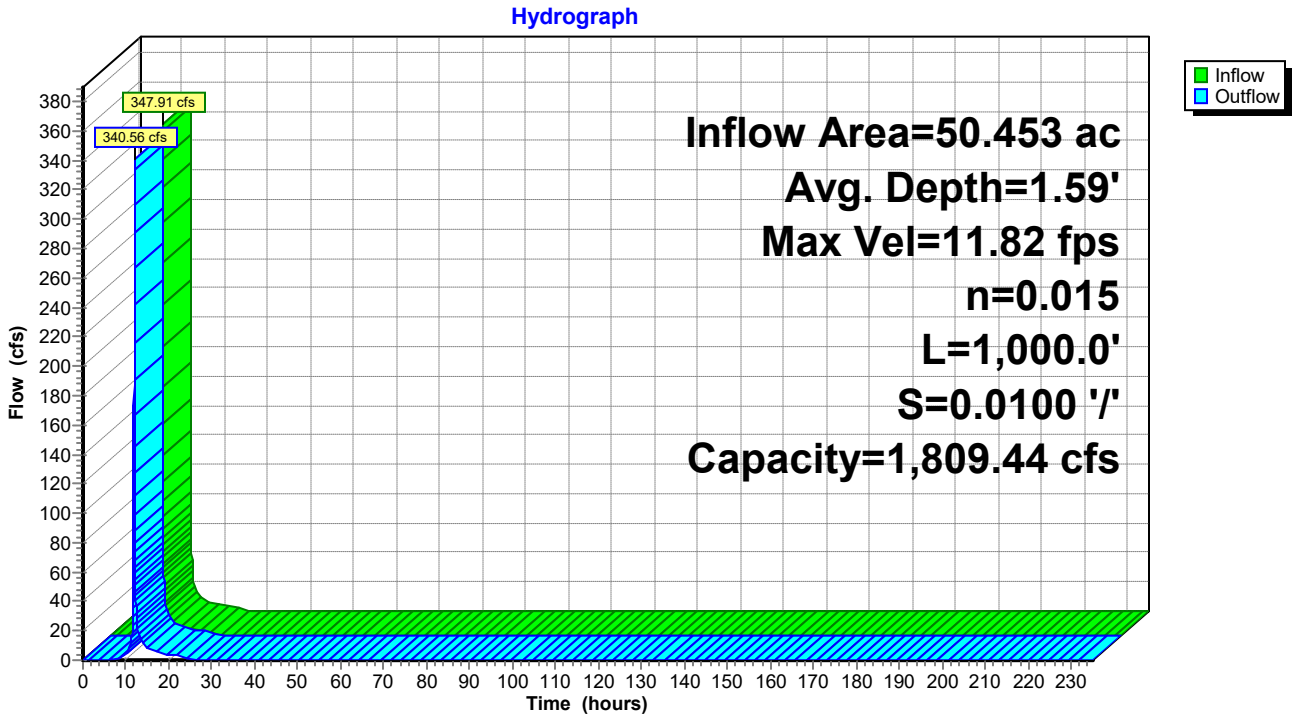
Peak Storage= 28,801 cf @ 11.98 hrs, Average Depth at Peak Storage= 1.59'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,809.44 cfs

15.00' x 4.00' deep channel, n= 0.015
Side Slope Z-value= 2.0 '/' Top Width= 31.00'
Length= 1,000.0' Slope= 0.0100 '/'
Inlet Invert= 90.00', Outlet Invert= 80.00'



‡

Reach 89R: PC 4G



Summary for Reach 95R: DC-1

Inflow Area = 8.371 ac, 21.28% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 60.95 cfs @ 11.96 hrs, Volume= 2.862 af
Outflow = 60.41 cfs @ 11.97 hrs, Volume= 2.862 af, Atten= 1%, Lag= 0.6 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.60 fps, Min. Travel Time= 0.9 min
Avg. Velocity = 2.94 fps, Avg. Travel Time= 4.5 min

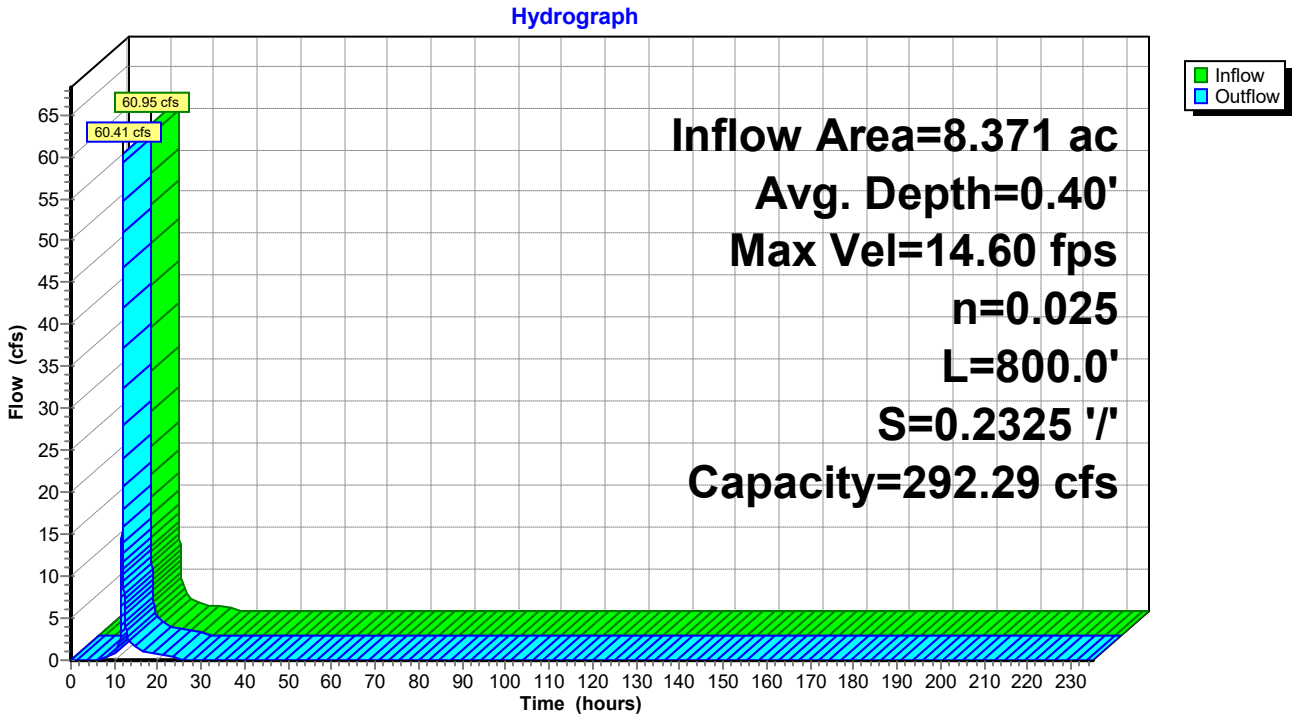
Peak Storage= 3,310 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 292.29 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 800.0' Slope= 0.2325 '/'
Inlet Invert= 264.00', Outlet Invert= 78.00'



‡

Reach 95R: DC-1



Summary for Reach 96R: DC-2

Inflow Area = 9.699 ac, 13.72% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = 67.20 cfs @ 11.96 hrs, Volume= 3.116 af
Outflow = 66.91 cfs @ 11.97 hrs, Volume= 3.116 af, Atten= 0%, Lag= 0.4 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.19 fps, Min. Travel Time= 0.6 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 3.0 min

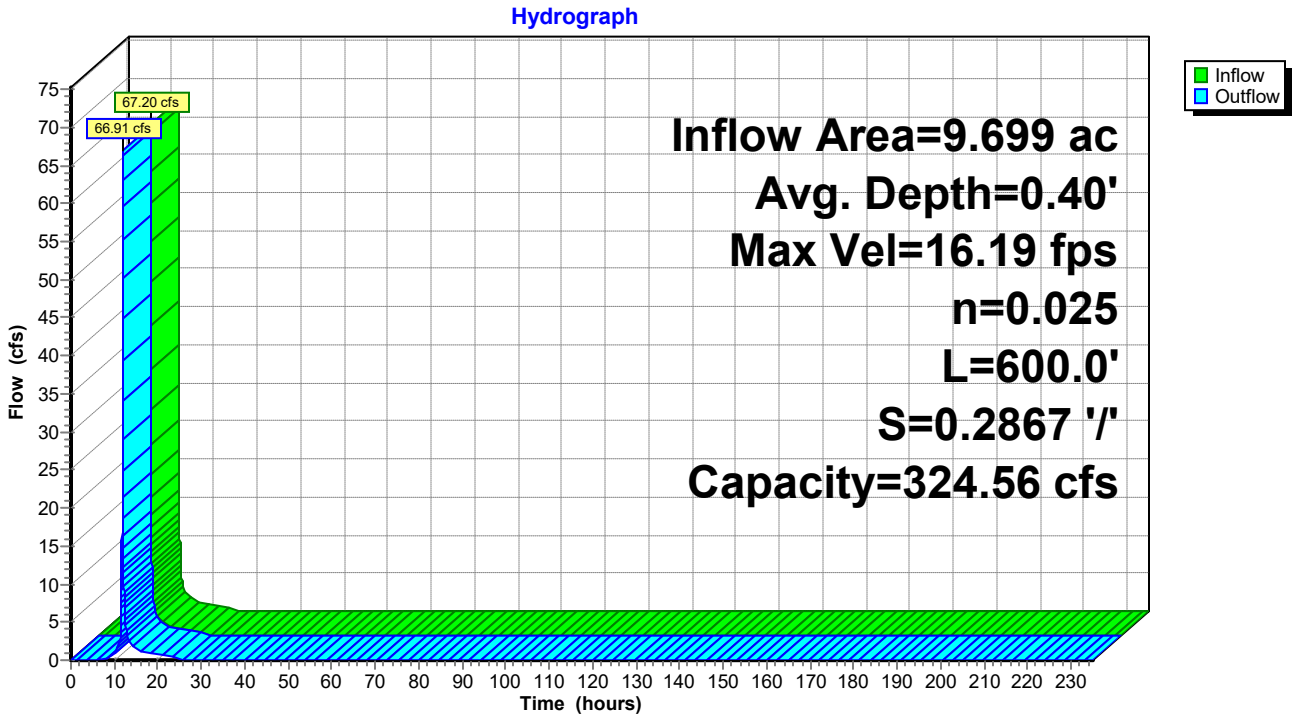
Peak Storage= 2,478 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.40'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 324.56 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 600.0' Slope= 0.2867 '/'
Inlet Invert= 264.00', Outlet Invert= 92.00'



‡

Reach 96R: DC-2



Summary for Reach 97R: DC-3

Inflow Area = 10.378 ac, 4.90% Impervious, Inflow Depth = 3.79" for 25-YR event
Inflow = 70.96 cfs @ 11.96 hrs, Volume= 3.280 af
Outflow = 70.77 cfs @ 11.96 hrs, Volume= 3.280 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.55 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.43 fps, Avg. Travel Time= 2.3 min

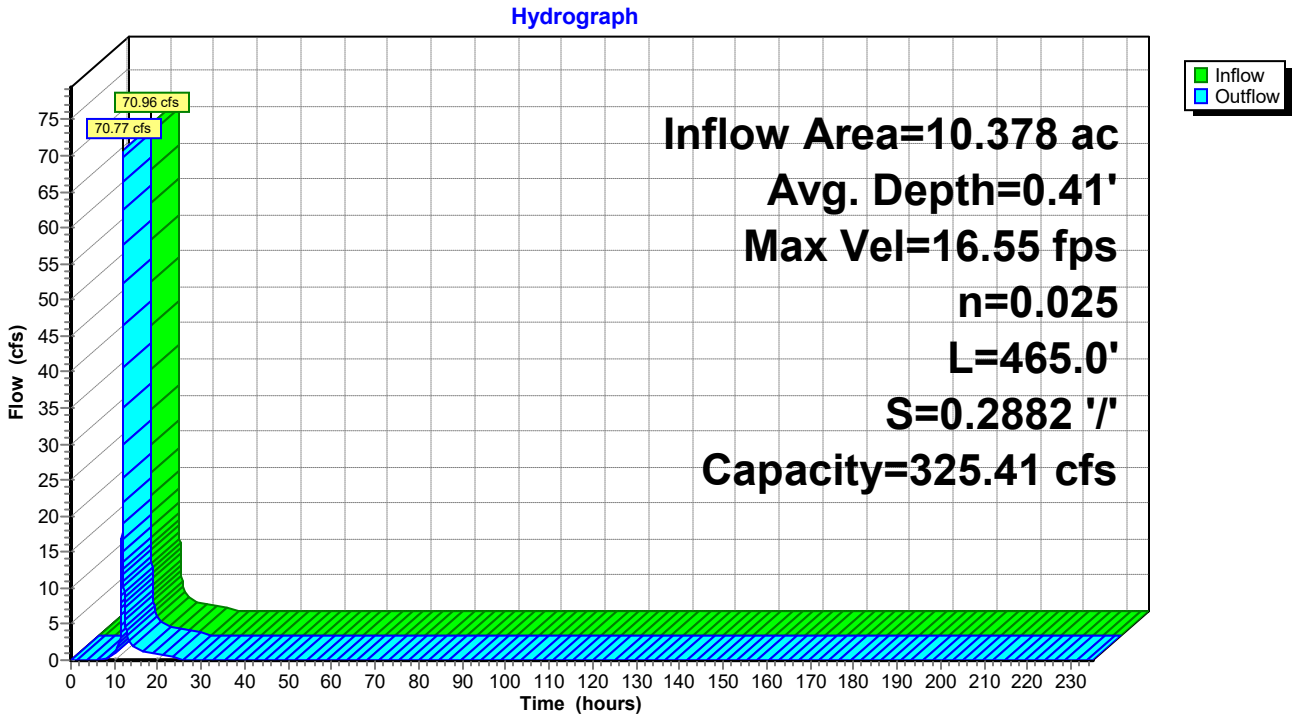
Peak Storage= 1,988 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.41 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 465.0' Slope= 0.2882 '/'
Inlet Invert= 264.00', Outlet Invert= 130.00'



‡

Reach 97R: DC-3



Summary for Reach 98R: DC-4

Inflow Area = 7.461 ac, 2.45% Impervious, Inflow Depth = 3.69" for 25-YR event
Inflow = 49.88 cfs @ 11.96 hrs, Volume= 2.295 af
Outflow = 49.75 cfs @ 11.97 hrs, Volume= 2.295 af, Atten= 0%, Lag= 0.3 min

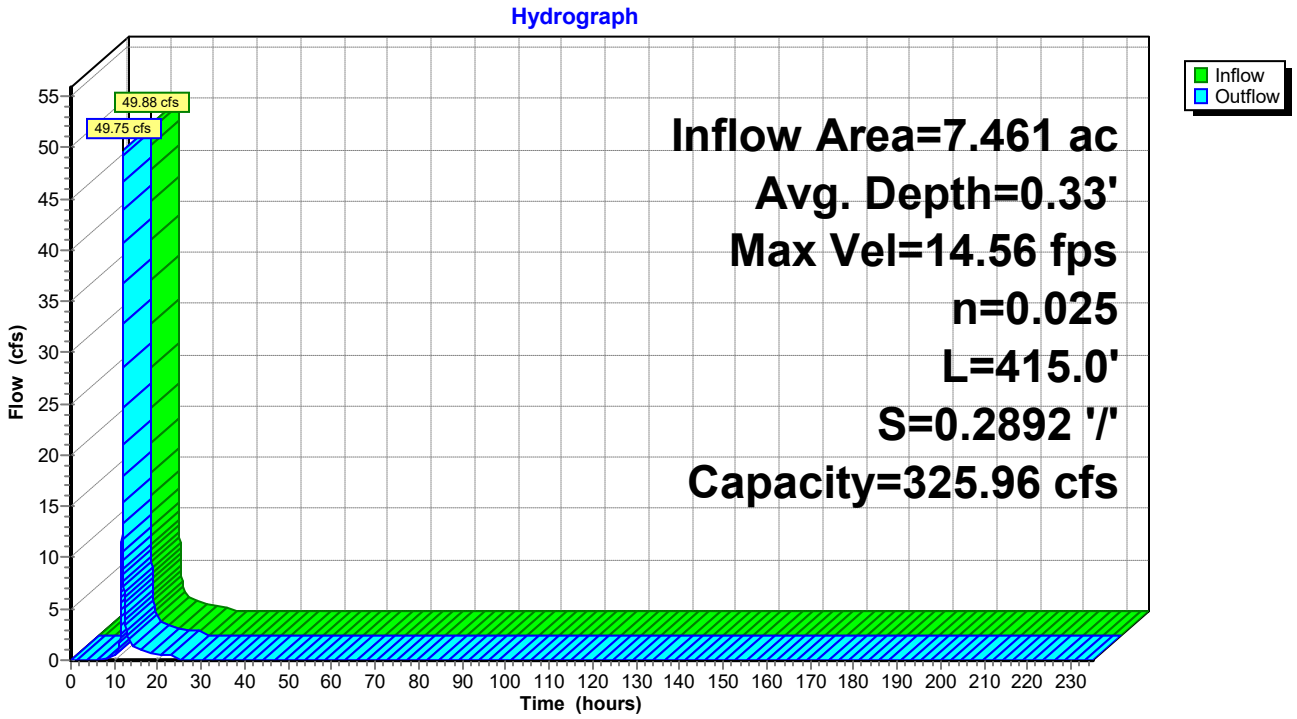
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.56 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.03 fps, Avg. Travel Time= 2.3 min

Peak Storage= 1,417 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.96 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 415.0' Slope= 0.2892 '/'
Inlet Invert= 264.00', Outlet Invert= 144.00'



‡



Summary for Reach 99R: DC-5

Inflow Area = 7.718 ac, 2.47% Impervious, Inflow Depth = 3.69" for 25-YR event
Inflow = 51.59 cfs @ 11.96 hrs, Volume= 2.374 af
Outflow = 51.47 cfs @ 11.96 hrs, Volume= 2.374 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 14.84 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.09 fps, Avg. Travel Time= 2.1 min

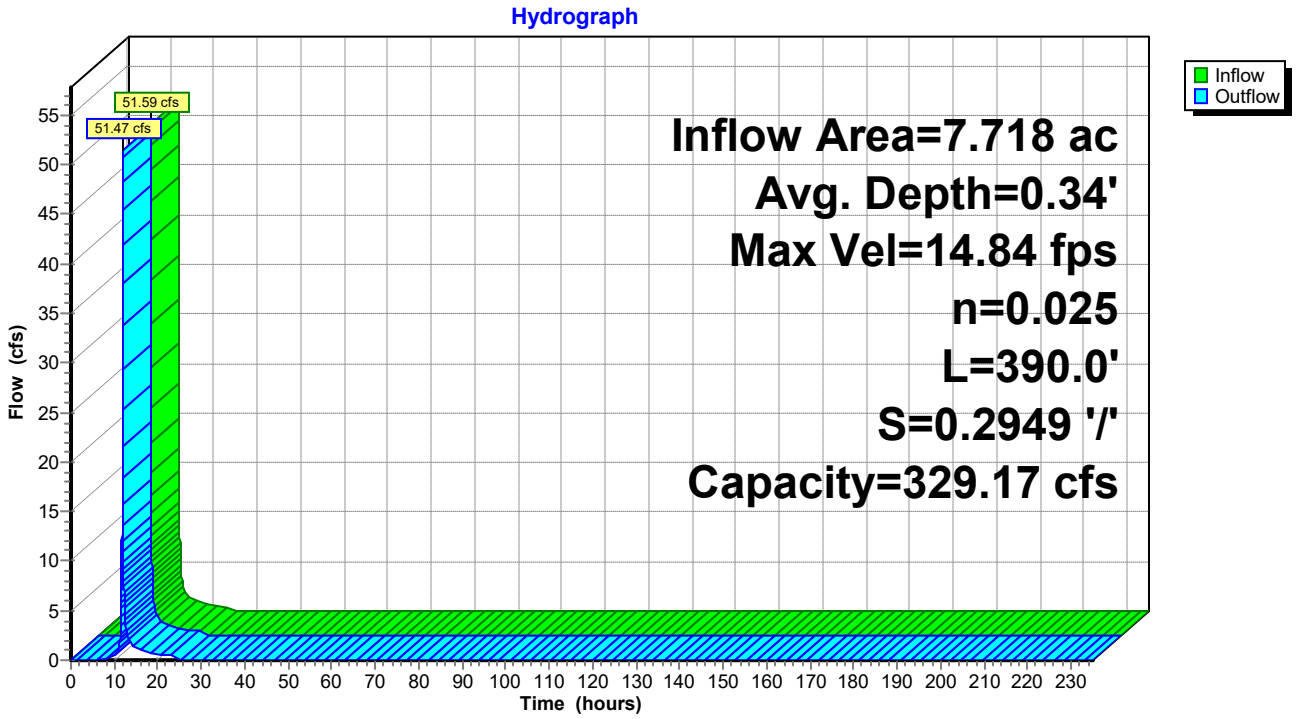
Peak Storage= 1,352 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.34'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 329.17 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2949 '/'
Inlet Invert= 264.00', Outlet Invert= 149.00'



‡

Reach 99R: DC-5



Summary for Reach 100R: DC-6

Inflow Area = 9.605 ac, 13.94% Impervious, Inflow Depth = 4.00" for 25-YR event
Inflow = 68.55 cfs @ 11.96 hrs, Volume= 3.201 af
Outflow = 68.47 cfs @ 11.96 hrs, Volume= 3.201 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.05 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.31 fps, Avg. Travel Time= 1.4 min

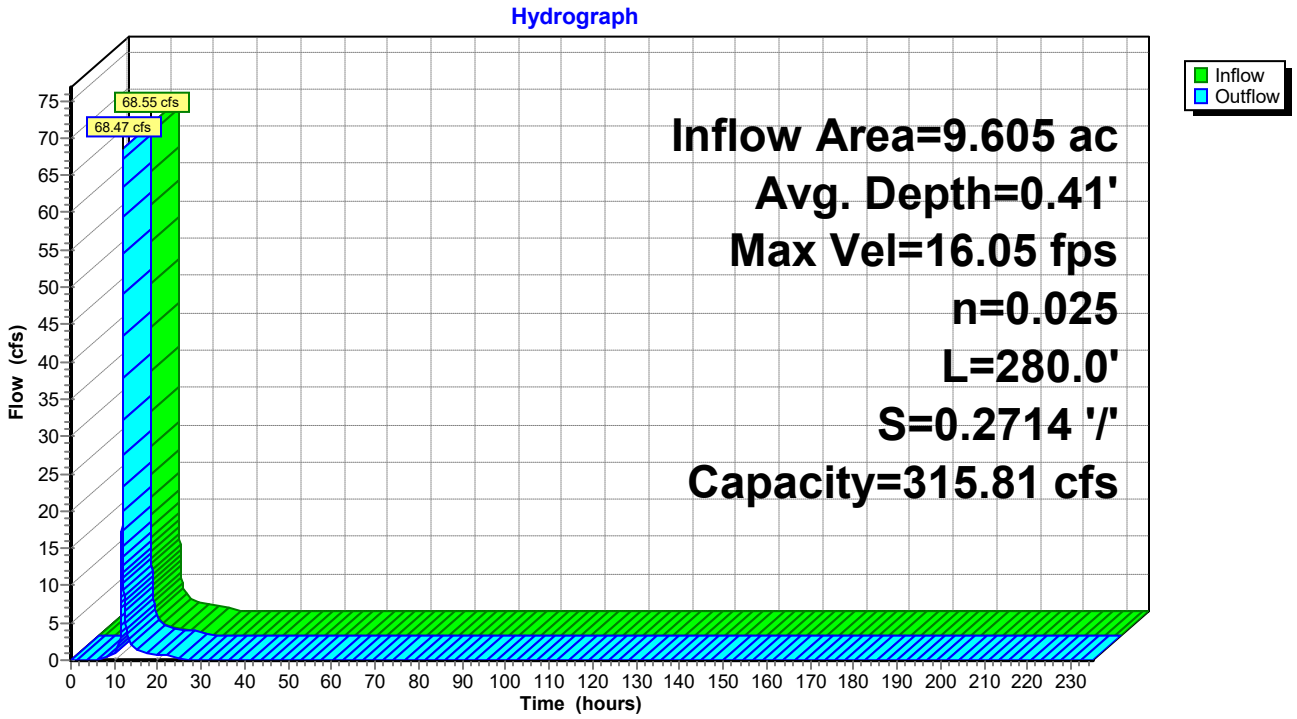
Peak Storage= 1,194 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.81 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 280.0' Slope= 0.2714 '/'
Inlet Invert= 230.00', Outlet Invert= 154.00'



‡

Reach 100R: DC-6



Summary for Reach 101R: DC-7

Inflow Area = 9.511 ac, 5.16% Impervious, Inflow Depth = 3.79" for 25-YR event
Inflow = 65.04 cfs @ 11.96 hrs, Volume= 3.006 af
Outflow = 64.90 cfs @ 11.96 hrs, Volume= 3.006 af, Atten= 0%, Lag= 0.3 min

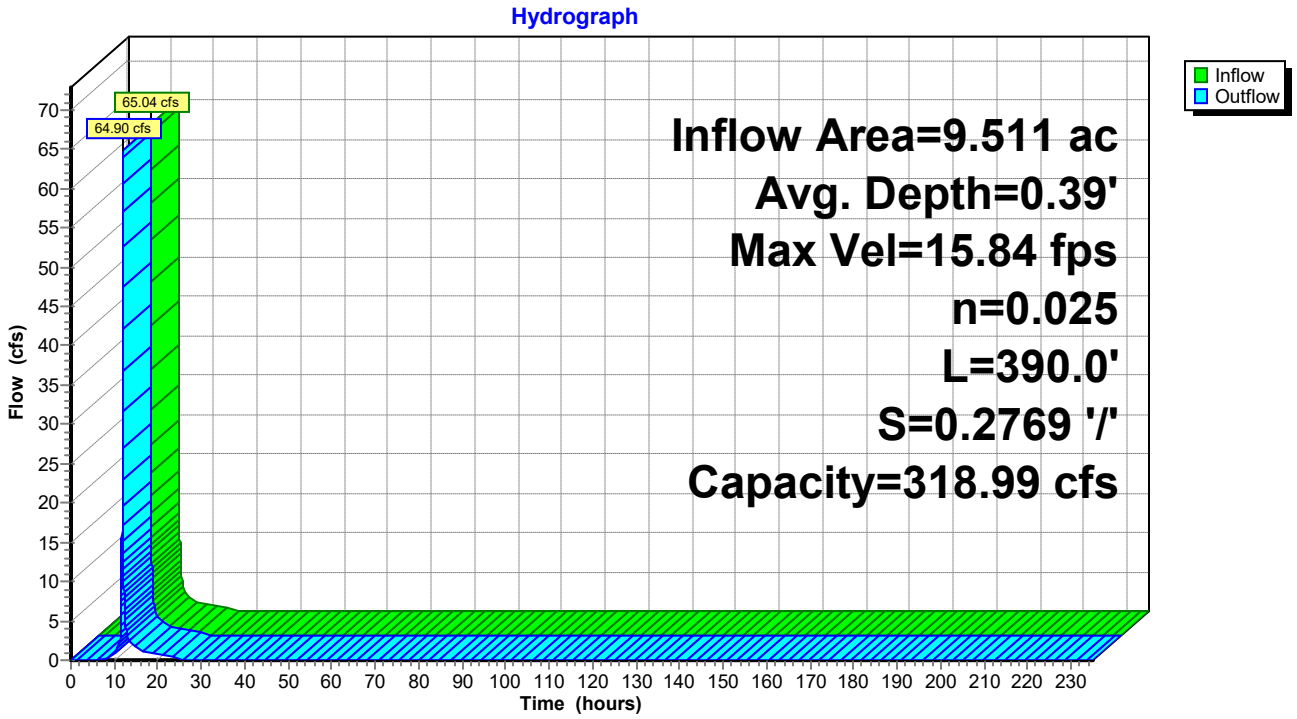
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.84 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.29 fps, Avg. Travel Time= 2.0 min

Peak Storage= 1,598 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.39'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.99 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2769 '/'
Inlet Invert= 266.00', Outlet Invert= 158.00'



‡



Summary for Reach 102R: DC-8

Inflow Area = 10.120 ac, 5.29% Impervious, Inflow Depth = 3.20" for 25-YR event
Inflow = 59.62 cfs @ 11.96 hrs, Volume= 2.696 af
Outflow = 59.47 cfs @ 11.97 hrs, Volume= 2.696 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.34 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.30 fps, Avg. Travel Time= 2.2 min

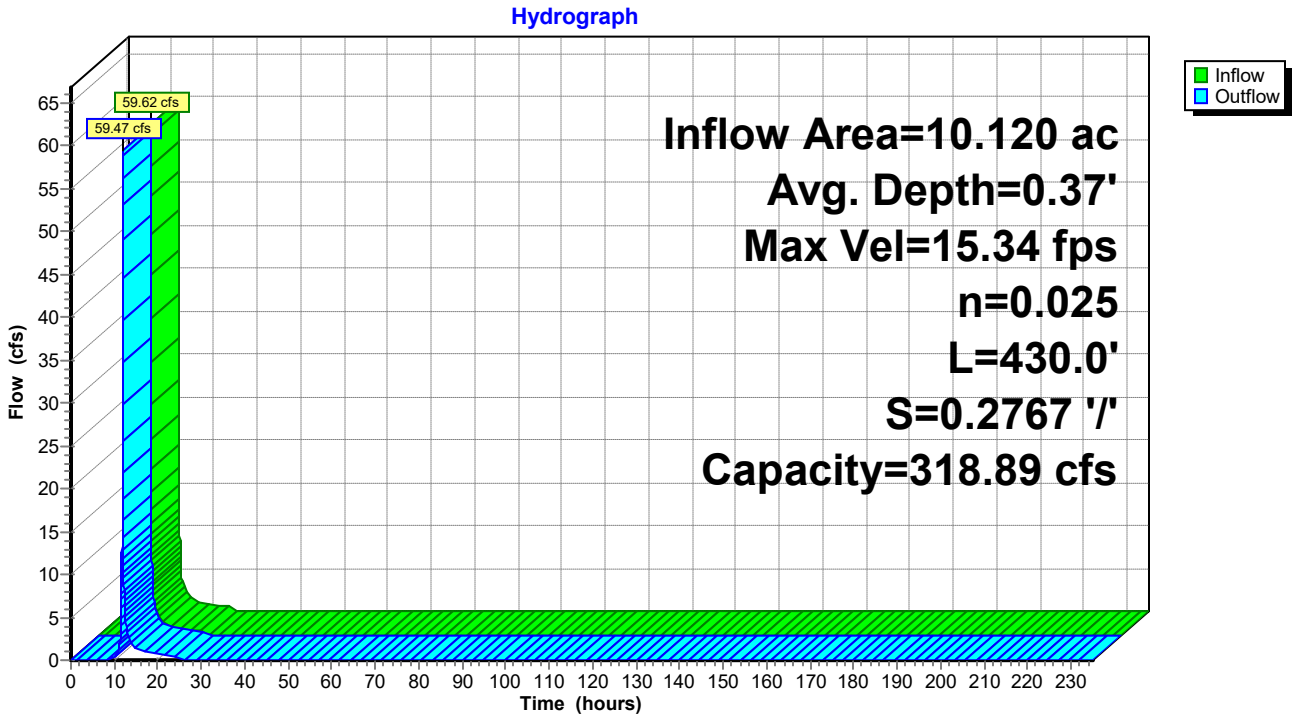
Peak Storage= 1,666 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.89 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 430.0' Slope= 0.2767 '/'
Inlet Invert= 262.00', Outlet Invert= 143.00'



‡

Reach 102R: DC-8



Summary for Reach 103R: DC-9

Inflow Area = 6.768 ac, 9.96% Impervious, Inflow Depth = 3.90" for 25-YR event
Inflow = 47.30 cfs @ 11.96 hrs, Volume= 2.197 af
Outflow = 47.14 cfs @ 11.97 hrs, Volume= 2.197 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.99 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.88 fps, Avg. Travel Time= 2.6 min

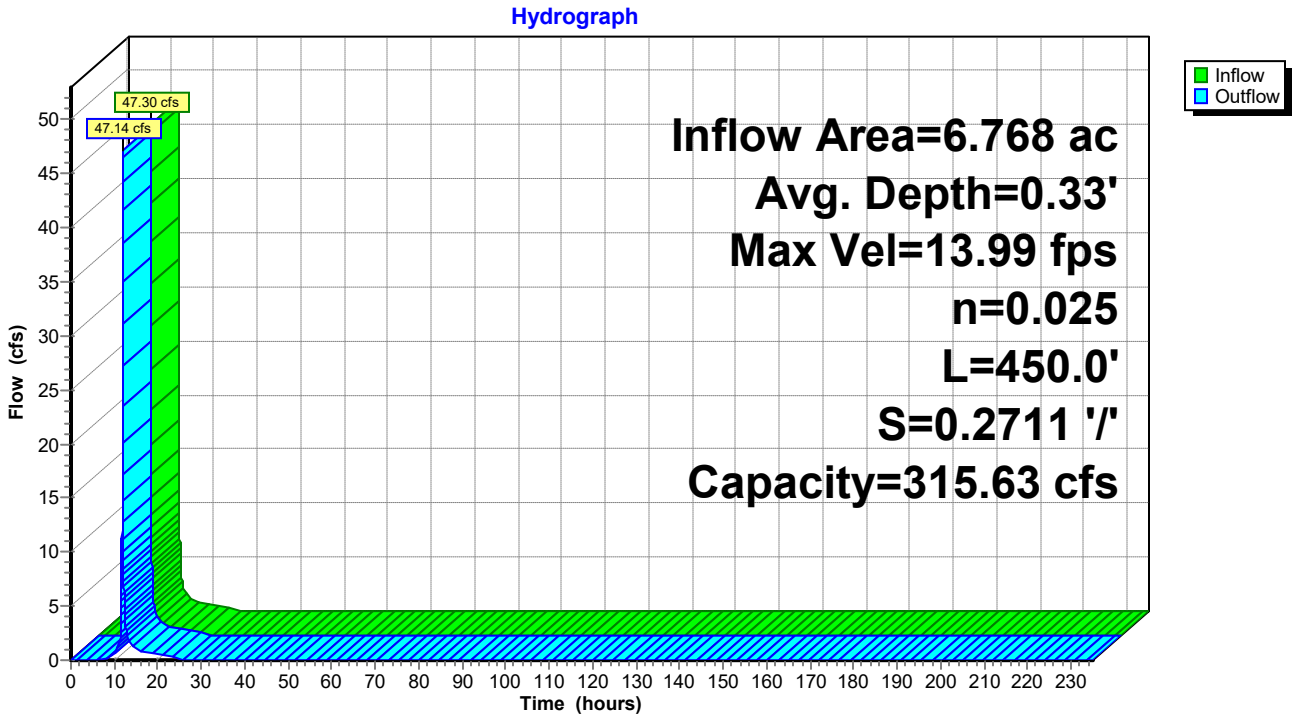
Peak Storage= 1,515 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.33'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.63 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 450.0' Slope= 0.2711 '/'
Inlet Invert= 252.00', Outlet Invert= 130.00'



‡

Reach 103R: DC-9



Summary for Reach 104R: DC-10

Inflow Area = 8.427 ac, 8.39% Impervious, Inflow Depth = 3.90" for 25-YR event
Inflow = 58.89 cfs @ 11.96 hrs, Volume= 2.735 af
Outflow = 58.81 cfs @ 11.96 hrs, Volume= 2.735 af, Atten= 0%, Lag= 0.2 min

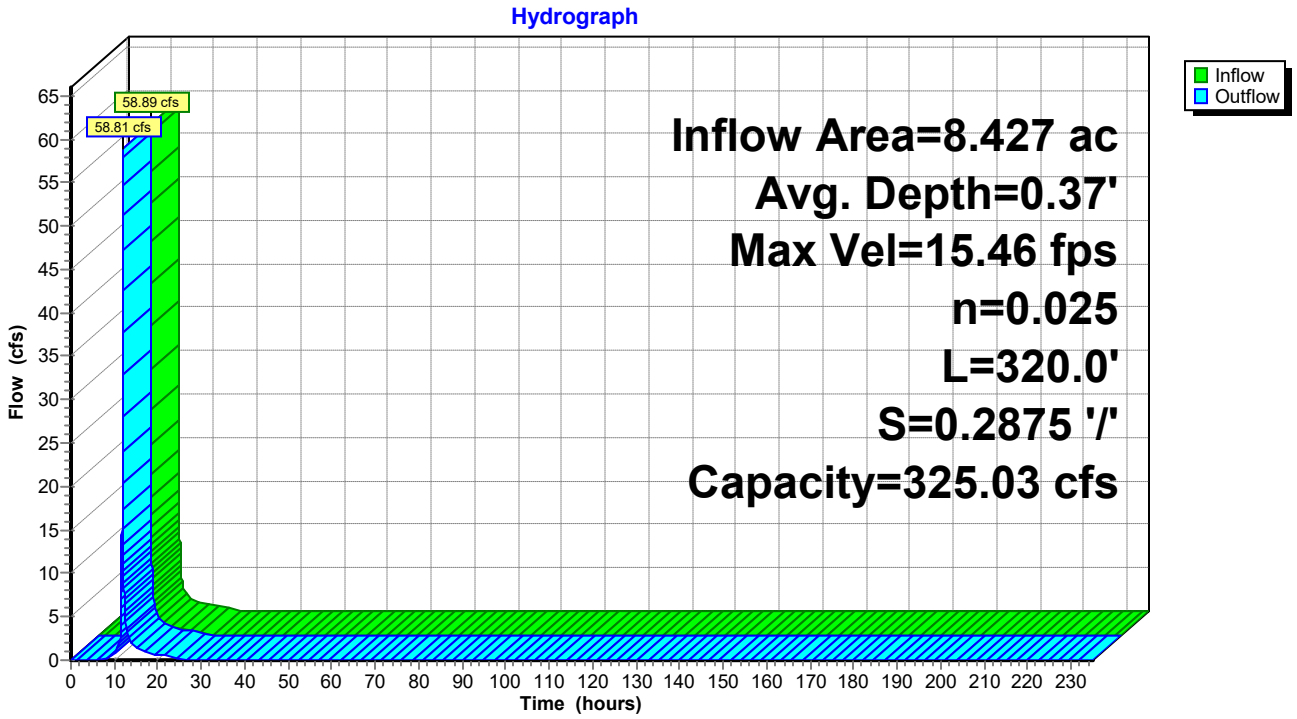
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 15.46 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.20 fps, Avg. Travel Time= 1.7 min

Peak Storage= 1,217 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.37'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.03 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 320.0' Slope= 0.2875 '/'
Inlet Invert= 210.00', Outlet Invert= 118.00'

‡



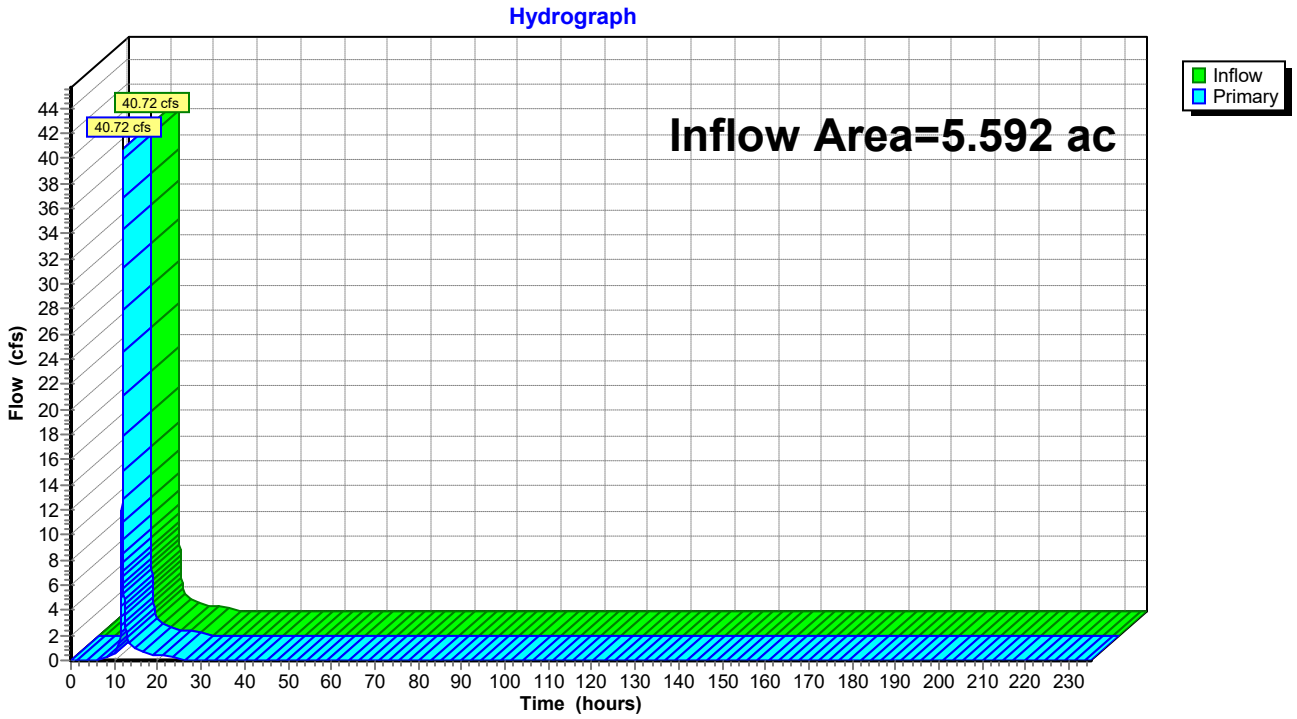


Summary for Link 57L: PC 4A

Inflow Area = 5.592 ac, 21.90% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 40.72 cfs @ 11.96 hrs, Volume= 1.912 af
Primary = 40.72 cfs @ 11.96 hrs, Volume= 1.912 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 57L: PC 4A

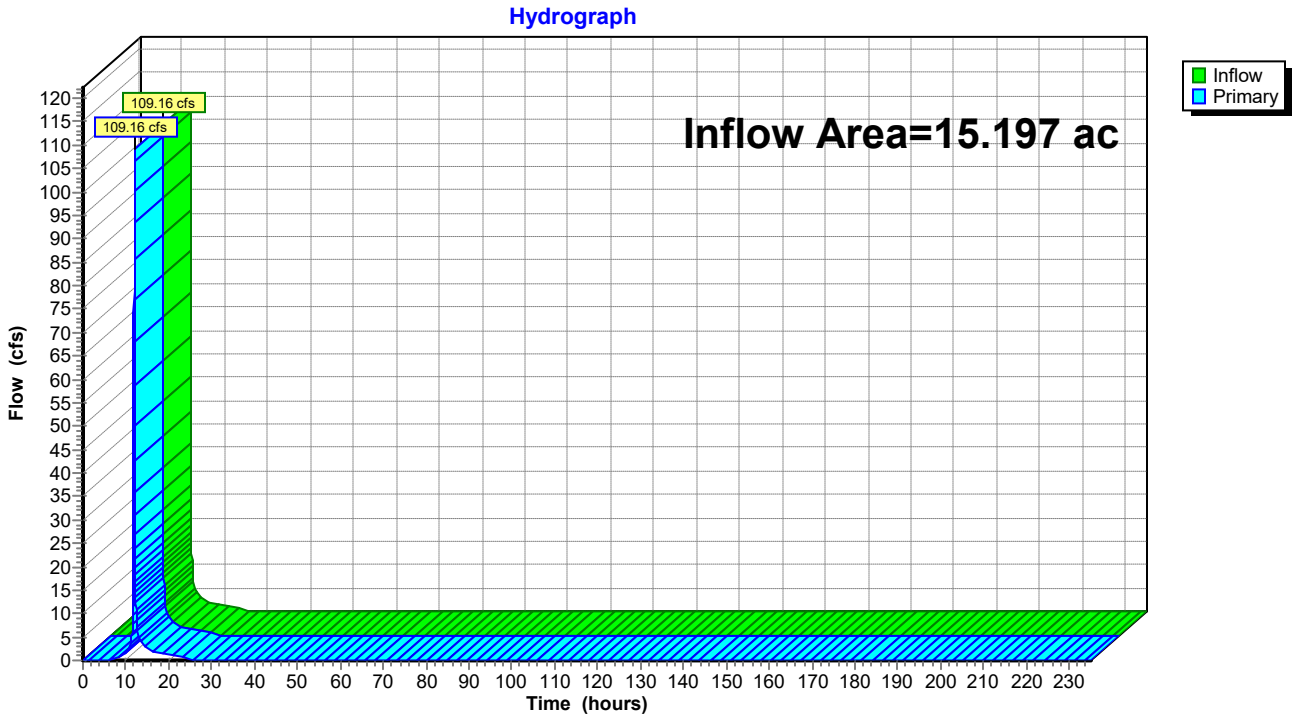


Summary for Link 58L: PC 4B

Inflow Area = 15.197 ac, 16.87% Impervious, Inflow Depth = 4.04" for 25-YR event
Inflow = 109.16 cfs @ 11.96 hrs, Volume= 5.113 af
Primary = 109.16 cfs @ 11.96 hrs, Volume= 5.113 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 58L: PC 4B

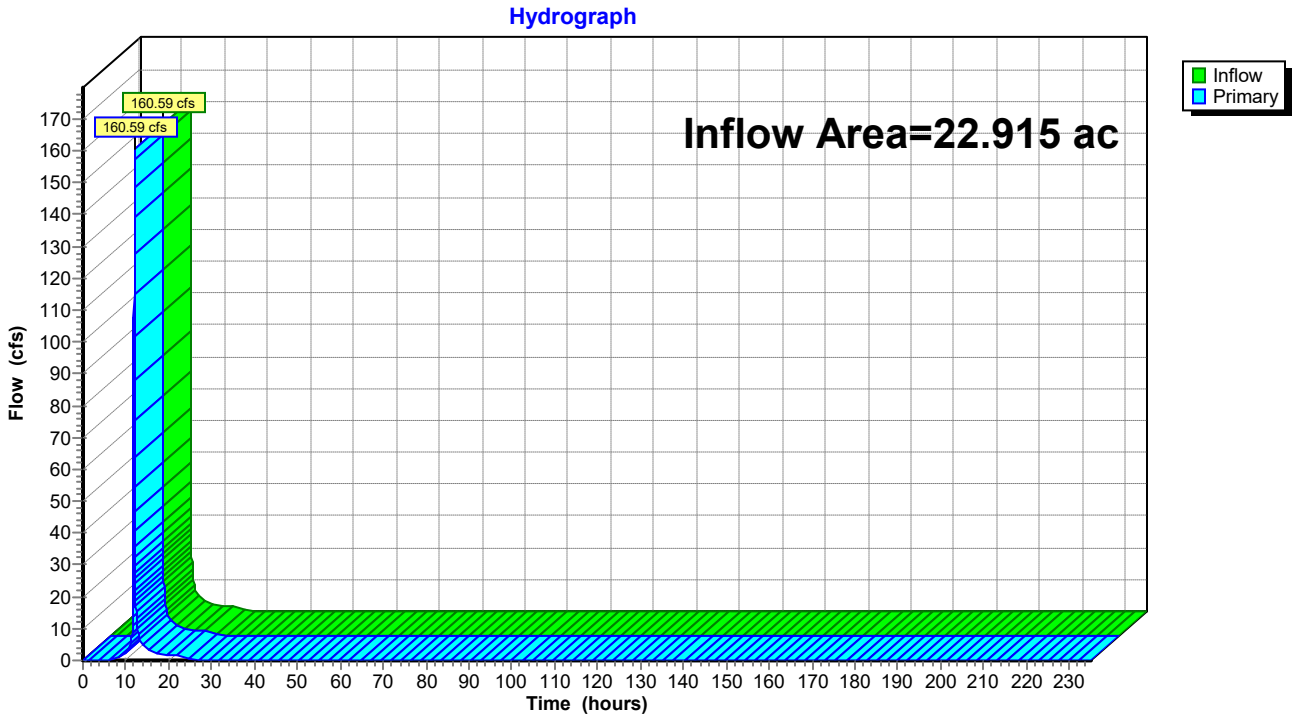


Summary for Link 59L: PC 4C

Inflow Area = 22.915 ac, 12.02% Impervious, Inflow Depth = 3.92" for 25-YR event
Inflow = 160.59 cfs @ 11.96 hrs, Volume= 7.487 af
Primary = 160.59 cfs @ 11.96 hrs, Volume= 7.487 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: PC 4C

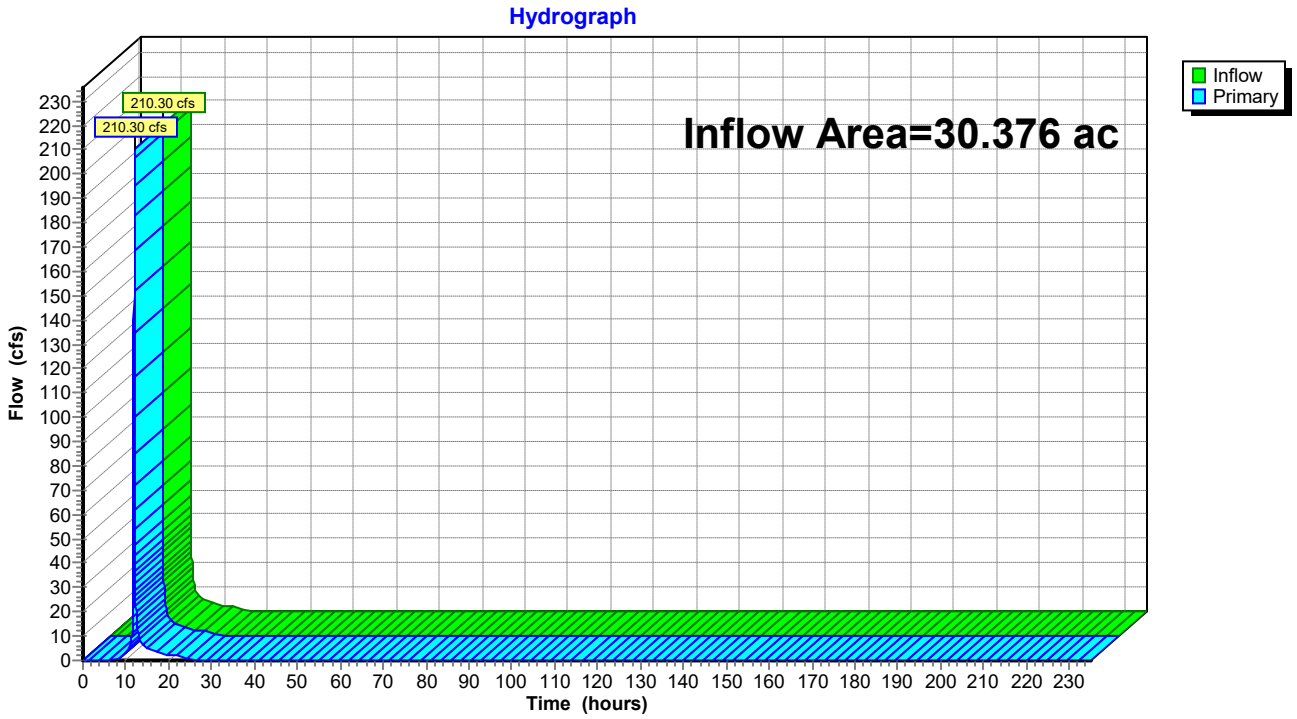


Summary for Link 60L: PC 4D

Inflow Area = 30.376 ac, 9.67% Impervious, Inflow Depth = 3.86" for 25-YR event
Inflow = 210.30 cfs @ 11.96 hrs, Volume= 9.782 af
Primary = 210.30 cfs @ 11.96 hrs, Volume= 9.782 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: PC 4D

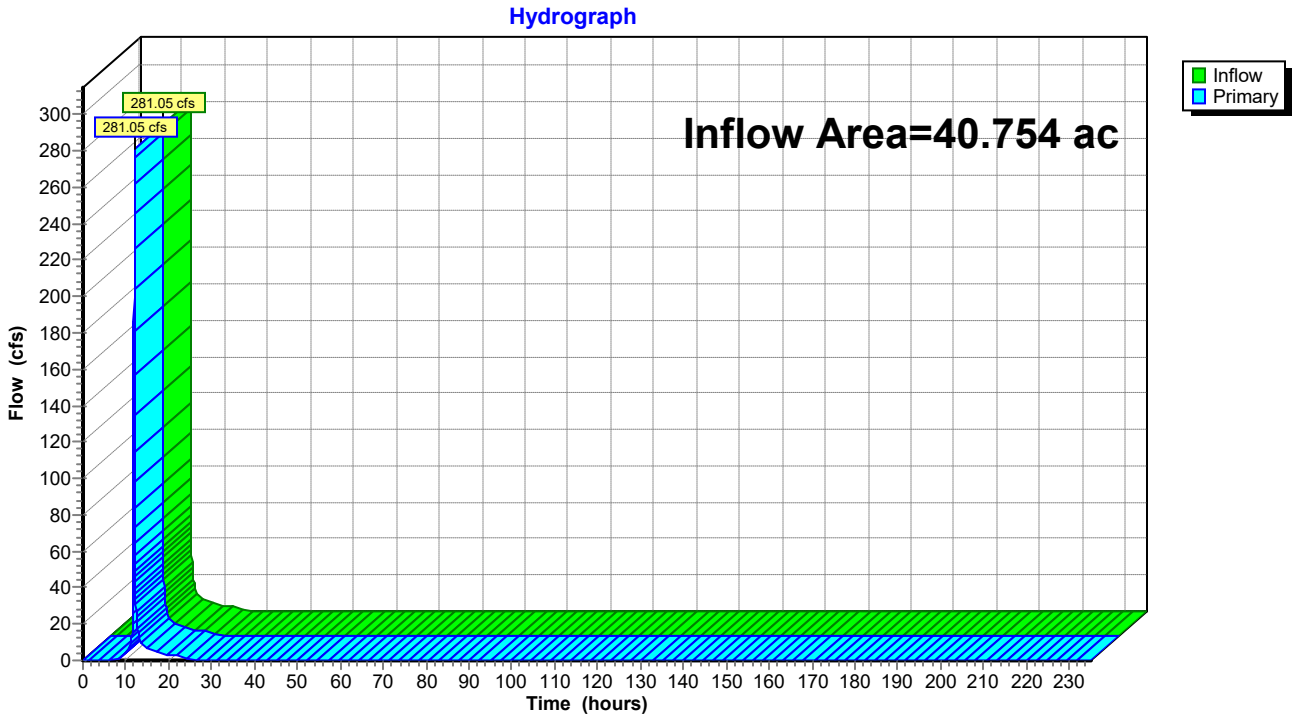


Summary for Link 61L: PC 4E

Inflow Area = 40.754 ac, 8.45% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = 281.05 cfs @ 11.96 hrs, Volume= 13.062 af
Primary = 281.05 cfs @ 11.96 hrs, Volume= 13.062 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: PC 4E

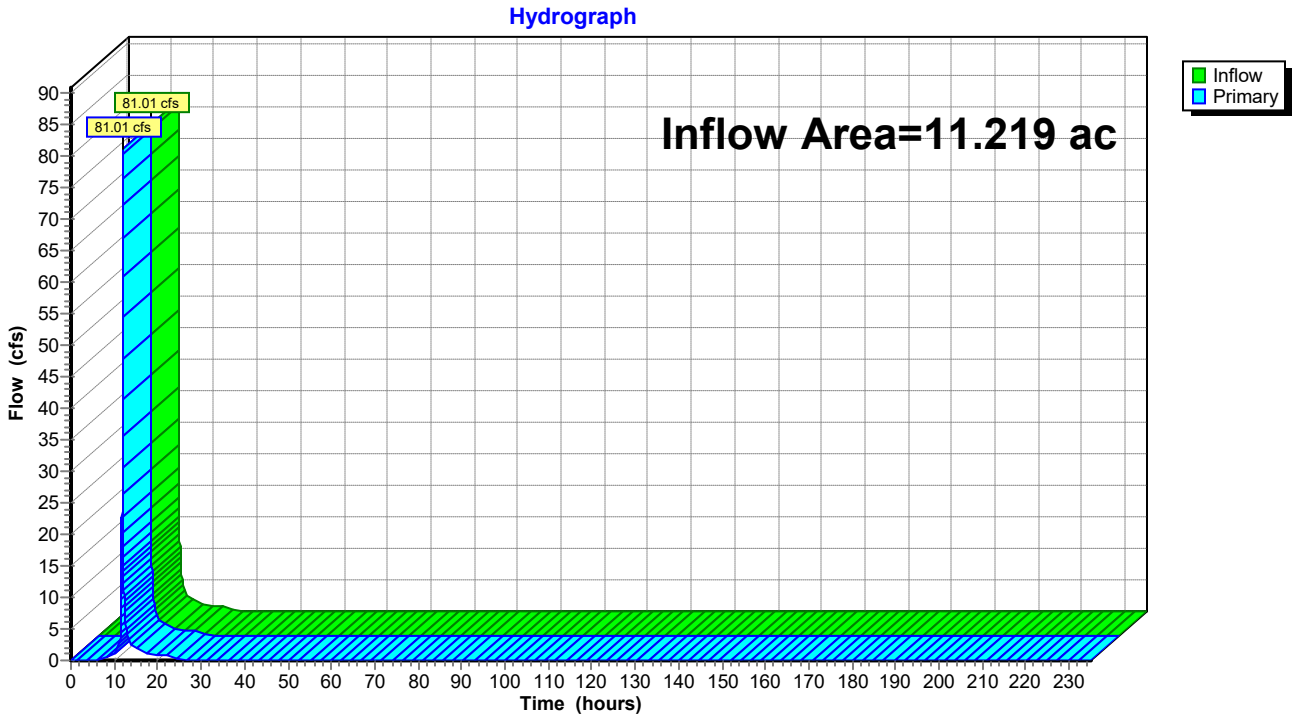


Summary for Link 62L: PC 5

Inflow Area = 11.219 ac, 21.53% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 81.01 cfs @ 11.97 hrs, Volume= 3.836 af
Primary = 81.01 cfs @ 11.97 hrs, Volume= 3.836 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: PC 5

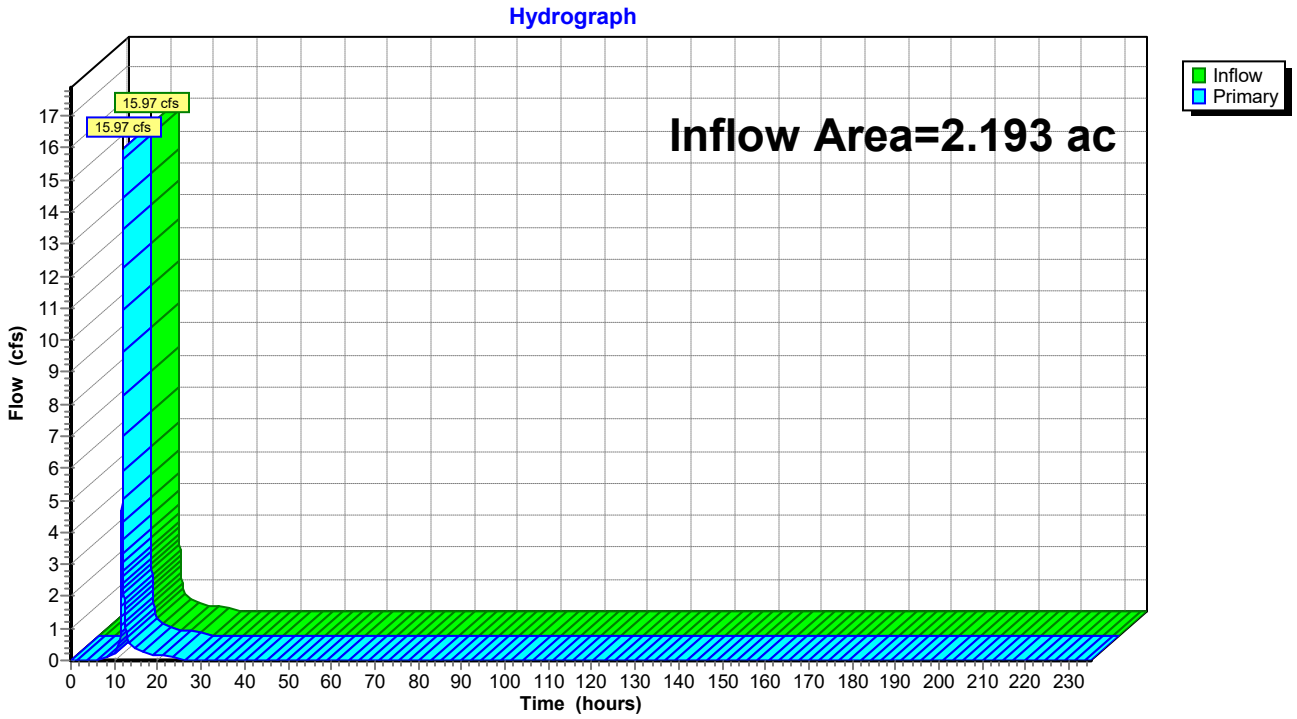


Summary for Link 63L: PC 3A

Inflow Area = 2.193 ac, 21.86% Impervious, Inflow Depth = 4.10" for 25-YR event
Inflow = 15.97 cfs @ 11.96 hrs, Volume= 0.750 af
Primary = 15.97 cfs @ 11.96 hrs, Volume= 0.750 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: PC 3A

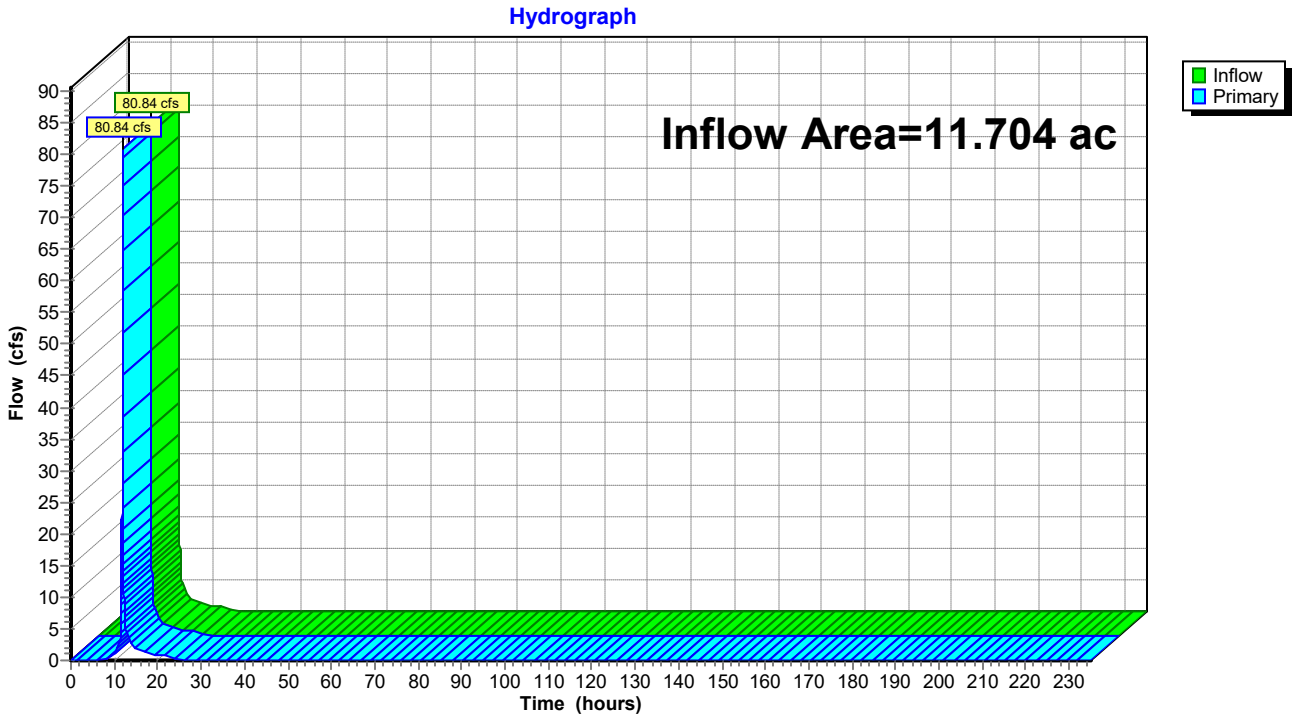


Summary for Link 64L: PC 3B

Inflow Area = 11.704 ac, 8.29% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = 80.84 cfs @ 11.96 hrs, Volume= 3.756 af
Primary = 80.84 cfs @ 11.96 hrs, Volume= 3.756 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 64L: PC 3B

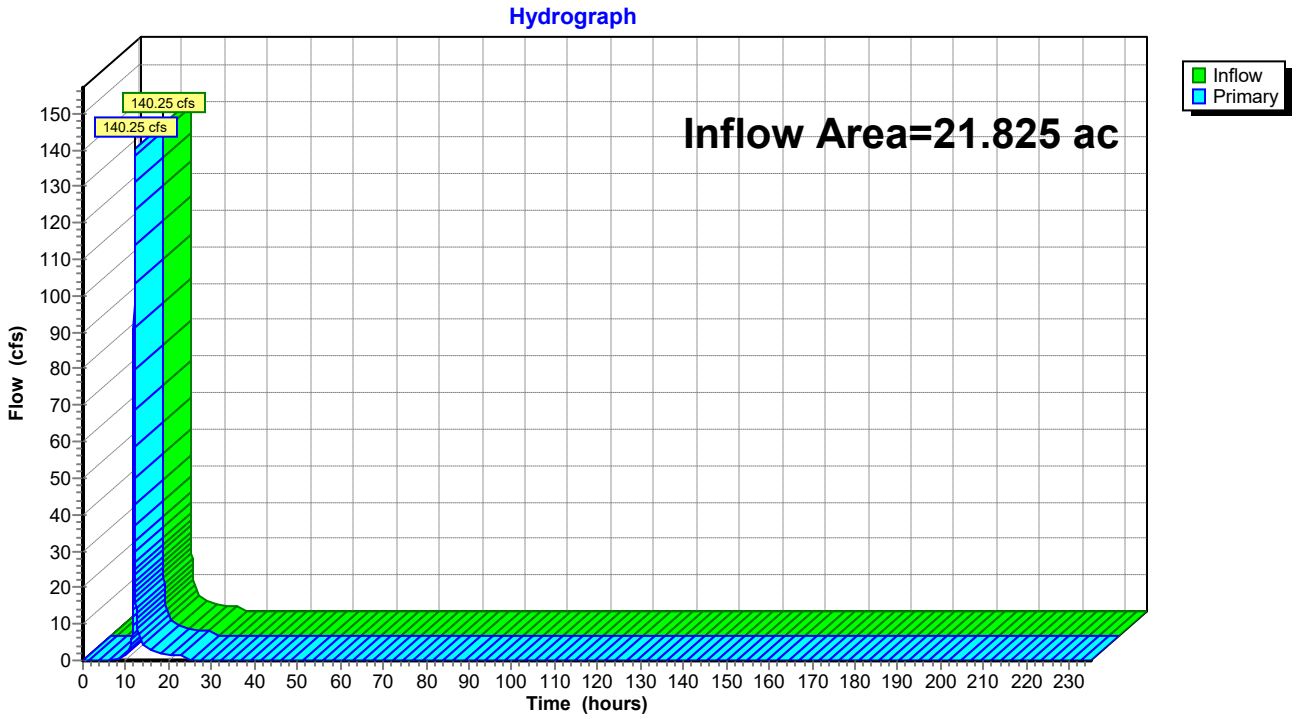


Summary for Link 65L: PC 3C

Inflow Area = 21.825 ac, 6.90% Impervious, Inflow Depth = 3.55" for 25-YR event
Inflow = 140.25 cfs @ 11.96 hrs, Volume= 6.452 af
Primary = 140.25 cfs @ 11.96 hrs, Volume= 6.452 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 65L: PC 3C

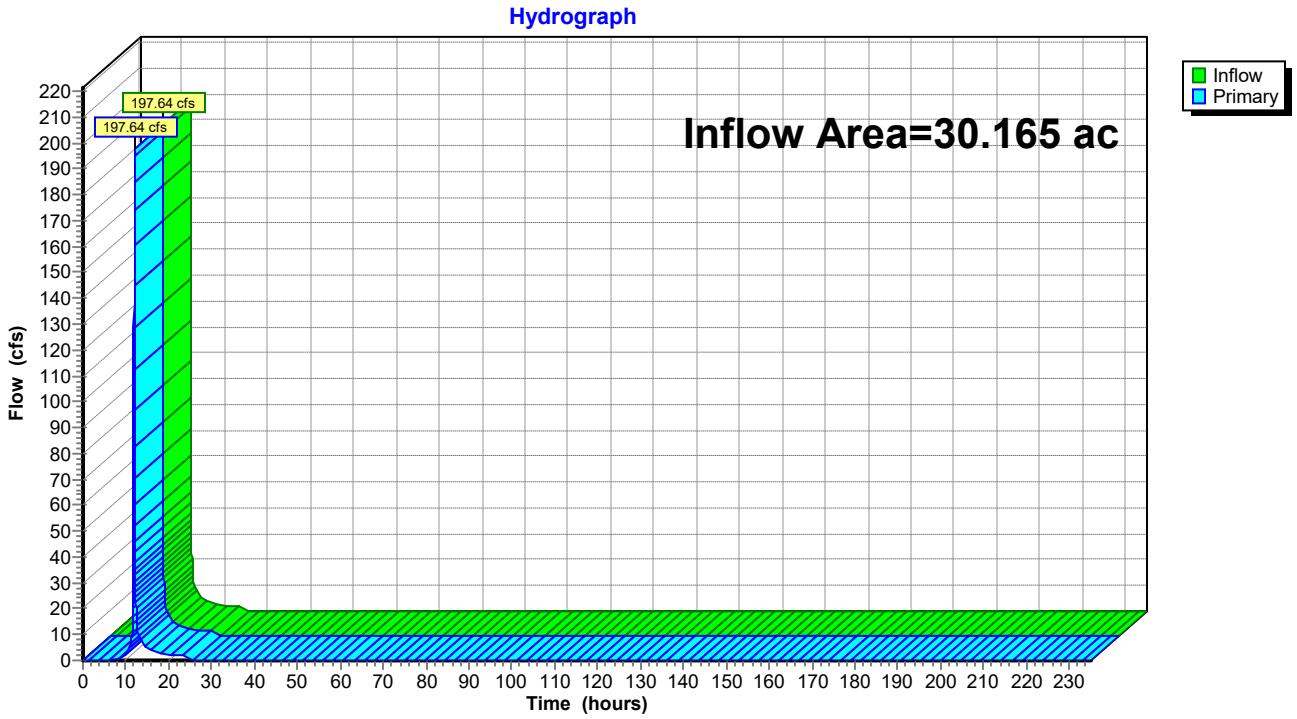


Summary for Link 66L: PC 3D

Inflow Area = 30.165 ac, 8.33% Impervious, Inflow Depth = 3.63" for 25-YR event
Inflow = 197.64 cfs @ 11.96 hrs, Volume= 9.120 af
Primary = 197.64 cfs @ 11.96 hrs, Volume= 9.120 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 66L: PC 3D

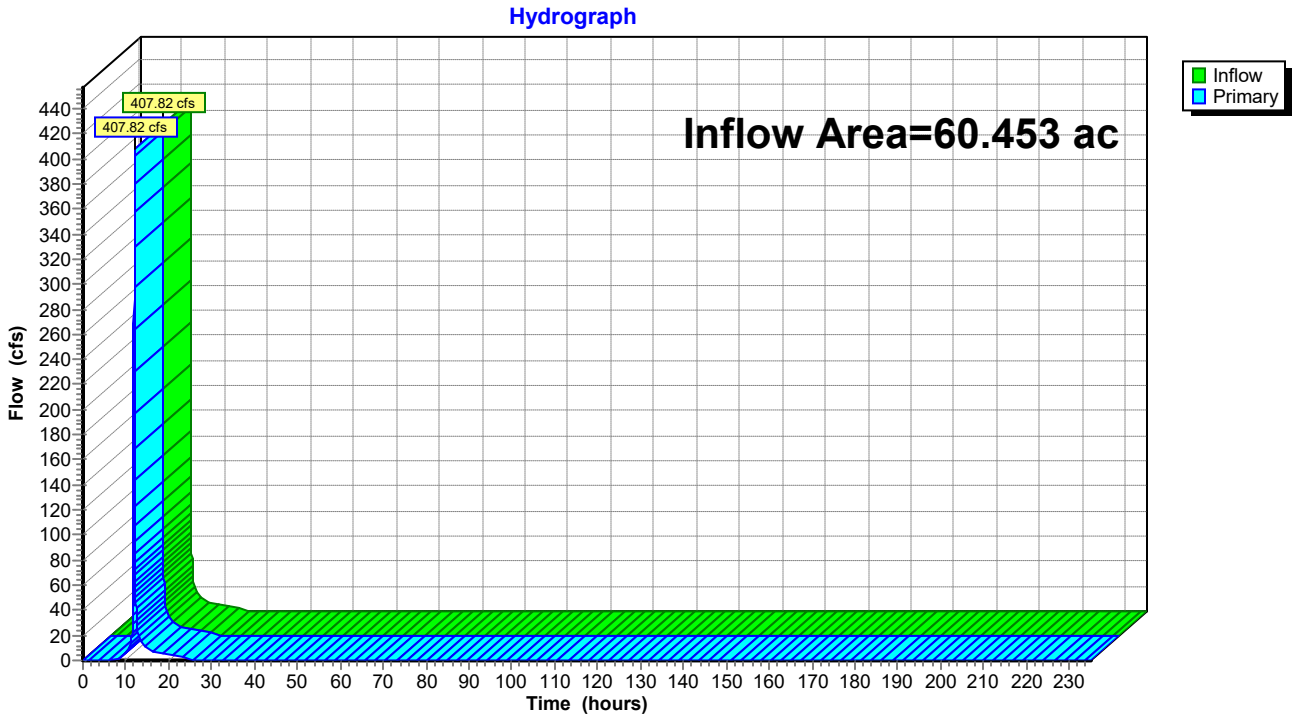


Summary for Link 67L: CROSS PIPE

Inflow Area = 60.453 ac, 10.64% Impervious, Inflow Depth = 3.76" for 25-YR event
Inflow = 407.82 cfs @ 11.96 hrs, Volume= 18.930 af
Primary = 407.82 cfs @ 11.96 hrs, Volume= 18.930 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 67L: CROSS PIPE

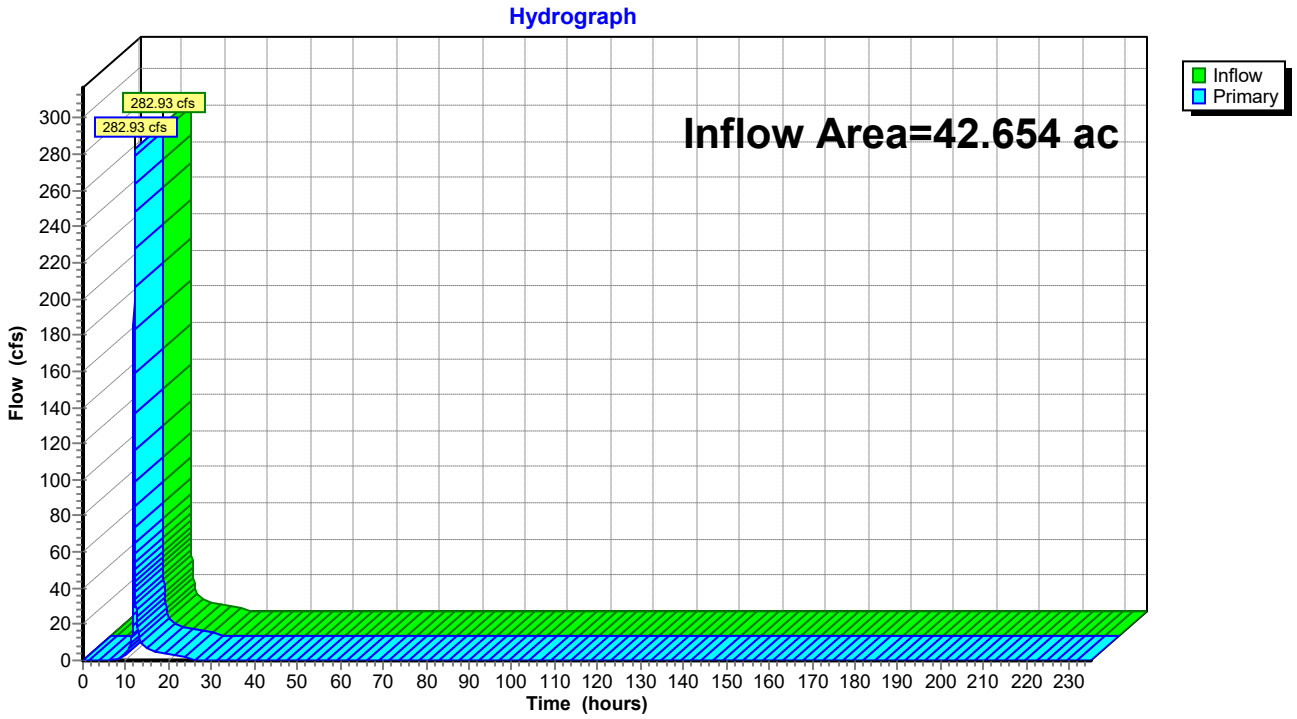


Summary for Link 68L: PC 3E

Inflow Area = 42.654 ac, 9.42% Impervious, Inflow Depth = 3.68" for 25-YR event
Inflow = 282.93 cfs @ 11.96 hrs, Volume= 13.070 af
Primary = 282.93 cfs @ 11.96 hrs, Volume= 13.070 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 68L: PC 3E

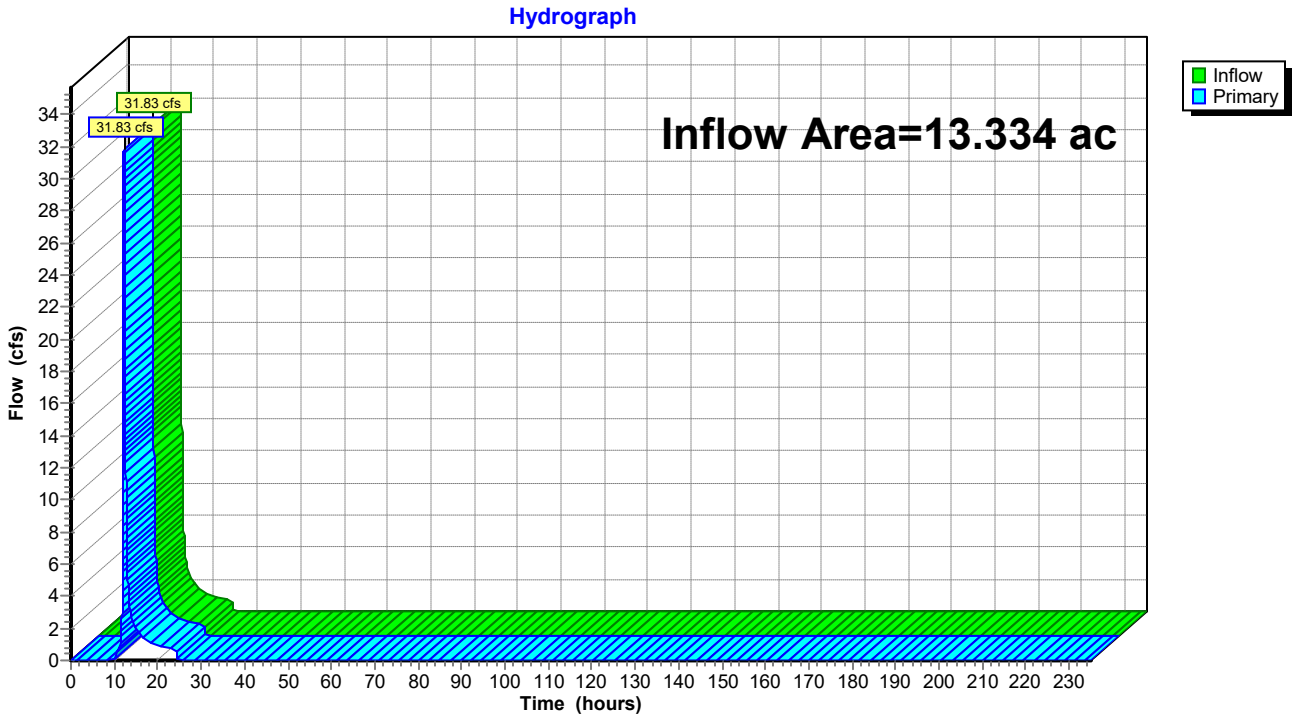


Summary for Link 86L: PC 2

Inflow Area = 13.334 ac, 0.00% Impervious, Inflow Depth = 2.73" for 25-YR event
Inflow = 31.83 cfs @ 12.24 hrs, Volume= 3.029 af
Primary = 31.83 cfs @ 12.24 hrs, Volume= 3.029 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 86L: PC 2

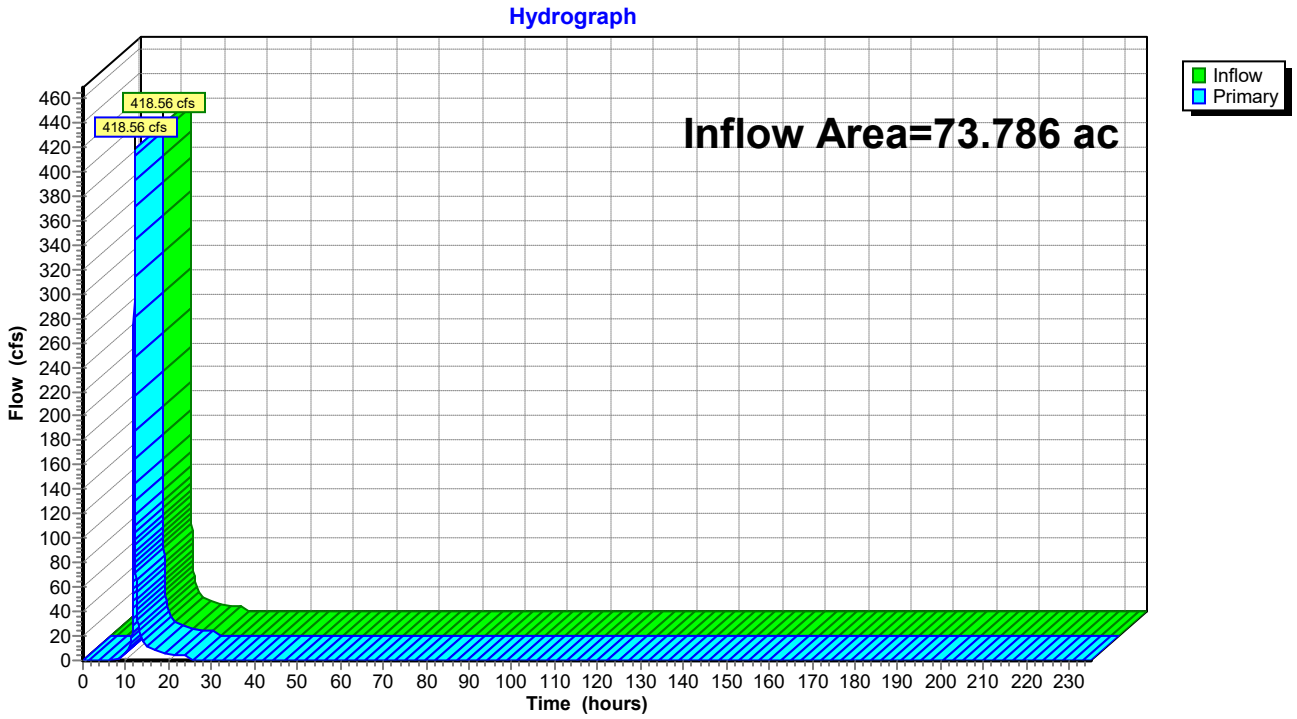


Summary for Link 87L: TO BASIN 1

Inflow Area = 73.786 ac, 8.72% Impervious, Inflow Depth = 3.57" for 25-YR event
Inflow = 418.56 cfs @ 11.96 hrs, Volume= 21.959 af
Primary = 418.56 cfs @ 11.96 hrs, Volume= 21.959 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

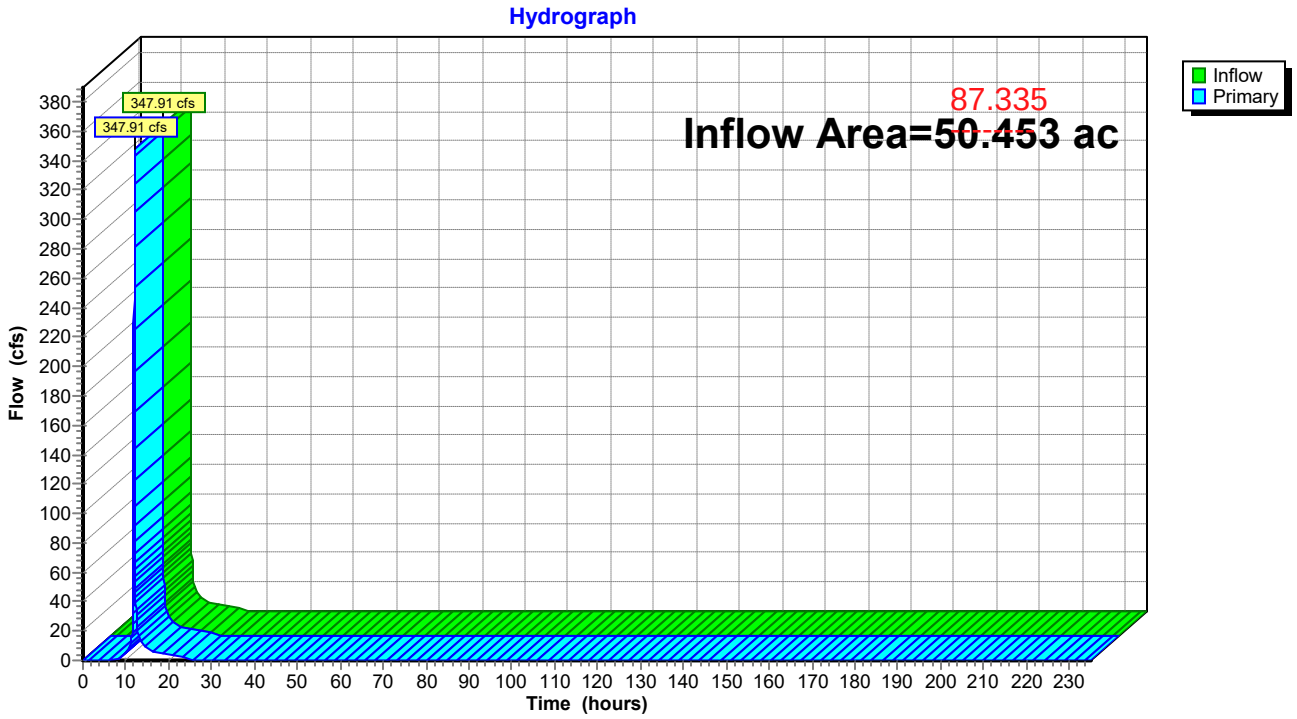
Link 87L: TO BASIN 1



Summary for Link 88L: PC 4F

Inflow Area = ~~50.453~~ 87.335 ac, 9.47% Impervious, Inflow Depth = 3.85" for 25-YR event
Inflow = ~~347.91~~ 391.91 cfs @ 11.96 hrs, Volume= ~~16.177~~ 20.390 af
Primary = ~~347.91~~ 391.91 cfs @ 11.96 hrs, Volume= ~~16.177~~ 20.390 af, Atten= 0%, Lag= 0.0 min
Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 88L: PC 4F



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 47S: DC-1 AT SWALE Runoff Area=8.371 ac 21.28% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=94.79 cfs 4.587 af

Subcatchment 48S: DC-2 AT SWALE Runoff Area=7.779 ac 11.04% Impervious Runoff Depth=6.34"
Tc=5.0 min CN=82 Runoff=85.88 cfs 4.107 af

Subcatchment 49S: DC-3 AT SWALE Runoff Area=10.378 ac 4.90% Impervious Runoff Depth=6.22"
Tc=5.0 min CN=81 Runoff=113.02 cfs 5.375 af

Subcatchment 50S: DC-4 AT SWALE Runoff Area=325,003 sf 2.45% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=80.10 cfs 3.790 af

Subcatchment 51S: DC-5 AT SWALE Runoff Area=336,190 sf 2.47% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=82.86 cfs 3.920 af

Subcatchment 52S: DC-6 AT SWALE Runoff Area=9.605 ac 13.94% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=83 Runoff=107.42 cfs 5.167 af

Subcatchment 53S: DC-7 AT SWALE Runoff Area=414,298 sf 5.16% Impervious Runoff Depth=6.22"
Tc=5.0 min CN=81 Runoff=103.58 cfs 4.926 af

Subcatchment 54S: DC-8 AT SWALE Runoff Area=440,848 sf 5.29% Impervious Runoff Depth=5.50"
Tc=5.0 min CN=75 Runoff=100.17 cfs 4.634 af

Subcatchment 55S: DC-9 AT SWALE Runoff Area=294,805 sf 9.96% Impervious Runoff Depth=6.34"
Tc=5.0 min CN=82 Runoff=74.71 cfs 3.573 af

Subcatchment 56S: DC-10 AT SWALE Runoff Area=8.427 ac 8.39% Impervious Runoff Depth=6.34"
Tc=5.0 min CN=82 Runoff=93.03 cfs 4.449 af

Subcatchment 69S: DA to PC 4A Runoff Area=243,601 sf 21.90% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=63.32 cfs 3.065 af

Subcatchment 70S: PC 3A Runoff Area=95,531 sf 21.86% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=24.83 cfs 1.202 af

Subcatchment 93S: CAP ROAD to DC2 Runoff Area=83,627 sf 24.59% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=20.61 cfs 0.975 af

Subcatchment 94S: AREA TO SWALE 2 Runoff Area=580,809 sf 0.00% Impervious Runoff Depth=4.90"
Flow Length=4,507' Tc=29.0 min CN=70 Runoff=57.96 cfs 5.441 af

Subcatchment 95S: Upslope Area of PC3D Runoff Area=1.573 ac 21.17% Impervious Runoff Depth=5.98"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=16.64 cfs 0.783 af

Subcatchment 96S: Upslope Area of PC3E Runoff Area=4.062 ac 19.62% Impervious Runoff Depth=5.98"
Flow Length=80' Slope=0.3300 '/' Tc=5.0 min CN=79 Runoff=42.96 cfs 2.023 af

Subcatchment 106S: AREA TO DS-10 Runoff Area=286,585 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=70.63 cfs 3.342 af

Subcatchment 107S: DA TO PC 5 Runoff Area=124,070 sf 22.29% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=32.25 cfs 1.561 af

Reach 89R: PC 4G Avg. Depth=2.07' Max Vel=13.72 fps Inflow=552.08 cfs 26.400 af
n=0.015 L=1,000.0' S=0.0100 '/' Capacity=1,809.44 cfs Outflow=542.99 cfs 26.400 af

Reach 95R: DC-1 Avg. Depth=0.52' Max Vel=17.11 fps Inflow=94.79 cfs 4.587 af
n=0.025 L=800.0' S=0.2325 '/' Capacity=292.29 cfs Outflow=94.16 cfs 4.587 af

Reach 96R: DC-2 Avg. Depth=0.52' Max Vel=19.10 fps Inflow=106.49 cfs 5.082 af
n=0.025 L=600.0' S=0.2867 '/' Capacity=324.56 cfs Outflow=106.14 cfs 5.082 af

Reach 97R: DC-3 Avg. Depth=0.54' Max Vel=19.56 fps Inflow=113.02 cfs 5.375 af
n=0.025 L=465.0' S=0.2882 '/' Capacity=325.41 cfs Outflow=112.80 cfs 5.375 af

Reach 98R: DC-4 Avg. Depth=0.44' Max Vel=17.32 fps Inflow=80.10 cfs 3.790 af
n=0.025 L=415.0' S=0.2892 '/' Capacity=325.96 cfs Outflow=79.94 cfs 3.790 af

Reach 99R: DC-5 Avg. Depth=0.45' Max Vel=17.64 fps Inflow=82.86 cfs 3.920 af
n=0.025 L=390.0' S=0.2949 '/' Capacity=329.17 cfs Outflow=82.72 cfs 3.920 af

Reach 100R: DC-6 Avg. Depth=0.53' Max Vel=18.85 fps Inflow=107.42 cfs 5.167 af
n=0.025 L=280.0' S=0.2714 '/' Capacity=315.81 cfs Outflow=107.34 cfs 5.167 af

Reach 101R: DC-7 Avg. Depth=0.52' Max Vel=18.72 fps Inflow=103.58 cfs 4.926 af
n=0.025 L=390.0' S=0.2769 '/' Capacity=318.99 cfs Outflow=103.42 cfs 4.926 af

Reach 102R: DC-8 Avg. Depth=0.51' Max Vel=18.49 fps Inflow=100.17 cfs 4.634 af
n=0.025 L=430.0' S=0.2767 '/' Capacity=318.89 cfs Outflow=99.97 cfs 4.634 af

Reach 103R: DC-9 Avg. Depth=0.43' Max Vel=16.54 fps Inflow=74.71 cfs 3.573 af
n=0.025 L=450.0' S=0.2711 '/' Capacity=315.63 cfs Outflow=74.53 cfs 3.573 af

Reach 104R: DC-10 Avg. Depth=0.48' Max Vel=18.25 fps Inflow=93.03 cfs 4.449 af
n=0.025 L=320.0' S=0.2875 '/' Capacity=325.03 cfs Outflow=92.93 cfs 4.449 af

Link 57L: PC 4A Inflow=63.32 cfs 3.065 af
Primary=63.32 cfs 3.065 af

Link 58L: PC 4B Inflow=170.64 cfs 8.232 af
Primary=170.64 cfs 8.232 af

Link 59L: PC 4C Inflow=253.31 cfs 12.152 af
Primary=253.31 cfs 12.152 af

Link 60L: PC 4D Inflow=333.21 cfs 15.942 af
Primary=333.21 cfs 15.942 af

Link 61L: PC 4E
Inflow=445.99 cfs 21.317 af
Primary=445.99 cfs 21.317 af

Link 62L: PC 5
Inflow=126.24 cfs 6.148 af
Primary=126.24 cfs 6.148 af

Link 63L: PC 3A
Inflow=24.83 cfs 1.202 af
Primary=24.83 cfs 1.202 af

Link 64L: PC 3B
Inflow=128.22 cfs 6.128 af
Primary=128.22 cfs 6.128 af

Link 65L: PC 3C
Inflow=228.15 cfs 10.762 af
Primary=228.15 cfs 10.762 af

Link 66L: PC 3D
Inflow=319.29 cfs 15.119 af
Primary=319.29 cfs 15.119 af

Link 67L: CROSS PIPE
Inflow=651.89 cfs 31.081 af
Primary=651.89 cfs 31.081 af

Link 68L: PC 3E
Inflow=455.14 cfs 21.591 af
Primary=455.14 cfs 21.591 af

Link 86L: PC 2
Inflow=57.96 cfs 5.441 af
Primary=57.96 cfs 5.441 af

Link 87L: TO BASIN 1
Inflow=673.39 cfs 36.522 af
Primary=673.39 cfs 36.522 af

Link 88L: PC 4F
653.39 35.297
Inflow=~~552.08~~ cfs 26.400 af
Primary=~~552.08~~ cfs 26.400 af
653.39 35.297

Total Runoff Area = 124.239 ac Runoff Volume = 62.922 af Average Runoff Depth = 6.08"
90.98% Pervious = 113.030 ac 9.02% Impervious = 11.209 ac

Summary for Subcatchment 47S: DC-1 AT SWALE

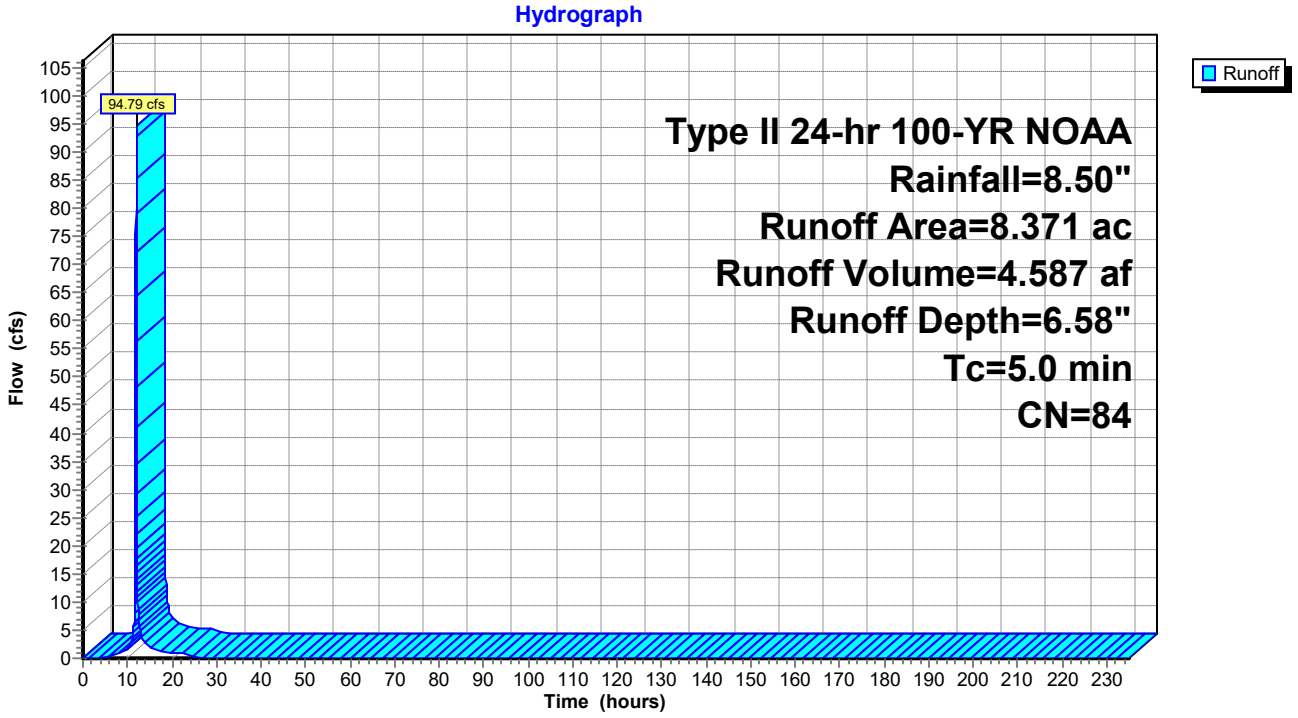
Runoff = 94.79 cfs @ 11.96 hrs, Volume= 4.587 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	1.242	98	PERIMETER ROAD
	6.590	80	>75% Grass cover, Good, HSG D
*	0.539	98	CAP ACCESS
	8.371	84	Weighted Average
	6.590		Pervious Area
	1.781		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 47S: DC-1 AT SWALE



Summary for Subcatchment 48S: DC-2 AT SWALE

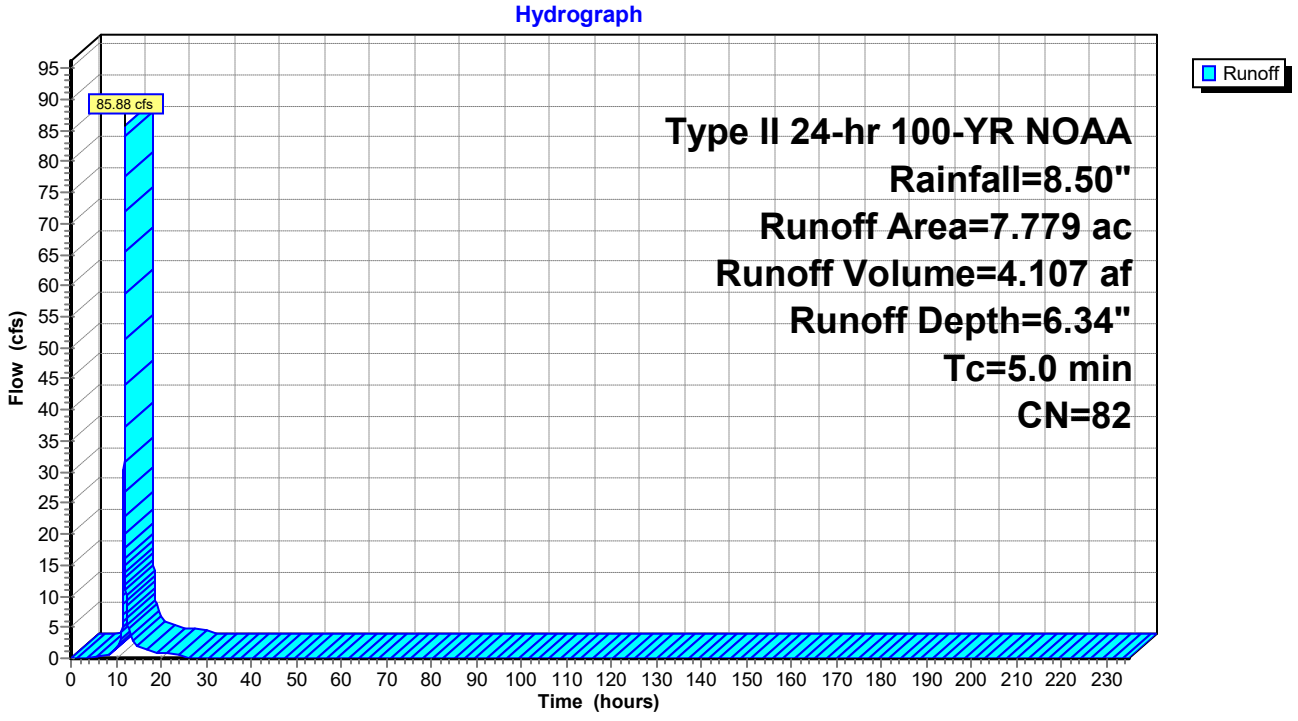
Runoff = 85.88 cfs @ 11.96 hrs, Volume= 4.107 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (ac)	CN	Description
*	0.634	98	PERIMETER ROAD
	6.920	80	>75% Grass cover, Good, HSG D
*	0.225	98	CAP ROAD
	7.779	82	Weighted Average
	6.920		Pervious Area
	0.859		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 48S: DC-2 AT SWALE



Summary for Subcatchment 49S: DC-3 AT SWALE

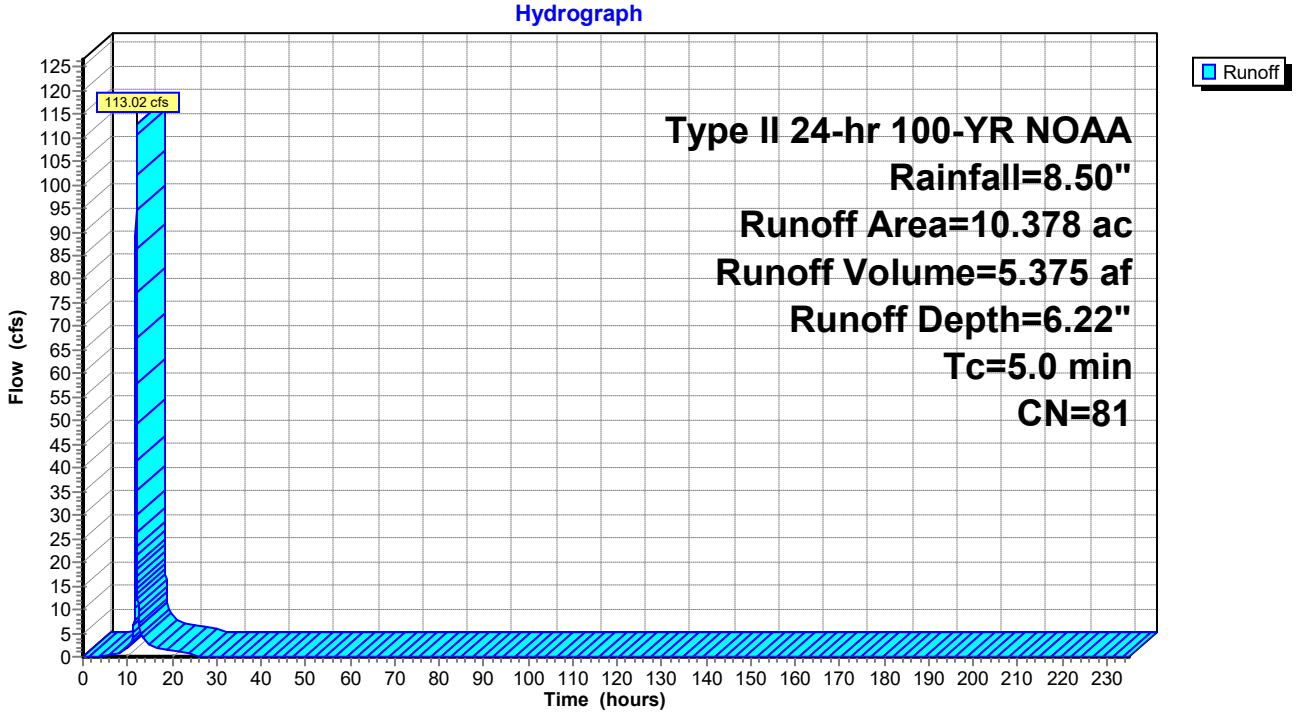
Runoff = 113.02 cfs @ 11.96 hrs, Volume= 5.375 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
0.509	98	Paved parking & roofs
9.869	80	>75% Grass cover, Good, HSG D
10.378	81	Weighted Average
9.869		Pervious Area
0.509		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 49S: DC-3 AT SWALE



Summary for Subcatchment 50S: DC-4 AT SWALE

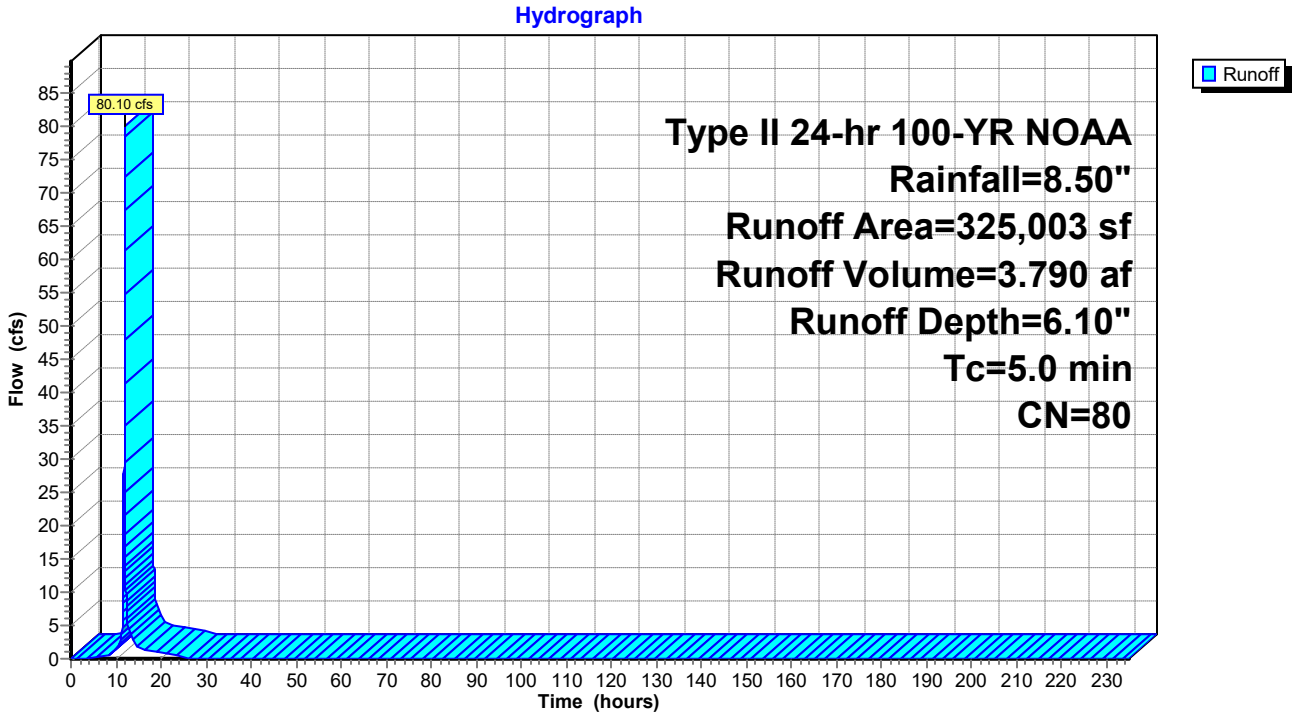
Runoff = 80.10 cfs @ 11.96 hrs, Volume= 3.790 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
7,956	98	Paved parking & roofs
317,047	80	>75% Grass cover, Good, HSG D
325,003	80	Weighted Average
317,047		Pervious Area
7,956		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 50S: DC-4 AT SWALE



Summary for Subcatchment 51S: DC-5 AT SWALE

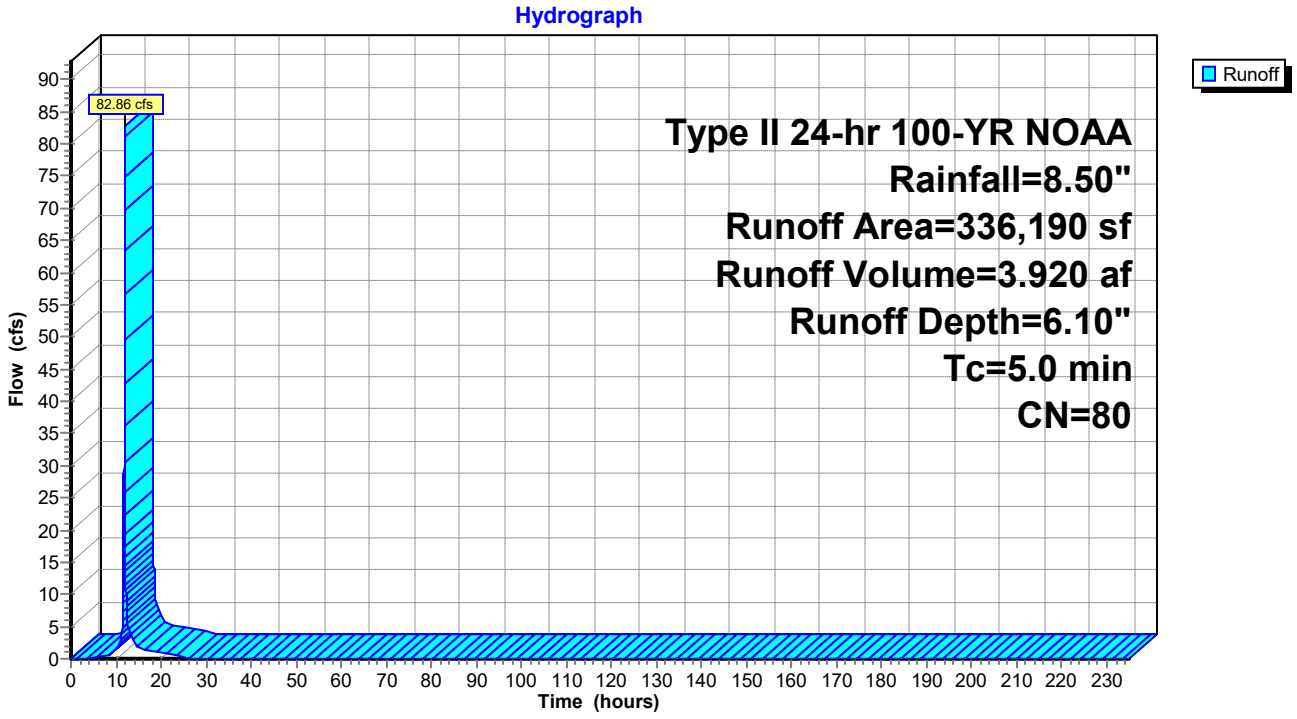
Runoff = 82.86 cfs @ 11.96 hrs, Volume= 3.920 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
8,293	98	Paved parking & roofs
327,897	80	>75% Grass cover, Good, HSG D
336,190	80	Weighted Average
327,897		Pervious Area
8,293		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 51S: DC-5 AT SWALE



Summary for Subcatchment 52S: DC-6 AT SWALE

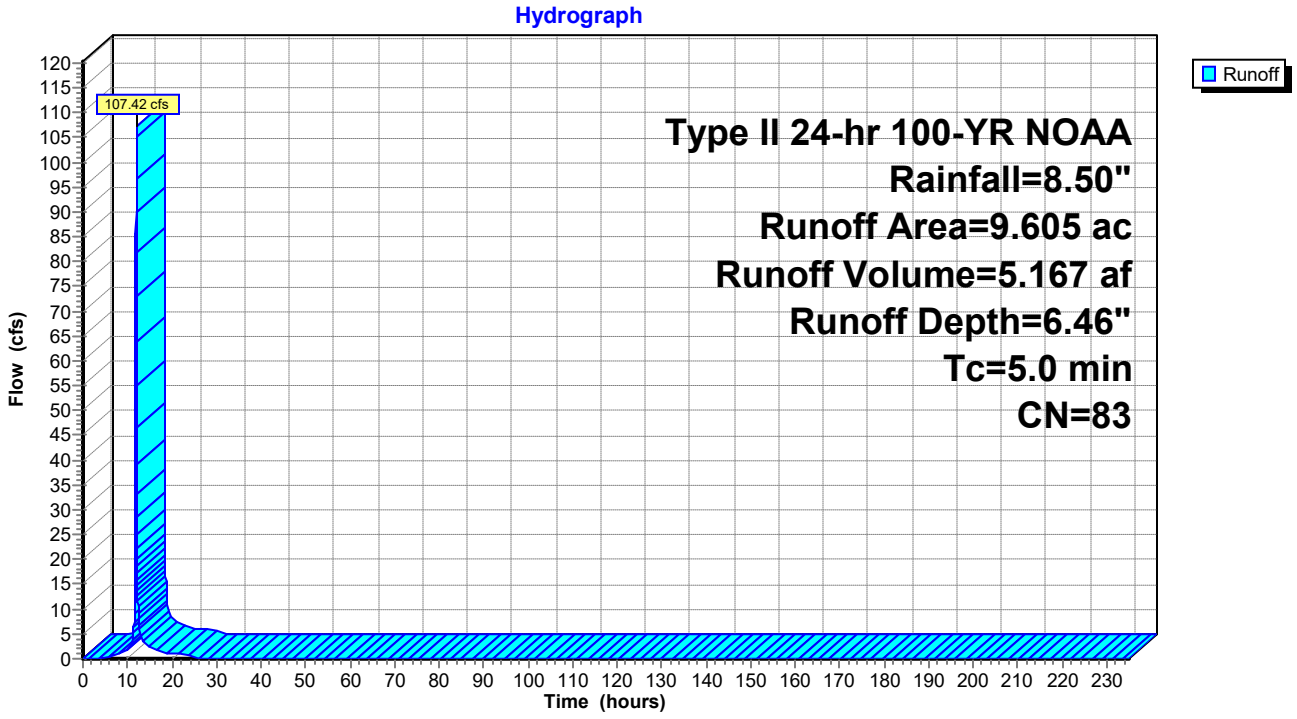
Runoff = 107.42 cfs @ 11.96 hrs, Volume= 5.167 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
1.339	98	Paved parking & roofs
8.266	80	>75% Grass cover, Good, HSG D
9.605	83	Weighted Average
8.266		Pervious Area
1.339		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 52S: DC-6 AT SWALE



Summary for Subcatchment 53S: DC-7 AT SWALE

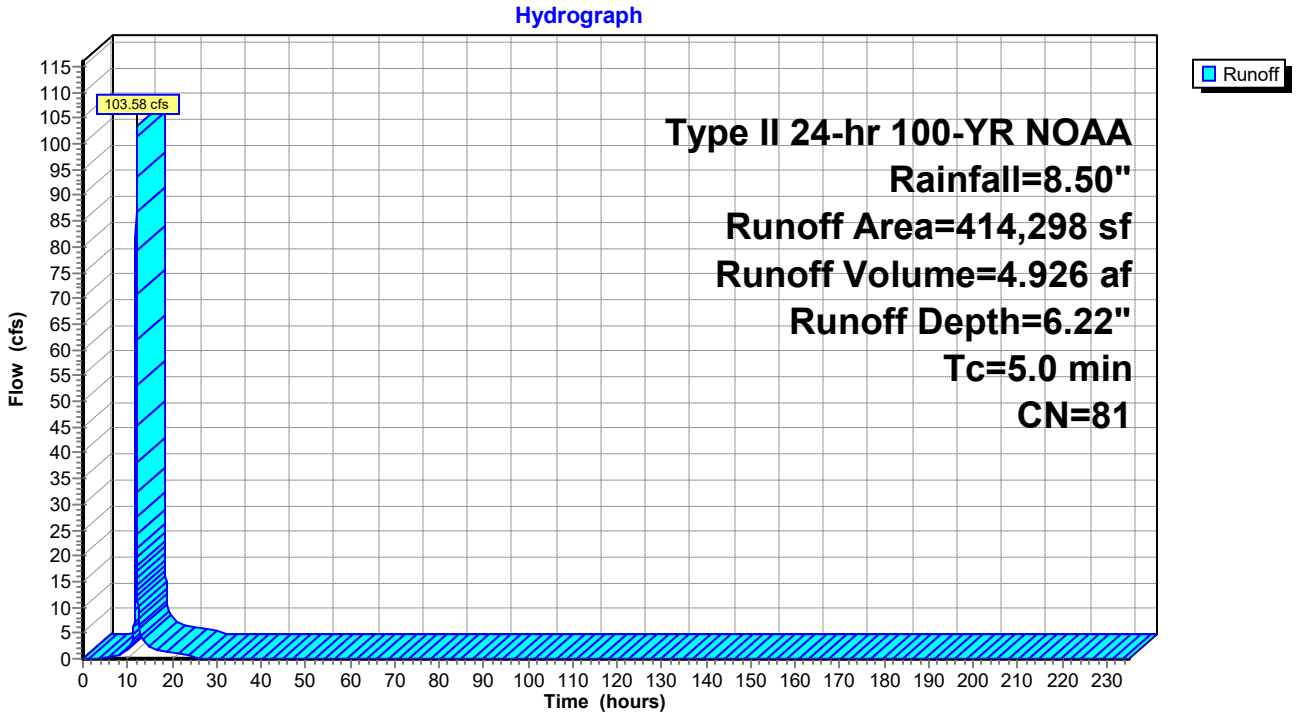
Runoff = 103.58 cfs @ 11.96 hrs, Volume= 4.926 af, Depth= 6.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
21,376	98	Paved parking & roofs
392,922	80	>75% Grass cover, Good, HSG D
414,298	81	Weighted Average
392,922		Pervious Area
21,376		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 53S: DC-7 AT SWALE



Summary for Subcatchment 54S: DC-8 AT SWALE

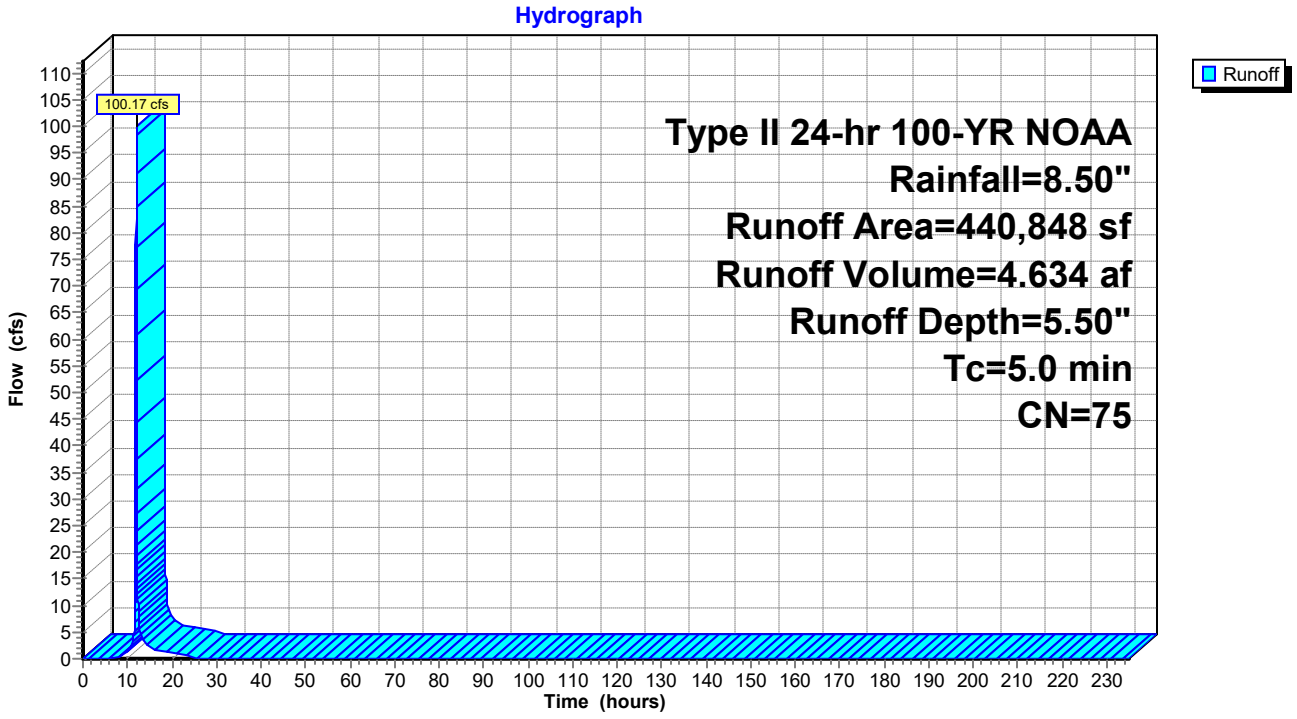
Runoff = 100.17 cfs @ 11.96 hrs, Volume= 4.634 af, Depth= 5.50"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
23,312	98	Paved parking & roofs
417,536	74	>75% Grass cover, Good, HSG C
440,848	75	Weighted Average
417,536		Pervious Area
23,312		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 54S: DC-8 AT SWALE



Summary for Subcatchment 55S: DC-9 AT SWALE

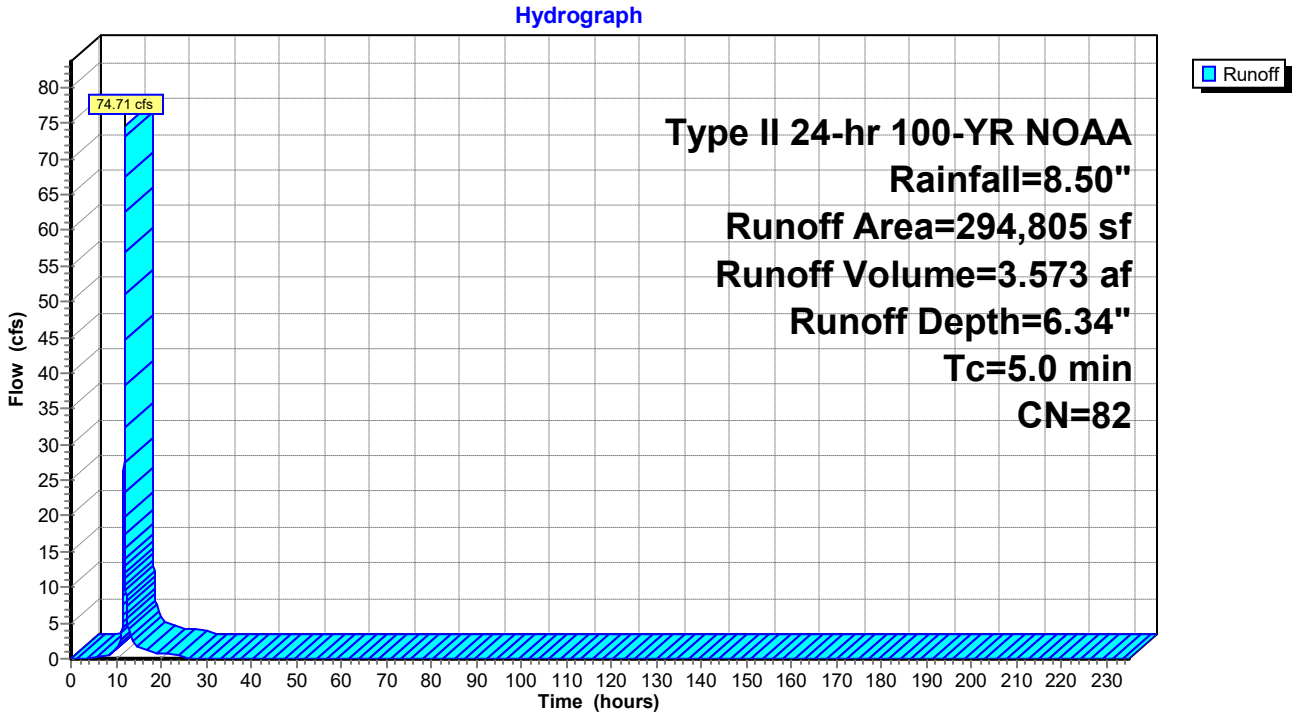
Runoff = 74.71 cfs @ 11.96 hrs, Volume= 3.573 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
29,366	98	Paved parking & roofs
265,439	80	>75% Grass cover, Good, HSG D
294,805	82	Weighted Average
265,439		Pervious Area
29,366		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 55S: DC-9 AT SWALE



Summary for Subcatchment 56S: DC-10 AT SWALE

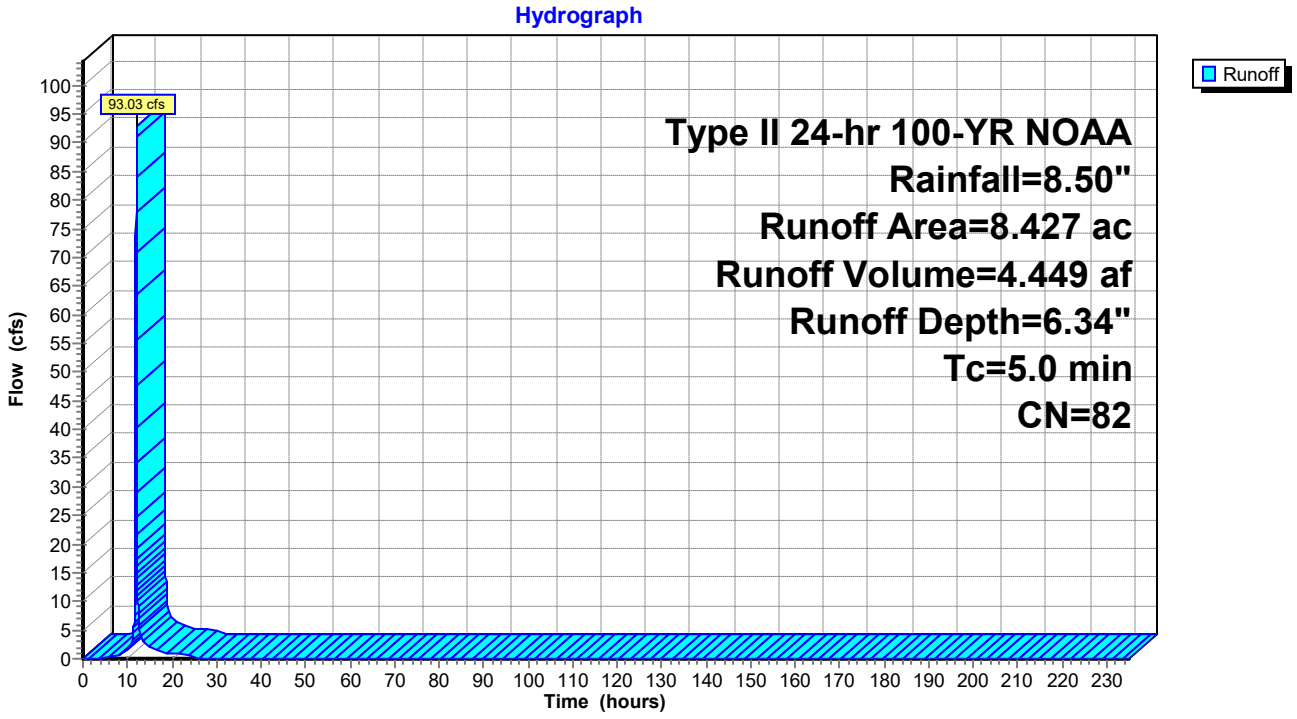
Runoff = 93.03 cfs @ 11.96 hrs, Volume= 4.449 af, Depth= 6.34"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
0.707	98	Paved parking & roofs
7.720	80	>75% Grass cover, Good, HSG D
8.427	82	Weighted Average
7.720		Pervious Area
0.707		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 56S: DC-10 AT SWALE



Summary for Subcatchment 69S: DA to PC 4A

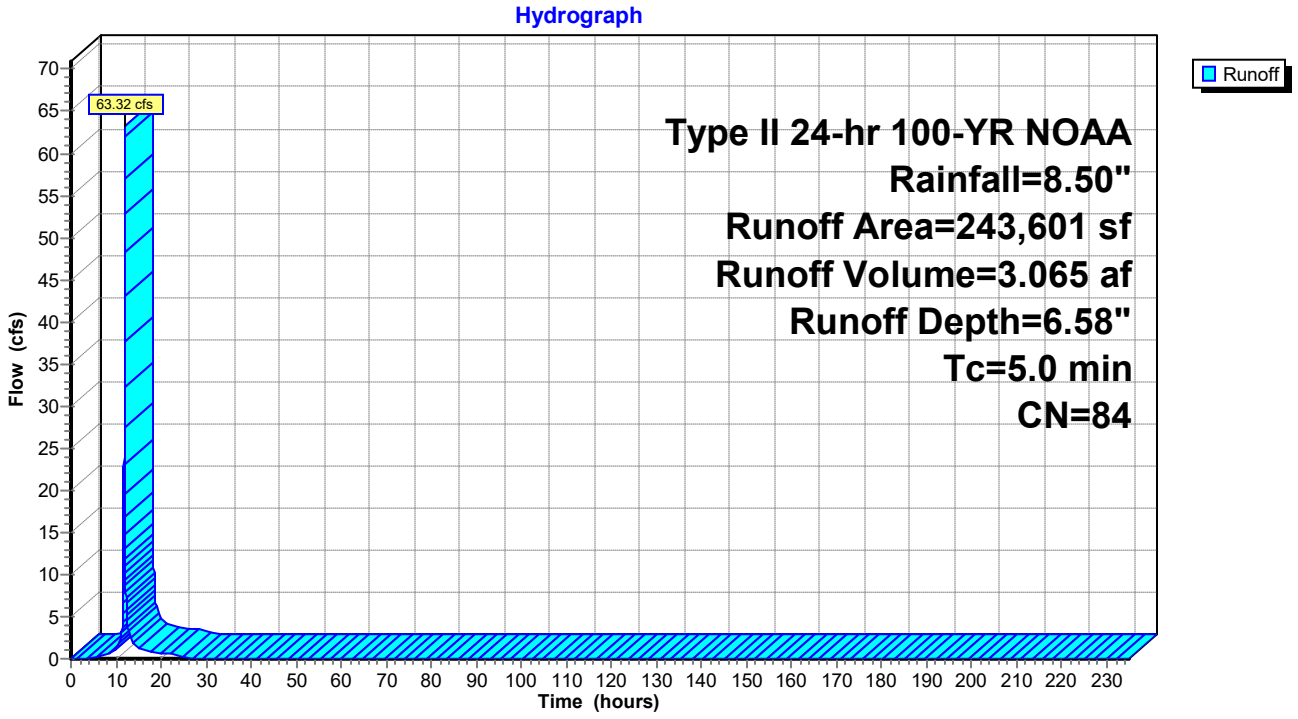
Runoff = 63.32 cfs @ 11.96 hrs, Volume= 3.065 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
53,337	98	Paved parking & roofs
190,264	80	>75% Grass cover, Good, HSG D
243,601	84	Weighted Average
190,264		Pervious Area
53,337		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 69S: DA to PC 4A



Summary for Subcatchment 70S: PC 3A

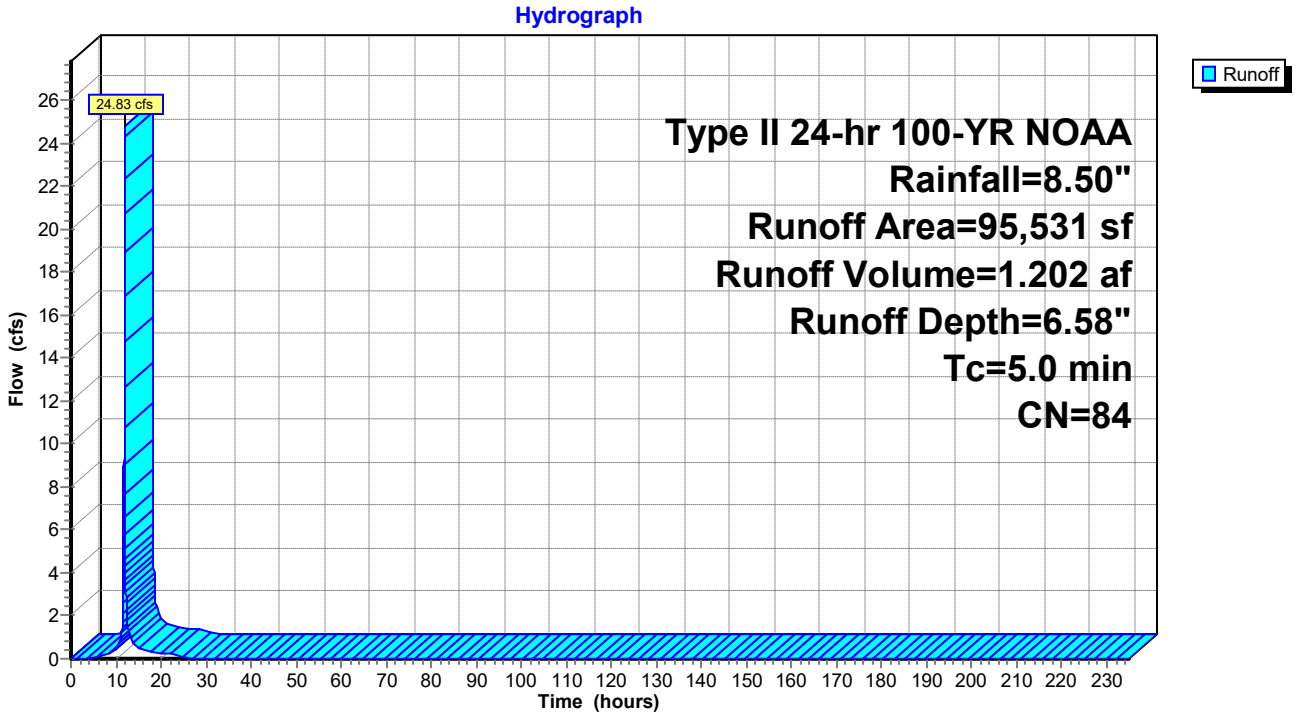
Runoff = 24.83 cfs @ 11.96 hrs, Volume= 1.202 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
20,880	98	Paved parking & roofs
74,651	80	>75% Grass cover, Good, HSG D
95,531	84	Weighted Average
74,651		Pervious Area
20,880		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 70S: PC 3A



Summary for Subcatchment 93S: CAP ROAD to DC2

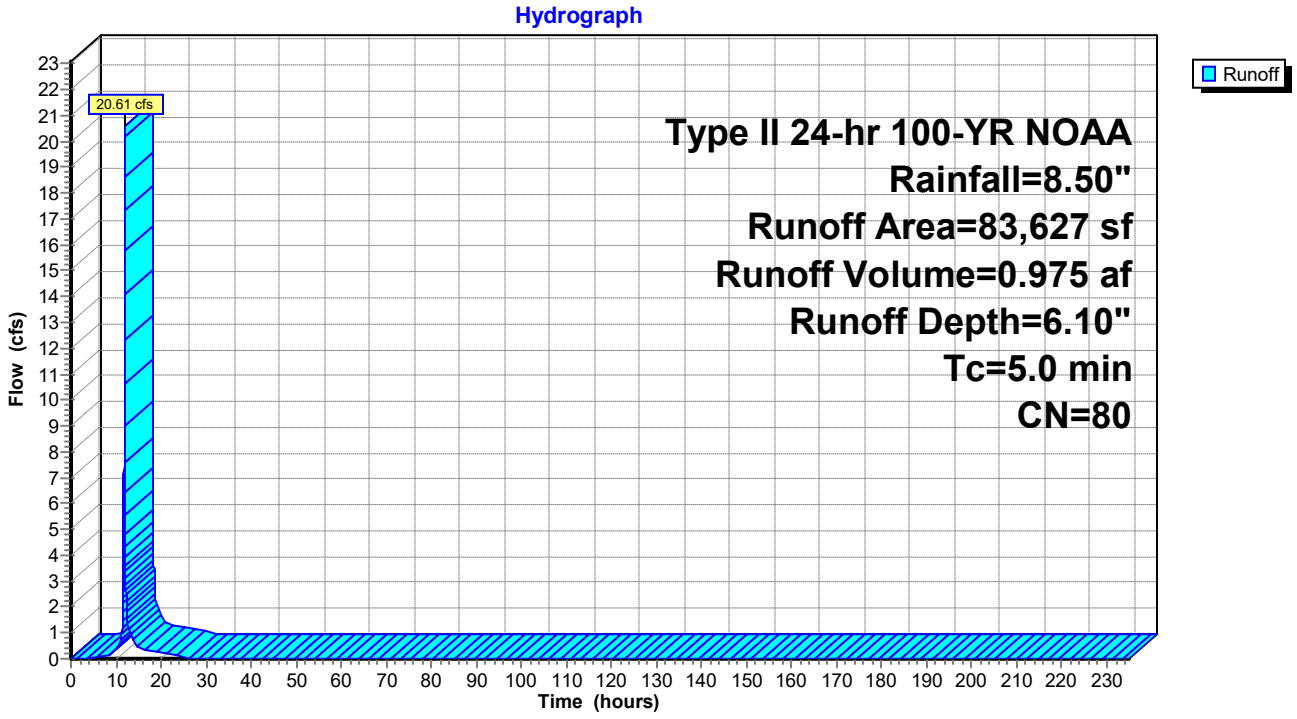
Runoff = 20.61 cfs @ 11.96 hrs, Volume= 0.975 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	63,066	74	FROM APPROVED CALCS
	20,561	98	Paved roads w/curbs & sewers
	83,627	80	Weighted Average
	63,066		Pervious Area
	20,561		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 93S: CAP ROAD to DC2



Summary for Subcatchment 94S: AREA TO SWALE 2

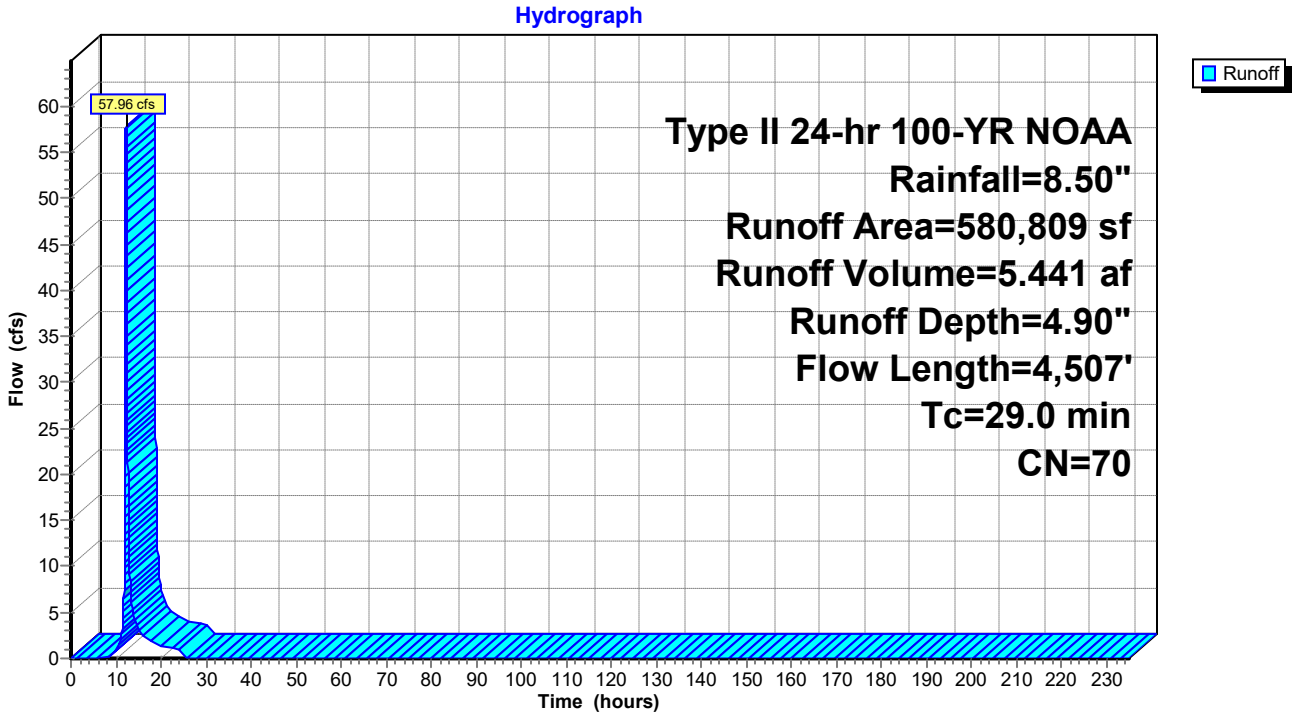
Runoff = 57.96 cfs @ 12.22 hrs, Volume= 5.441 af, Depth= 4.90"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	23,760	30	Woods, Good, HSG A
	29,120	70	Woods, Good, HSG C
*	113,835	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	272,732	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	12,155	80	>75% Grass cover, Good, HSG D (ONSITE D)
	33,629	30	Woods, Good, HSG A
	31,887	77	Woods, Good, HSG D
*	63,691	76	RA ZONING C SOILS
	580,809	70	Weighted Average
	580,809		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.8	100	0.0500	0.25		**Sheet Flow, A-B** Grass: Short n= 0.150 P2= 3.20"
0.6	120	0.0400	3.22		**Shallow Concentrated Flow, B-C** Unpaved Kv= 16.1 fps
0.1	27	0.3000	8.82		**Shallow Concentrated Flow, C-D** Unpaved Kv= 16.1 fps
1.5	250	0.0300	2.79		**Shallow Concentrated Flow, D-E** Unpaved Kv= 16.1 fps
20.0	4,010	0.0200	3.34	10.02	**Trap/Vee/Rect Channel Flow, F-G** Bot.W=5.00' D=0.50' Z= 2.0 '/' Top.W=7.00' n= 0.035 Earth, dense weeds
29.0	4,507	Total			

Subcatchment 94S: AREA TO SWALE 2



Summary for Subcatchment 95S: Upslope Area of PC3D

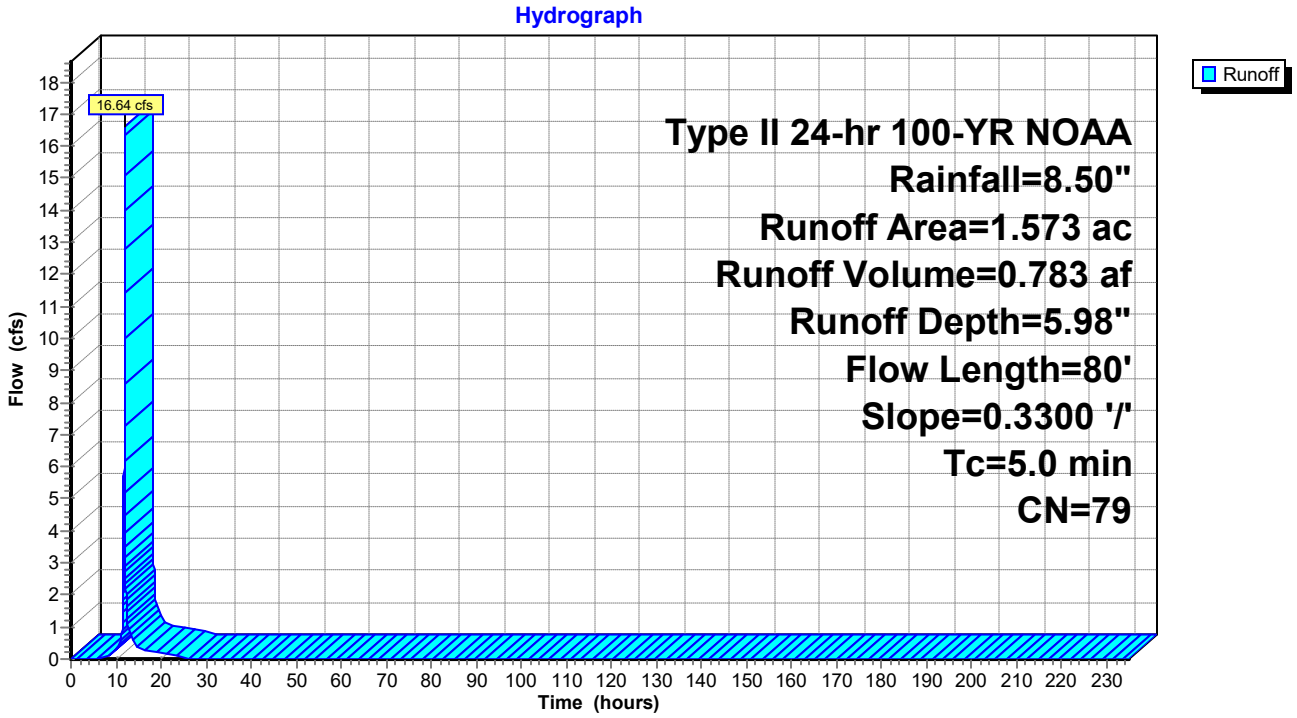
Runoff = 16.64 cfs @ 11.96 hrs, Volume= 0.783 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
1.240	74	>75% Grass cover, Good, HSG C
0.333	98	Paved parking & roofs
1.573	79	Weighted Average
1.240		Pervious Area
0.333		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, PErimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 95S: Upslope Area of PC3D



Summary for Subcatchment 96S: Upslope Area of PC3E

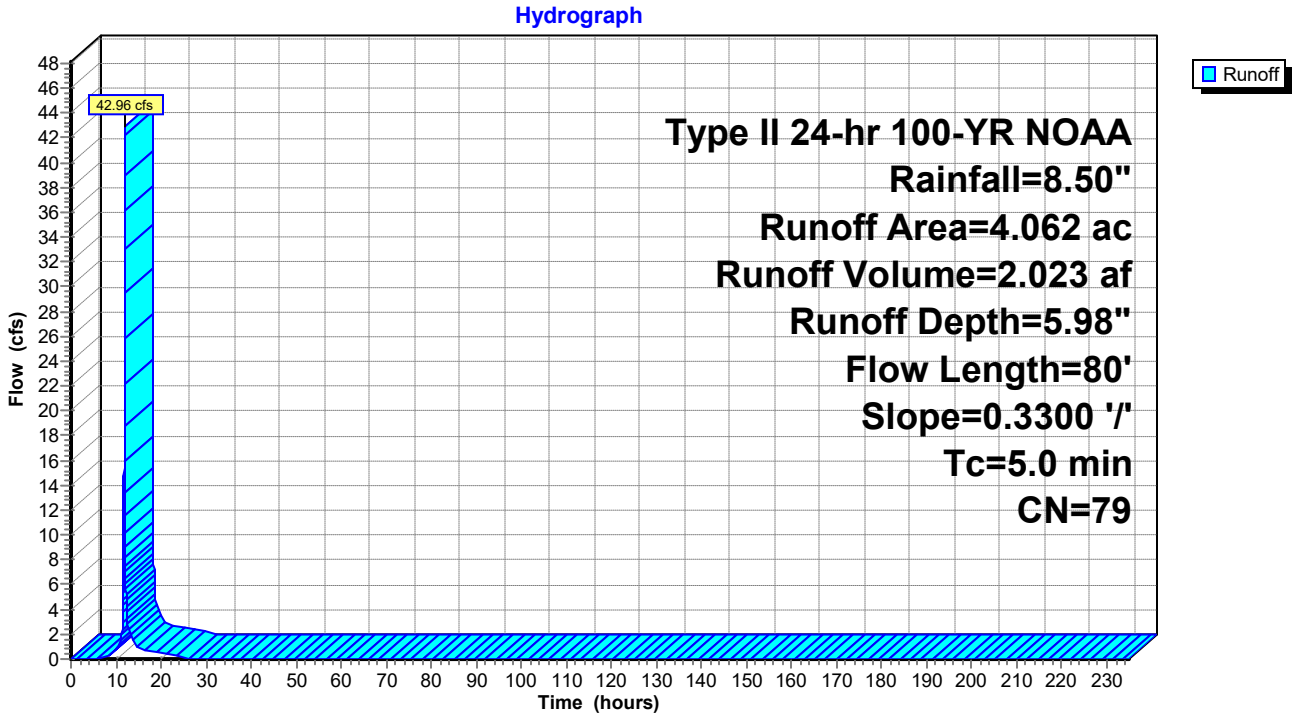
Runoff = 42.96 cfs @ 11.96 hrs, Volume= 2.023 af, Depth= 5.98"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
3.265	74	>75% Grass cover, Good, HSG C
0.797	98	Paved parking & roofs
4.062	79	Weighted Average
3.265		Pervious Area
0.797		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
2.7	80	0.3300	0.50		**Sheet Flow, Perimeter Berm** Grass: Short n= 0.150 P2= 3.20"
2.7	80	Total, Increased to minimum Tc = 5.0 min			

Subcatchment 96S: Upslope Area of PC3E



Summary for Subcatchment 106S: AREA TO DS-10 CULVERT

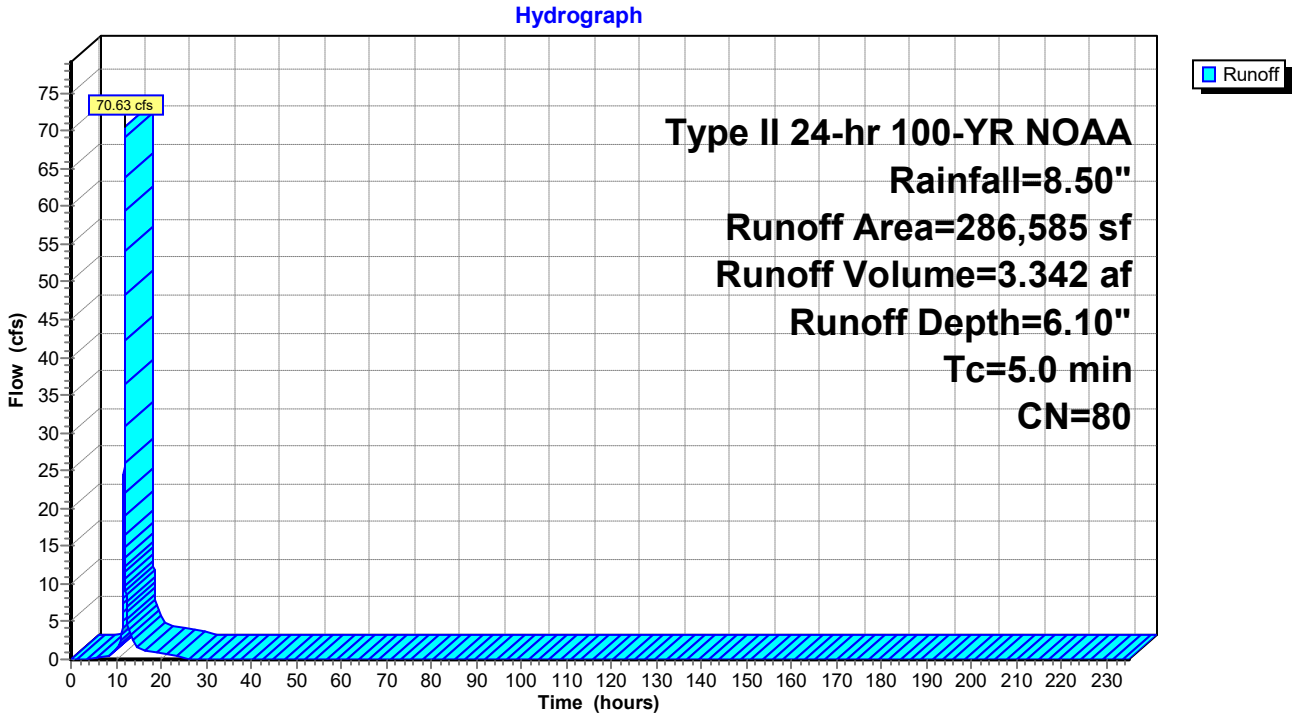
Runoff = 70.63 cfs @ 11.96 hrs, Volume= 3.342 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
286,585	80	>75% Grass cover, Good, HSG D
286,585		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 106S: AREA TO DS-10 CULVERT



Summary for Subcatchment 107S: DA TO PC 5

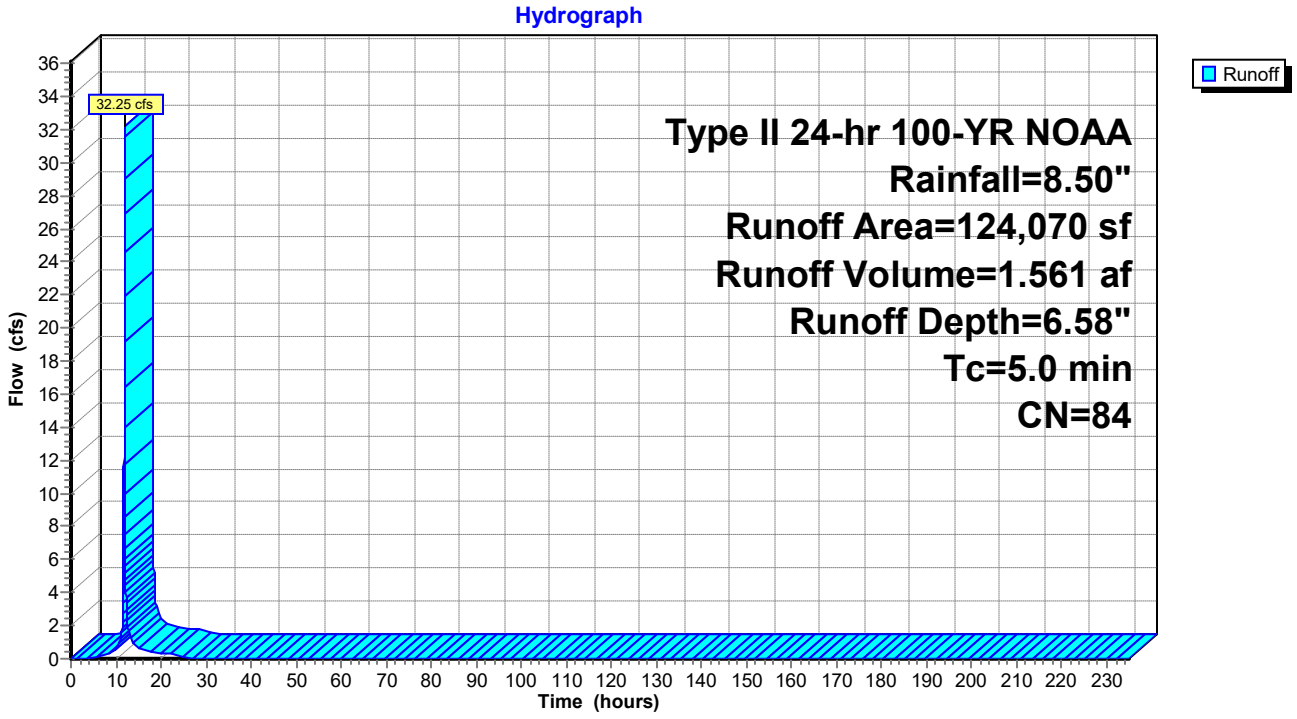
Runoff = 32.25 cfs @ 11.96 hrs, Volume= 1.561 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	27,657	98	PERIMETER ROAD
	96,413	80	>75% Grass cover, Good, HSG D
	124,070	84	Weighted Average
	96,413		Pervious Area
	27,657		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 107S: DA TO PC 5



Summary for Reach 89R: PC 4G

Inflow Area = 50.453 ac, 9.47% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 552.08 cfs @ 11.96 hrs, Volume= 26.400 af
Outflow = 542.99 cfs @ 11.97 hrs, Volume= 26.400 af, Atten= 2%, Lag= 0.8 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 13.72 fps, Min. Travel Time= 1.2 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 5.8 min

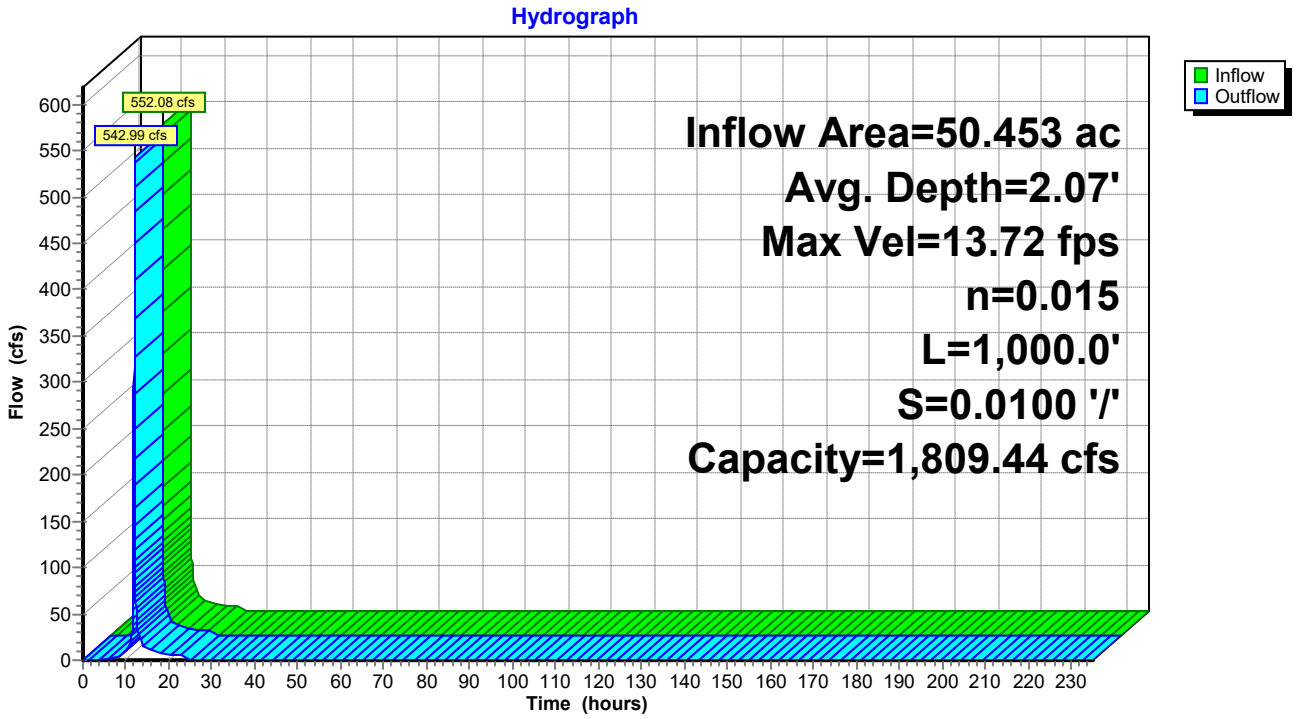
Peak Storage= 39,550 cf @ 11.97 hrs, Average Depth at Peak Storage= 2.07'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 1,809.44 cfs

15.00' x 4.00' deep channel, n= 0.015
Side Slope Z-value= 2.0 '/' Top Width= 31.00'
Length= 1,000.0' Slope= 0.0100 '/'
Inlet Invert= 90.00', Outlet Invert= 80.00'



‡

Reach 89R: PC 4G



Summary for Reach 95R: DC-1

Inflow Area = 8.371 ac, 21.28% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 94.79 cfs @ 11.96 hrs, Volume= 4.587 af
Outflow = 94.16 cfs @ 11.97 hrs, Volume= 4.587 af, Atten= 1%, Lag= 0.5 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 17.11 fps, Min. Travel Time= 0.8 min
Avg. Velocity = 3.41 fps, Avg. Travel Time= 3.9 min

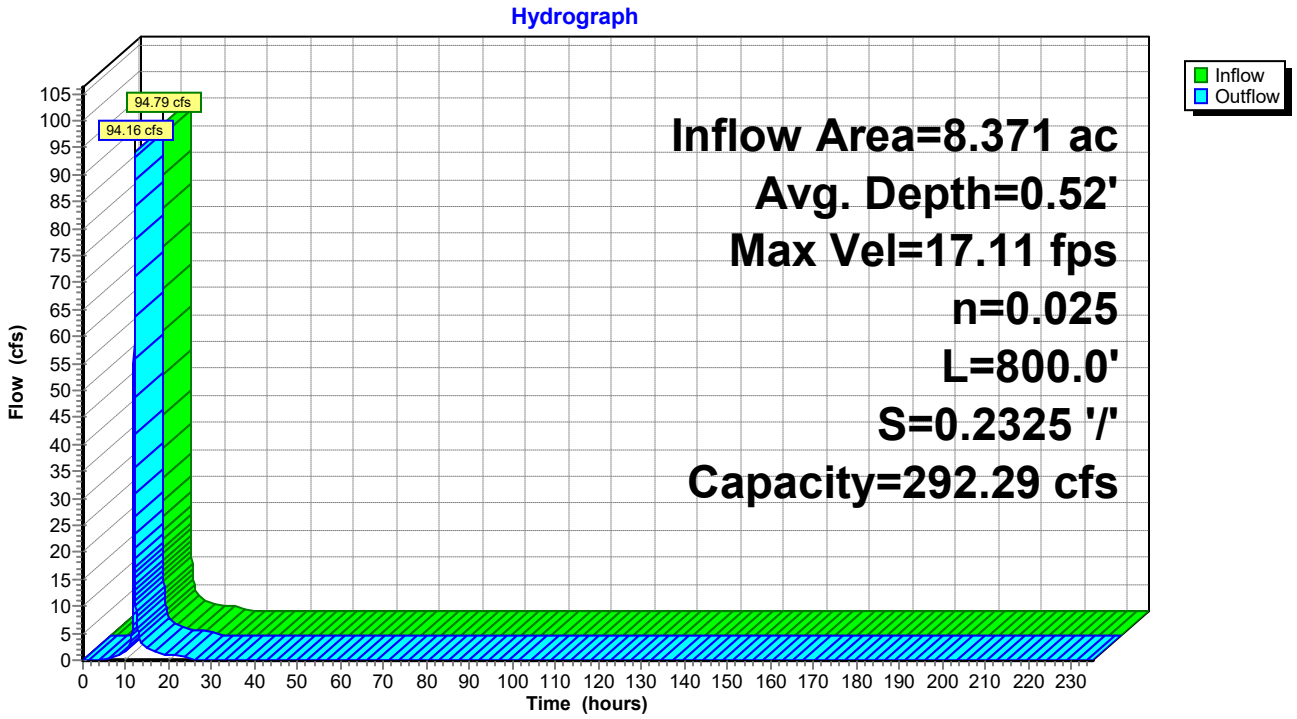
Peak Storage= 4,400 cf @ 11.97 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 292.29 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 800.0' Slope= 0.2325 '/'
Inlet Invert= 264.00', Outlet Invert= 78.00'



‡

Reach 95R: DC-1



Summary for Reach 96R: DC-2

Inflow Area = 9.699 ac, 13.72% Impervious, Inflow Depth = 6.29" for 100-YR NOAA event
Inflow = 106.49 cfs @ 11.96 hrs, Volume= 5.082 af
Outflow = 106.14 cfs @ 11.96 hrs, Volume= 5.082 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 19.10 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.85 fps, Avg. Travel Time= 2.6 min

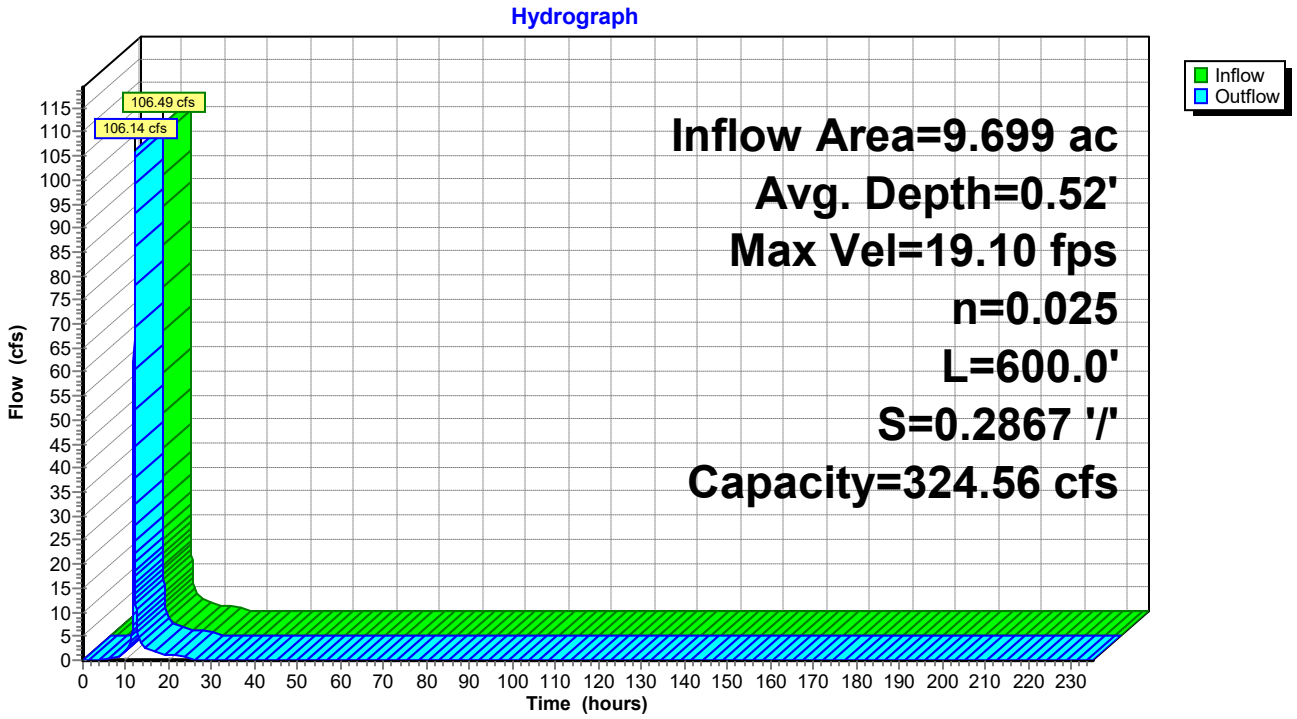
Peak Storage= 3,332 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 324.56 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 600.0' Slope= 0.2867 '/'
Inlet Invert= 264.00', Outlet Invert= 92.00'



‡

Reach 96R: DC-2



Summary for Reach 97R: DC-3

Inflow Area = 10.378 ac, 4.90% Impervious, Inflow Depth = 6.22" for 100-YR NOAA event
Inflow = 113.02 cfs @ 11.96 hrs, Volume= 5.375 af
Outflow = 112.80 cfs @ 11.96 hrs, Volume= 5.375 af, Atten= 0%, Lag= 0.3 min

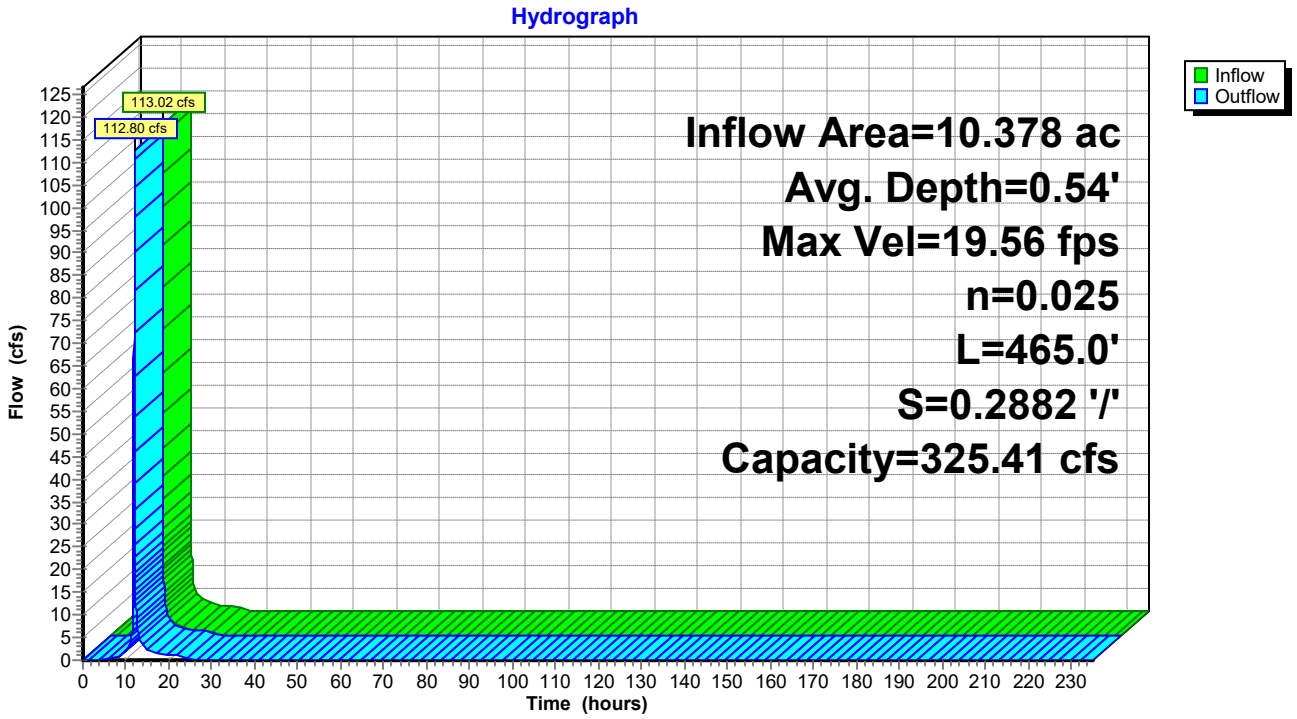
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 19.56 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.99 fps, Avg. Travel Time= 1.9 min

Peak Storage= 2,681 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.54'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.41 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 465.0' Slope= 0.2882 '/'
Inlet Invert= 264.00', Outlet Invert= 130.00'



‡



Summary for Reach 98R: DC-4

Inflow Area = 7.461 ac, 2.45% Impervious, Inflow Depth = 6.10" for 100-YR NOAA event
Inflow = 80.10 cfs @ 11.96 hrs, Volume= 3.790 af
Outflow = 79.94 cfs @ 11.96 hrs, Volume= 3.790 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 17.32 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.53 fps, Avg. Travel Time= 2.0 min

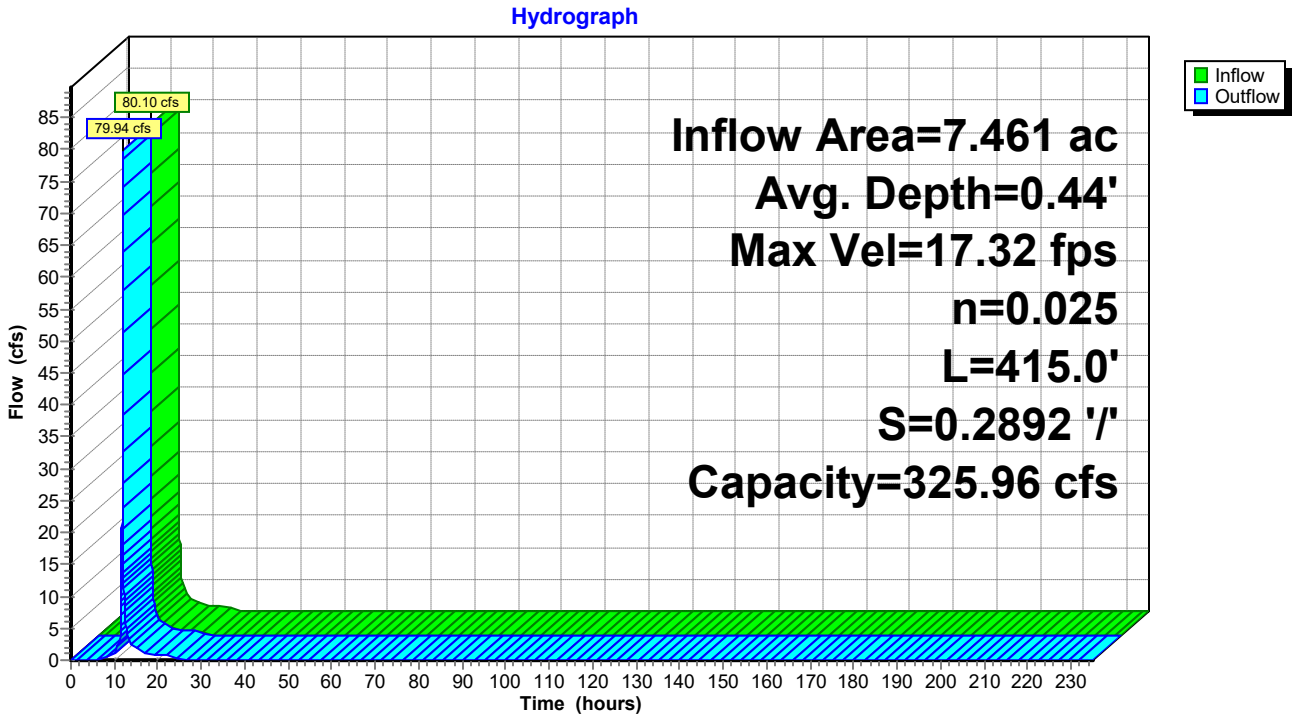
Peak Storage= 1,915 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.44'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.96 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 415.0' Slope= 0.2892 '/'
Inlet Invert= 264.00', Outlet Invert= 144.00'



‡

Reach 98R: DC-4



Summary for Reach 99R: DC-5

Inflow Area = 7.718 ac, 2.47% Impervious, Inflow Depth = 6.10" for 100-YR NOAA event
Inflow = 82.86 cfs @ 11.96 hrs, Volume= 3.920 af
Outflow = 82.72 cfs @ 11.96 hrs, Volume= 3.920 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 17.64 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.60 fps, Avg. Travel Time= 1.8 min

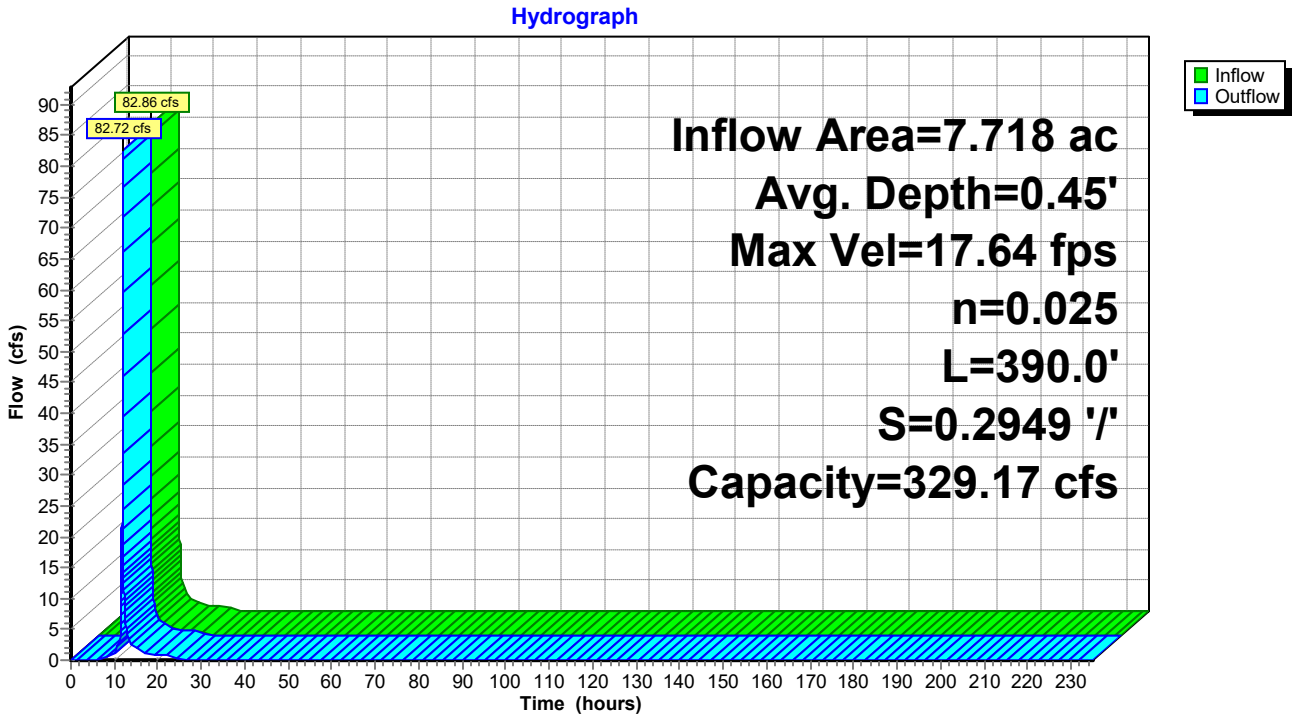
Peak Storage= 1,828 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.45'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 329.17 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2949 '/'
Inlet Invert= 264.00', Outlet Invert= 149.00'



‡

Reach 99R: DC-5



Summary for Reach 100R: DC-6

Inflow Area = 9.605 ac, 13.94% Impervious, Inflow Depth = 6.46" for 100-YR NOAA event
Inflow = 107.42 cfs @ 11.96 hrs, Volume= 5.167 af
Outflow = 107.34 cfs @ 11.96 hrs, Volume= 5.167 af, Atten= 0%, Lag= 0.2 min

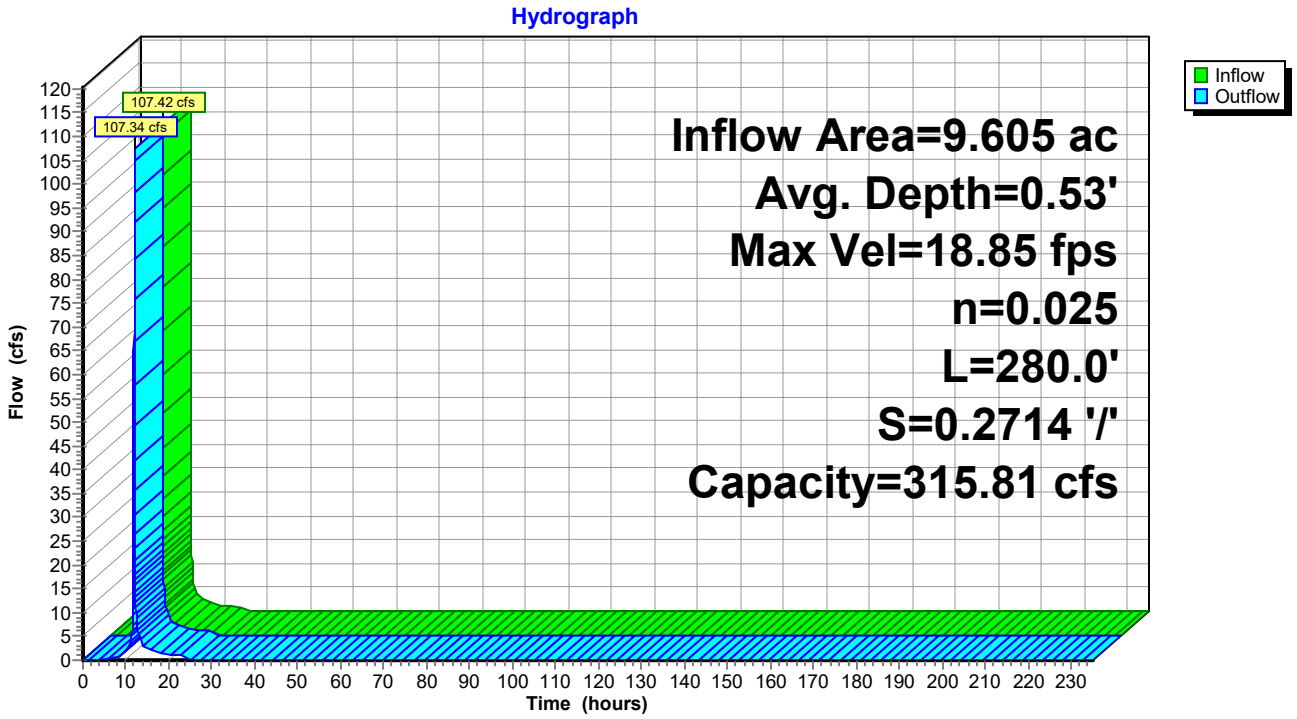
Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.85 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.85 fps, Avg. Travel Time= 1.2 min

Peak Storage= 1,594 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.53'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.81 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 280.0' Slope= 0.2714 '/'
Inlet Invert= 230.00', Outlet Invert= 154.00'



‡



Summary for Reach 101R: DC-7

Inflow Area = 9.511 ac, 5.16% Impervious, Inflow Depth = 6.22" for 100-YR NOAA event
Inflow = 103.58 cfs @ 11.96 hrs, Volume= 4.926 af
Outflow = 103.42 cfs @ 11.96 hrs, Volume= 4.926 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.72 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.82 fps, Avg. Travel Time= 1.7 min

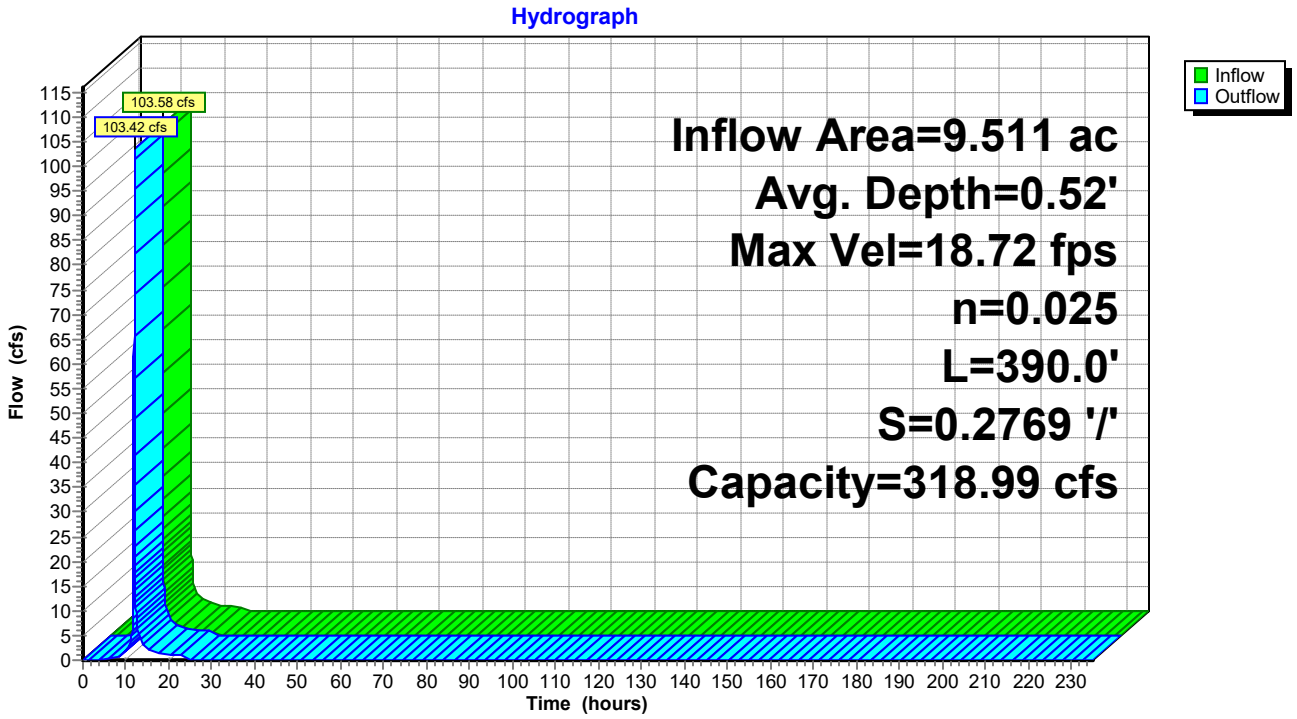
Peak Storage= 2,154 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.52'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.99 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 390.0' Slope= 0.2769 '/'
Inlet Invert= 266.00', Outlet Invert= 158.00'



‡

Reach 101R: DC-7



Summary for Reach 102R: DC-8

Inflow Area = 10.120 ac, 5.29% Impervious, Inflow Depth = 5.50" for 100-YR NOAA event
Inflow = 100.17 cfs @ 11.96 hrs, Volume= 4.634 af
Outflow = 99.97 cfs @ 11.96 hrs, Volume= 4.634 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.49 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 3.84 fps, Avg. Travel Time= 1.9 min

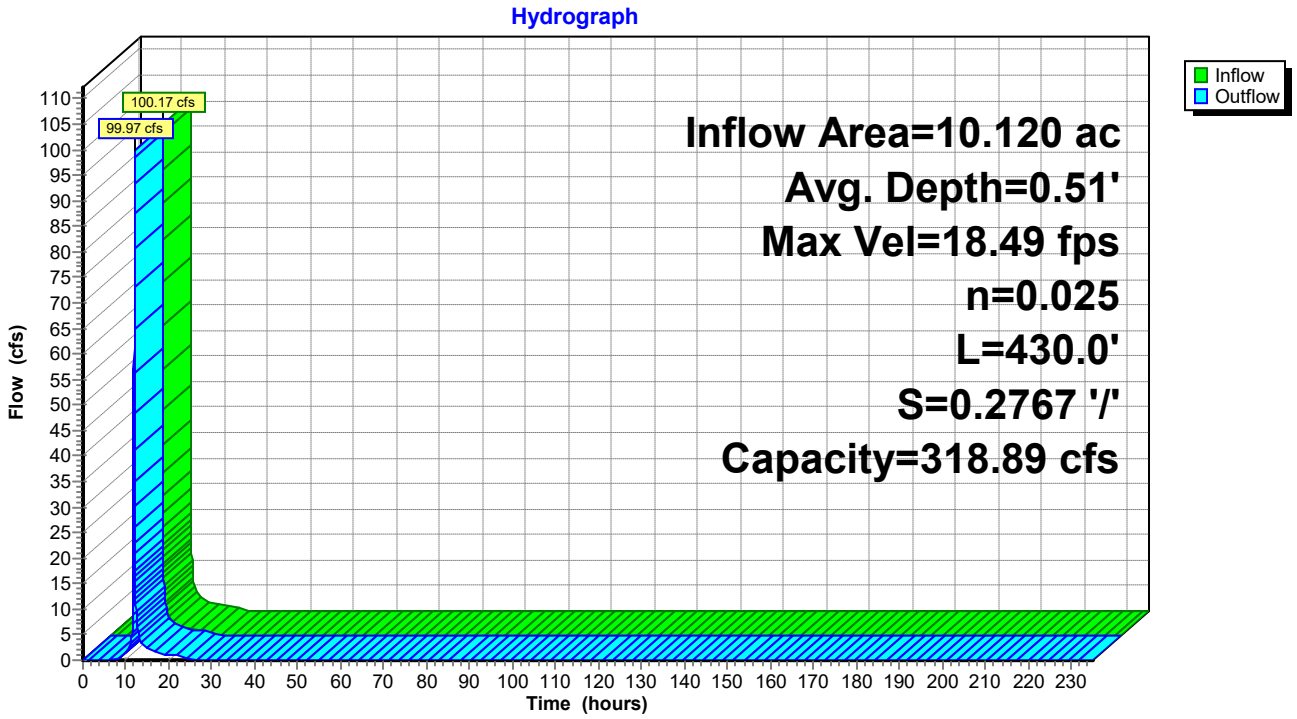
Peak Storage= 2,324 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.51'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 318.89 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 430.0' Slope= 0.2767 '/'
Inlet Invert= 262.00', Outlet Invert= 143.00'



‡

Reach 102R: DC-8



Summary for Reach 103R: DC-9

Inflow Area = 6.768 ac, 9.96% Impervious, Inflow Depth = 6.34" for 100-YR NOAA event
Inflow = 74.71 cfs @ 11.96 hrs, Volume= 3.573 af
Outflow = 74.53 cfs @ 11.96 hrs, Volume= 3.573 af, Atten= 0%, Lag= 0.3 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 16.54 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 3.35 fps, Avg. Travel Time= 2.2 min

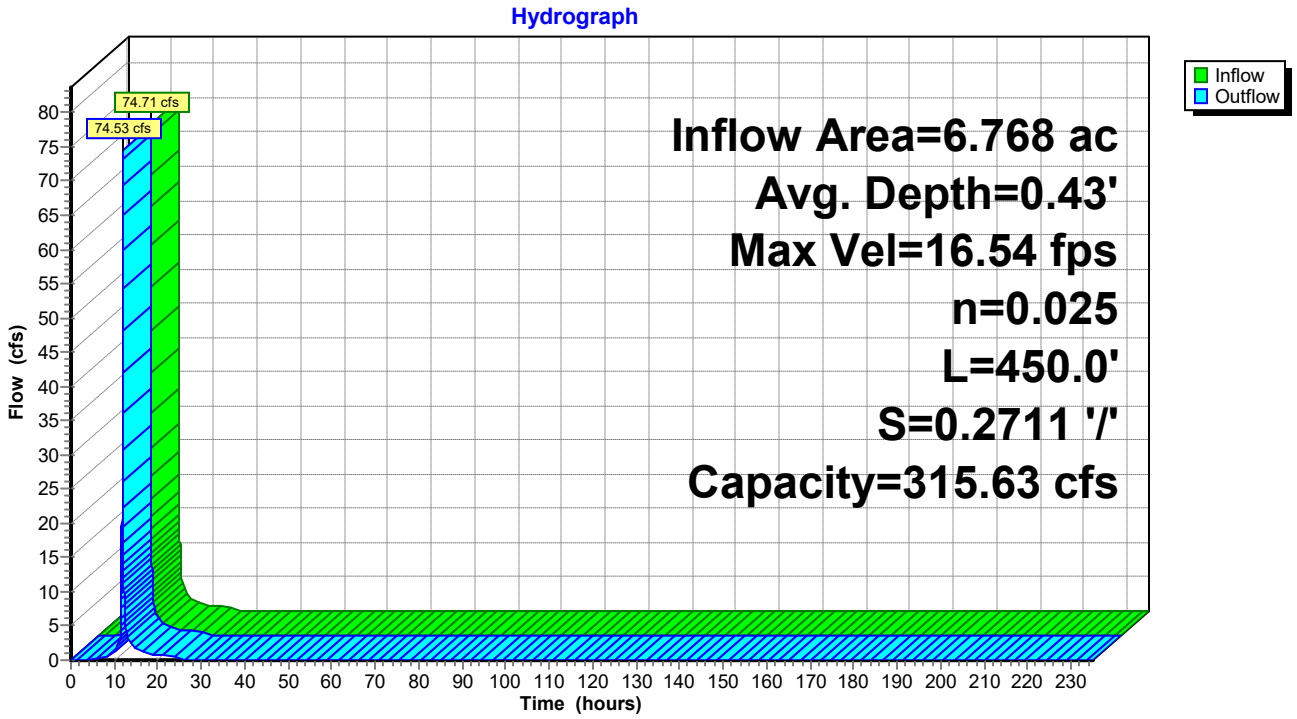
Peak Storage= 2,027 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.43'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 315.63 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 450.0' Slope= 0.2711 '/'
Inlet Invert= 252.00', Outlet Invert= 130.00'



‡

Reach 103R: DC-9



Summary for Reach 104R: DC-10

Inflow Area = 8.427 ac, 8.39% Impervious, Inflow Depth = 6.34" for 100-YR NOAA event
Inflow = 93.03 cfs @ 11.96 hrs, Volume= 4.449 af
Outflow = 92.93 cfs @ 11.96 hrs, Volume= 4.449 af, Atten= 0%, Lag= 0.2 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Max. Velocity= 18.25 fps, Min. Travel Time= 0.3 min
Avg. Velocity = 3.72 fps, Avg. Travel Time= 1.4 min

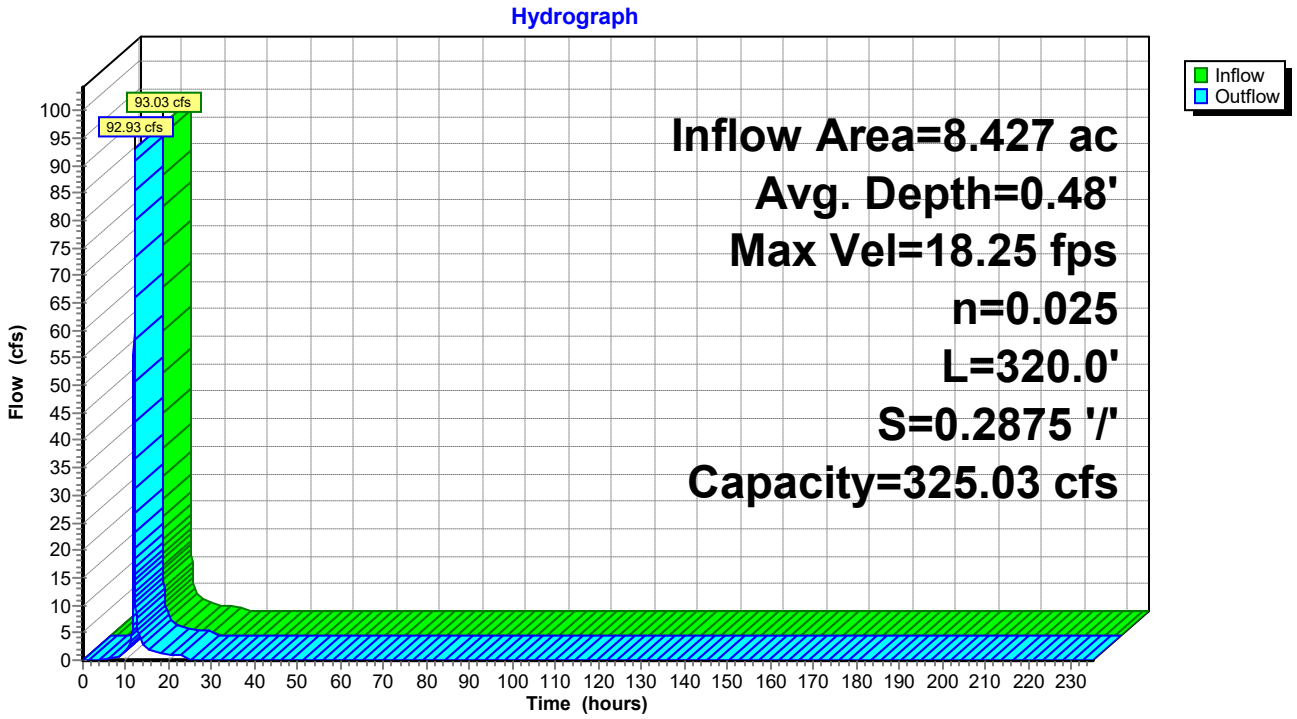
Peak Storage= 1,630 cf @ 11.96 hrs, Average Depth at Peak Storage= 0.48'
Bank-Full Depth= 1.00', Capacity at Bank-Full= 325.03 cfs

9.60' x 1.00' deep channel, n= 0.025 Rubble masonry, cemented
Side Slope Z-value= 2.0 '/' Top Width= 13.60'
Length= 320.0' Slope= 0.2875 '/'
Inlet Invert= 210.00', Outlet Invert= 118.00'



‡

Reach 104R: DC-10

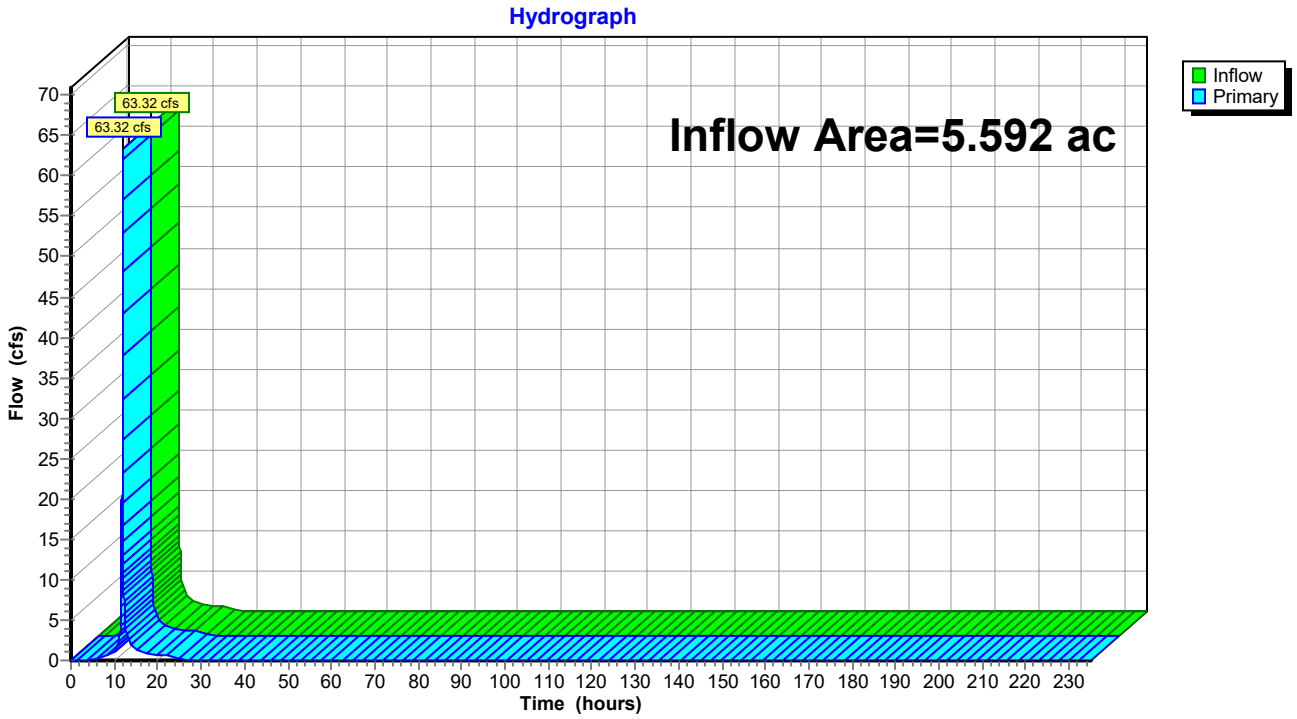


Summary for Link 57L: PC 4A

Inflow Area = 5.592 ac, 21.90% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 63.32 cfs @ 11.96 hrs, Volume= 3.065 af
Primary = 63.32 cfs @ 11.96 hrs, Volume= 3.065 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 57L: PC 4A

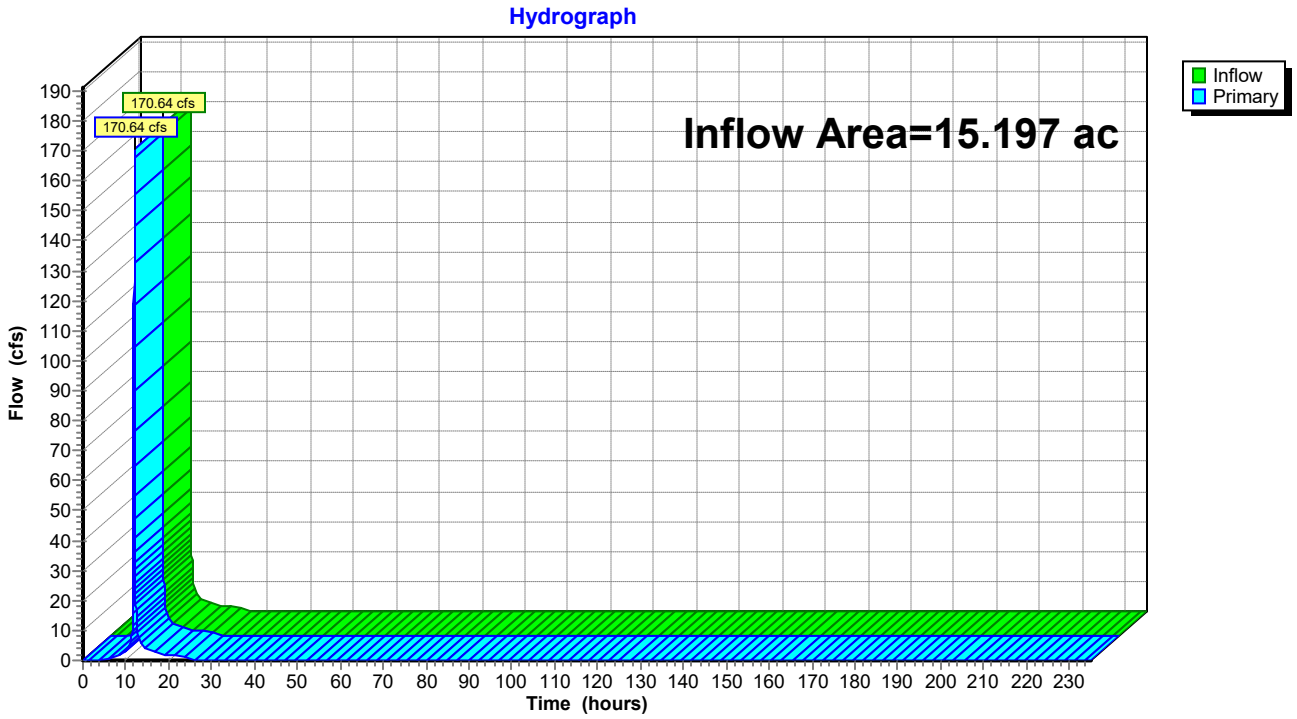


Summary for Link 58L: PC 4B

Inflow Area = 15.197 ac, 16.87% Impervious, Inflow Depth = 6.50" for 100-YR NOAA event
Inflow = 170.64 cfs @ 11.96 hrs, Volume= 8.232 af
Primary = 170.64 cfs @ 11.96 hrs, Volume= 8.232 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 58L: PC 4B

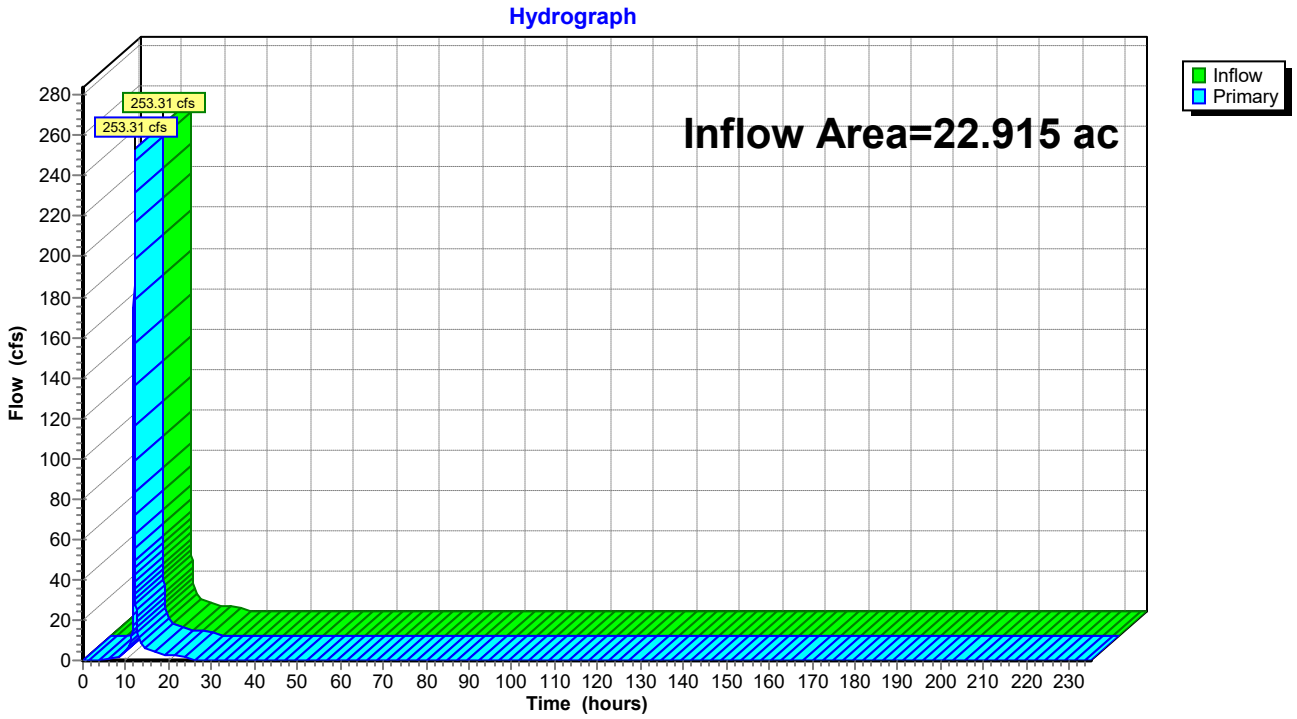


Summary for Link 59L: PC 4C

Inflow Area = 22.915 ac, 12.02% Impervious, Inflow Depth = 6.36" for 100-YR NOAA event
Inflow = 253.31 cfs @ 11.96 hrs, Volume= 12.152 af
Primary = 253.31 cfs @ 11.96 hrs, Volume= 12.152 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 59L: PC 4C

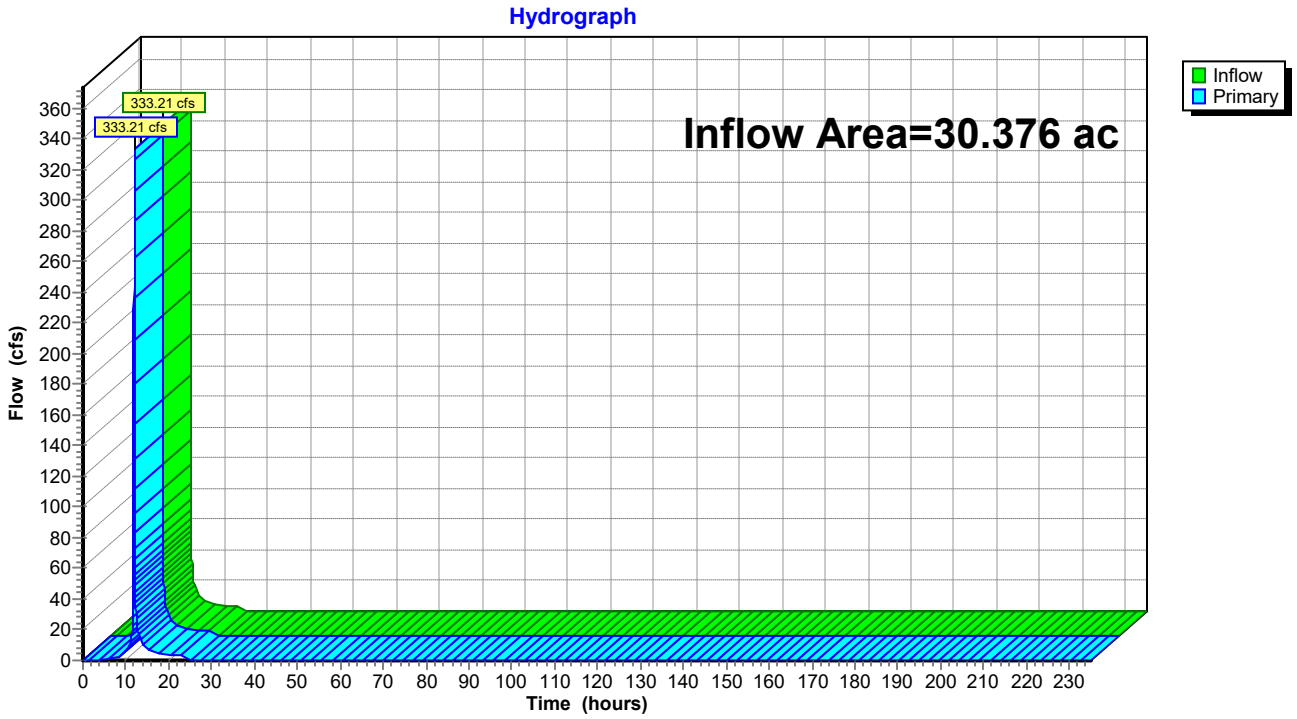


Summary for Link 60L: PC 4D

Inflow Area = 30.376 ac, 9.67% Impervious, Inflow Depth = 6.30" for 100-YR NOAA event
Inflow = 333.21 cfs @ 11.96 hrs, Volume= 15.942 af
Primary = 333.21 cfs @ 11.96 hrs, Volume= 15.942 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 60L: PC 4D

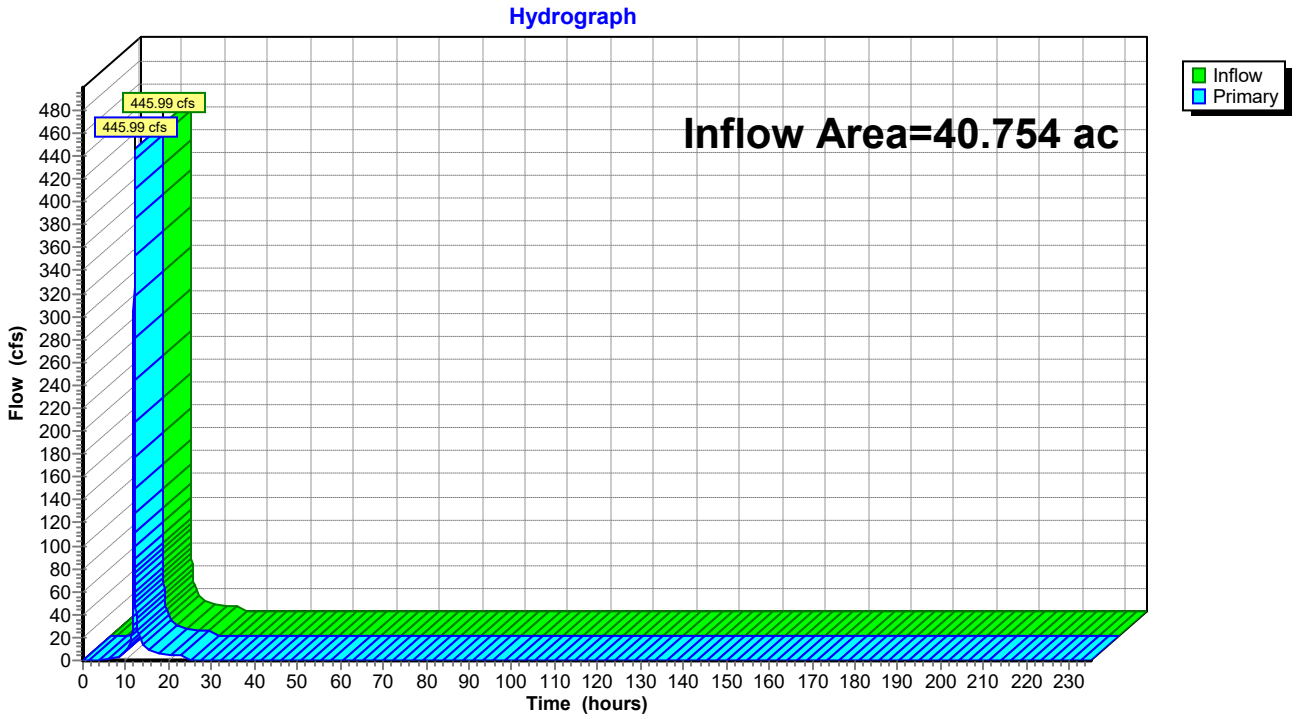


Summary for Link 61L: PC 4E

Inflow Area = 40.754 ac, 8.45% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 445.99 cfs @ 11.96 hrs, Volume= 21.317 af
Primary = 445.99 cfs @ 11.96 hrs, Volume= 21.317 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 61L: PC 4E

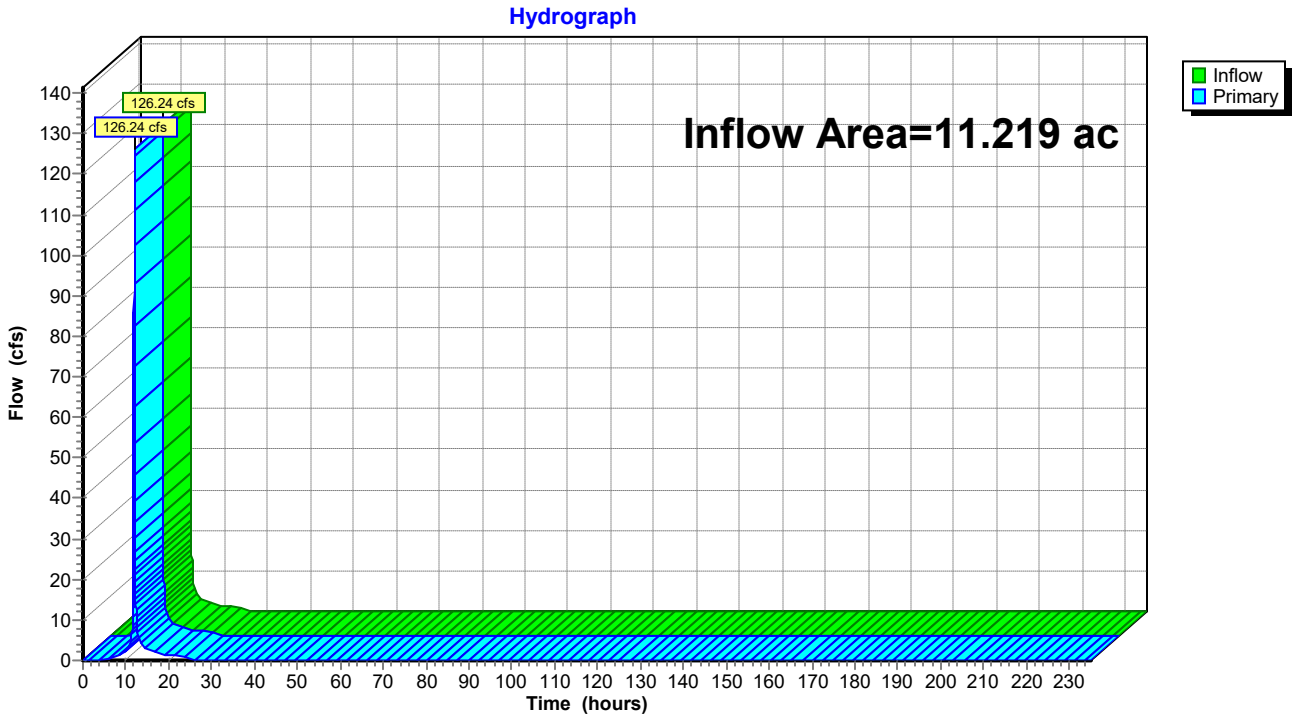


Summary for Link 62L: PC 5

Inflow Area = 11.219 ac, 21.53% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 126.24 cfs @ 11.96 hrs, Volume= 6.148 af
Primary = 126.24 cfs @ 11.96 hrs, Volume= 6.148 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 62L: PC 5

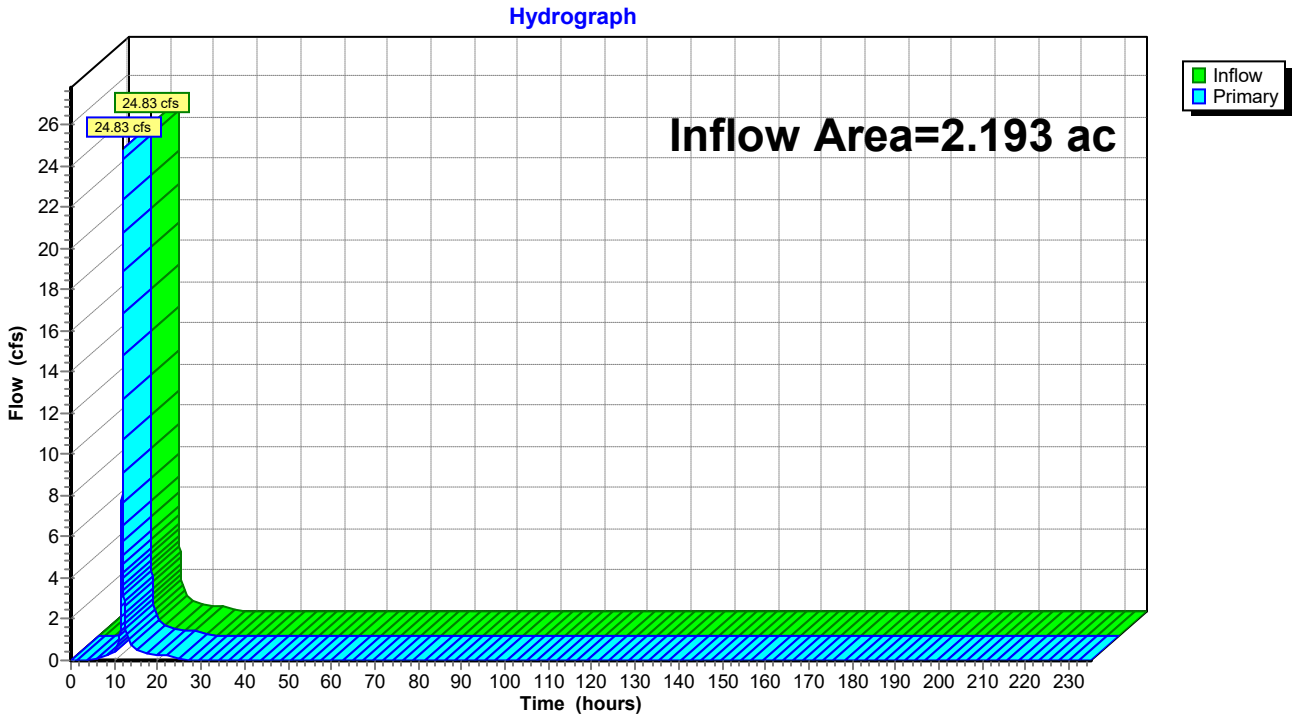


Summary for Link 63L: PC 3A

Inflow Area = 2.193 ac, 21.86% Impervious, Inflow Depth = 6.58" for 100-YR NOAA event
Inflow = 24.83 cfs @ 11.96 hrs, Volume= 1.202 af
Primary = 24.83 cfs @ 11.96 hrs, Volume= 1.202 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 63L: PC 3A

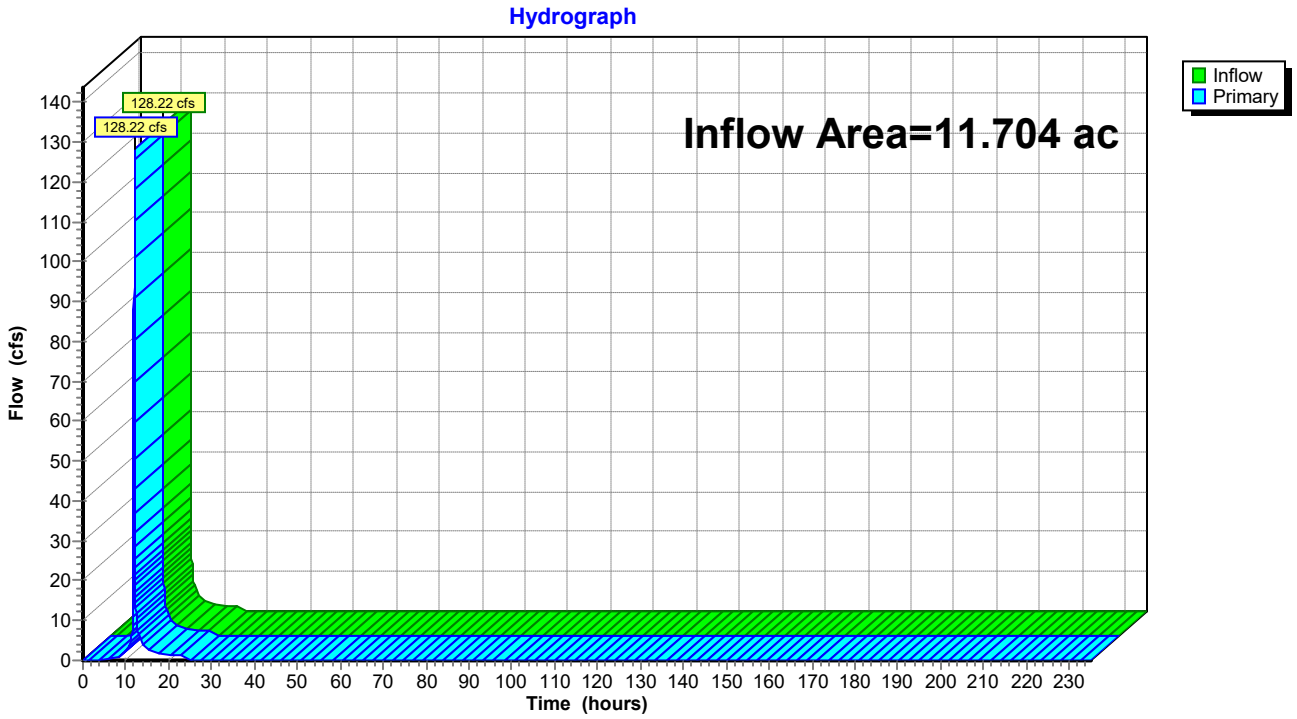


Summary for Link 64L: PC 3B

Inflow Area = 11.704 ac, 8.29% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 128.22 cfs @ 11.96 hrs, Volume= 6.128 af
Primary = 128.22 cfs @ 11.96 hrs, Volume= 6.128 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 64L: PC 3B

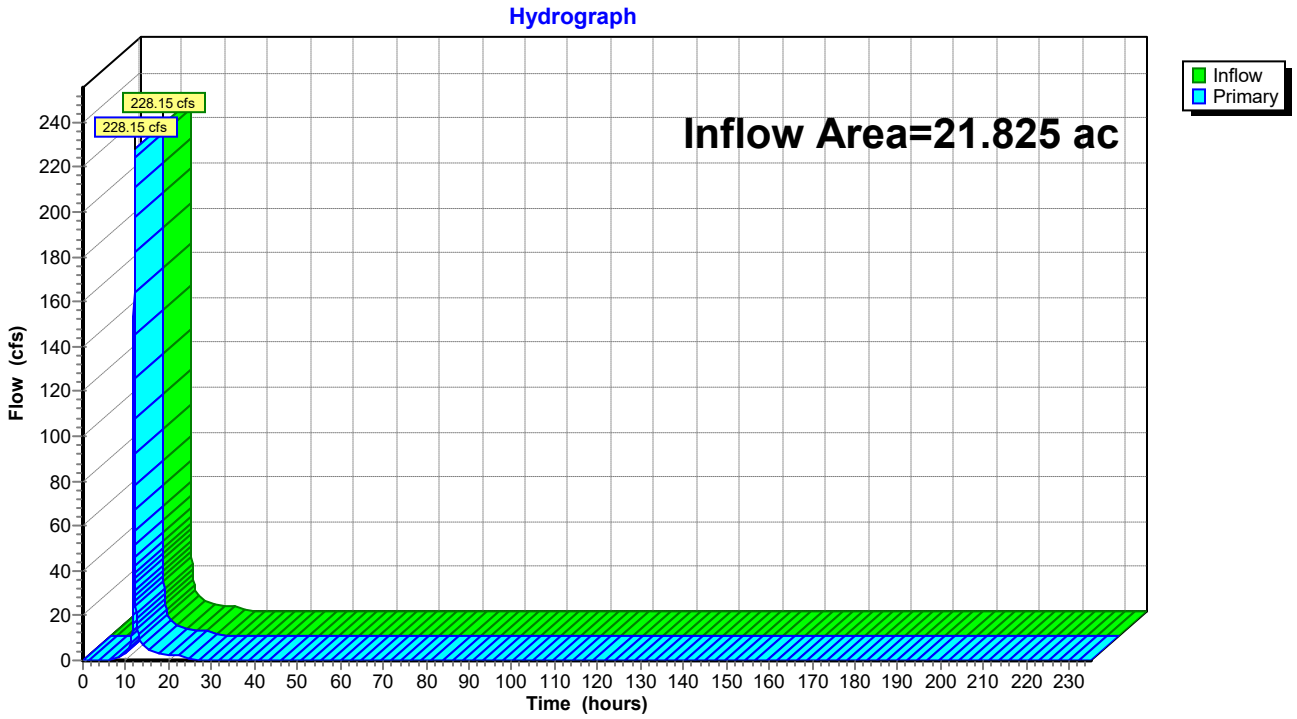


Summary for Link 65L: PC 3C

Inflow Area = 21.825 ac, 6.90% Impervious, Inflow Depth = 5.92" for 100-YR NOAA event
Inflow = 228.15 cfs @ 11.96 hrs, Volume= 10.762 af
Primary = 228.15 cfs @ 11.96 hrs, Volume= 10.762 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 65L: PC 3C

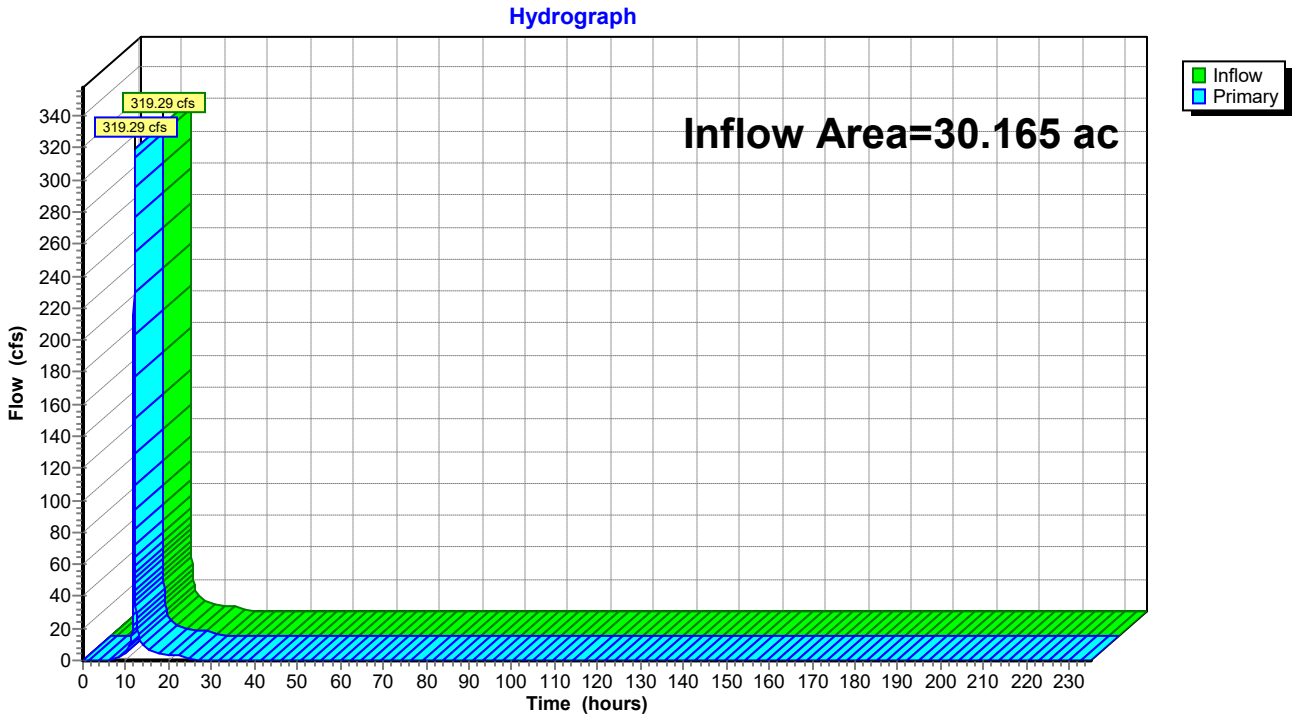


Summary for Link 66L: PC 3D

Inflow Area = 30.165 ac, 8.33% Impervious, Inflow Depth = 6.01" for 100-YR NOAA event
Inflow = 319.29 cfs @ 11.96 hrs, Volume= 15.119 af
Primary = 319.29 cfs @ 11.96 hrs, Volume= 15.119 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 66L: PC 3D

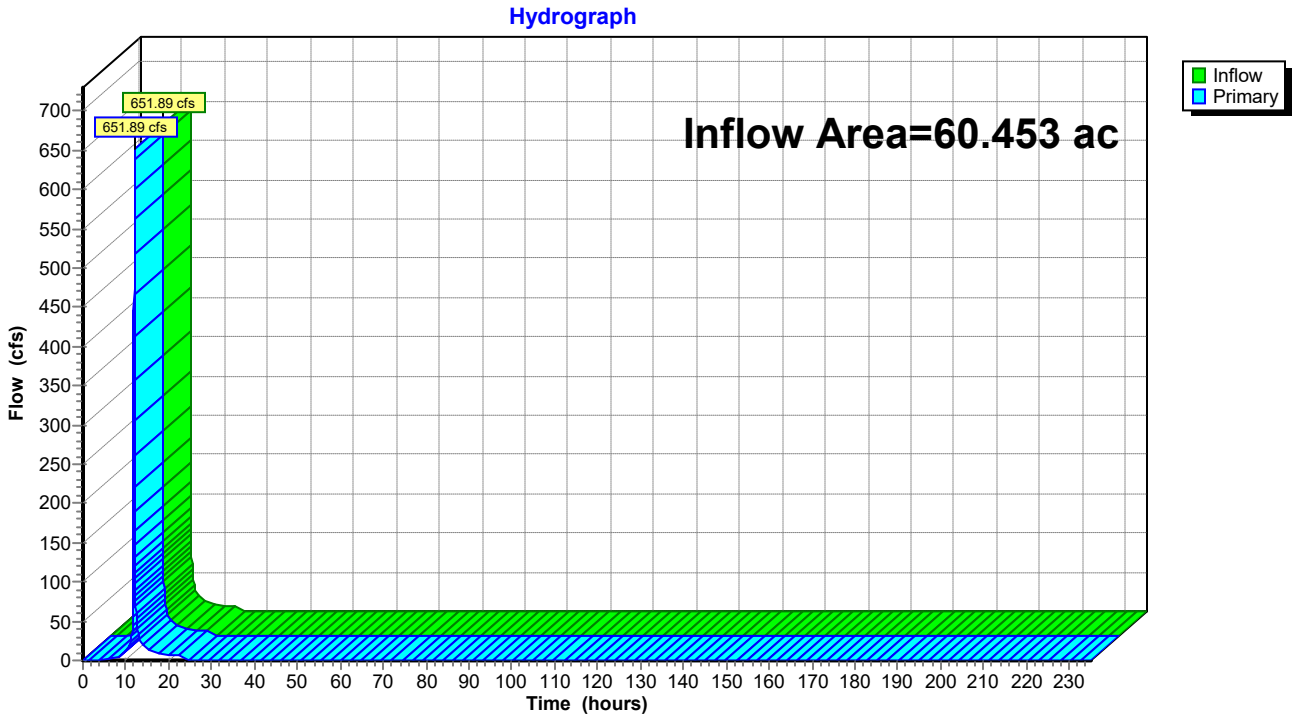


Summary for Link 67L: CROSS PIPE

Inflow Area = 60.453 ac, 10.64% Impervious, Inflow Depth = 6.17" for 100-YR NOAA event
Inflow = 651.89 cfs @ 11.96 hrs, Volume= 31.081 af
Primary = 651.89 cfs @ 11.96 hrs, Volume= 31.081 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 67L: CROSS PIPE

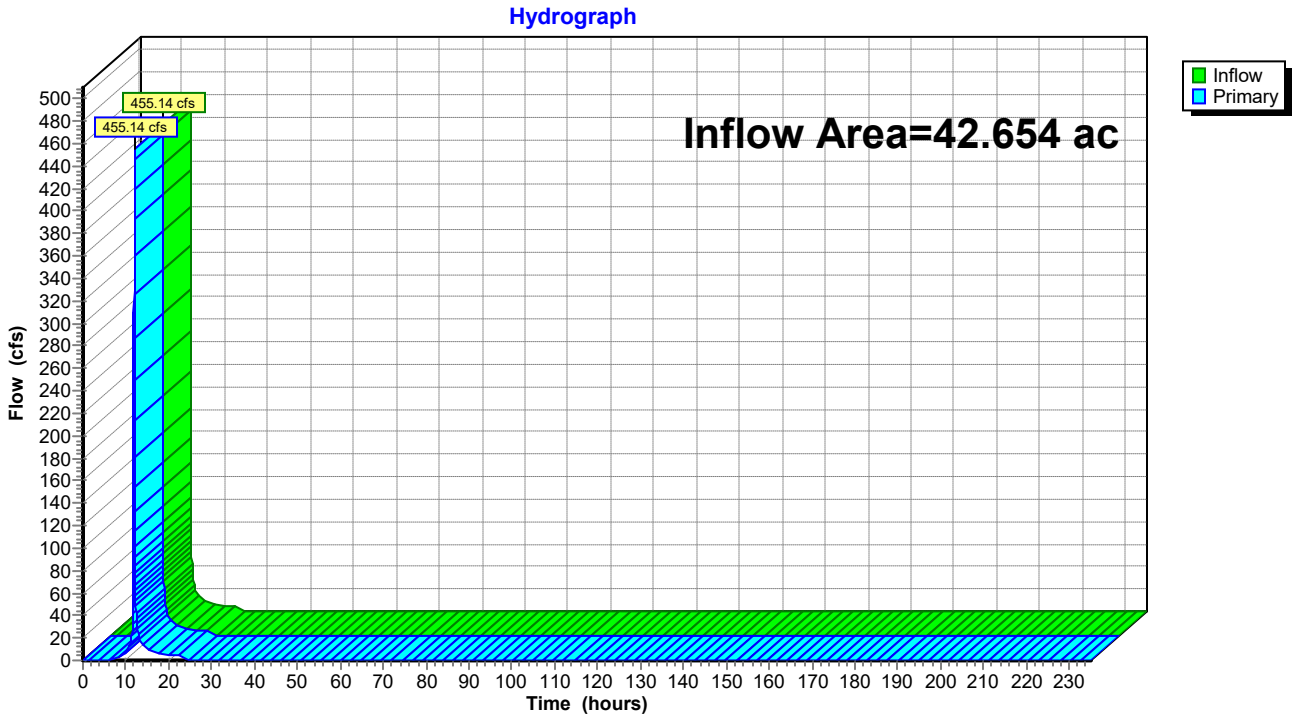


Summary for Link 68L: PC 3E

Inflow Area = 42.654 ac, 9.42% Impervious, Inflow Depth = 6.07" for 100-YR NOAA event
Inflow = 455.14 cfs @ 11.96 hrs, Volume= 21.591 af
Primary = 455.14 cfs @ 11.96 hrs, Volume= 21.591 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 68L: PC 3E

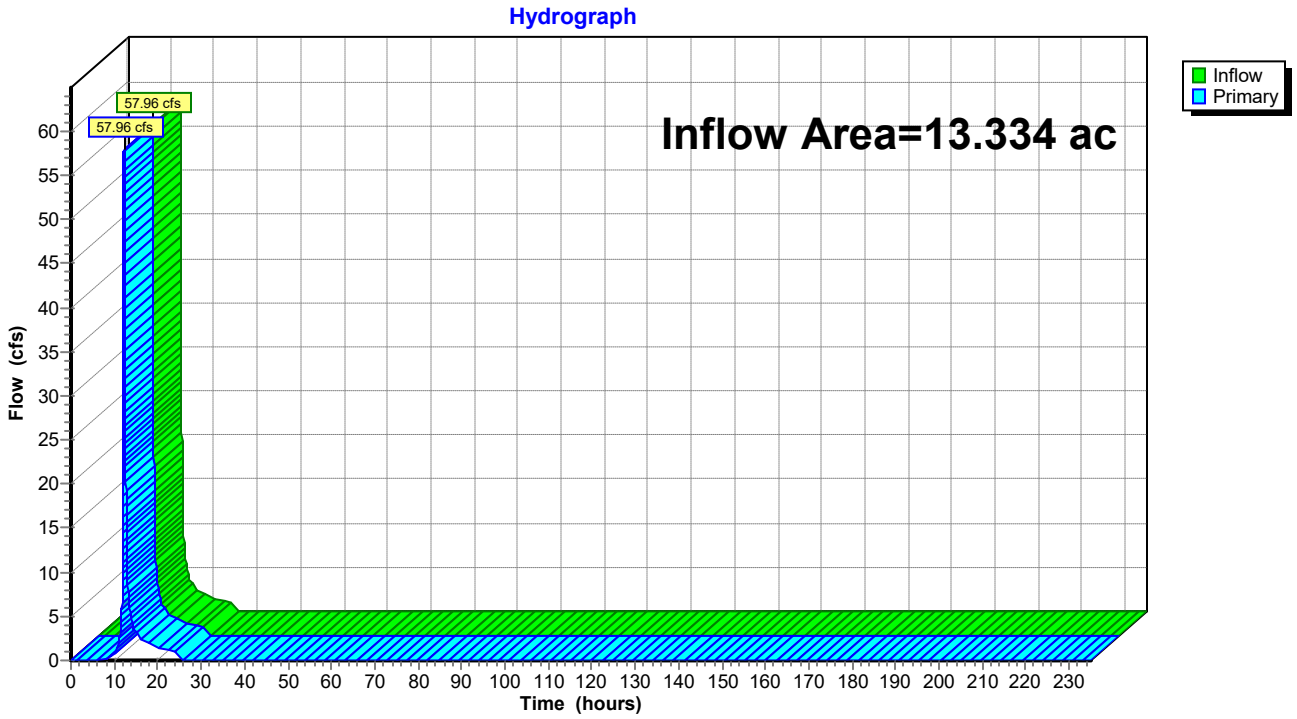


Summary for Link 86L: PC 2

Inflow Area = 13.334 ac, 0.00% Impervious, Inflow Depth = 4.90" for 100-YR NOAA event
Inflow = 57.96 cfs @ 12.22 hrs, Volume= 5.441 af
Primary = 57.96 cfs @ 12.22 hrs, Volume= 5.441 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 86L: PC 2

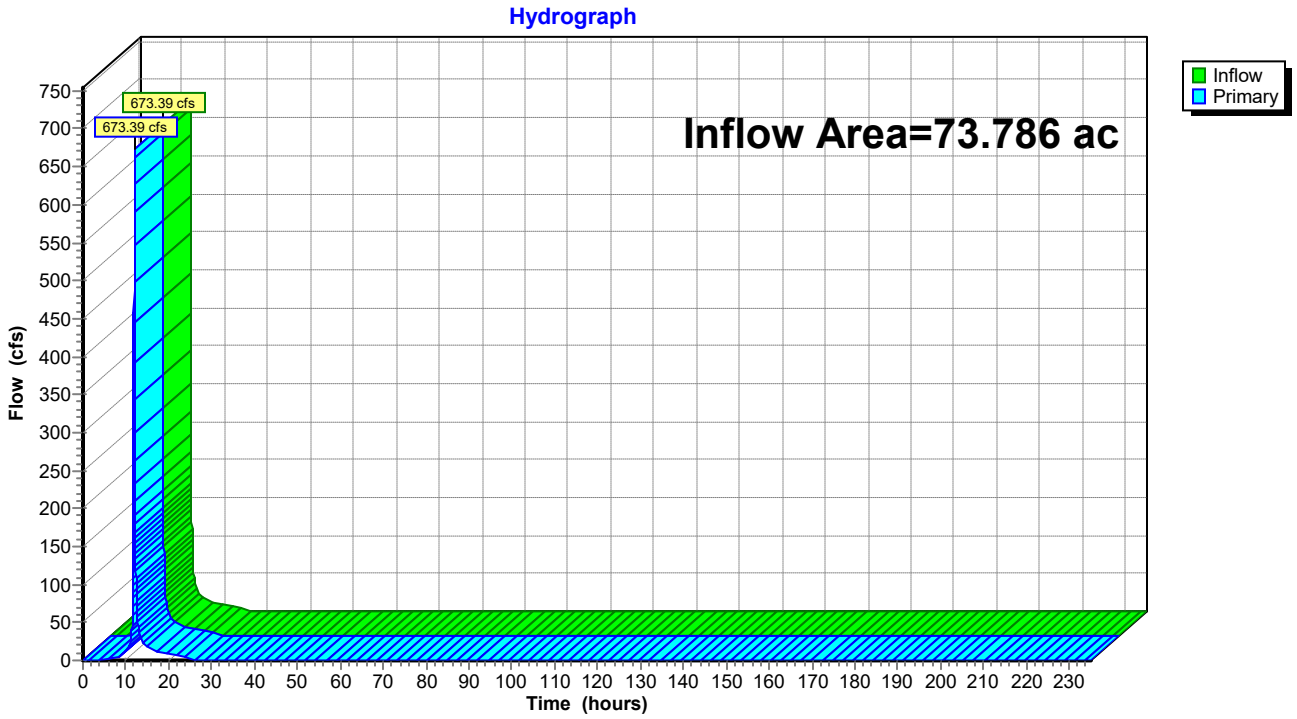


Summary for Link 87L: TO BASIN 1

Inflow Area = 73.786 ac, 8.72% Impervious, Inflow Depth = 5.94" for 100-YR NOAA event
Inflow = 673.39 cfs @ 11.96 hrs, Volume= 36.522 af
Primary = 673.39 cfs @ 11.96 hrs, Volume= 36.522 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 87L: TO BASIN 1

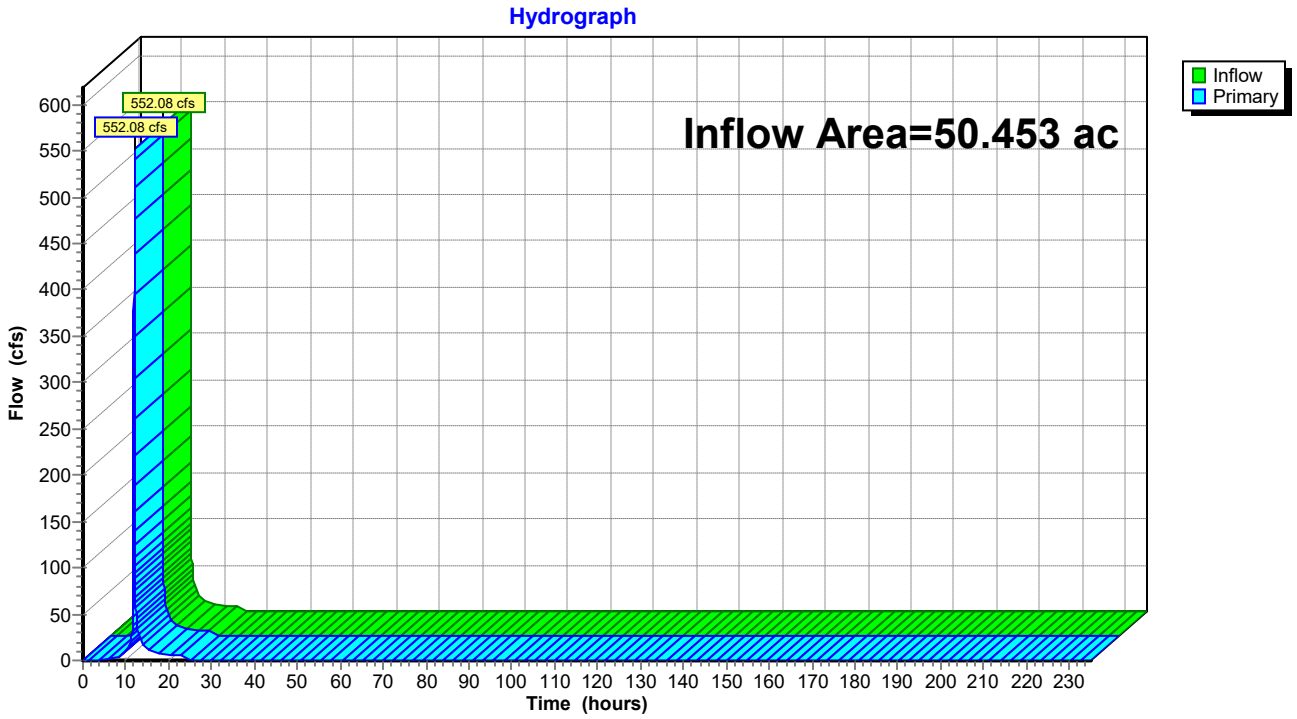


Summary for Link 88L: PC 4F

Inflow Area = 50.453 ac, 9.47% Impervious, Inflow Depth = 6.28" for 100-YR NOAA event
Inflow = 552.08 cfs @ 11.96 hrs, Volume= 26.400 af
Primary = 552.08 cfs @ 11.96 hrs, Volume= 26.400 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 88L: PC 4F

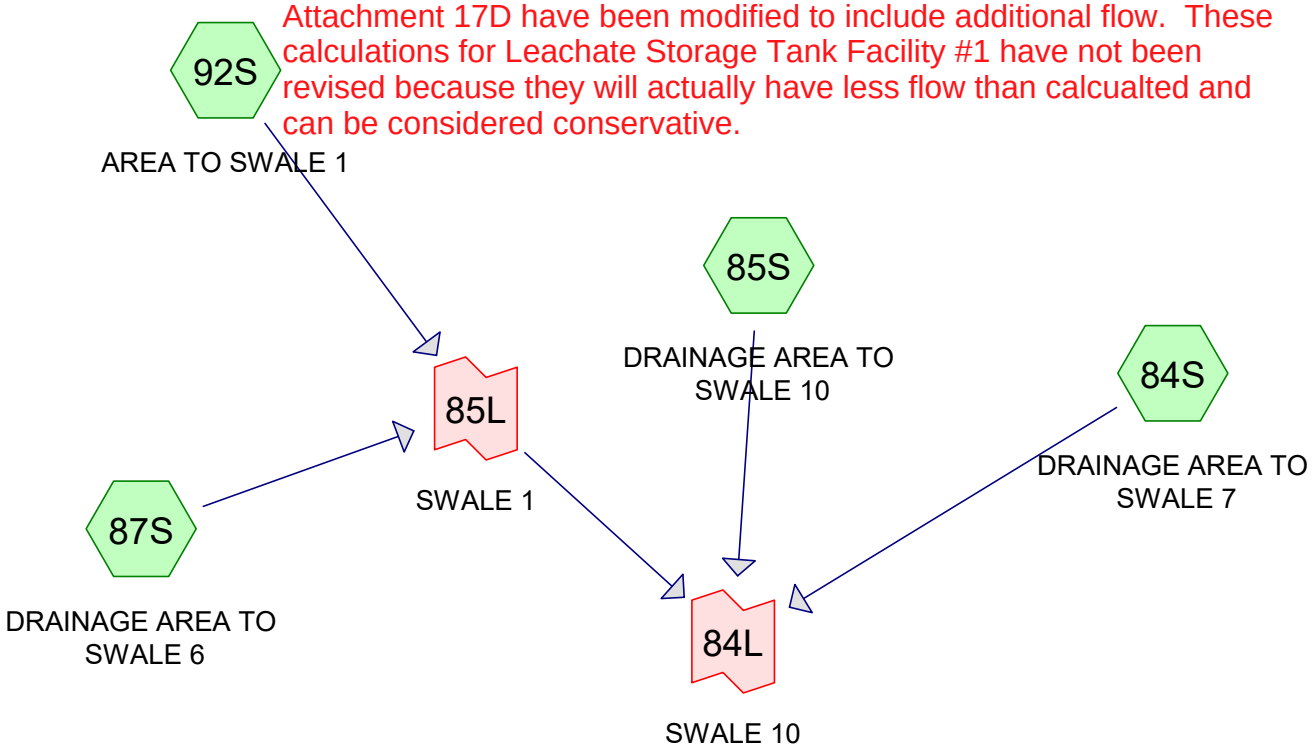


ADVANCED GeoServices

a Montrose Environmental Group company

Leachate Storage Facility No. 1

Based on routing calculations 92S and 87S do not combine. 92S flows into PC-4F through Culvert #6. Proposed channel flow calculations Attachment 17D have been modified to include additional flow. These calculations for Leachate Storage Tank Facility #1 have not been revised because they will actually have less flow than calcualted and can be considered conservative.



Revised by PGS 08/21/2021

Subcat Reach Pond Link

Drainage Diagram for PC AND DOWNCHUTES_07152020
Prepared by {enter your company name here}, Printed 7/18/2020
HydroCAD® 8.50 s/n 005690 © 2007 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
5.485	30	Woods, Good, HSG A (92S)
4.665	30	Woods, Good, HSG A (ONSITE) (87S)
19.521	42	RA ZONING A SOILS (87S,92S)
5.191	61	>75% Grass cover, Good, HSG B (ONSITE A) (87S,92S)
2.514	64	RA ZONING B SOILS (87S,92S)
1.808	70	Woods, Good, HSG C (92S)
1.272	70	Woods, Good, HSG C (ONSITE) (87S)
5.791	76	RA ZONING C SOILS (87S,92S)
0.611	77	Woods, Good, HSG D (92S)
0.018	77	Woods, Good, HSG D (ONSITE) (87S)
2.595	80	>75% Grass cover, Good, HSG D (84S,85S)
4.270	80	>75% Grass cover, Good, HSG D (ONSITE C) (87S,92S)
1.650	80	>75% Grass cover, Good, HSG D (ONSITE D) (92S)
1.846	82	RA ZONING D SOILS (87S,92S)
0.108	98	Paved parking & roofs (87S)
1.037	98	Paved roads w/curbs & sewers (84S,85S)
58.383		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
10.150	HSG A	87S, 92S
5.191	HSG B	87S, 92S
3.080	HSG C	87S, 92S
9.145	HSG D	84S, 85S, 87S, 92S
30.817	Other	84S, 85S, 87S, 92S
58.383		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 84S: DRAINAGE AREA TO Runoff Area=101,792 sf 25.93% Impervious Runoff Depth=4.21"
Tc=5.0 min CN=85 Runoff=17.34 cfs 0.819 af

Subcatchment 85S: DRAINAGE AREA TO Runoff Area=56,453 sf 33.28% Impervious Runoff Depth=4.31"
Tc=5.0 min CN=86 Runoff=9.80 cfs 0.466 af

Subcatchment 87S: DRAINAGE AREA TO Runoff Area=952,570 sf 0.49% Impervious Runoff Depth=1.09"
Tc=16.3 min CN=50 Runoff=24.00 cfs 1.994 af

Subcatchment 92S: AREA TO SWALE 1 Runoff Area=1,432,342 sf 0.00% Impervious Runoff Depth=1.54"
Tc=24.7 min CN=56 Runoff=44.00 cfs 4.213 af

Link 84L: SWALE 10 Inflow=68.46 cfs 7.493 af
Primary=68.46 cfs 7.493 af

Link 85L: SWALE 1 Inflow=64.62 cfs 6.207 af
Primary=64.62 cfs 6.207 af

Total Runoff Area = 58.383 ac Runoff Volume = 7.493 af Average Runoff Depth = 1.54"
98.04% Pervious = 57.238 ac 1.96% Impervious = 1.145 ac

Summary for Subcatchment 84S: DRAINAGE AREA TO SWALE 7

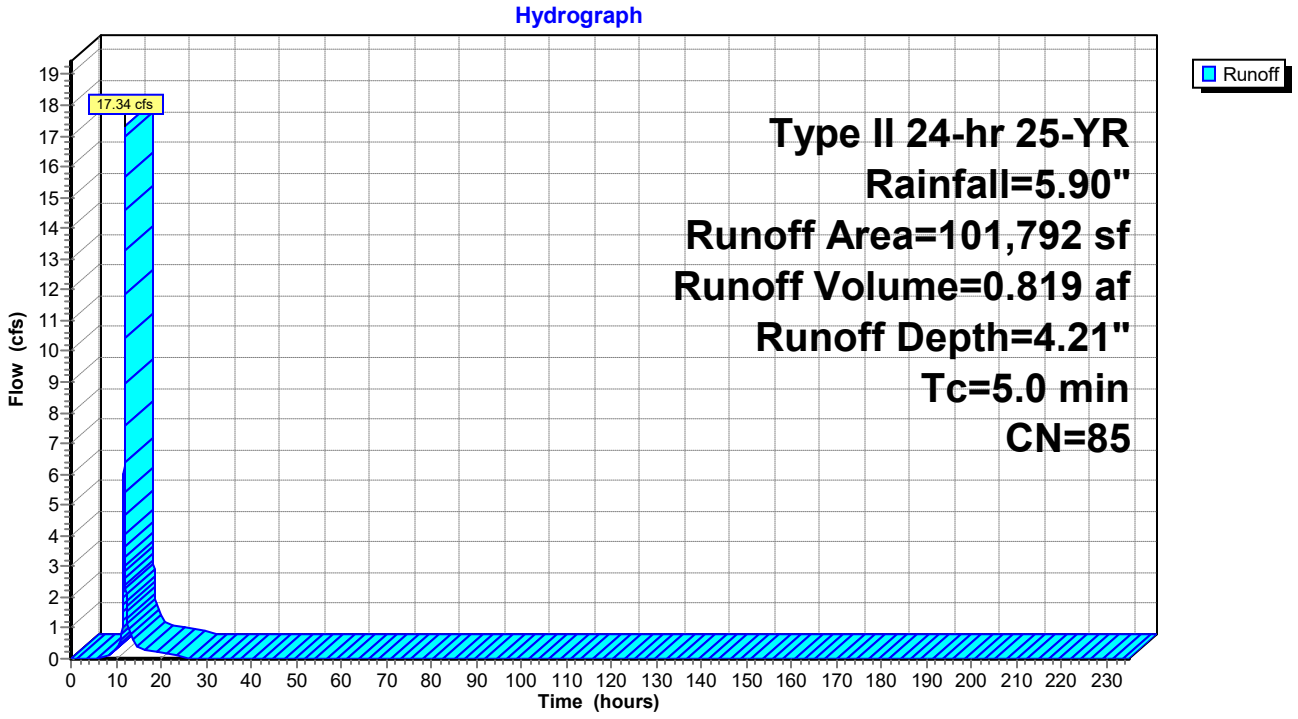
Runoff = 17.34 cfs @ 11.96 hrs, Volume= 0.819 af, Depth= 4.21"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
75,393	80	>75% Grass cover, Good, HSG D
26,399	98	Paved roads w/curbs & sewers
101,792	85	Weighted Average
75,393		Pervious Area
26,399		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 84S: DRAINAGE AREA TO SWALE 7



Summary for Subcatchment 85S: DRAINAGE AREA TO SWALE 10

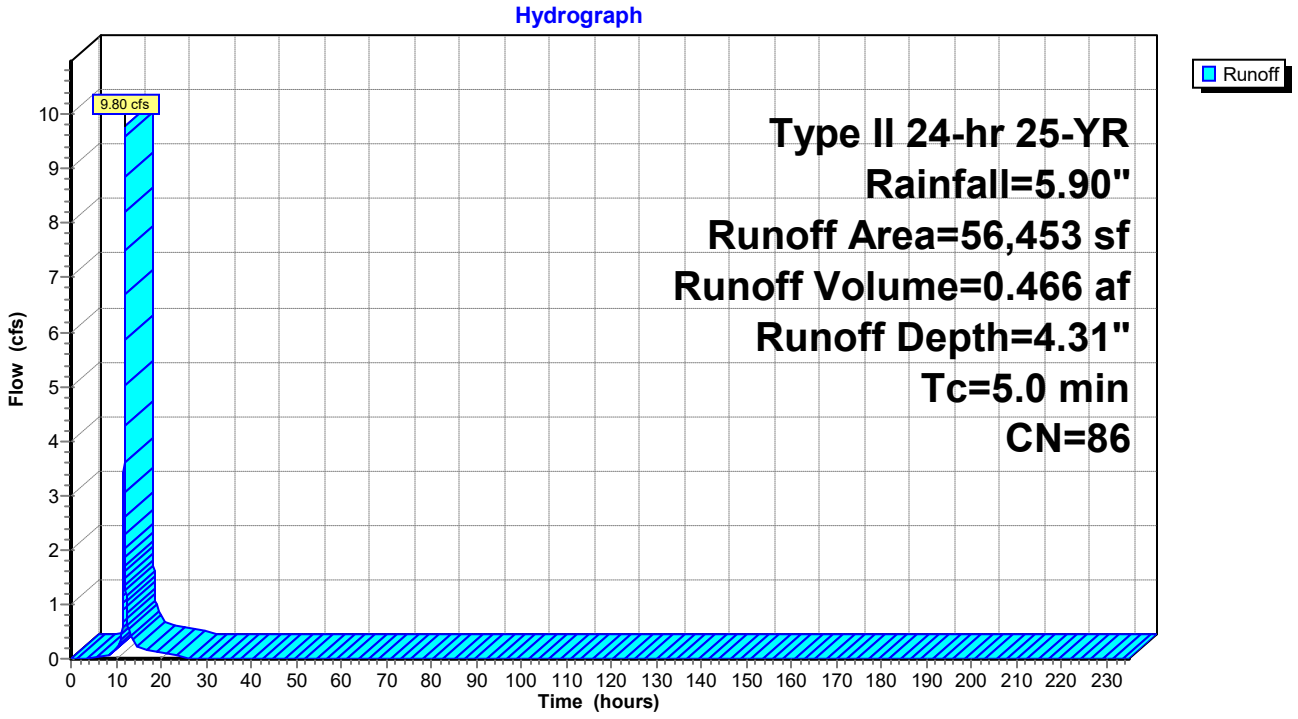
Runoff = 9.80 cfs @ 11.96 hrs, Volume= 0.466 af, Depth= 4.31"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
37,666	80	>75% Grass cover, Good, HSG D
18,787	98	Paved roads w/curbs & sewers
56,453	86	Weighted Average
37,666		Pervious Area
18,787		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 85S: DRAINAGE AREA TO SWALE 10



Summary for Subcatchment 87S: DRAINAGE AREA TO SWALE 6

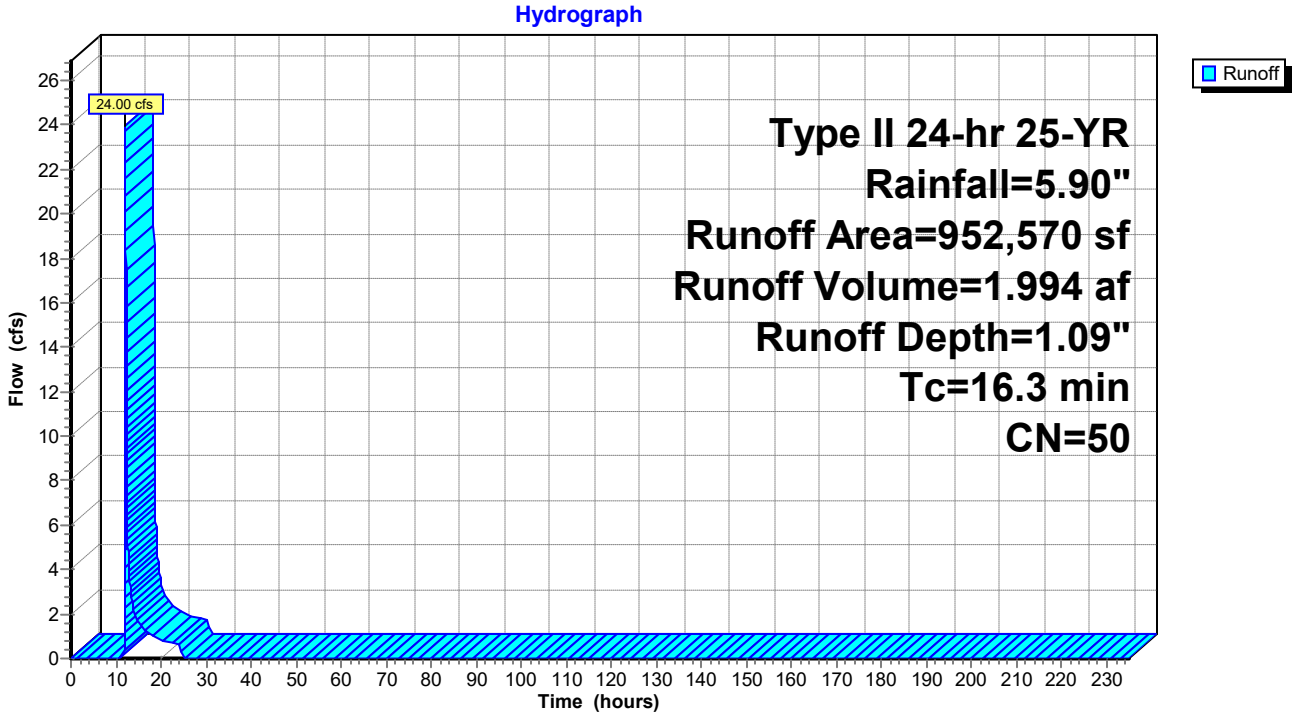
Runoff = 24.00 cfs @ 12.12 hrs, Volume= 1.994 af, Depth= 1.09"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
*	203,207	30	Woods, Good, HSG A (ONSITE)
*	55,408	70	Woods, Good, HSG C (ONSITE)
*	784	77	Woods, Good, HSG D (ONSITE)
*	47,045	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	82,633	80	>75% Grass cover, Good, HSG D (ONSITE C)
	4,704	98	Paved parking & roofs
*	447,100	42	RA ZONING A SOILS
*	5,881	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	24,786	82	RA ZONING D SOILS
	952,570	50	Weighted Average
	947,866		Pervious Area
	4,704		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3					**Direct Entry, FROM BASIN A HYDROGRAPH**

Subcatchment 87S: DRAINAGE AREA TO SWALE 6



Summary for Subcatchment 92S: AREA TO SWALE 1

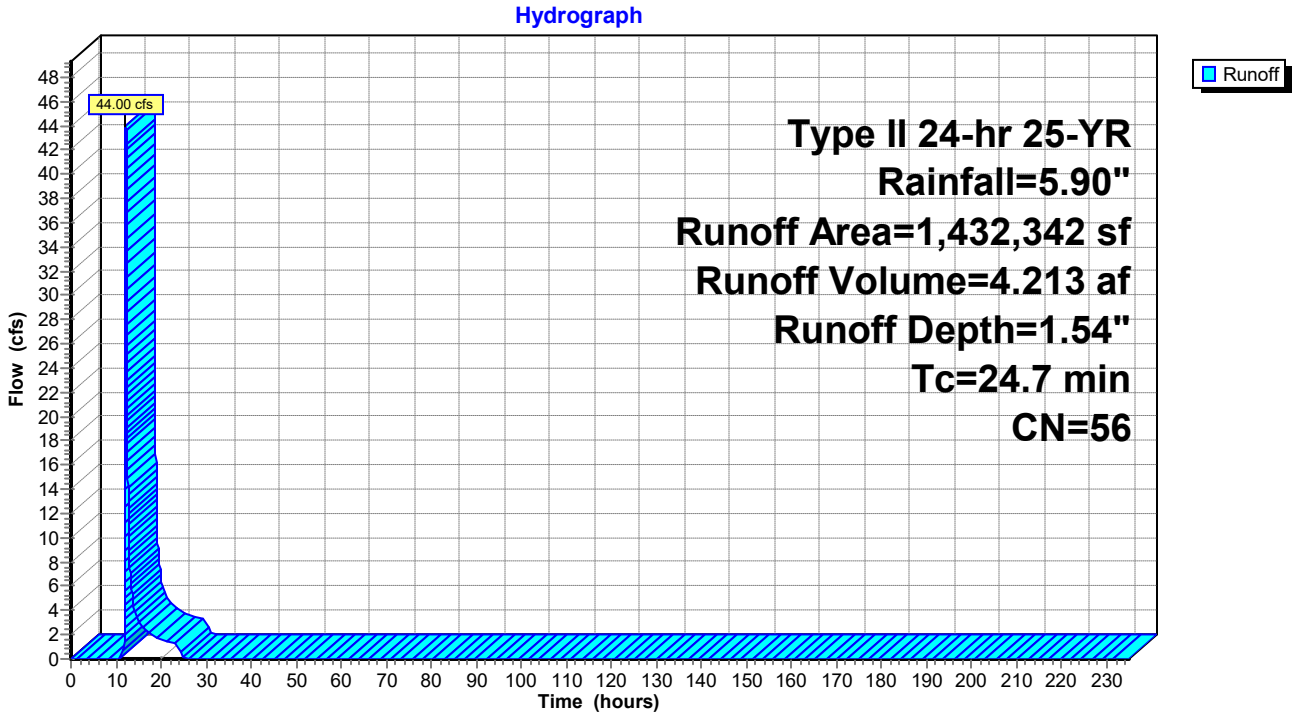
Runoff = 44.00 cfs @ 12.21 hrs, Volume= 4.213 af, Depth= 1.54"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

	Area (sf)	CN	Description
	238,936	30	Woods, Good, HSG A
	78,739	70	Woods, Good, HSG C
	26,634	77	Woods, Good, HSG D
*	179,075	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	103,360	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	71,885	80	>75% Grass cover, Good, HSG D (ONSITE D)
*	403,214	42	RA ZONING A SOILS
*	103,642	64	RA ZONING B SOILS
*	171,248	76	RA ZONING C SOILS
*	55,609	82	RA ZONING D SOILS
	1,432,342	56	Weighted Average
	1,432,342		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.7					**Direct Entry, A-F OF BASIN 1 Tc**

Subcatchment 92S: AREA TO SWALE 1

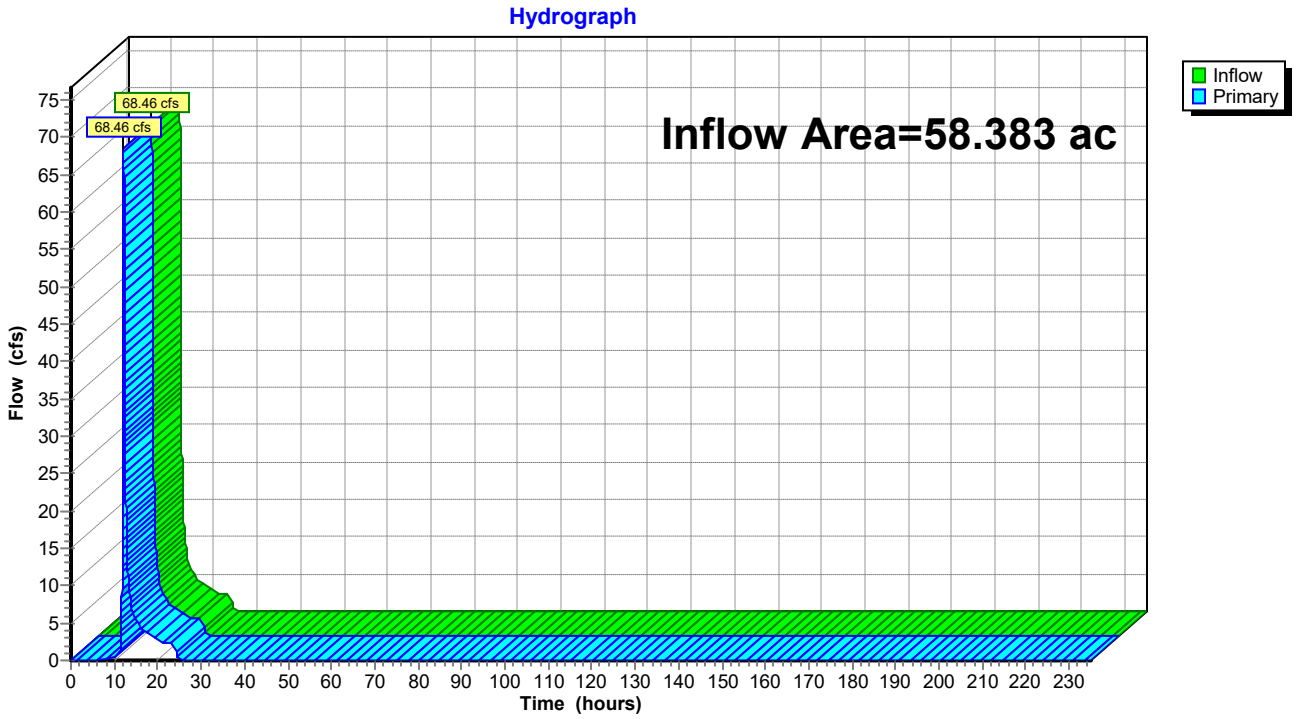


Summary for Link 84L: SWALE 10

Inflow Area = 58.383 ac, 1.96% Impervious, Inflow Depth = 1.54" for 25-YR event
Inflow = 68.46 cfs @ 12.16 hrs, Volume= 7.493 af
Primary = 68.46 cfs @ 12.16 hrs, Volume= 7.493 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 84L: SWALE 10

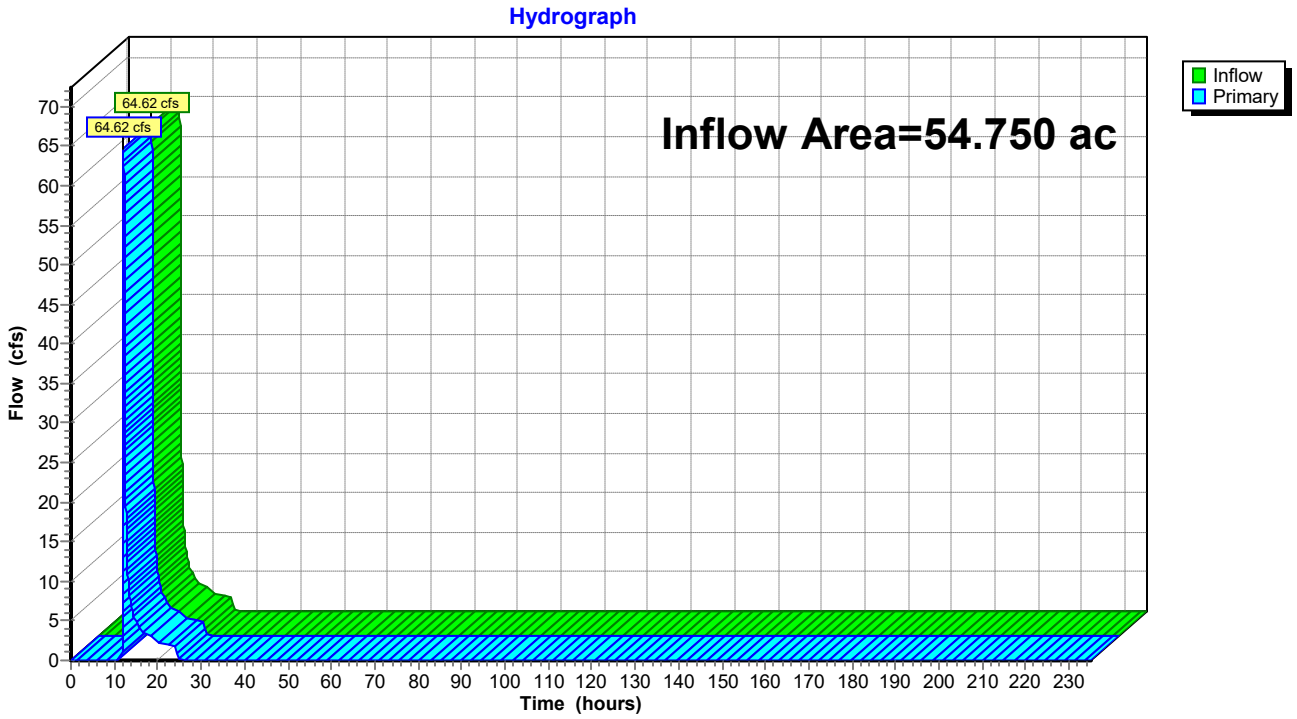


Summary for Link 85L: SWALE 1

Inflow Area = 54.750 ac, 0.20% Impervious, Inflow Depth = 1.36" for 25-YR event
Inflow = 64.62 cfs @ 12.16 hrs, Volume= 6.207 af
Primary = 64.62 cfs @ 12.16 hrs, Volume= 6.207 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 85L: SWALE 1



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 84S: DRAINAGE AREA TO Runoff Area=101,792 sf 25.93% Impervious Runoff Depth=6.70"
Tc=5.0 min CN=85 Runoff=26.77 cfs 1.304 af

Subcatchment 85S: DRAINAGE AREA TO Runoff Area=56,453 sf 33.28% Impervious Runoff Depth=6.82"
Tc=5.0 min CN=86 Runoff=15.01 cfs 0.736 af

Subcatchment 87S: DRAINAGE AREA TO Runoff Area=952,570 sf 0.49% Impervious Runoff Depth=2.56"
Tc=16.3 min CN=50 Runoff=65.73 cfs 4.666 af

Subcatchment 92S: AREA TO SWALE 1 Runoff Area=1,432,342 sf 0.00% Impervious Runoff Depth=3.25"
Tc=24.7 min CN=56 Runoff=101.31 cfs 8.897 af

Link 84L: SWALE 10 Inflow=164.87 cfs 15.603 af
Primary=164.87 cfs 15.603 af

Link 85L: SWALE 1 Inflow=158.72 cfs 13.563 af
Primary=158.72 cfs 13.563 af

Total Runoff Area = 58.383 ac Runoff Volume = 15.603 af Average Runoff Depth = 3.21"
98.04% Pervious = 57.238 ac 1.96% Impervious = 1.145 ac

Summary for Subcatchment 84S: DRAINAGE AREA TO SWALE 7

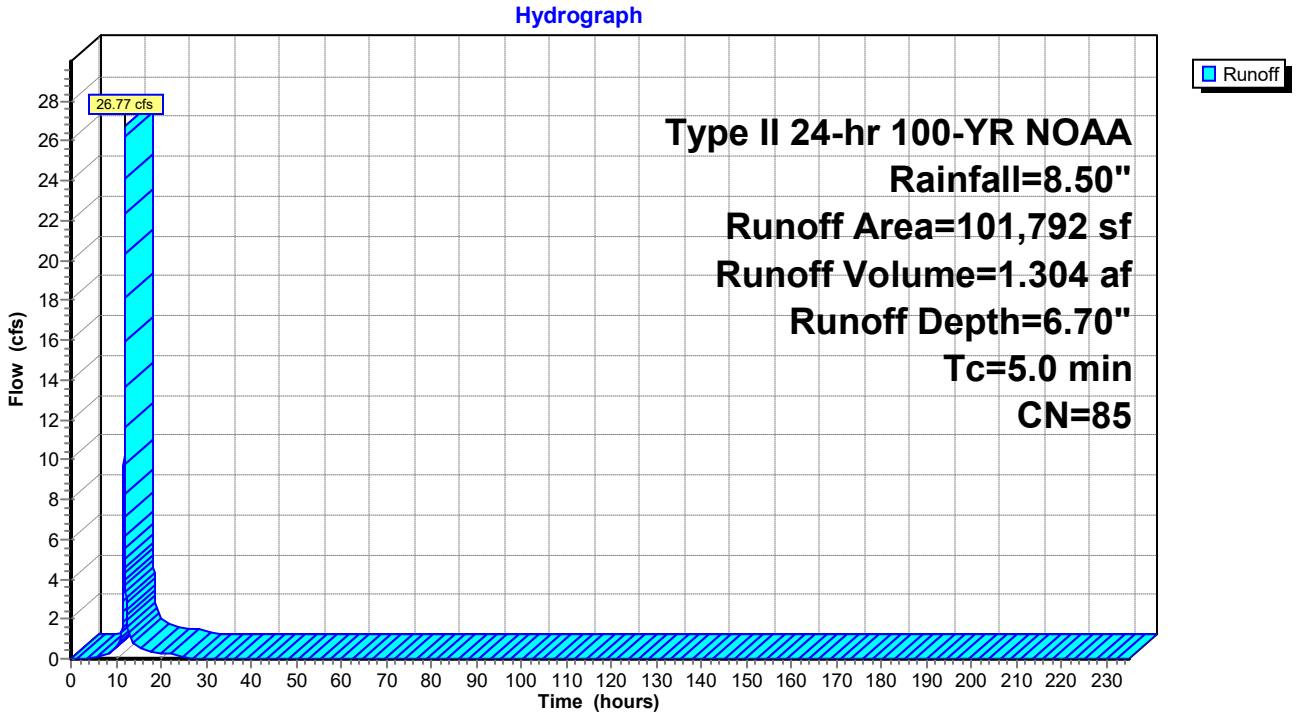
Runoff = 26.77 cfs @ 11.96 hrs, Volume= 1.304 af, Depth= 6.70"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
75,393	80	>75% Grass cover, Good, HSG D
26,399	98	Paved roads w/curbs & sewers
101,792	85	Weighted Average
75,393		Pervious Area
26,399		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 84S: DRAINAGE AREA TO SWALE 7



Summary for Subcatchment 85S: DRAINAGE AREA TO SWALE 10

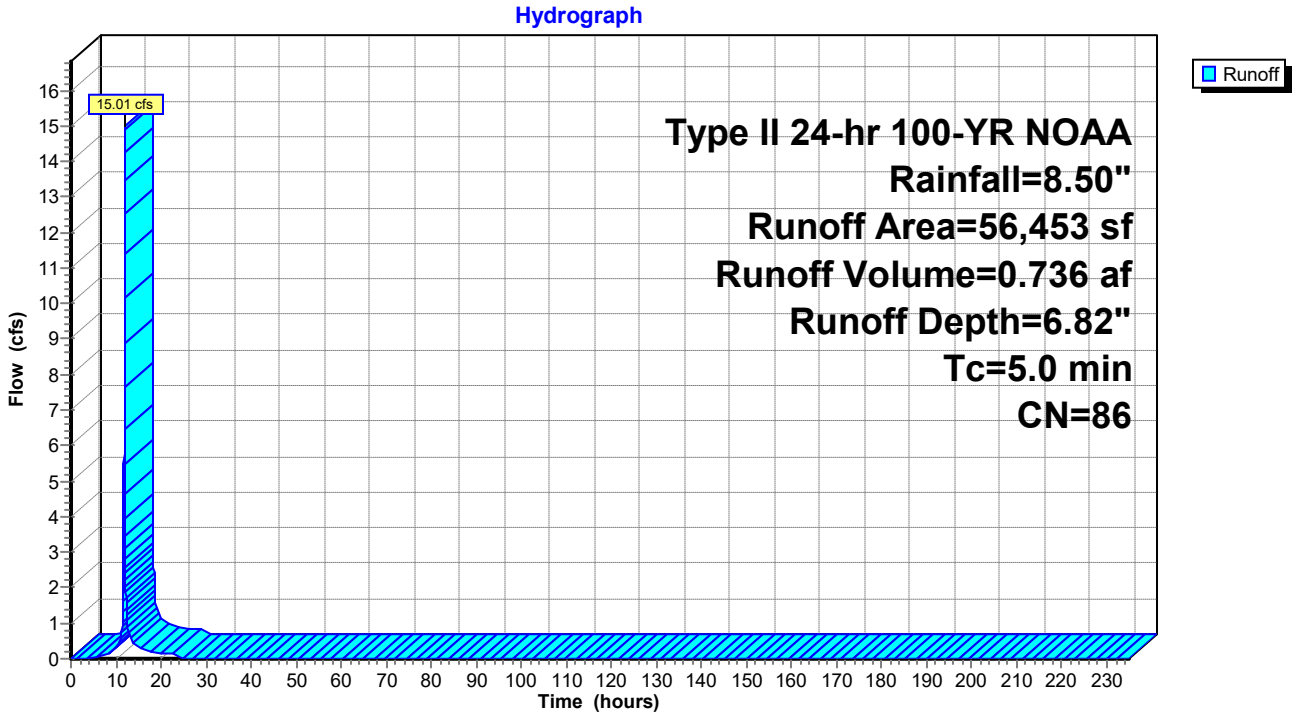
Runoff = 15.01 cfs @ 11.96 hrs, Volume= 0.736 af, Depth= 6.82"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
37,666	80	>75% Grass cover, Good, HSG D
18,787	98	Paved roads w/curbs & sewers
56,453	86	Weighted Average
37,666		Pervious Area
18,787		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 85S: DRAINAGE AREA TO SWALE 10



Summary for Subcatchment 87S: DRAINAGE AREA TO SWALE 6

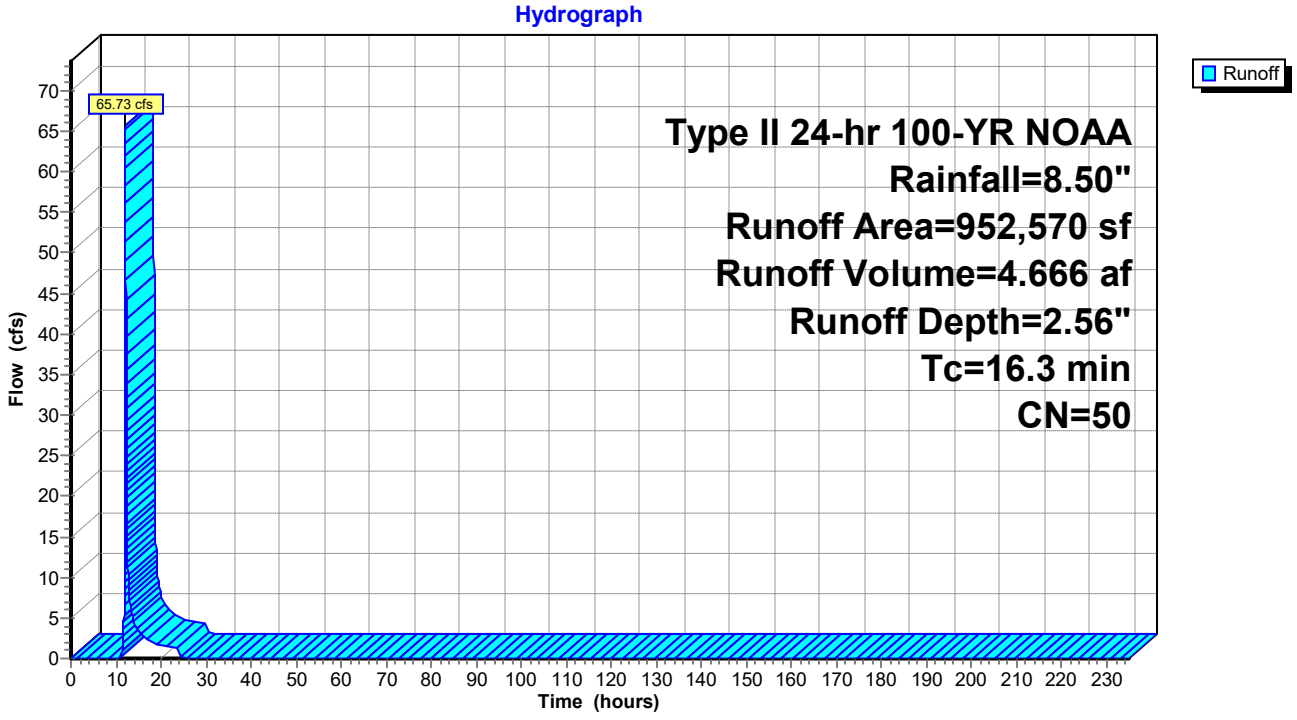
Runoff = 65.73 cfs @ 12.10 hrs, Volume= 4.666 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
*	203,207	30	Woods, Good, HSG A (ONSITE)
*	55,408	70	Woods, Good, HSG C (ONSITE)
*	784	77	Woods, Good, HSG D (ONSITE)
*	47,045	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	82,633	80	>75% Grass cover, Good, HSG D (ONSITE C)
	4,704	98	Paved parking & roofs
*	447,100	42	RA ZONING A SOILS
*	5,881	64	RA ZONING B SOILS
*	81,022	76	RA ZONING C SOILS
*	24,786	82	RA ZONING D SOILS
	952,570	50	Weighted Average
	947,866		Pervious Area
	4,704		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
16.3					**Direct Entry, FROM BASIN A HYDROGRAPH**

Subcatchment 87S: DRAINAGE AREA TO SWALE 6



Summary for Subcatchment 92S: AREA TO SWALE 1

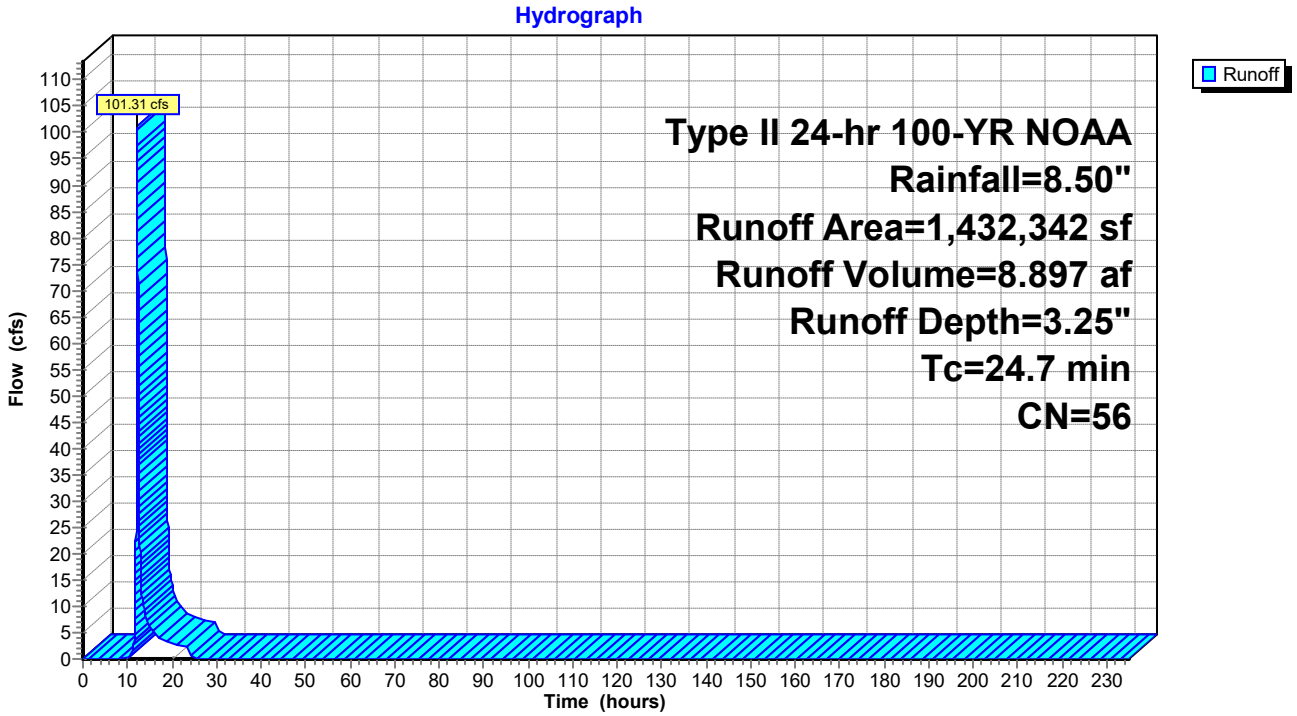
Runoff = 101.31 cfs @ 12.19 hrs, Volume= 8.897 af, Depth= 3.25"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

	Area (sf)	CN	Description
	238,936	30	Woods, Good, HSG A
	78,739	70	Woods, Good, HSG C
	26,634	77	Woods, Good, HSG D
*	179,075	61	>75% Grass cover, Good, HSG B (ONSITE A)
*	103,360	80	>75% Grass cover, Good, HSG D (ONSITE C)
*	71,885	80	>75% Grass cover, Good, HSG D (ONSITE D)
*	403,214	42	RA ZONING A SOILS
*	103,642	64	RA ZONING B SOILS
*	171,248	76	RA ZONING C SOILS
*	55,609	82	RA ZONING D SOILS
	1,432,342	56	Weighted Average
	1,432,342		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
24.7					**Direct Entry, A-F OF BASIN 1 Tc**

Subcatchment 92S: AREA TO SWALE 1

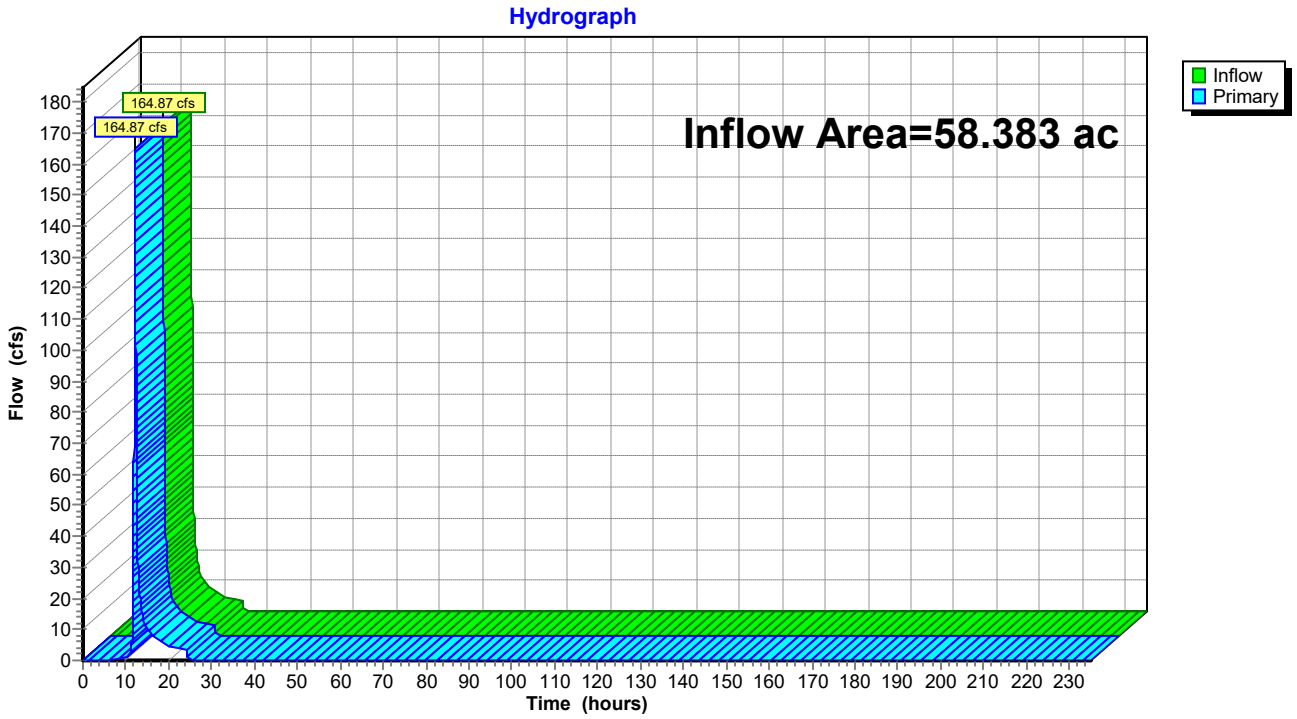


Summary for Link 84L: SWALE 10

Inflow Area = 58.383 ac, 1.96% Impervious, Inflow Depth = 3.21" for 100-YR NOAA event
Inflow = 164.87 cfs @ 12.14 hrs, Volume= 15.603 af
Primary = 164.87 cfs @ 12.14 hrs, Volume= 15.603 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 84L: SWALE 10

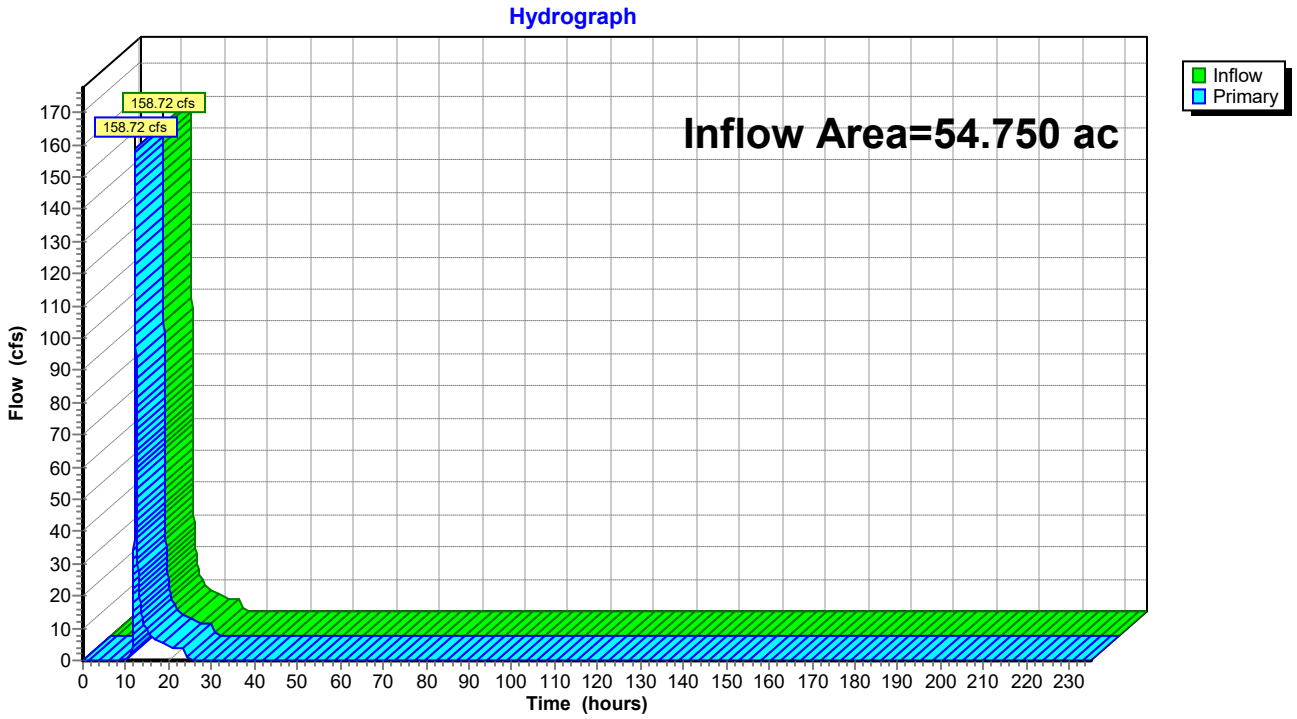


Summary for Link 85L: SWALE 1

Inflow Area = 54.750 ac, 0.20% Impervious, Inflow Depth = 2.97" for 100-YR NOAA event
Inflow = 158.72 cfs @ 12.15 hrs, Volume= 13.563 af
Primary = 158.72 cfs @ 12.15 hrs, Volume= 13.563 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

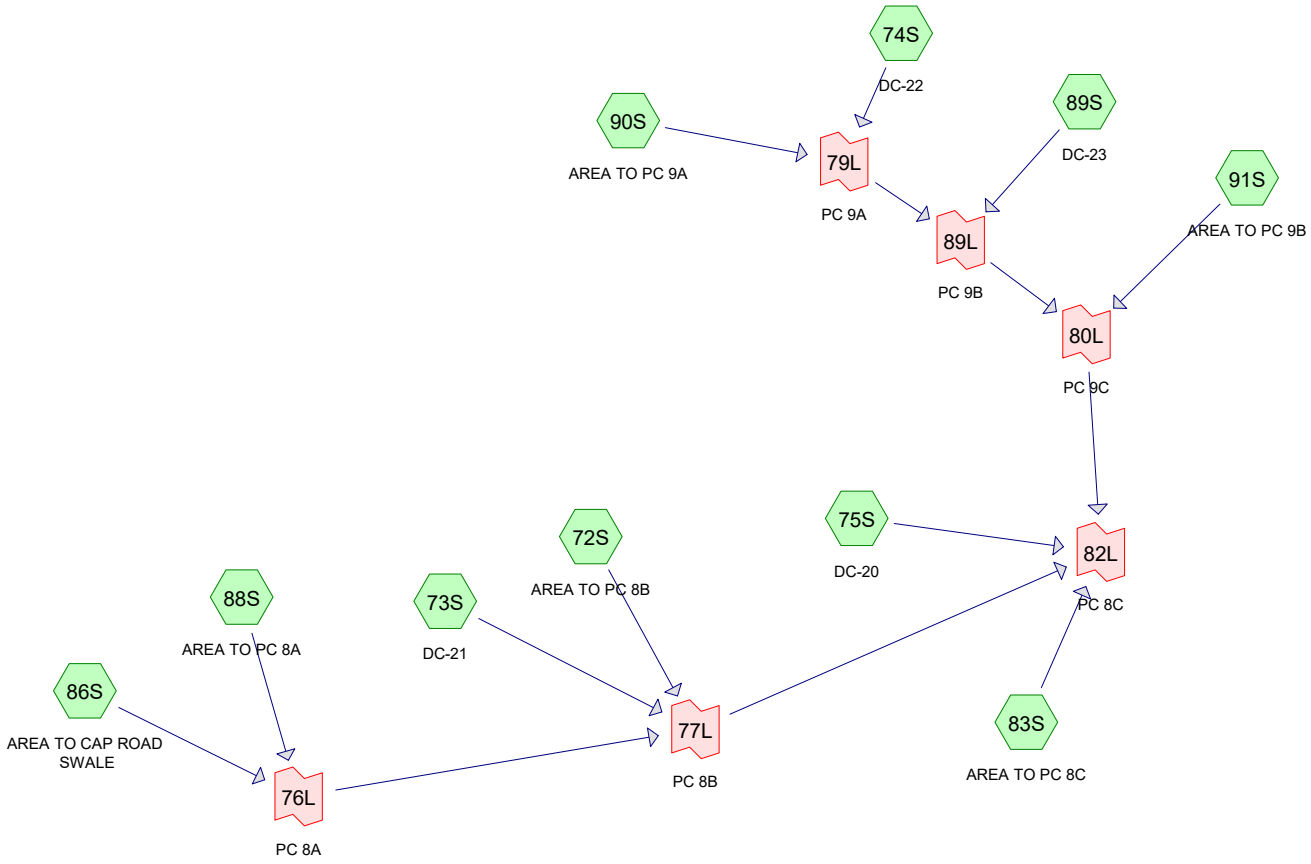
Link 85L: SWALE 1



ADVANCED GeoServices

a Montrose Environmental Group company

East Side (Cells 11-16)



Revised by PGS 08/21/2021

Subcat Reach Pond Link

Drainage Diagram for PC AND DOWNCHUTES_07152020
Prepared by {enter your company name here}, Printed 7/18/2020
HydroCAD® 8.50 s/n 005690 © 2007 HydroCAD Software Solutions LLC

Area Listing (selected nodes)

Area (acres)	CN	Description (subcatchment-numbers)
37.672	80	>75% Grass cover, Good, HSG D (72S,73S,74S,75S,83S,86S,88S,89S,90S,91S)
3.021	98	Paved parking & roofs (72S,83S,88S,90S,91S)
40.694		**TOTAL AREA**

Soil Listing (selected nodes)

Area (acres)	Soil Goup	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
0.000	HSG C	
37.672	HSG D	72S, 73S, 74S, 75S, 83S, 86S, 88S, 89S, 90S, 91S
3.021	Other	72S, 83S, 88S, 90S, 91S
40.694		**TOTAL AREA**

Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 72S: AREA TO PC 8B Runoff Area=146,396 sf 15.66% Impervious Runoff Depth=4.00"
Tc=5.0 min CN=83 Runoff=23.98 cfs 1.120 af

Subcatchment 73S: DC-21 Runoff Area=347,408 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=53.31 cfs 2.453 af

Subcatchment 74S: DC-22 Runoff Area=190,896 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=29.30 cfs 1.348 af

Subcatchment 75S: DC-20 Runoff Area=233,065 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=35.77 cfs 1.646 af

Subcatchment 83S: AREA TO PC 8C Runoff Area=44,677 sf 22.27% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=7.47 cfs 0.351 af

Subcatchment 86S: AREA TO CAP ROAD Runoff Area=65,391 sf 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=10.04 cfs 0.462 af

Subcatchment 88S: AREA TO PC 8A Runoff Area=158,379 sf 24.90% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=26.47 cfs 1.243 af

Subcatchment 89S: DC-23 Runoff Area=6.417 ac 0.00% Impervious Runoff Depth=3.69"
Tc=5.0 min CN=80 Runoff=42.90 cfs 1.974 af

Subcatchment 90S: AREA TO PC 9A Runoff Area=113,003 sf 20.90% Impervious Runoff Depth=4.10"
Tc=5.0 min CN=84 Runoff=18.89 cfs 0.887 af

Subcatchment 91S: AREA TO PC 9B Runoff Area=193,876 sf 18.41% Impervious Runoff Depth=4.00"
Tc=5.0 min CN=83 Runoff=31.76 cfs 1.483 af

Link 76L: PC 8A Inflow=36.51 cfs 1.705 af
Primary=36.51 cfs 1.705 af

Link 77L: PC 8B Inflow=113.80 cfs 5.278 af
Primary=113.80 cfs 5.278 af

Link 79L: PC 9A Inflow=48.18 cfs 2.235 af
Primary=48.18 cfs 2.235 af

Link 80L: PC 9C Inflow=122.84 cfs 5.692 af
Primary=122.84 cfs 5.692 af

Link 82L: PC 8C Inflow=279.88 cfs 12.966 af
Primary=279.88 cfs 12.966 af

Link 89L: PC 9B Inflow=91.08 cfs 4.209 af
Primary=91.08 cfs 4.209 af

Total Runoff Area = 40.694 ac Runoff Volume = 12.966 af Average Runoff Depth = 3.82"
92.58% Pervious = 37.672 ac 7.42% Impervious = 3.021 ac

Summary for Subcatchment 72S: AREA TO PC 8B

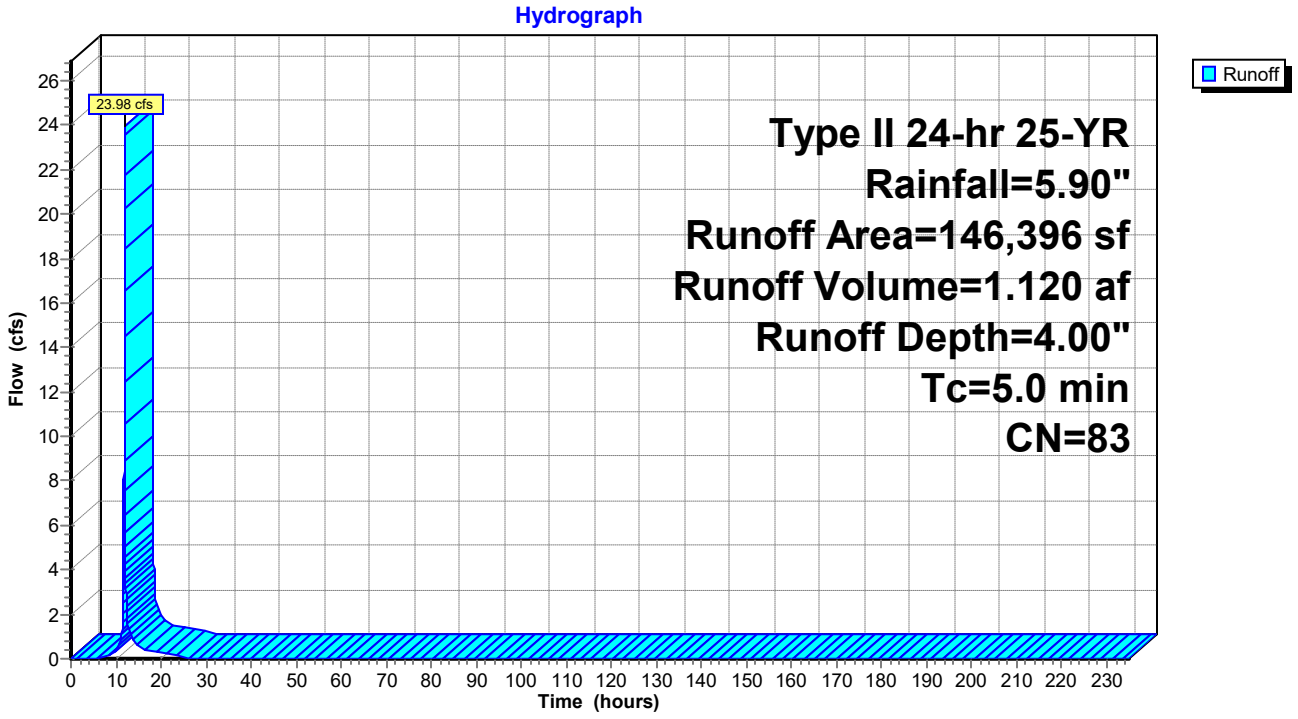
Runoff = 23.98 cfs @ 11.96 hrs, Volume= 1.120 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
123,465	80	>75% Grass cover, Good, HSG D
22,931	98	Paved parking & roofs
146,396	83	Weighted Average
123,465		Pervious Area
22,931		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 72S: AREA TO PC 8B



Summary for Subcatchment 73S: DC-21

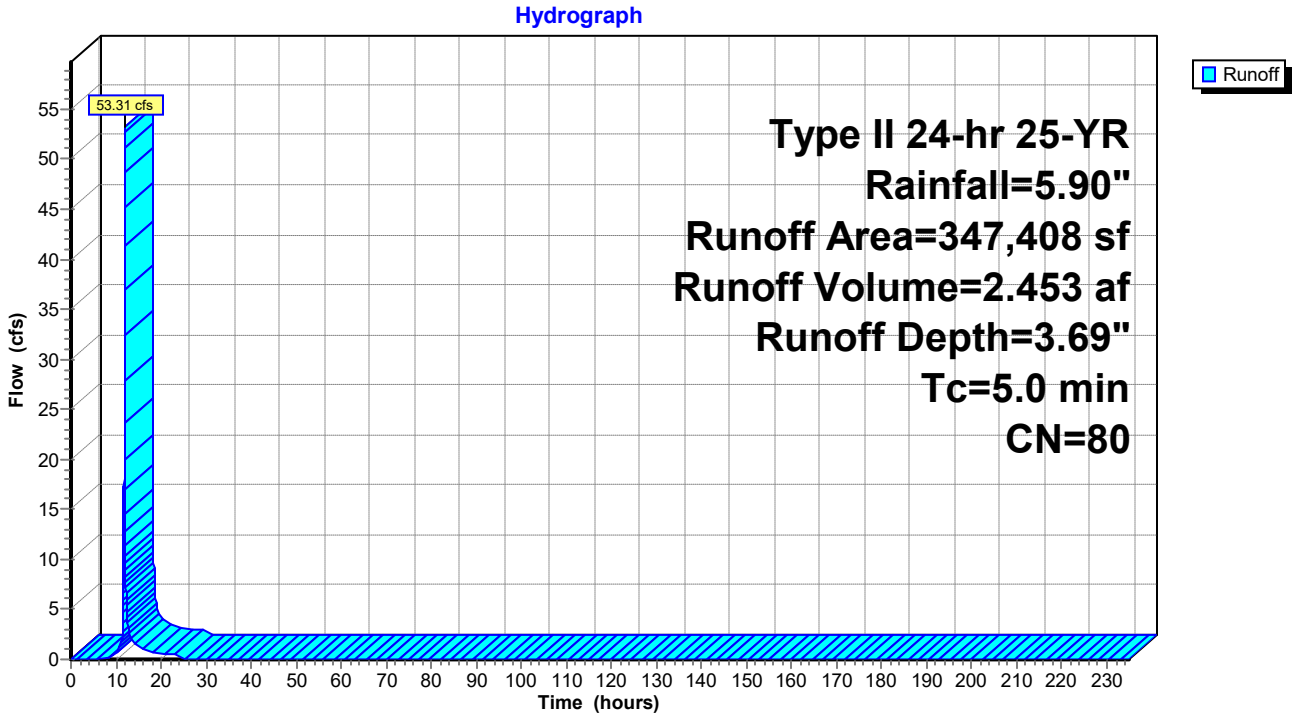
Runoff = 53.31 cfs @ 11.96 hrs, Volume= 2.453 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
347,408	80	>75% Grass cover, Good, HSG D
347,408		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 73S: DC-21



Summary for Subcatchment 74S: DC-22

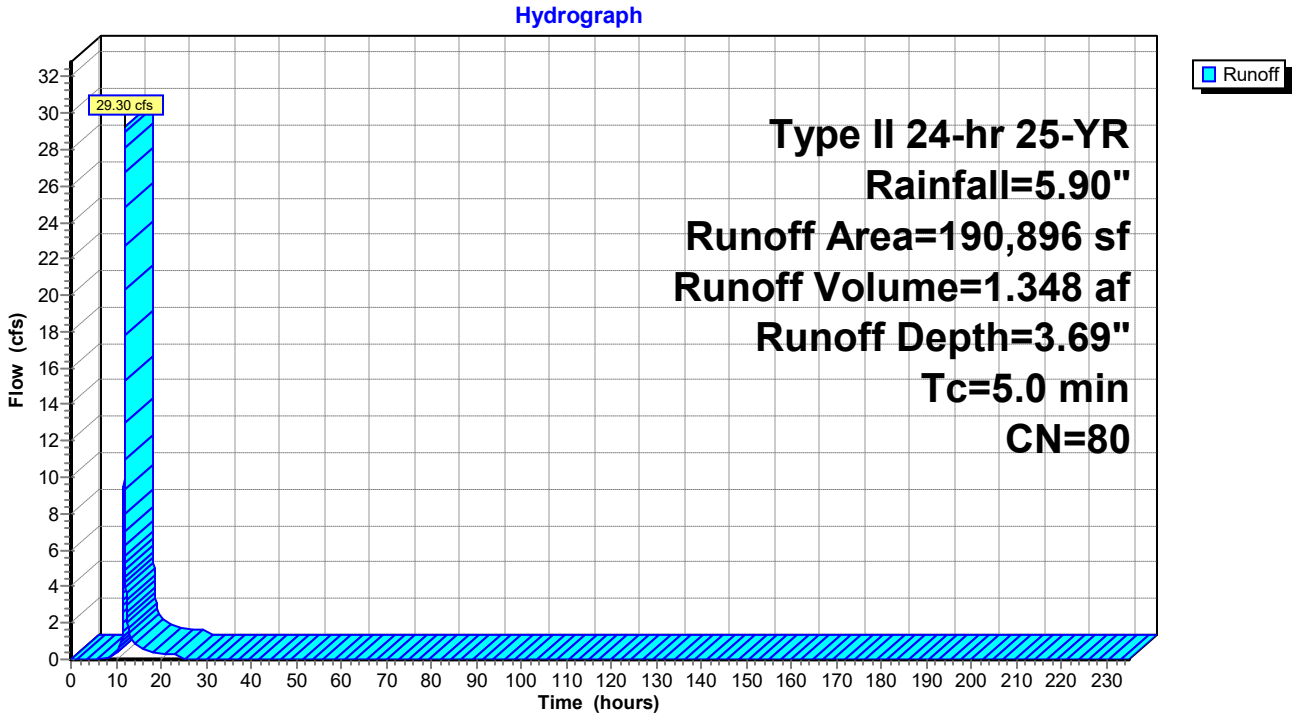
Runoff = 29.30 cfs @ 11.96 hrs, Volume= 1.348 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
190,896	80	>75% Grass cover, Good, HSG D
190,896		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 74S: DC-22



Summary for Subcatchment 75S: DC-20

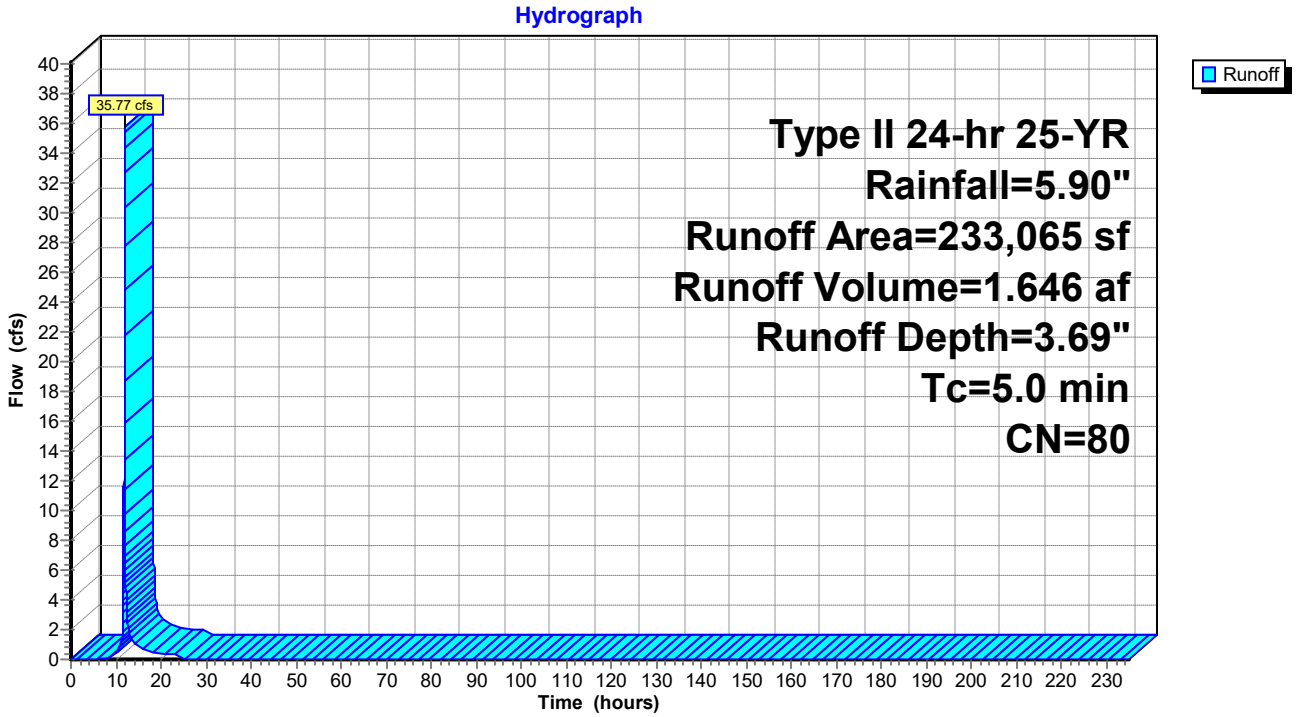
Runoff = 35.77 cfs @ 11.96 hrs, Volume= 1.646 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
233,065	80	>75% Grass cover, Good, HSG D
233,065		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 75S: DC-20



Summary for Subcatchment 83S: AREA TO PC 8C

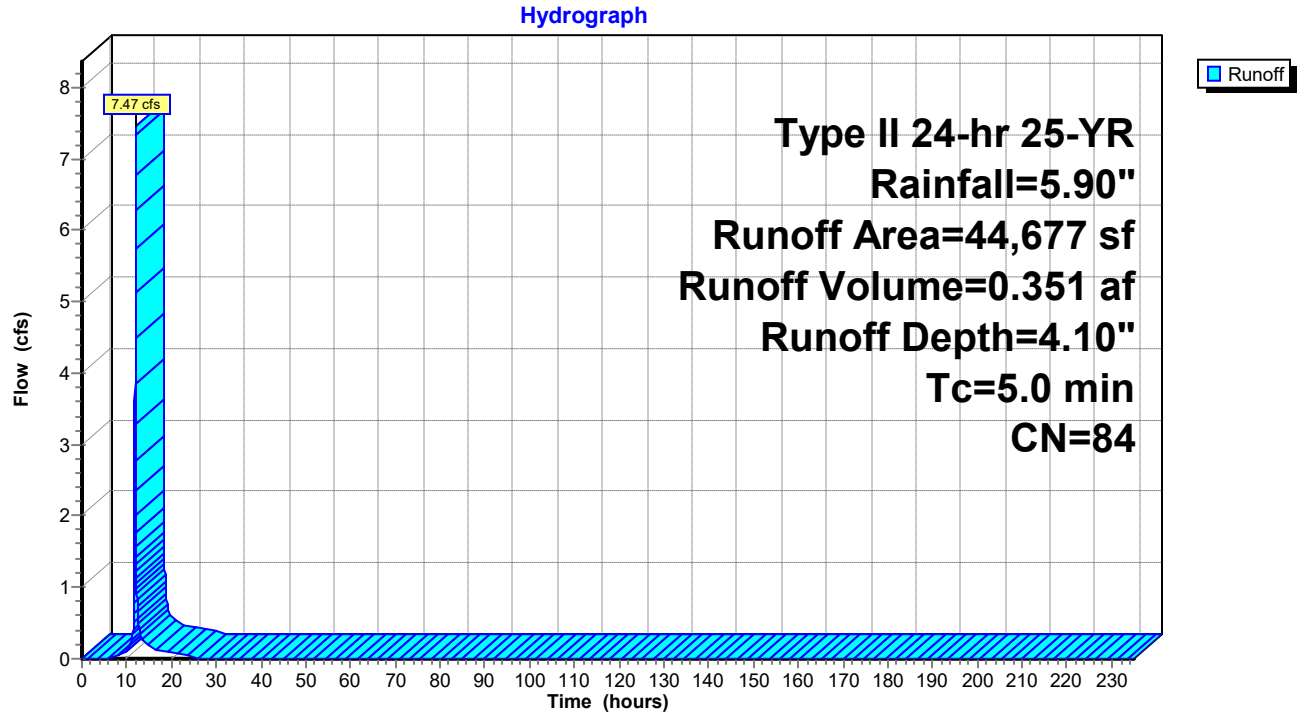
Runoff = 7.47 cfs @ 11.96 hrs, Volume= 0.351 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
34,727	80	>75% Grass cover, Good, HSG D
9,950	98	Paved parking & roofs
44,677	84	Weighted Average
34,727		Pervious Area
9,950		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 83S: AREA TO PC 8C



Summary for Subcatchment 86S: AREA TO CAP ROAD SWALE

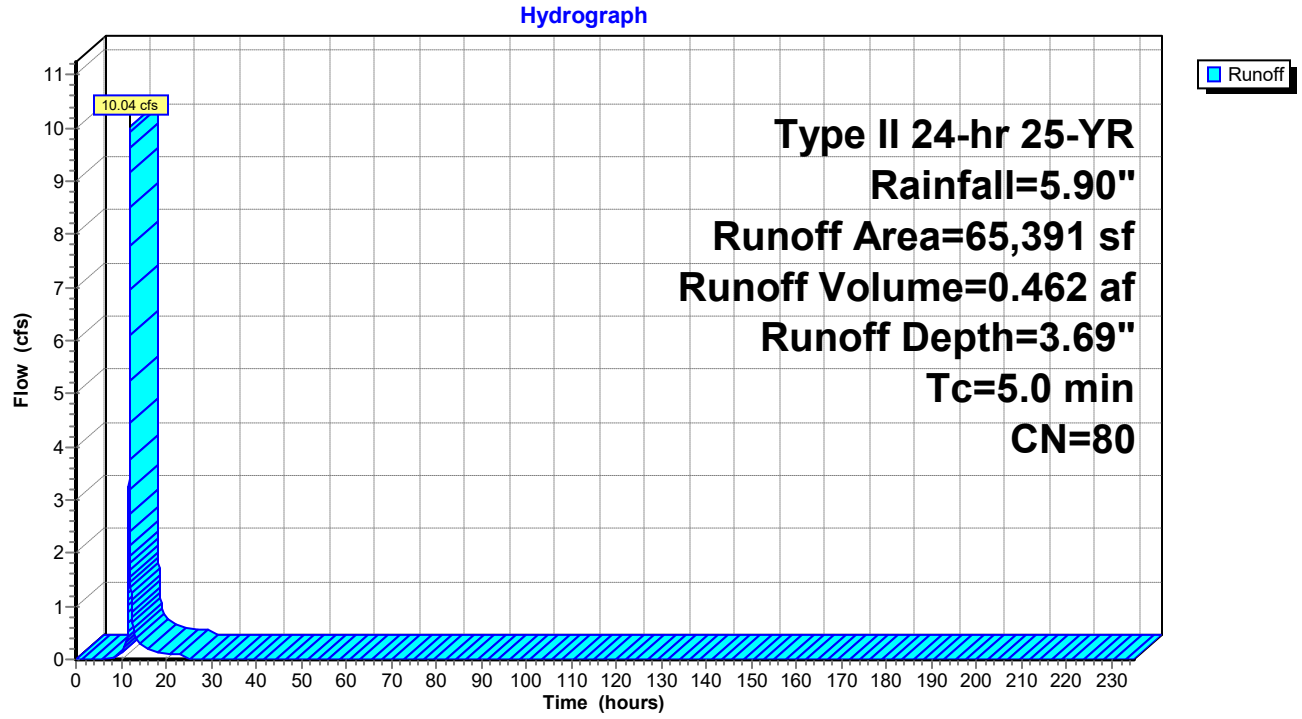
Runoff = 10.04 cfs @ 11.96 hrs, Volume= 0.462 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
65,391	80	>75% Grass cover, Good, HSG D
65,391		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 86S: AREA TO CAP ROAD SWALE



Summary for Subcatchment 88S: AREA TO PC 8A

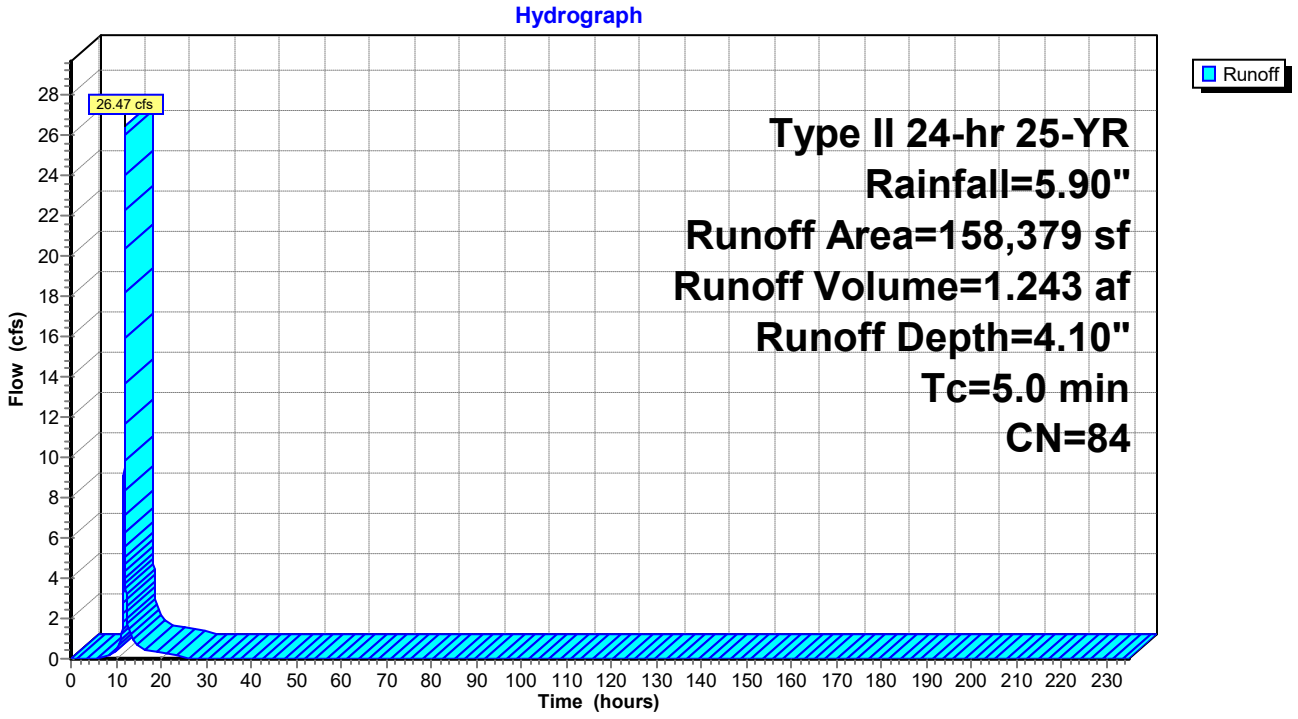
Runoff = 26.47 cfs @ 11.96 hrs, Volume= 1.243 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
118,947	80	>75% Grass cover, Good, HSG D
39,432	98	Paved parking & roofs
158,379	84	Weighted Average
118,947		Pervious Area
39,432		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 88S: AREA TO PC 8A



Summary for Subcatchment 89S: DC-23

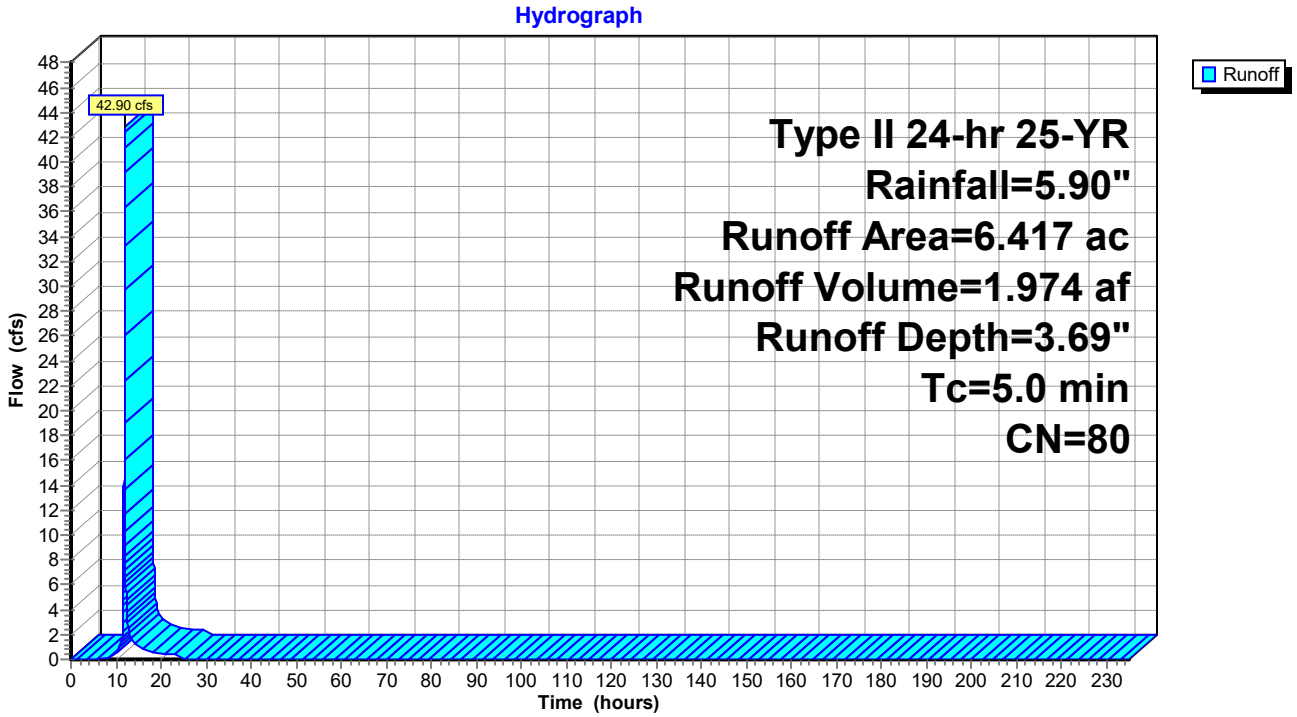
Runoff = 42.90 cfs @ 11.96 hrs, Volume= 1.974 af, Depth= 3.69"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (ac)	CN	Description
6.417	80	>75% Grass cover, Good, HSG D
6.417		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 89S: DC-23



Summary for Subcatchment 90S: AREA TO PC 9A

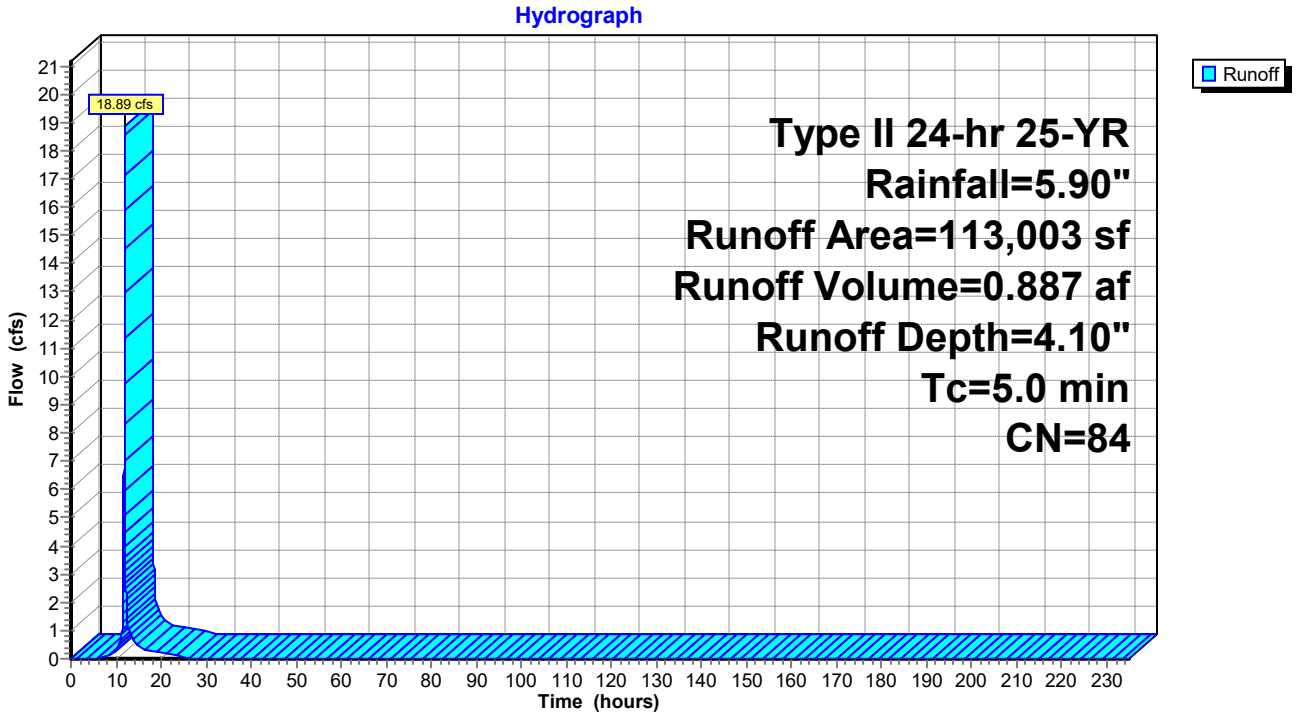
Runoff = 18.89 cfs @ 11.96 hrs, Volume= 0.887 af, Depth= 4.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
89,389	80	>75% Grass cover, Good, HSG D
23,614	98	Paved parking & roofs
113,003	84	Weighted Average
89,389		Pervious Area
23,614		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 90S: AREA TO PC 9A



Summary for Subcatchment 91S: AREA TO PC 9B

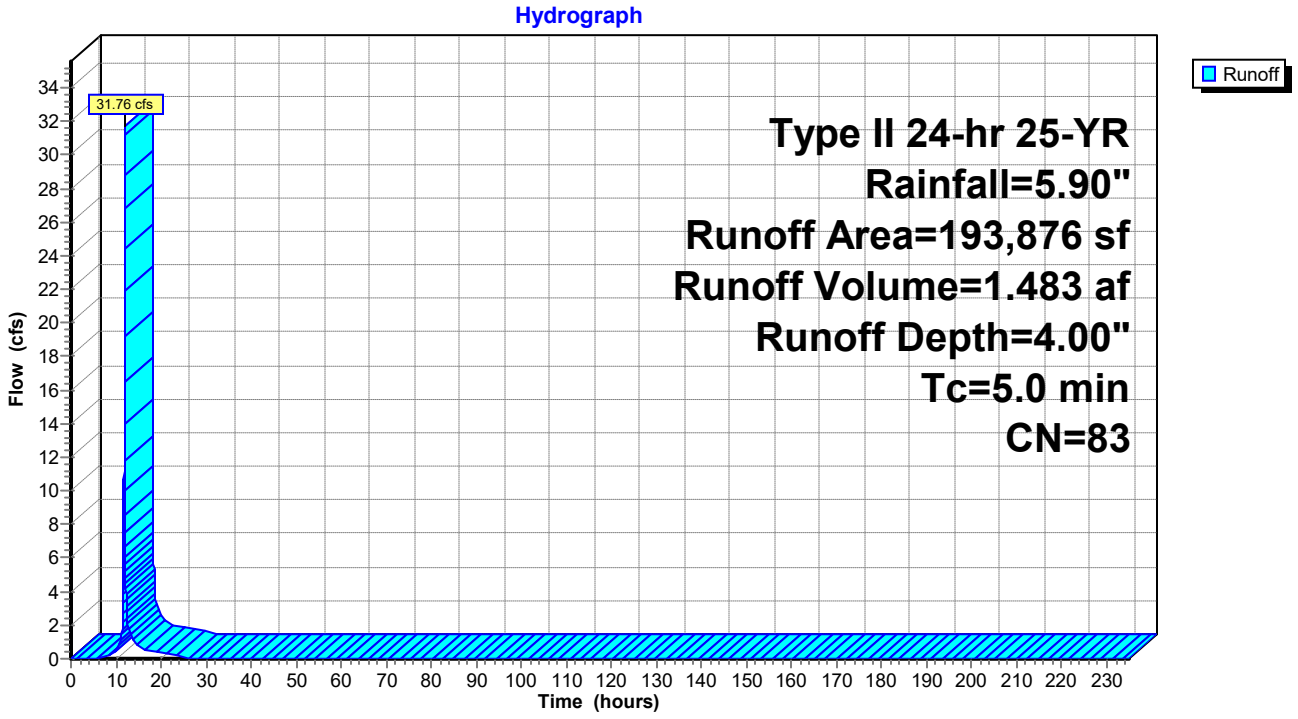
Runoff = 31.76 cfs @ 11.96 hrs, Volume= 1.483 af, Depth= 4.00"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 25-YR Rainfall=5.90"

Area (sf)	CN	Description
158,192	80	>75% Grass cover, Good, HSG D
35,684	98	Paved parking & roofs
193,876	83	Weighted Average
158,192		Pervious Area
35,684		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 91S: AREA TO PC 9B

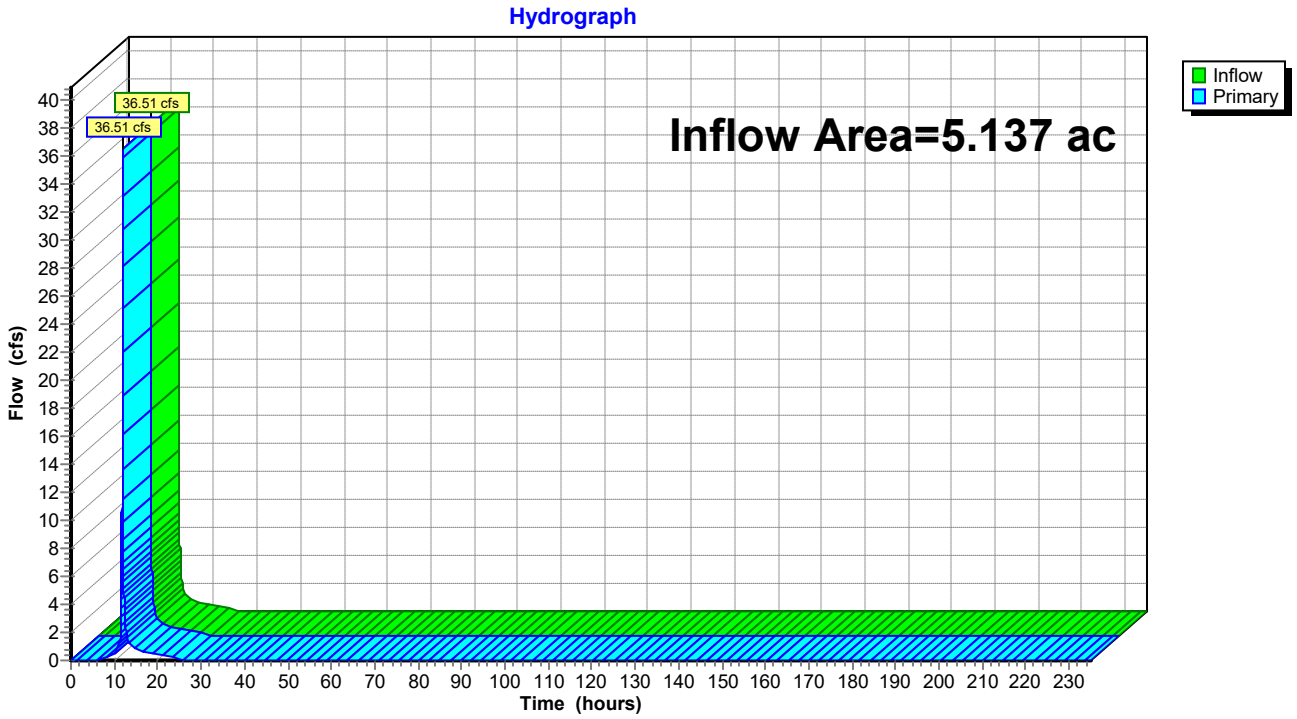


Summary for Link 76L: PC 8A

Inflow Area = 5.137 ac, 17.62% Impervious, Inflow Depth = 3.98" for 25-YR event
Inflow = 36.51 cfs @ 11.96 hrs, Volume= 1.705 af
Primary = 36.51 cfs @ 11.96 hrs, Volume= 1.705 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 76L: PC 8A

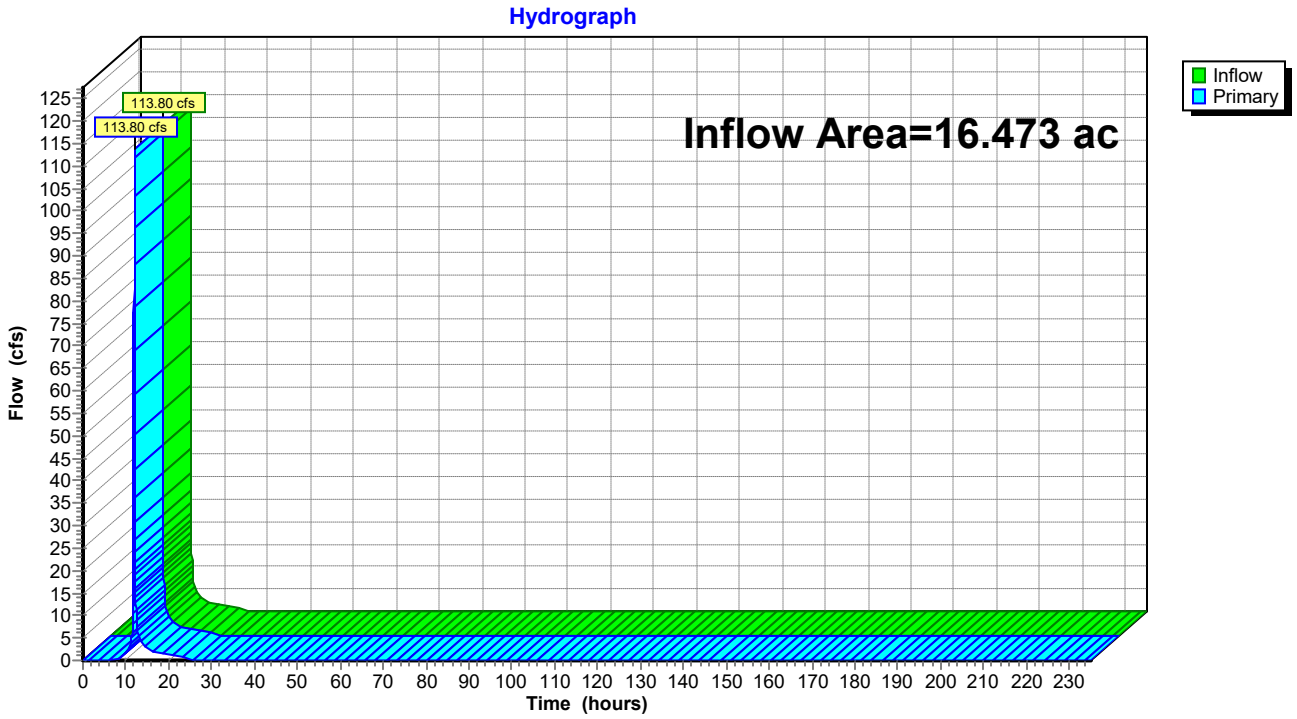


Summary for Link 77L: PC 8B

Inflow Area = 16.473 ac, 8.69% Impervious, Inflow Depth = 3.84" for 25-YR event
Inflow = 113.80 cfs @ 11.96 hrs, Volume= 5.278 af
Primary = 113.80 cfs @ 11.96 hrs, Volume= 5.278 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 77L: PC 8B

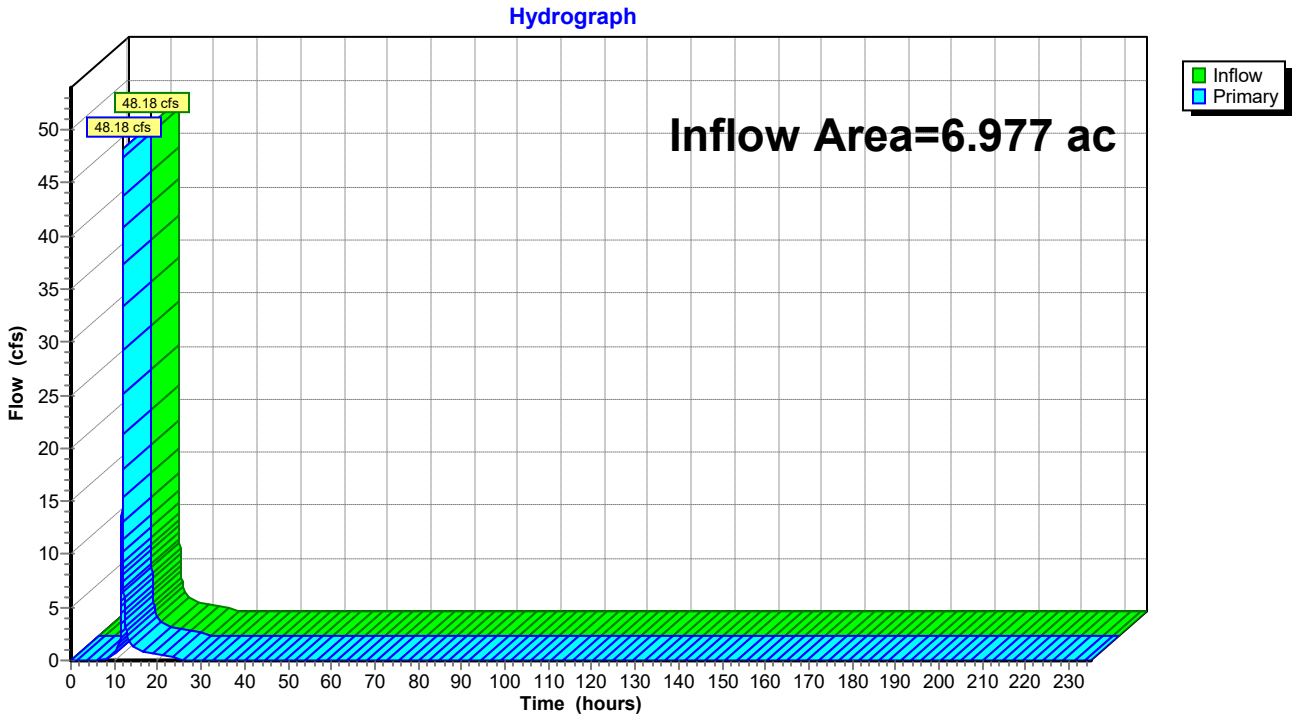


Summary for Link 79L: PC 9A

Inflow Area = 6.977 ac, 7.77% Impervious, Inflow Depth = 3.84" for 25-YR event
Inflow = 48.18 cfs @ 11.96 hrs, Volume= 2.235 af
Primary = 48.18 cfs @ 11.96 hrs, Volume= 2.235 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 79L: PC 9A

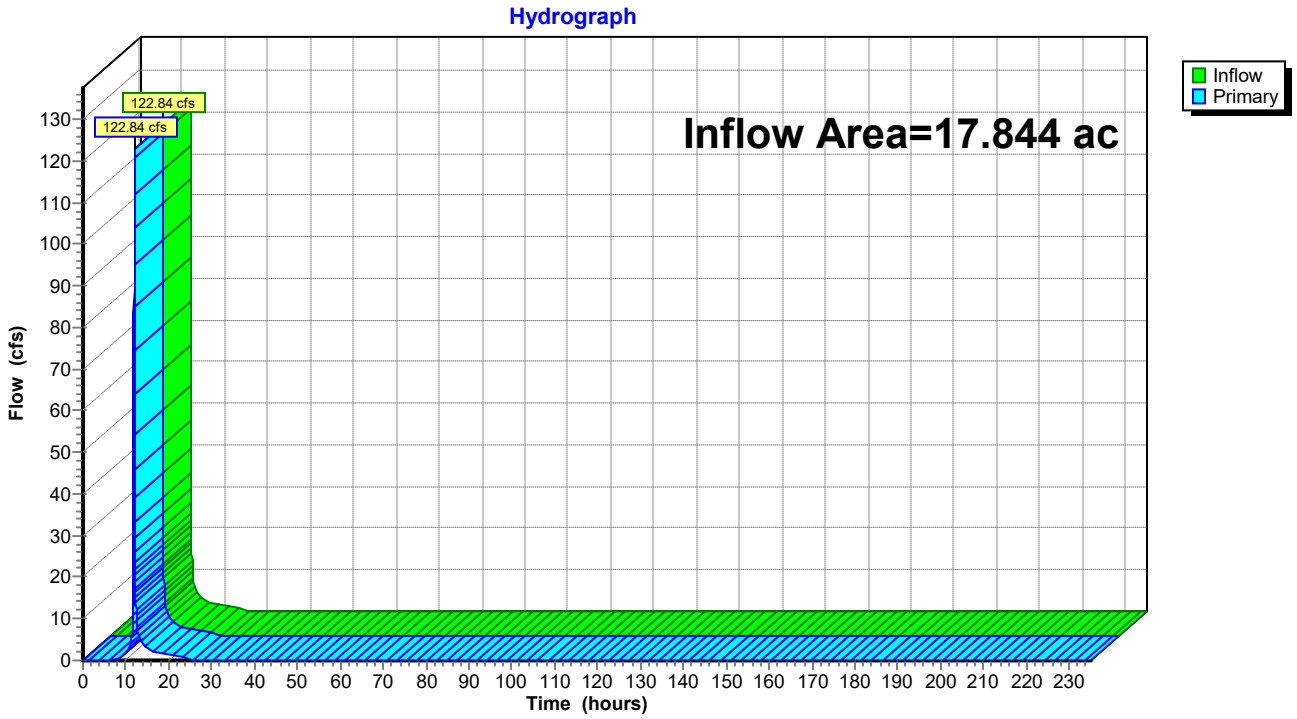


Summary for Link 80L: PC 9C

Inflow Area = 17.844 ac, 7.63% Impervious, Inflow Depth = 3.83" for 25-YR event
Inflow = 122.84 cfs @ 11.96 hrs, Volume= 5.692 af
Primary = 122.84 cfs @ 11.96 hrs, Volume= 5.692 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 80L: PC 9C

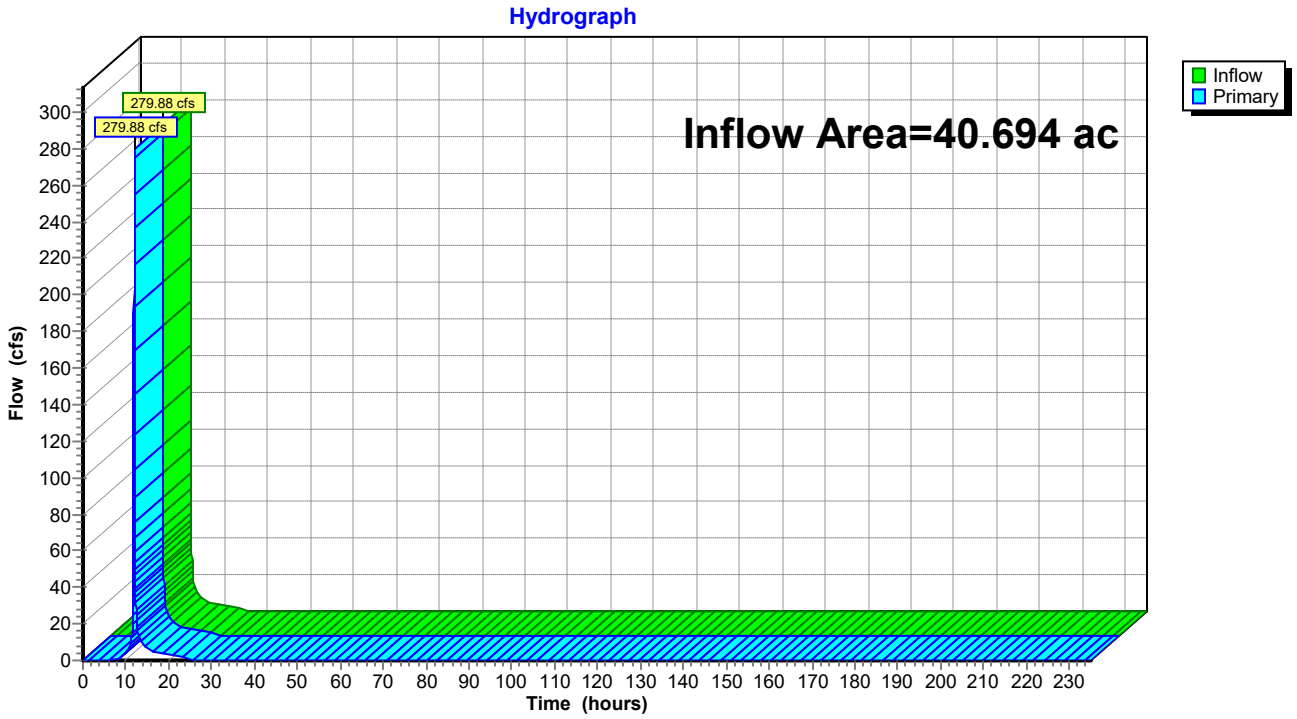


Summary for Link 82L: PC 8C

Inflow Area = 40.694 ac, 7.42% Impervious, Inflow Depth = 3.82" for 25-YR event
Inflow = 279.88 cfs @ 11.96 hrs, Volume= 12.966 af
Primary = 279.88 cfs @ 11.96 hrs, Volume= 12.966 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 82L: PC 8C

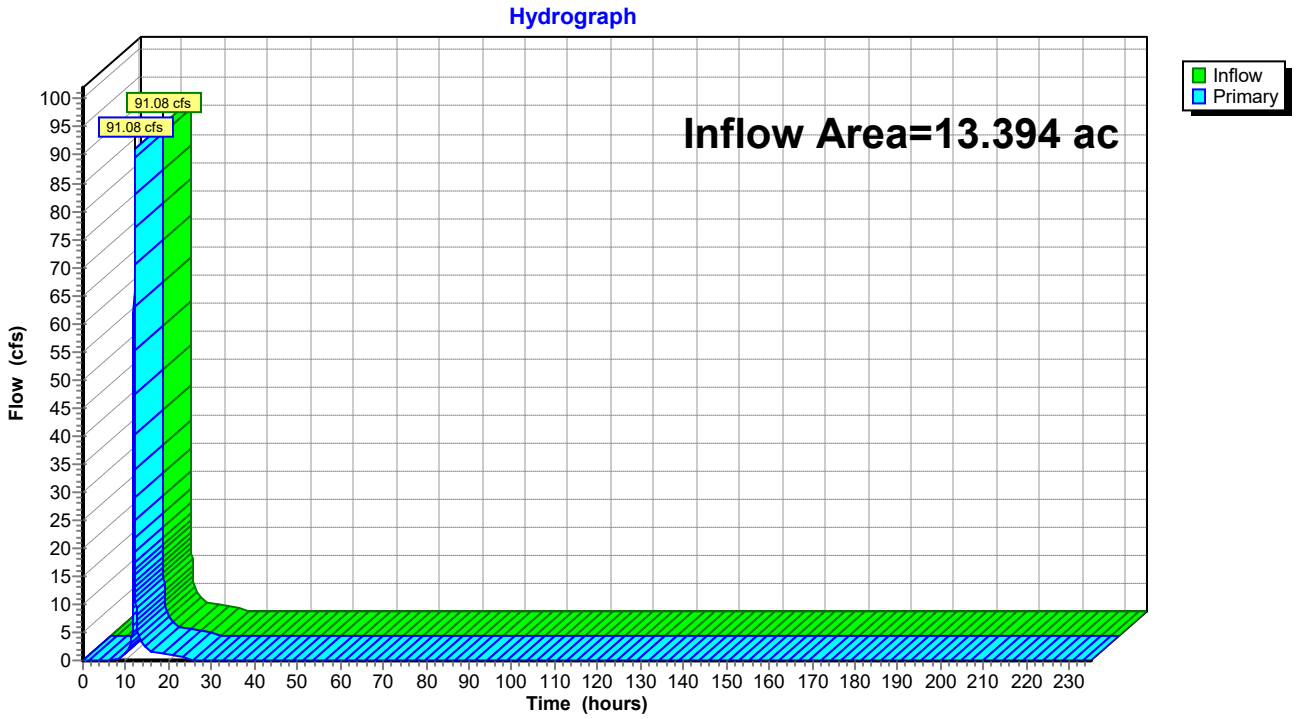


Summary for Link 89L: PC 9B

Inflow Area = 13.394 ac, 4.05% Impervious, Inflow Depth = 3.77" for 25-YR event
Inflow = 91.08 cfs @ 11.96 hrs, Volume= 4.209 af
Primary = 91.08 cfs @ 11.96 hrs, Volume= 4.209 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 89L: PC 9B



Time span=0.00-235.00 hrs, dt=0.01 hrs, 23501 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 72S: AREA TO PC 8B Runoff Area=146,396 sf 15.66% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=83 Runoff=37.59 cfs 1.808 af

Subcatchment 73S: DC-21 Runoff Area=347,408 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=85.62 cfs 4.051 af

Subcatchment 74S: DC-22 Runoff Area=190,896 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=47.05 cfs 2.226 af

Subcatchment 75S: DC-20 Runoff Area=233,065 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=57.44 cfs 2.718 af

Subcatchment 83S: AREA TO PC 8C Runoff Area=44,677 sf 22.27% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=11.61 cfs 0.562 af

Subcatchment 86S: AREA TO CAP ROAD Runoff Area=65,391 sf 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=16.12 cfs 0.762 af

Subcatchment 88S: AREA TO PC 8A Runoff Area=158,379 sf 24.90% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=41.17 cfs 1.993 af

Subcatchment 89S: DC-23 Runoff Area=6.417 ac 0.00% Impervious Runoff Depth=6.10"
Tc=5.0 min CN=80 Runoff=68.89 cfs 3.259 af

Subcatchment 90S: AREA TO PC 9A Runoff Area=113,003 sf 20.90% Impervious Runoff Depth=6.58"
Tc=5.0 min CN=84 Runoff=29.38 cfs 1.422 af

Subcatchment 91S: AREA TO PC 9B Runoff Area=193,876 sf 18.41% Impervious Runoff Depth=6.46"
Tc=5.0 min CN=83 Runoff=49.78 cfs 2.394 af

Link 76L: PC 8A Inflow=57.29 cfs 2.755 af
Primary=57.29 cfs 2.755 af

Link 77L: PC 8B Inflow=180.49 cfs 8.614 af
Primary=180.49 cfs 8.614 af

Link 79L: PC 9A Inflow=76.42 cfs 3.648 af
Primary=76.42 cfs 3.648 af

Link 80L: PC 9C Inflow=195.09 cfs 9.302 af
Primary=195.09 cfs 9.302 af

Link 82L: PC 8C Inflow=444.63 cfs 21.195 af
Primary=444.63 cfs 21.195 af

Link 89L: PC 9B Inflow=145.31 cfs 6.907 af
Primary=145.31 cfs 6.907 af

Total Runoff Area = 40.694 ac Runoff Volume = 21.195 af Average Runoff Depth = 6.25"
92.58% Pervious = 37.672 ac 7.42% Impervious = 3.021 ac

Summary for Subcatchment 72S: AREA TO PC 8B

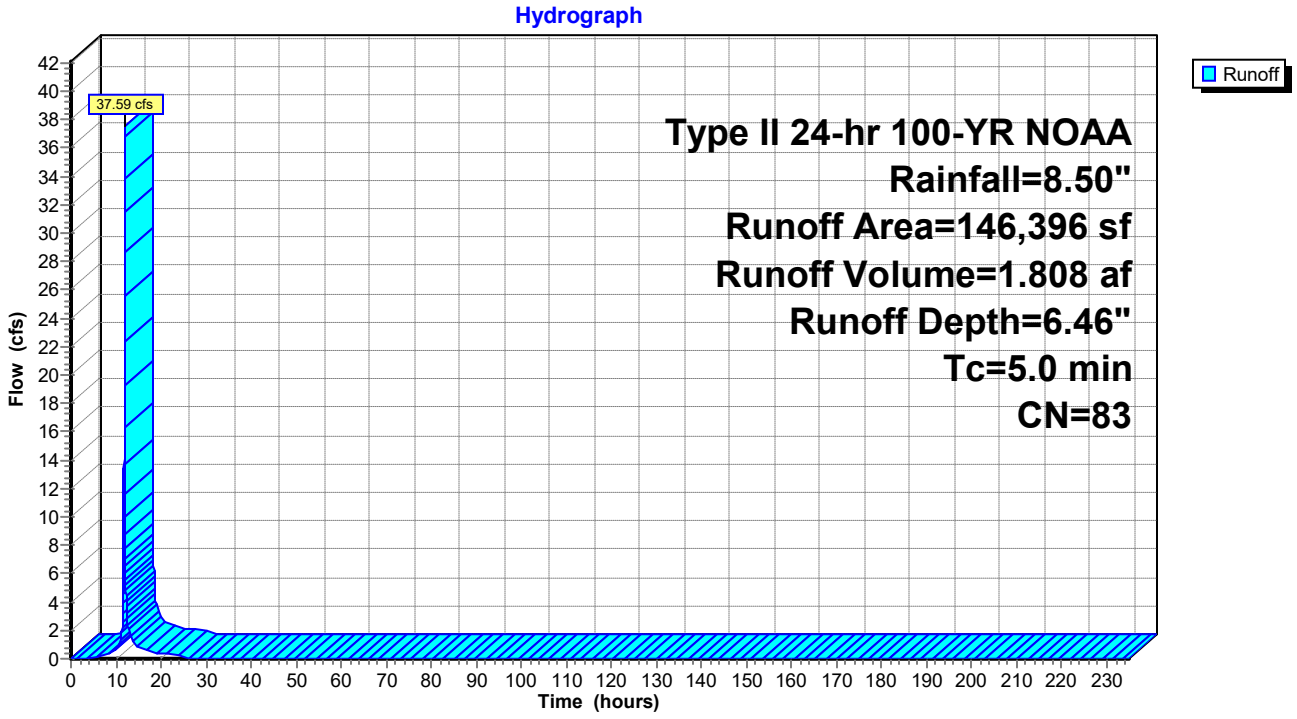
Runoff = 37.59 cfs @ 11.96 hrs, Volume= 1.808 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
123,465	80	>75% Grass cover, Good, HSG D
22,931	98	Paved parking & roofs
146,396	83	Weighted Average
123,465		Pervious Area
22,931		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 72S: AREA TO PC 8B



Summary for Subcatchment 73S: DC-21

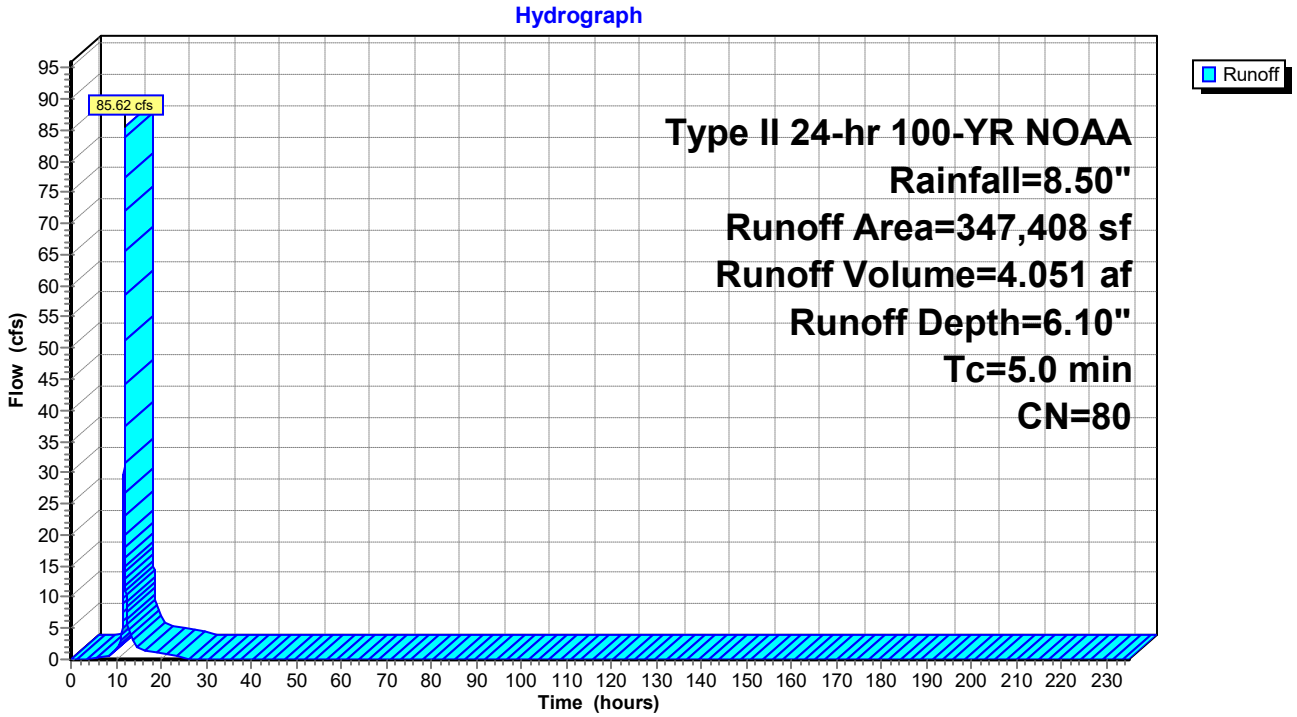
Runoff = 85.62 cfs @ 11.96 hrs, Volume= 4.051 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
347,408	80	>75% Grass cover, Good, HSG D
347,408		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 73S: DC-21



Summary for Subcatchment 74S: DC-22

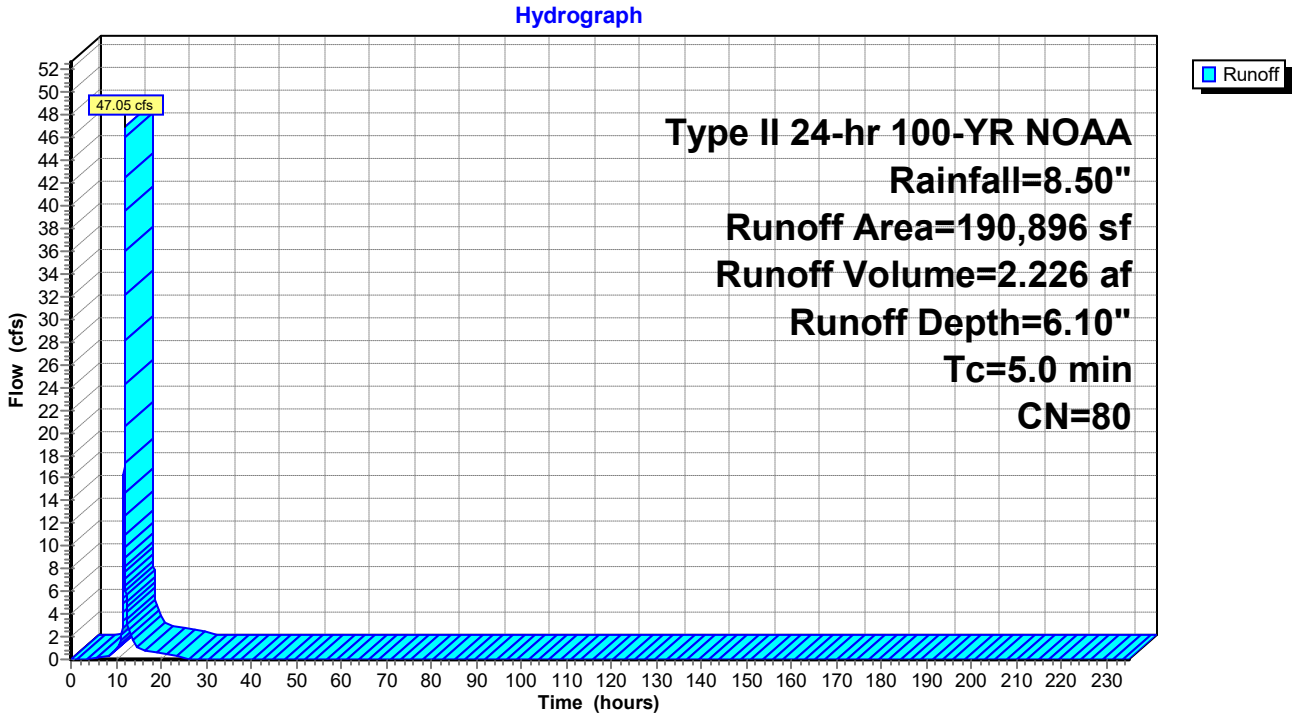
Runoff = 47.05 cfs @ 11.96 hrs, Volume= 2.226 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
190,896	80	>75% Grass cover, Good, HSG D
190,896		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 74S: DC-22



Summary for Subcatchment 75S: DC-20

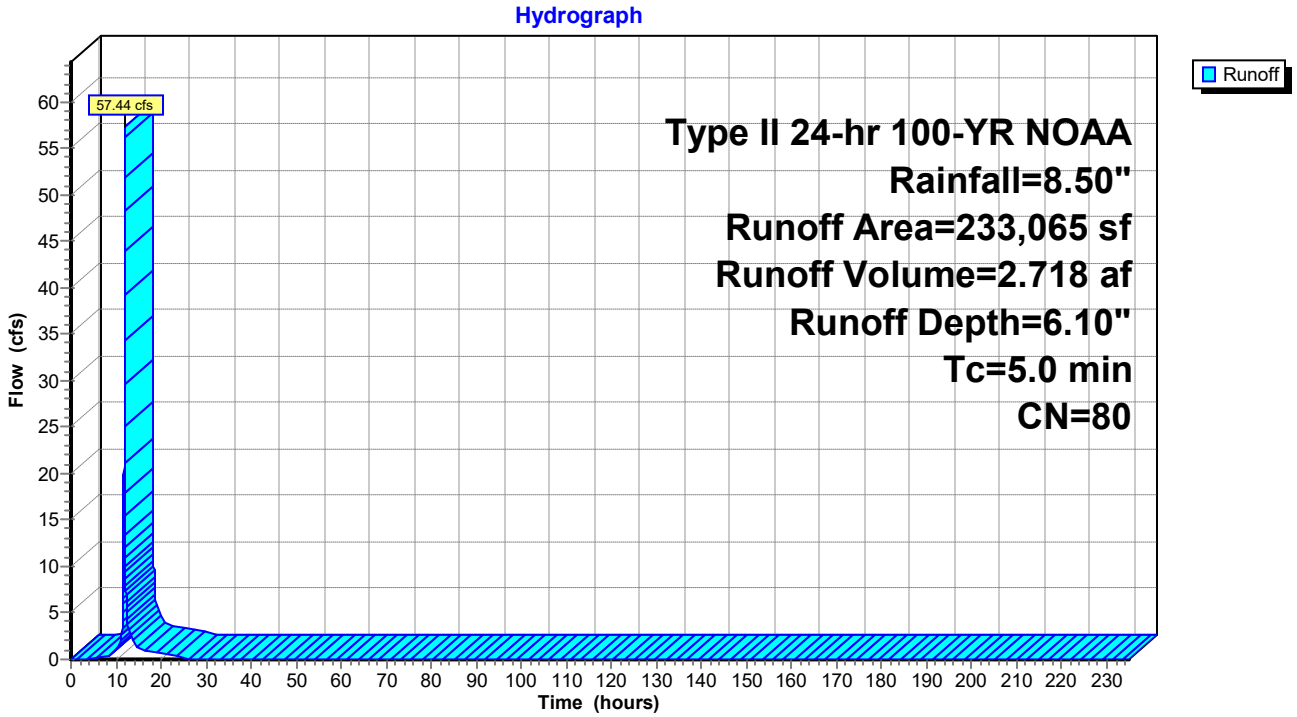
Runoff = 57.44 cfs @ 11.96 hrs, Volume= 2.718 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
233,065	80	>75% Grass cover, Good, HSG D
233,065		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 75S: DC-20



Summary for Subcatchment 83S: AREA TO PC 8C

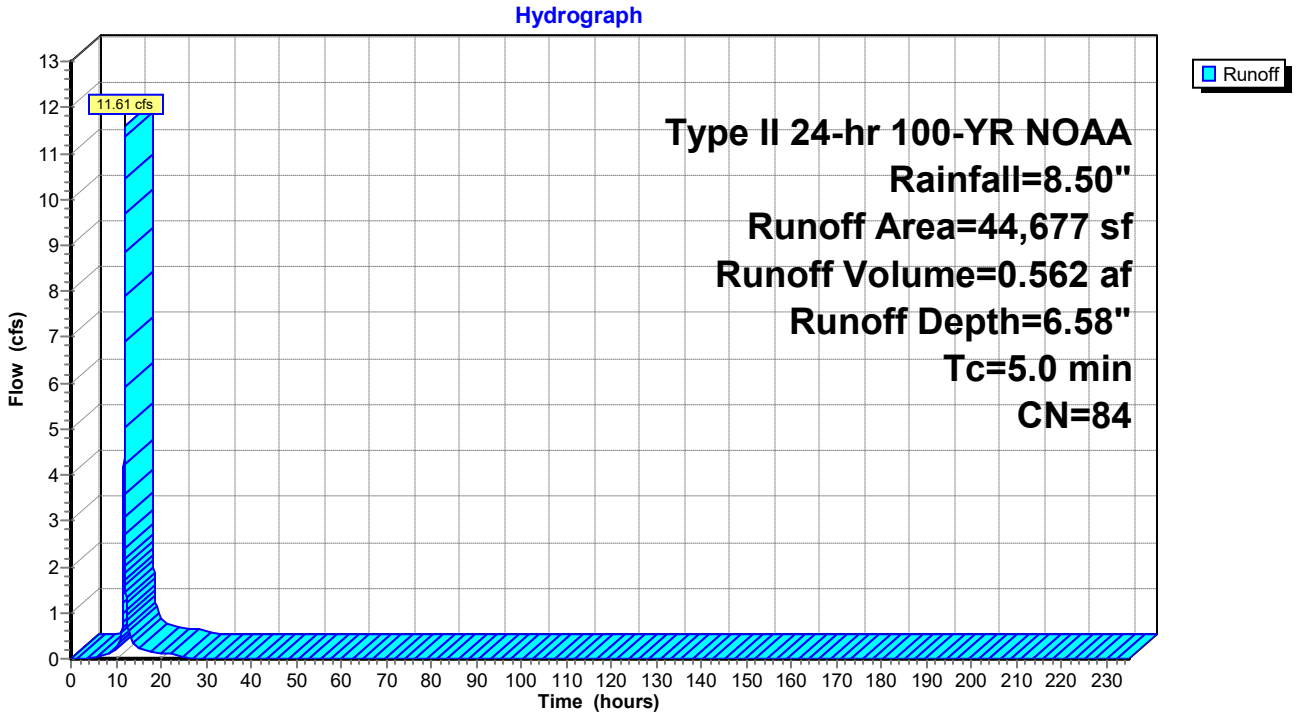
Runoff = 11.61 cfs @ 11.96 hrs, Volume= 0.562 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
34,727	80	>75% Grass cover, Good, HSG D
9,950	98	Paved parking & roofs
44,677	84	Weighted Average
34,727		Pervious Area
9,950		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 83S: AREA TO PC 8C



Summary for Subcatchment 86S: AREA TO CAP ROAD SWALE

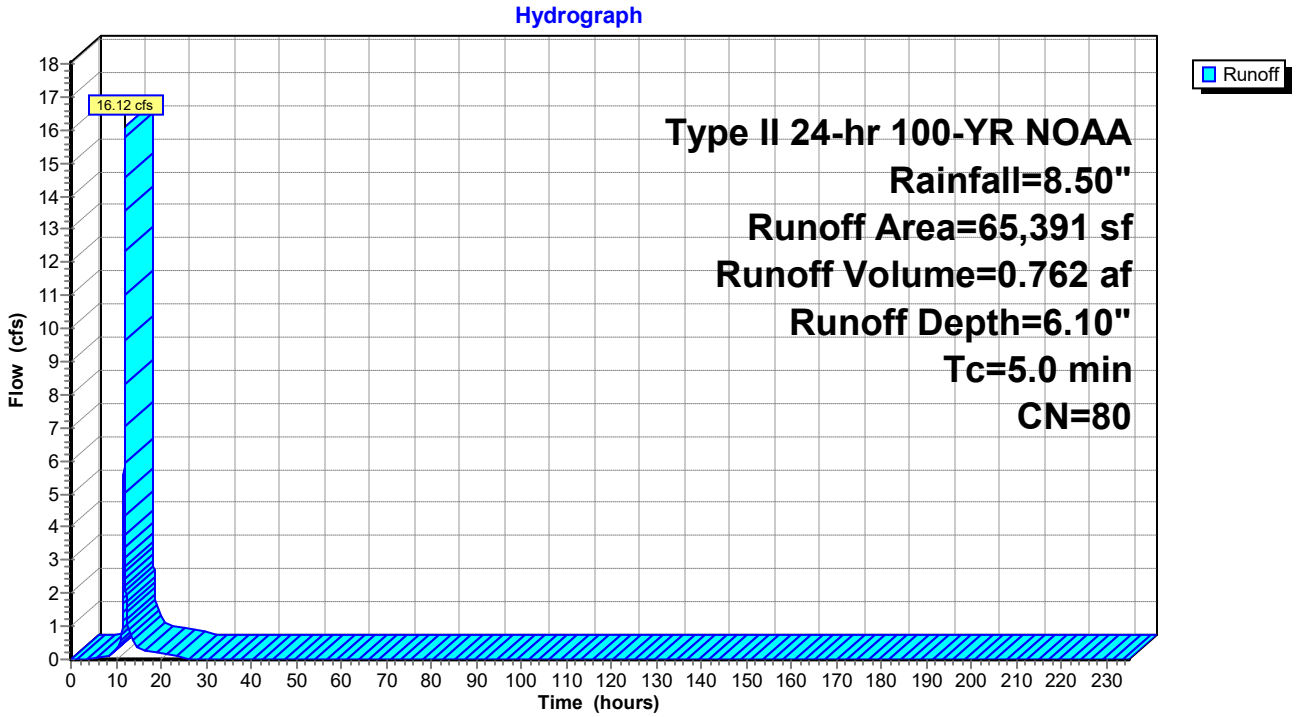
Runoff = 16.12 cfs @ 11.96 hrs, Volume= 0.762 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
65,391	80	>75% Grass cover, Good, HSG D
65,391		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 86S: AREA TO CAP ROAD SWALE



Summary for Subcatchment 88S: AREA TO PC 8A

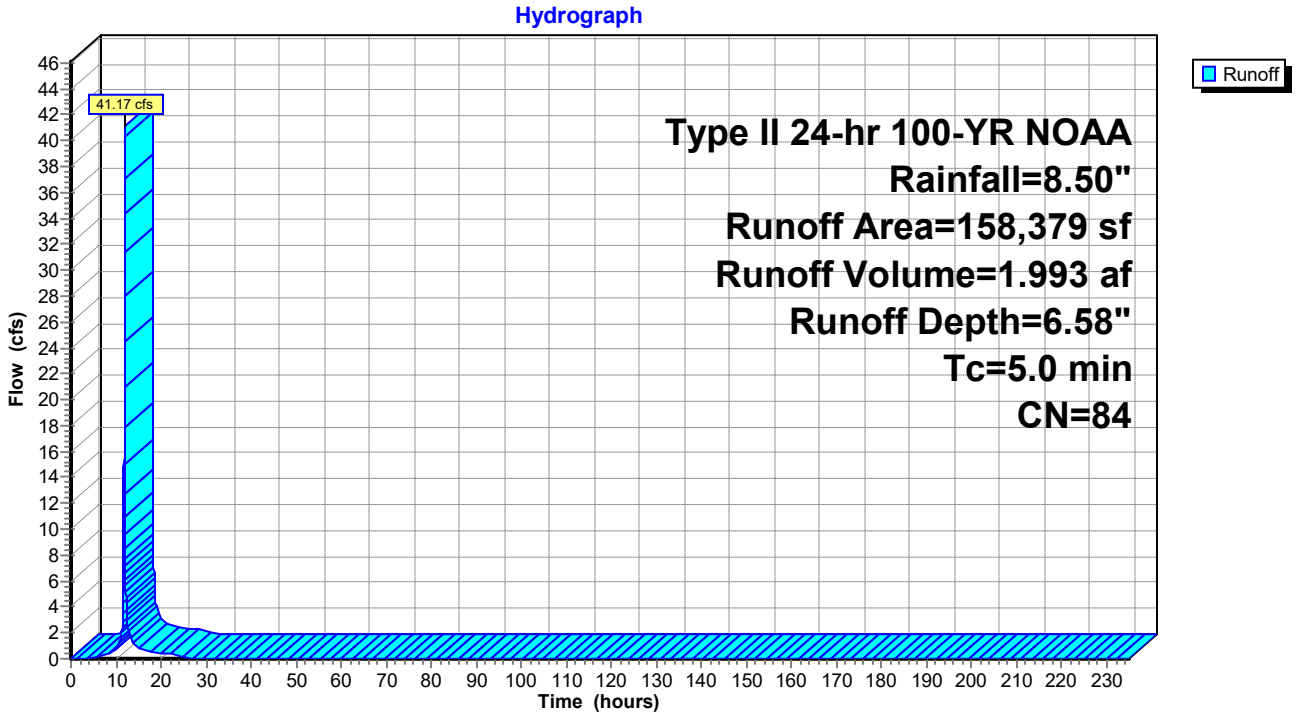
Runoff = 41.17 cfs @ 11.96 hrs, Volume= 1.993 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
118,947	80	>75% Grass cover, Good, HSG D
39,432	98	Paved parking & roofs
158,379	84	Weighted Average
118,947		Pervious Area
39,432		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 88S: AREA TO PC 8A



Summary for Subcatchment 89S: DC-23

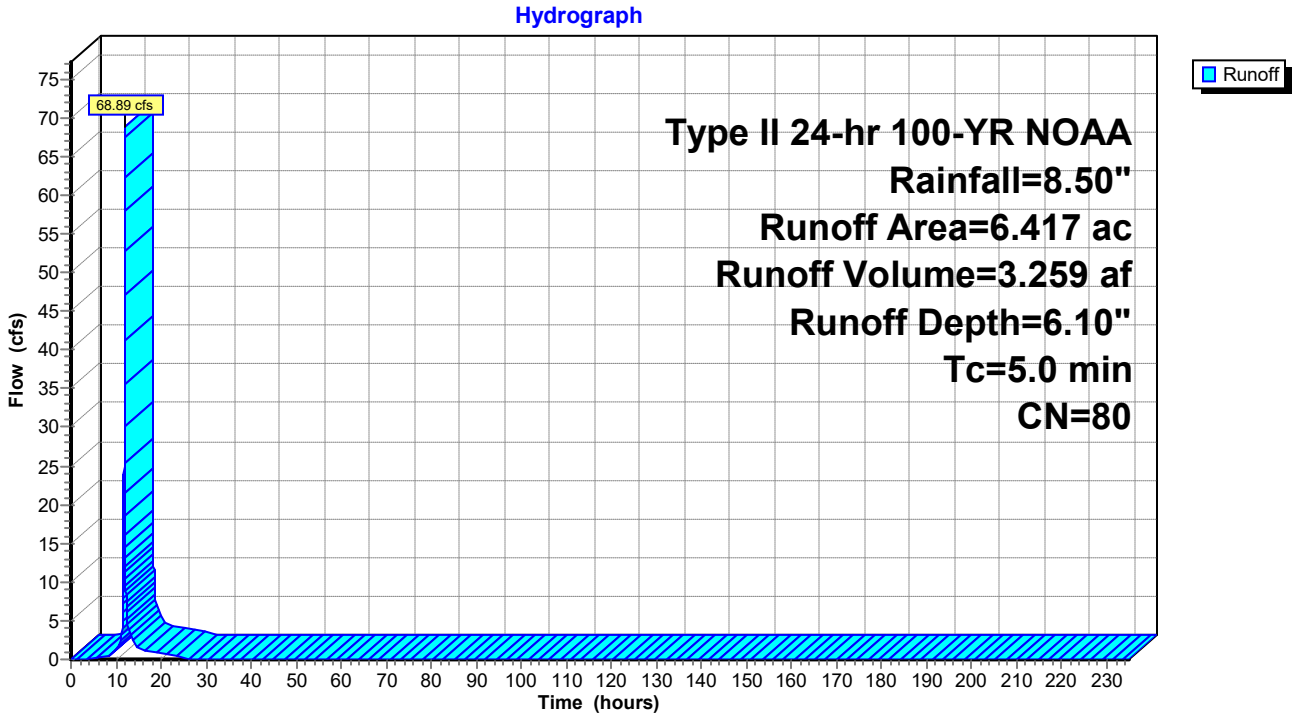
Runoff = 68.89 cfs @ 11.96 hrs, Volume= 3.259 af, Depth= 6.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (ac)	CN	Description
6.417	80	>75% Grass cover, Good, HSG D
6.417		Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 89S: DC-23



Summary for Subcatchment 90S: AREA TO PC 9A

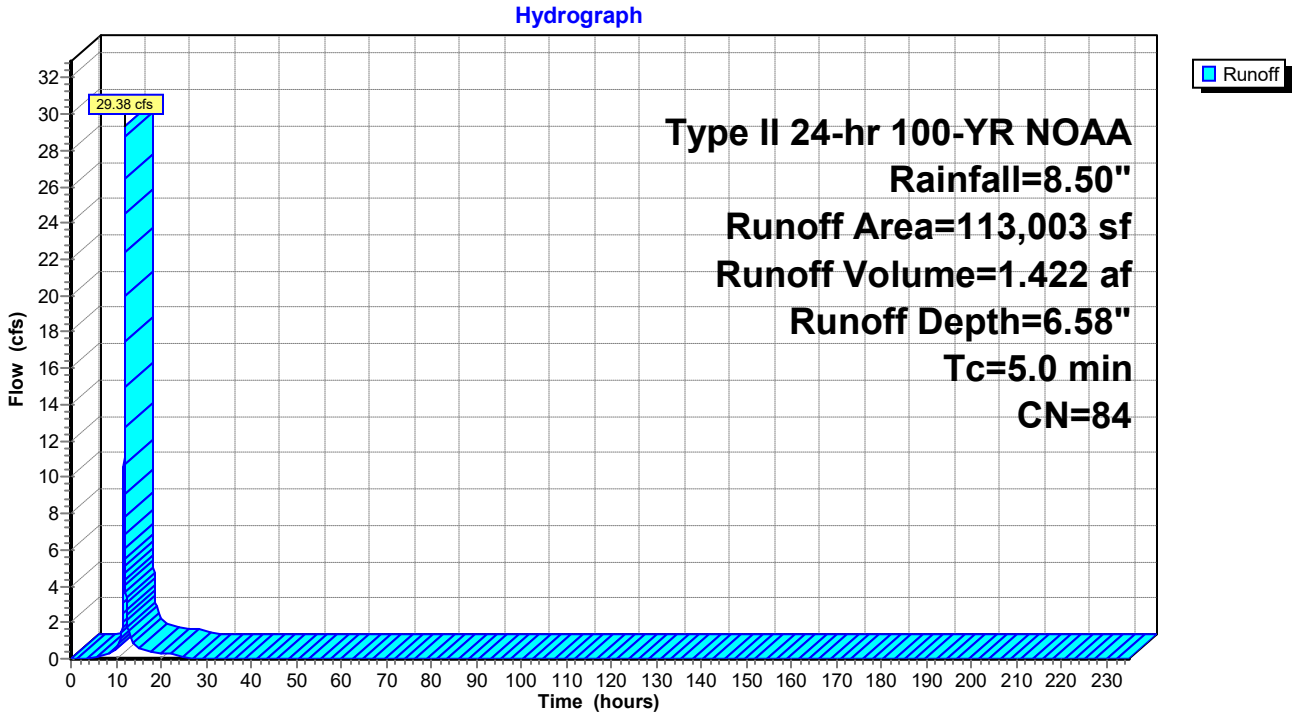
Runoff = 29.38 cfs @ 11.96 hrs, Volume= 1.422 af, Depth= 6.58"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
89,389	80	>75% Grass cover, Good, HSG D
23,614	98	Paved parking & roofs
113,003	84	Weighted Average
89,389		Pervious Area
23,614		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 90S: AREA TO PC 9A



Summary for Subcatchment 91S: AREA TO PC 9B

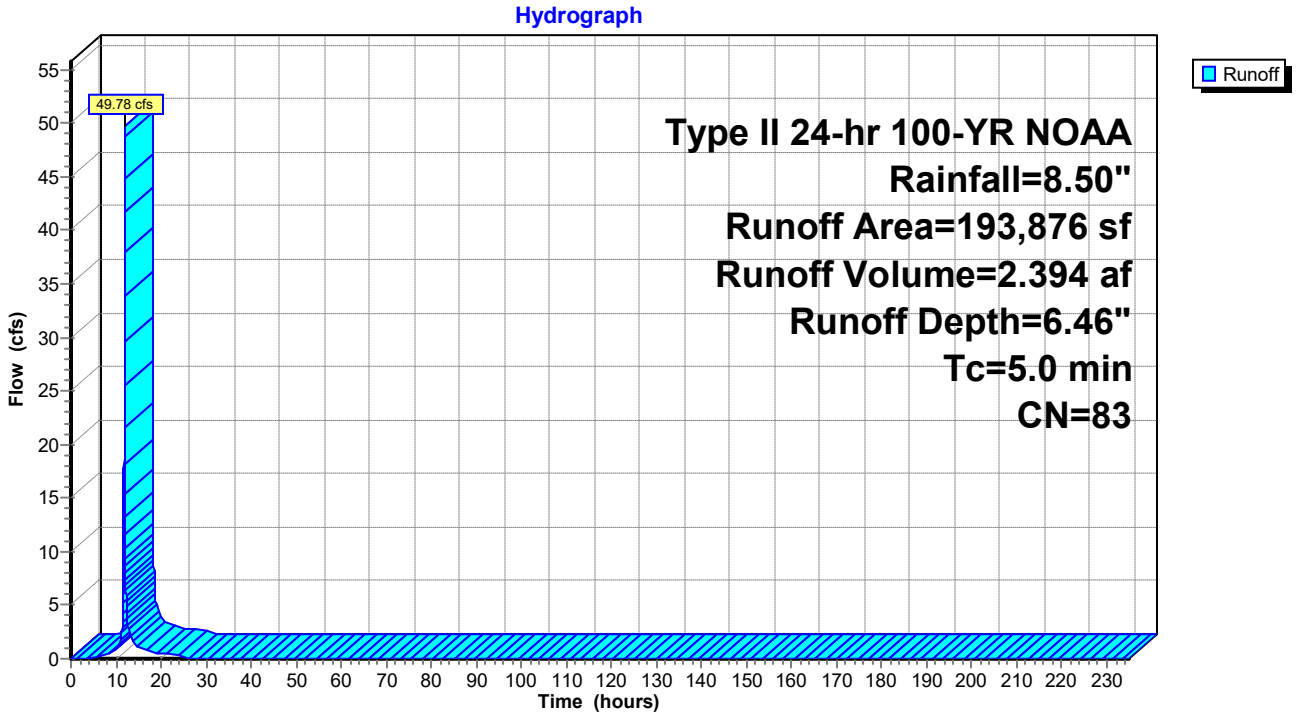
Runoff = 49.78 cfs @ 11.96 hrs, Volume= 2.394 af, Depth= 6.46"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs
Type II 24-hr 100-YR NOAA Rainfall=8.50"

Area (sf)	CN	Description
158,192	80	>75% Grass cover, Good, HSG D
35,684	98	Paved parking & roofs
193,876	83	Weighted Average
158,192		Pervious Area
35,684		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 91S: AREA TO PC 9B

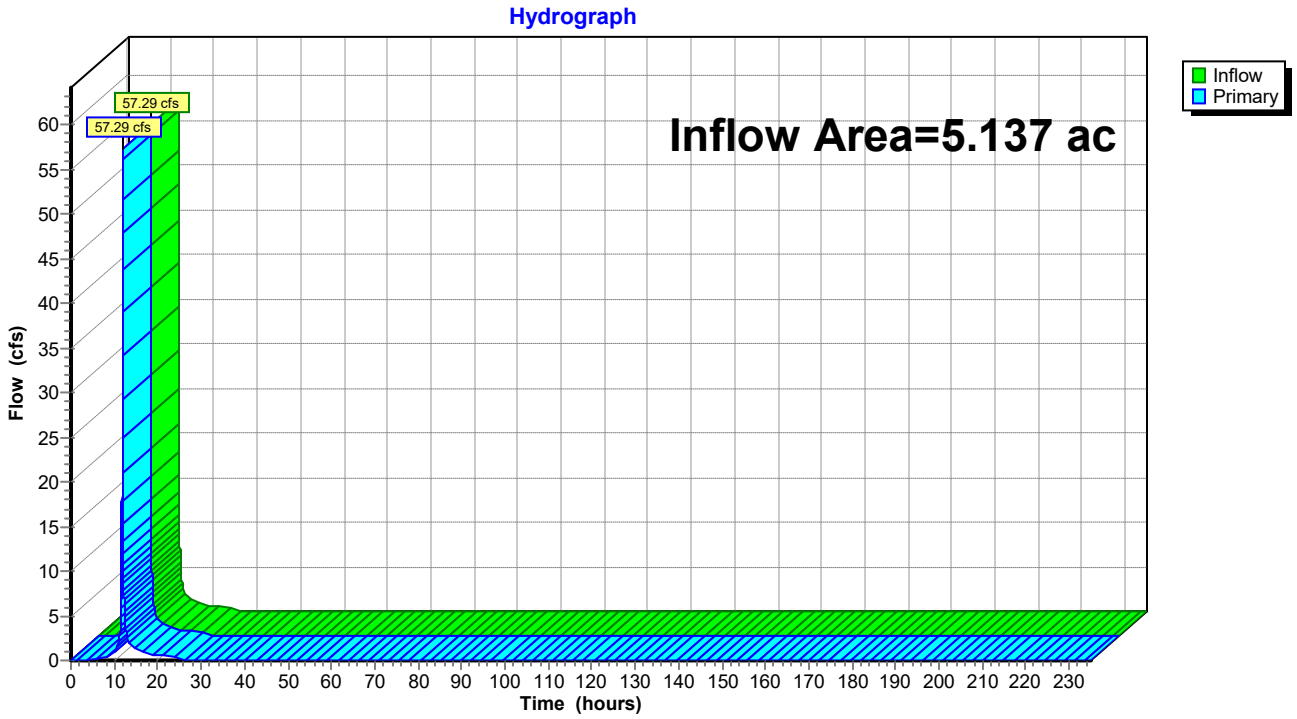


Summary for Link 76L: PC 8A

Inflow Area = 5.137 ac, 17.62% Impervious, Inflow Depth = 6.44" for 100-YR NOAA event
Inflow = 57.29 cfs @ 11.96 hrs, Volume= 2.755 af
Primary = 57.29 cfs @ 11.96 hrs, Volume= 2.755 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 76L: PC 8A

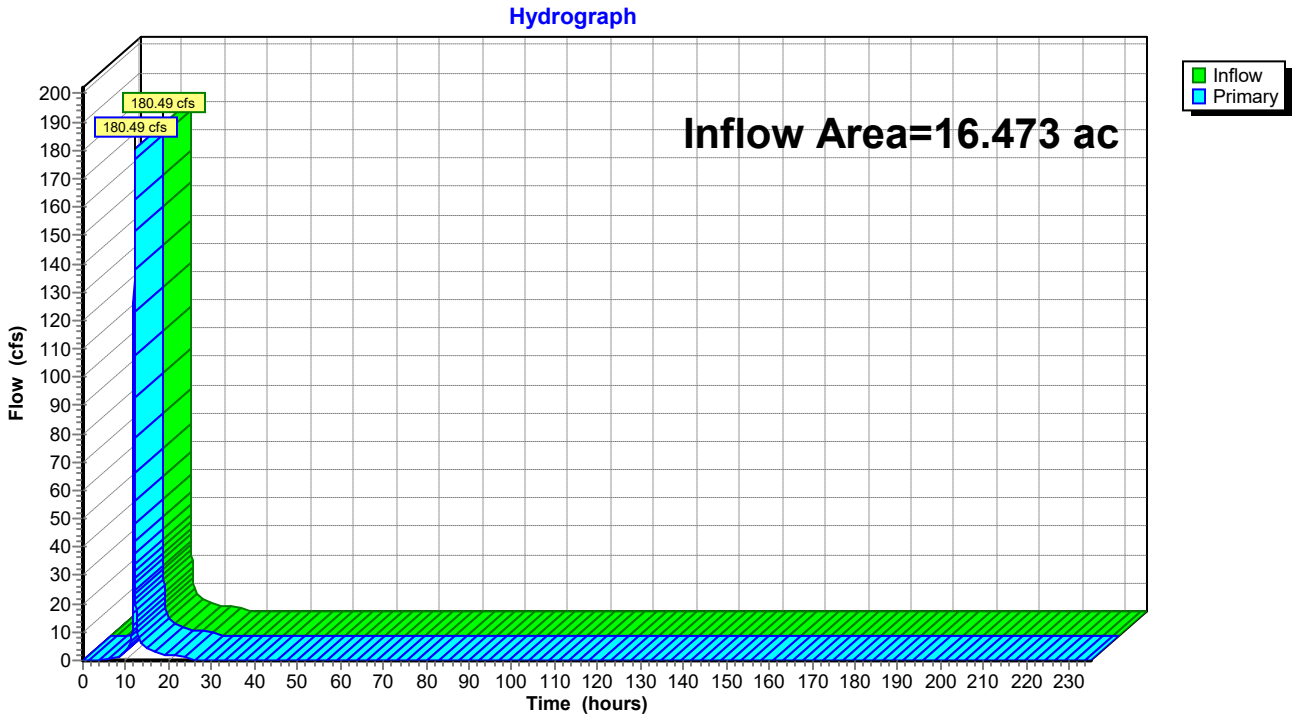


Summary for Link 77L: PC 8B

Inflow Area = 16.473 ac, 8.69% Impervious, Inflow Depth = 6.27" for 100-YR NOAA event
Inflow = 180.49 cfs @ 11.96 hrs, Volume= 8.614 af
Primary = 180.49 cfs @ 11.96 hrs, Volume= 8.614 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 77L: PC 8B

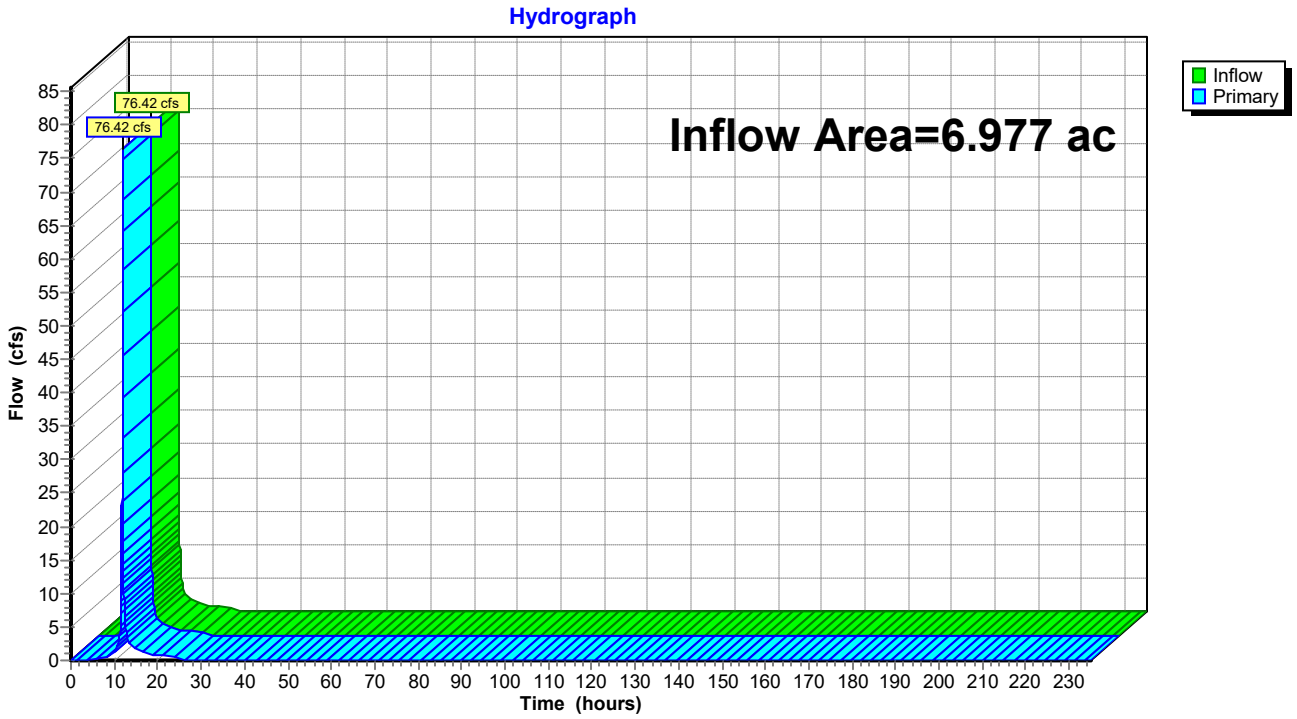


Summary for Link 79L: PC 9A

Inflow Area = 6.977 ac, 7.77% Impervious, Inflow Depth = 6.27" for 100-YR NOAA event
Inflow = 76.42 cfs @ 11.96 hrs, Volume= 3.648 af
Primary = 76.42 cfs @ 11.96 hrs, Volume= 3.648 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 79L: PC 9A

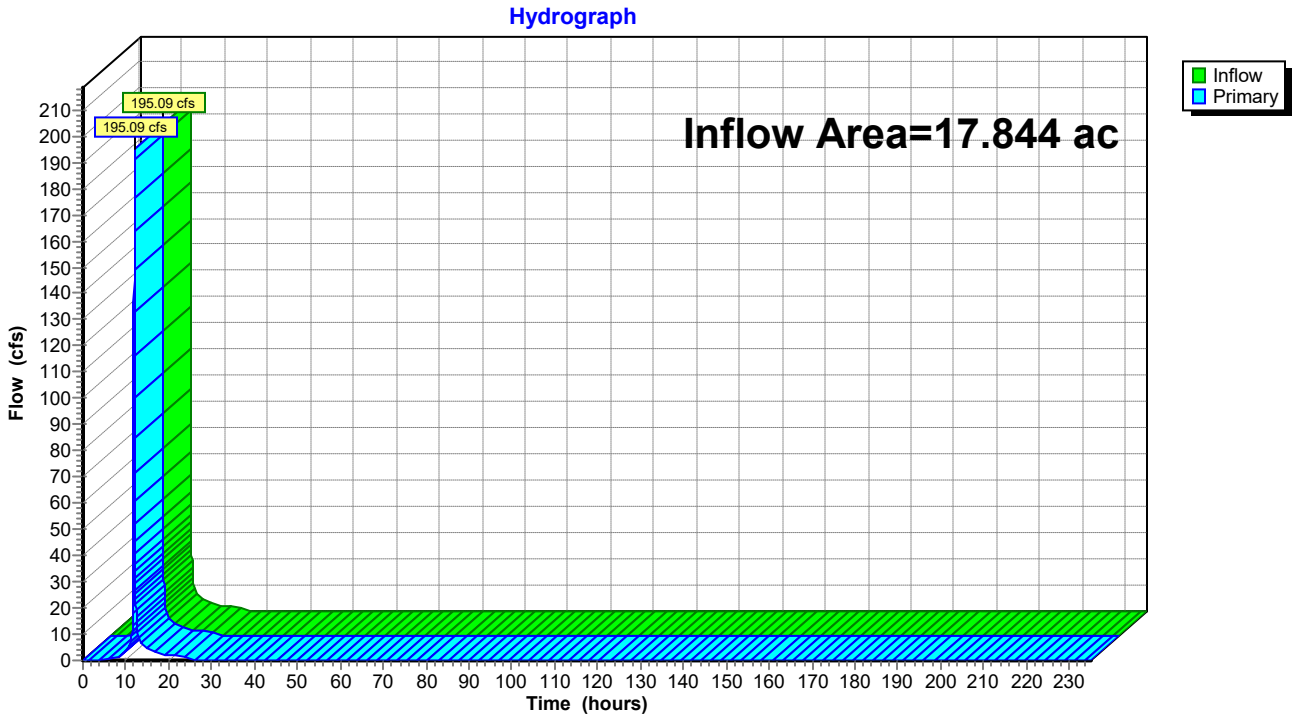


Summary for Link 80L: PC 9C

Inflow Area = 17.844 ac, 7.63% Impervious, Inflow Depth = 6.26" for 100-YR NOAA event
Inflow = 195.09 cfs @ 11.96 hrs, Volume= 9.302 af
Primary = 195.09 cfs @ 11.96 hrs, Volume= 9.302 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 80L: PC 9C

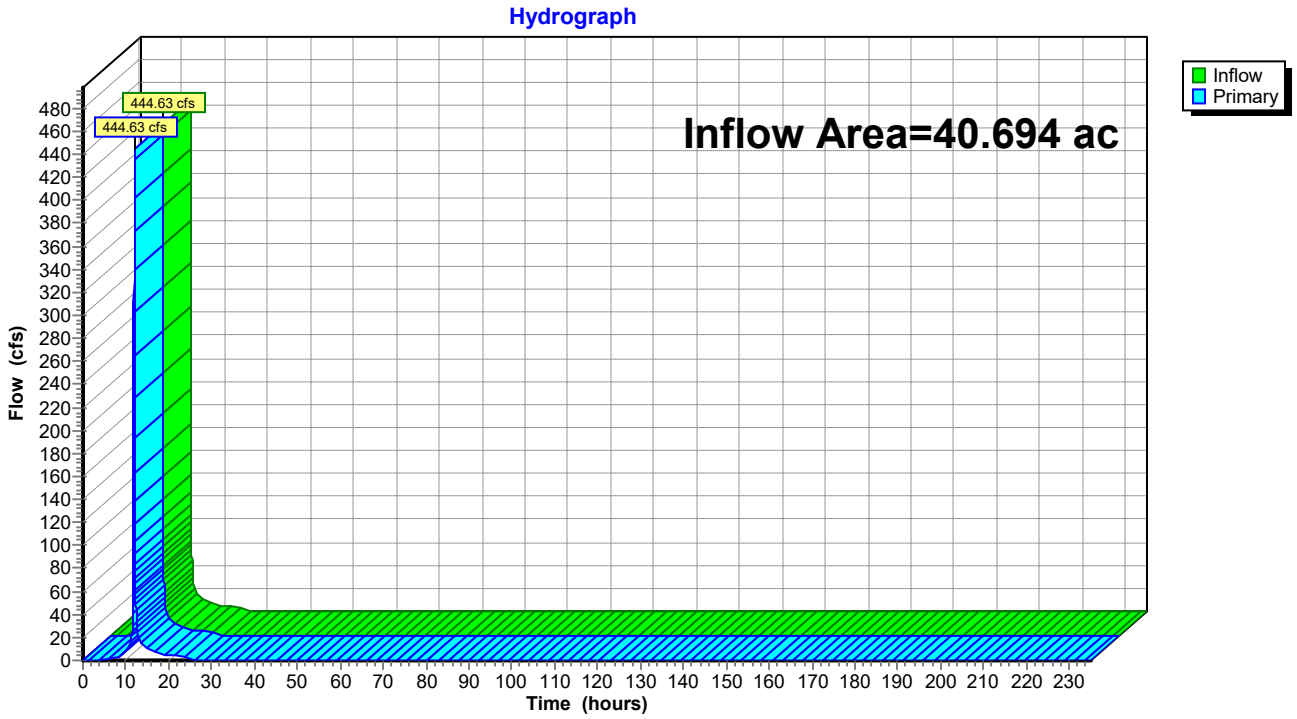


Summary for Link 82L: PC 8C

Inflow Area = 40.694 ac, 7.42% Impervious, Inflow Depth = 6.25" for 100-YR NOAA event
Inflow = 444.63 cfs @ 11.96 hrs, Volume= 21.195 af
Primary = 444.63 cfs @ 11.96 hrs, Volume= 21.195 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 82L: PC 8C

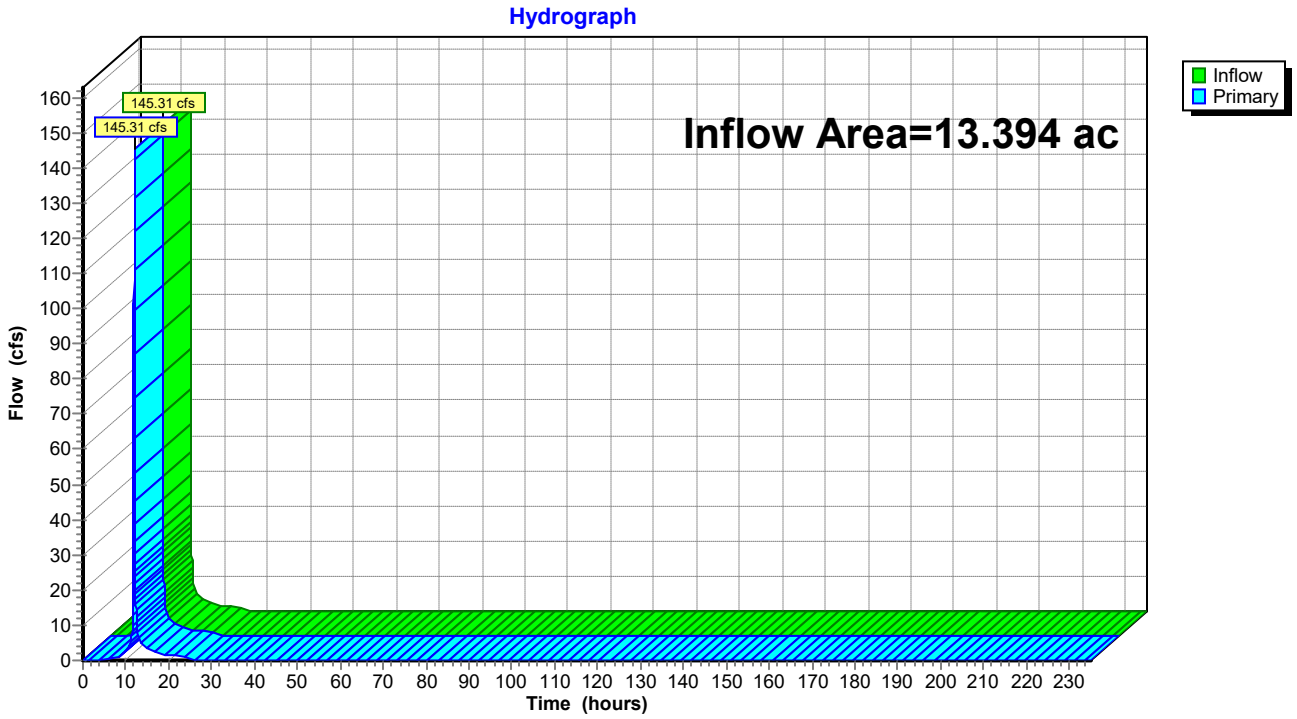


Summary for Link 89L: PC 9B

Inflow Area = 13.394 ac, 4.05% Impervious, Inflow Depth = 6.19" for 100-YR NOAA event
Inflow = 145.31 cfs @ 11.96 hrs, Volume= 6.907 af
Primary = 145.31 cfs @ 11.96 hrs, Volume= 6.907 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-235.00 hrs, dt= 0.01 hrs

Link 89L: PC 9B



ATTACHMENT 17E

Proposed Channels Design

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** RP	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 4

Revised by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the flow in the proposed stormwater management channels under the design storms being considered.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) With proposed channel flows for the 25 year, 24 hour and 100 year, 24 hour storm events, size the perimeter and downchute channels using open channel flow methods.
2) Design the channels to meet 25-year, 24-hour peak flow rates with adequate freeboard.

   Use an Excel Spreadsheet that implements Manning's equation, where

$$Q = (1.49 \times R_h^{2/3} \times A \times S^{1/2})/n, \text{ where}$$

Q = channel flow rate (cfs)
R_h = hydrualic radius of channel = A/P
A = cross-sectional area of flow
P = wetted perimeter of flow
S = channel slope
n = Manning's coefficient

   In the spreadsheet you back-calculate the actual flow depth to meet the design flow, then add freeboard and check shear stress, where

$$\tau = 62.4\ d \times S, \text{ when}$$

d = flow depth (ft)
s = channel slope (ft/ft)

3) Check the selected channel size also contains the flow from the 100-year 24 hour peak flows.

Calculations:

Attached is a summary table of the input data to the HydroCAD program and the computer printout for evaluation for the design storm events.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater Management – Proposed Channel Flow," dated July 15, 2020.
3. McCuen, Richard H., et al, "Hydrologic Analysis and Design," 1989.
4. PADEP, "Erosion and Sediment Pollution Control Program Manual," March 2000.

Revised by PGS 08/27/2021

Conclusions:

A summary of the inflow and the proposed channel configurations for perimeter channels and downchutes are provided in the table below.

Channel ID	Channel Dimensions			25 year, 24 hour storm event		100 year, 24 hour storm event	
	Base Width	Depth	Side Slope	Qout (cfs)	V (fps)*	Qout (cfs)	V (fps)*
DOWNCHUTES							
DC- 1	15.3	1.0	2H:1V	60.95	12.1	94.79	14.4
DC- 2	13.8	1.0	2H:1V	54.36	12.0	85.88	14.3
DC- 3	17.9	1.0	2H:1V	70.96	12.1	113.02	14.4
DC- 4	13.8	1.0	2H:1V	49.88	11.6	80.10	13.9
DC- 5	13.8	1.0	2H:1V	51.59	11.8	82.86	14.1
DC- 6	17.9	1.0	2H:1V	68.55	11.9	107.42	14.2
DC- 7	17.9	1.0	2H:1V	65.04	11.9	103.58	14.0
DC- 8	17.9	1.0	2H:1V	59.62	11.4	100.17	13.8
DC- 9	12.4	1.0	2H:1V	47.30	11.8	74.71	14.0
DC- 10	16.5	1.0	2H:1V	58.89	11.6	93.03	14.0
DC- 20	11.0	1.0	2H:1V	35.77	11.0	57.44	13.3
DC- 21	15.1	1.0	2H:1V	53.31	11.6	85.62	13.9
DC- 22	9.6	1.0	2H:1V	29.30	10.7	47.05	12.8
DC- 23	11	1.0	2H:1V	42.90	11.9	68.89	13.9
PERIMETER CHANNELS							
PC- 1	9.6	2.5	2H:1V	64.62	5.7	158.72	6.6
PC-2	4.1	2.0	2H:1V	31.83	5.7	57.96	6.6
PC-3A	4.1	2.0	2H:1V	15.97	6.4	24.83	7.6
PC- 3B	9.6	2.0	2H:1V	80.84	7.7	128.22	4.7
PC- 3C	13.8	2.6	2H:1V	140.25	8.2	228.15	9.0
PC- 3D	15.1	2.6	2H:1V	197.64	7.0	319.29	9.7
PC- 3E	15.1	3.2	2H:1V	282.93	9.1	455.14	10.6
PC- 4A	4.1	2.0	2H:1V	40.72	6.1	63.32	6.9
PC- 4B	13.8	2.0	2H:1V	109.16	7.2	170.64	8.4
PC- 4C	13.8	2.5	2H:1V	160.59	7.7	253.31	8.9
PC- 4D	15.1	2.8	2H:1V	210.30	8.8	333.21	10.2
PC- 4E	15.1	3.3	2H:1V	281.05	9.1	445.99	10.5
PC- 4F	15.1	3.5	2H:1V	347.91	9.7	552.08	11.2
PC- 5	9.6	2.2	2H:1V	81.01	8.9	126.24	10.3
PC- 6	8.3	2.0	2H:1V	24.00	7.4	65.73	10.5
PC- 7	2.8	2.0	2H:1V	17.34	8.9	26.77	10.1
PC- 8A	2.8	2.0	2H:1V	36.51	7.2	57.29	8.1
PC- 8B	8.3	2.0	2H:1V	113.80	8.4	180.49	9.3
PC- 8C	17.9	2.2	2H:1V	279.88	8.1	444.63	9.4
PC- 9A	8.3	2.6	2H:1V	48.18	5.4	76.42	6.2
PC- 9B	9.6	2.6	2H:1V	91.08	6.4	145.31	7.4
PC- 9C	13.8	2.6	2H:1V	122.84	4.6	195.09	5.3
PC- 10	9.6	2.0	2H:1V	68.46	8.4	164.87	11.2

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The required channel depth and velocities were checked for minimum and maximum slope conditions for each channel. The velocity values provided in the table are the maximum values associated with the maximum slope. Perimeter channels and downchutes will both be armored with cable-concrete channel lining (CC-45 from Bethlehem Precast, or equivalent).

The 25 year, 24 hour storm event flow rates will be used to determine the size of the channels and select channel lining. These flow rates will also be used to size culverts.

Terraces

The Terraces and (Final Cover) Access Road channels were checked for typical expected flows.

The longest terrace is on the West Side with a drainage area of ~~1200~~ 900 liner feet in length by ~~80~~ 120 feet slope upgradient. Drainage area = ~~96,000~~ 108,000 s.f. = ~~2.2~~ 2.5 acres

The 2nd longest Terrace is on the East side at 520 ~~feet~~ 725 ft in length with an upgradient slope of ~~80~~ 120 feet provide an area of ~~520~~ 725 ft x 80 = ~~41,600~~ 87,000 s.f. = ~~0.96~~ 2.0 acres

Using a c = 0.35 and an i = 8.0 in.hr (assuming a Tc of 5 minutes for 25 year storm)

Using the Rational Method, where Q (cfs) = c i A, with i in inches/hr and A in acres

Q west = (0.35) (8.0) ~~(2.2)~~ 2.5 = ~~6.2~~ 7.0 cfs
Q east = (0.35) (8.0) ~~(0.96)~~ 2.0 = ~~2.7~~ 5.6 cfs

Using the open channel flow method for evaluation, with

Manning's n = 0.08 for Retardance D (Rh = 0.38, S=2%)
Manning's n = 0.065 for Retardance D (Rh = 0.34, S=3%)

Min channel depth for the longest and 2nd longest terraces are 0.81 and 0.59 feet, respectively. The Remaining terraces have drainage areas comparable to or smaller than the 2nd longest terrace. With a specified depth of 1.0 for the terraces, there is adequate freeboard. Velocities under both conditions remained below 2 fps, which is less than the recommended 4 fps for grassed, easily eroded soil and 5 fps for erosion resistant soils (on slopes less than 5%) when stabilized with permanent vegetation.

The final Terrace design is: Triangular channel,
4 3H:1V on one side; 10H:1V on the other
1 foot deep.
Grassed lined.

AR Channel

The Access Road Channel is along the inside edge of the final cover access road, and collect runoff mostly from the access road and small areas of upgradient slope between terraces. Where the

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access road (AR) channel intersects with Downchutes channels, the flow discharges into the Downchute.

The longest AR channel is on the East Section where it does not cross a Downchute. The length of the AR Channel is 750 feet, with an upslope measures 0 ft and the upgradient slope measuring 90 ftat the downgradient end. The access road is 24-feet wide.

Drainage Area = 750 x ({ (90+24) + (0 + 24)} /2) = 750 x (69) = 51,750 s.f. = 1.19 acres

Using a c = 0.35 and an i = 8.0 in.hr (assuming a Tc of 5 minutes for 25 year storm)

Using the Rational Method, where Q (cfs) = c i A, with i in inches/hr and A in acres

$$Q_{\text{AR Channel}} = (0.35)\ (8.0)\ (1.19) = 3.3 \text{ cfs}$$

Using an Excel spreadsheet the employs Manning's Equation for open channel flow, the AR Channel will be the following configuration:

Trapezoidal channel,
4 3H:1V on one side; 2H:1V on the other
3 foot base width
1 foot deep.
Grassed lined.

Velocity was check for the 4% and 8% slopes. The calculated peak velocity of 2.31 fps was on the 8% sloped segments of the channel, which is less than the recommended 3 fps for grassed, easily eroded soil and 4 fps for erosion resistant soils (on slopes between 5% and 10%) when stabilized with permanent vegetation.

JULY 2020

PERIMETER CHANNEL DESIGN

25-year, 24 hour storm event flows

20183854

CHANNEL OR CHANNEL SECTION	1A	1A	1B	1B	2	2	3A	3B	3C	3C	3D	3E	3E	4A	4A
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	16.68	15.52	16.68	15.52	10.38	9.54	9.70	15.24	21.96	20.12	23.34	23.86	24.90	10.38	11.02
CHANNEL TOP WIDTH @ d (FT)	14.68	13.52	14.68	13.52	8.38	7.54	7.70	13.24	19.96	18.12	21.34	21.86	22.90	8.38	9.02
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	9.60	9.60	9.60	9.60	4.10	4.10	4.1	9.6	13.8	13.8	15.1	15.1	15.1	4.1	4.1
d (FLOW DEPTH IN FEET)	1.27	0.98	1.27	0.98	1.07	0.86	0.9	0.91	1.54	1.08	1.56	1.69	1.95	1.07	1.23
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	7.56	9.80	7.56	9.80	3.83	4.77	4.6	10.5	9.0	12.8	9.7	8.9	7.7	3.8	3.3
A (AREA IN SF)	15.42	11.33	15.42	11.33	6.68	5.01	5.31	10.3922	25.9952	17.2368	28.4232	31.2312	37.05	6.6768	8.0688
R (HYDRAULIC RADIUS)	1.01	0.81	1.01	0.81	0.75	0.63	0.65	0.76	1.26	0.93	1.29	1.38	1.56	0.75	0.84
S (BED SLOPE, FT/FT) *	0.008	0.02	0.008	0.02	0.015	0.035	0.018	0.040	0.010	0.035	0.016	0.025	0.015	0.025	0.015
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	4.18	5.71	4.18	5.71	4.70	6.38	4.7	7.7	5.4	8.2	7.0	9.1	7.6	6.1	5.1
Q (AT FLOW DEPTH d, CFS)	64.42	64.66	64.42	64.66	31.39	31.95	24.9	80.4	140.6	142.2	197.6	284.0	282.9	40.5	40.9
Qr (REQUIRED CAPACITY, CFS)	64.62	64.62	64.62	64.62	31.83	31.83	16.0	80.8	140.3	140.3	197.6	282.9	282.9	40.7	40.7
Sc (CRITICAL SLOPE)	0.02	0.02	0.02	0.02	0.02	0.02	0.018	0.017	0.014	0.016	0.014	0.014	0.013	0.017	0.017
.7Sc	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.012	0.010	0.011	0.010	0.010	0.009	0.012	0.012
1.3Sc	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.022	0.019	0.020	0.018	0.018	0.017	0.023	0.022
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.32	0.25	0.32	0.25	0.27	0.22	0.225	0.2275	0.385	0.27	0.39	0.4225	0.4875	0.2675	0.3075
MINIMUM REQUIRED FREEBOARD, FT	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.77	1.48	1.77	1.48	1.57	1.36	1.4	1.41	2.04	1.58	2.06	2.19	2.45	1.57	1.73
PROVIDED DEPTH (FT)	2.50	2.50	2.50	2.50	2.00	2.00	2	2	2.6	2.6	2.6	3.2	3.2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	0.63	1.22	0.63	1.22	1.00	1.88	1.01	2.27	0.96	2.36	1.56	2.64	1.83	1.67	1.15
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.

** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.

*** Minimum Freeboard, F, is 0.5 feet.

**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

PERIMETER CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	4B	4B	4C	4C	4D	4D	4E	4E	4F	4F	5	5	6	6	7
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	20.56	19.68	20.92	21.72	25.80	22.50	23.82	24.90	24.70	26.05	16.56	14.88	11.78	12.46	7.84
CHANNEL TOP WIDTH @ d (FT)	18.56	17.68	18.92	19.72	23.66	20.50	21.82	22.90	22.70	23.86	14.56	12.88	9.78	10.46	5.84
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	13.8	13.8	13.8	13.8	15.1	15.1	15.1	15.1	15.1	15.1	9.6	9.6	8.3	8.3	2.8
d (FLOW DEPTH IN FEET)	1.19	0.97	1.28	1.48	2.14	1.35	1.68	1.95	1.9	2.19	1.24	0.82	0.37	0.54	0.76
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	11.6	14.2	10.8	9.3	7.1	11.2	9.0	7.7	7.9	6.9	7.7	11.7	22.4	15.4	3.7
A (AREA IN SF)	19.2542	15.2678	20.9408	24.8048	41.4732	24.03	31.0128	37.05	35.91	42.6612	14.9792	9.2168	3.3448	5.0652	3.2832
R (HYDRAULIC RADIUS)	1.01	0.84	1.07	1.21	1.68	1.14	1.37	1.56	1.52	1.71	0.99	0.69	0.34	0.47	0.53
S (BED SLOPE, FT/FT) *	0.015	0.030	0.025	0.015	0.015	0.030	0.025	0.015	0.025	0.015	0.014	0.060	0.110	0.030	0.030
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	5.7	7.2	7.7	6.5	8.0	8.8	9.1	7.6	9.7	8.1	5.5	8.9	7.4	4.9	5.3
Q (AT FLOW DEPTH d, CFS)	110.0	109.5	161.1	160.6	333.5	210.5	281.1	282.9	348.8	347.5	81.7	82.2	24.9	24.7	17.3
Qr (REQUIRED CAPACITY, CFS)	109.2	109.2	160.6	160.6	210.3	210.3	281.1	281.1	347.9	347.9	81.0	81.0	24.0	24.0	17.3
Sc (CRITICAL SLOPE)	0.015	0.016	0.015	0.014	0.013	0.015	0.014	0.013	0.013	0.013	0.016	0.017	0.022	0.020	0.020
.7Sc	0.011	0.011	0.011	0.010	0.009	0.010	0.010	0.009	0.009	0.009	0.011	0.012	0.015	0.014	0.014
1.3Sc	0.020	0.021	0.020	0.019	0.017	0.019	0.018	0.017	0.018	0.017	0.020	0.023	0.028	0.025	0.025
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.2975	0.2425	0.32	0.37	0.535	0.3375	0.42	0.4875	0.475	0.5475	0.31	0.205	0.0925	0.135	0.19
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.69	1.47	1.78	1.98	2.675	1.85	2.18	2.45	2.4	2.7375	1.74	1.32	0.87	1.04	1.26
PROVIDED DEPTH (FT)	2	2	2.5	2.5	2.8	2.8	3.3	3.3	3.5	3.5	2.2	2.2	2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	1.11	1.82	2.00	1.39	2.00	2.53	2.62	1.83	2.96	2.05	1.08	3.07	2.54	1.01	1.42
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

PERIMETER CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	7	8A	8A	8B	8B	8C	9A	9B	9B	9C	10	10	FC AR Channel	FC AR Channel
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	Grass	Grass
CHANNEL TOP WIDTH @ D (FT)	6.88	8.96	9.76	15.90	16.58	26.42	13.90	16.40	18.00	22.12	15.20	14.56	8.05	9.35
CHANNEL TOP WIDTH @ d (FT)	4.88	6.96	7.76	13.90	14.58	24.42	11.90	14.40	16.00	20.12	13.20	12.56	5.55	6.85
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5
CHANNEL BOTTOM WIDTH (FT)	2.8	2.8	2.8	8.3	8.3	17.9	8.3	9.6	9.6	13.8	9.6	9.6	4	4
d (FLOW DEPTH IN FEET)	0.52	1.04	1.24	1.40	1.57	1.63	0.9	1.20	1.60	1.58	0.9	0.74	0.31	0.57
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	5.4	2.7	2.3	5.9	5.3	11.0	9.2	8.0	6.0	8.7	10.7	13.0	12.9	7.0
A (AREA IN SF)	1.9968	5.0752	6.5472	15.54	17.9608	34.4908	9.09	14.4	20.48	26.7968	10.26	8.1992	1.48025	3.09225
R (HYDRAULIC RADIUS)	0.39	0.68	0.78	1.07	1.17	1.37	0.74	0.96	1.22	1.28	0.75	0.64	0.26	0.44
S (BED SLOPE, FT/FT) *	0.130	0.040	0.020	0.030	0.015	0.020	0.020	0.020	0.007	0.007	0.030	0.060	0.080	0.080
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.050	0.050
V (AT FLOW DEPTH d, FPS)	8.9	7.2	5.6	8.4	6.3	8.1	5.4	6.4	4.4	4.6	6.7	8.4	3.4	4.8
Q (AT FLOW DEPTH d, CFS)	17.8	36.5	36.6	130.5	113.6	279.3	48.7	92.2	91.0	123.0	68.3	68.9	5.1	15.0
Qr (REQUIRED CAPACITY, CFS)	17.3	36.5	36.5	113.8	113.8	279.9	48.2	91.1	91.1	122.8	68.5	68.5	5.0	15.0
Sc (CRITICAL SLOPE)	0.021	0.018	0.017	0.015	0.015	0.014	0.017	0.016	0.015	0.014	0.017	0.018	0.058	0.049
.7Sc	0.015	0.013	0.012	0.011	0.010	0.010	0.012	0.011	0.010	0.010	0.012	0.012	0.041	0.035
1.3Sc	0.028	0.024	0.023	0.020	0.019	0.018	0.022	0.020	0.019	0.018	0.022	0.023	0.076	0.064
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.13	0.26	0.31	0.35	0.3925	0.4075	0.225	0.3	0.4	0.395	0.225	0.185	0.0775	0.1425
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.02	1.54	1.74	1.9	2.07	2.13	1.4	1.7	2.1	2.08	1.4	1.24	0.81	1.07
PROVIDED DEPTH (FT)	2	2	2	2	2	2.2	2.6	2.6	2.6	2.6	2	2	1.5	1.5
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	4.22	2.60	1.55	2.62	1.47	2.03	1.12	1.50	0.70	0.69	1.68	2.77	1.55	2.85
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

PERIMETER CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	1A	1A	1B	1B	2	2	3A	3B	3C	3C	3D	3E	3E	4A	4A
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	18.15	16.66	18.15	16.66	11.98	10.82	9.70	16.36	23.95	21.48	25.35	26.15	27.85	11.50	12.26
CHANNEL TOP WIDTH @ d (FT)	16.15	14.66	16.15	14.66	9.98	8.82	7.70	14.36	21.92	19.48	23.30	23.94	25.30	9.50	10.26
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	9.60	9.60	9.60	9.60	4.10	4.10	4.1	9.6	13.8	13.8	15.1	15.1	15.1	4.1	4.1
d (FLOW DEPTH IN FEET)	1.64	1.27	1.64	1.27	1.47	1.18	0.9	1.19	2.03	1.42	2.05	2.21	2.55	1.35	1.54
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	5.86	7.58	5.86	7.58	2.79	3.47	4.6	8.1	6.8	9.7	7.4	6.8	5.9	3.0	2.7
A (AREA IN SF)	21.07	15.36	21.07	15.36	10.35	7.62	5.31	14.26	36.26	23.63	39.36	43.14	51.51	9.18	11.06
R (HYDRAULIC RADIUS)	1.25	1.01	1.25	1.01	0.97	0.81	0.65	0.96	1.58	1.17	1.62	1.73	1.94	0.91	1.01
S (BED SLOPE, FT/FT) *	0.008	0.02	0.008	0.02	0.015	0.035	0.018	0.040	0.010	0.035	0.016	0.025	0.015	0.025	0.015
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	4.81	6.60	4.81	6.60	5.57	7.57	4.7	9.0	6.3	9.7	8.1	10.6	8.9	6.9	5.7
Q (AT FLOW DEPTH d, CFS)	101.33	101.30	101.33	101.30	57.66	57.68	24.9	128.4	228.8	228.3	319.2	455.9	456.2	63.1	63.2
Qr (REQUIRED CAPACITY, CFS)	101.31	101.31	101.31	101.31	57.96	57.96	24.8	128.2	228.2	228.2	319.3	455.1	455.1	63.3	63.3
Sc (CRITICAL SLOPE)	0.01	0.02	0.01	0.02	0.02	0.02	0.018	0.016	0.013	0.015	0.013	0.013	0.013	0.016	0.016
.7Sc	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.011	0.009	0.010	0.009	0.009	0.009	0.012	0.011
1.3Sc	0.02	0.02	0.02	0.02	0.02	0.02	0.024	0.020	0.017	0.019	0.017	0.017	0.016	0.021	0.021
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.41	0.32	0.41	0.32	0.37	0.30	0.23	0.30	0.51	0.36	0.51	0.55	0.64	0.34	0.39
MINIMUM REQUIRED FREEBOARD, FT	0.50	0.50	0.50	0.50	0.50	0.50	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	2.14	1.77	2.14	1.77	1.97	1.68	1.40	1.69	2.54	1.92	2.56	2.76	3.19	1.85	2.04
PROVIDED DEPTH (FT)	2.50	2.50	2.50	2.50	2.00	2.00	2	2	2.6	2.6	2.6	3.2	3.2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	0.82	1.58	0.82	1.58	1.38	2.58	1.01	2.97	1.27	3.10	2.05	3.45	2.39	2.11	1.44
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

PERIMETER CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	4B	4B	4C	4C	4D	4D	4E	4E	4F	4F	5	5	6	6	7
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	21.92	20.84	22.44	23.48	25.80	24.14	26.03	27.70	27.40	29.25	17.96	15.80	12.92	14.10	8.62
CHANNEL TOP WIDTH @ d (FT)	19.92	18.84	20.44	21.48	23.66	22.14	23.84	25.18	24.94	26.42	15.96	13.80	10.92	12.10	6.62
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	13.8	13.8	13.8	13.8	15.1	15.1	15.1	15.1	15.1	15.1	9.6	9.6	8.3	8.3	2.8
d (FLOW DEPTH IN FEET)	1.53	1.26	1.66	1.92	2.14	1.76	2.185	2.52	2.46	2.83	1.59	1.05	0.65	0.95	0.96
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	9.0	11.0	8.3	7.2	7.1	8.6	6.9	6.0	6.1	5.3	6.0	9.1	12.7	8.7	2.9
A (AREA IN SF)	25.80	20.56	28.42	33.87	41.47	32.77	42.54	50.75	49.25	58.75	20.32	12.29	6.28	9.70	4.50
R (HYDRAULIC RADIUS)	1.25	1.06	1.34	1.51	1.68	1.43	1.71	1.92	1.89	2.12	1.22	0.86	0.56	0.77	0.64
S (BED SLOPE, FT/FT) *	0.015	0.030	0.025	0.015	0.015	0.030	0.025	0.015	0.025	0.015	0.014	0.060	0.110	0.030	0.030
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	6.6	8.4	8.9	7.5	8.0	10.2	10.5	8.8	11.2	9.4	6.3	10.3	10.5	6.8	6.0
Q (AT FLOW DEPTH d, CFS)	170.2	171.7	253.5	253.9	333.5	334.0	446.8	446.6	552.2	550.8	127.2	126.3	65.7	65.7	26.8
Qr (REQUIRED CAPACITY, CFS)	170.6	170.6	253.3	253.3	333.2	333.2	446.0	446.0	552.1	552.1	126.2	126.2	65.7	65.7	26.8
Sc (CRITICAL SLOPE)	0.014	0.015	0.014	0.014	0.013	0.014	0.013	0.013	0.013	0.012	0.015	0.016	0.019	0.017	0.019
.7Sc	0.010	0.011	0.010	0.009	0.009	0.010	0.009	0.009	0.009	0.009	0.010	0.011	0.013	0.012	0.013
1.3Sc	0.019	0.020	0.018	0.018	0.017	0.018	0.017	0.016	0.016	0.016	0.019	0.021	0.024	0.022	0.024
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.38	0.32	0.42	0.48	0.54	0.44	0.55	0.63	0.62	0.71	0.40	0.26	0.16	0.24	0.24
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	2.03	1.76	2.16	2.42	2.68	2.26	2.73	3.15	3.08	3.54	2.09	1.55	1.15	1.45	1.46
PROVIDED DEPTH (FT)	2	2	2.5	2.5	2.8	2.8	3.3	3.3	3.5	3.5	2.2	2.2	2	2	2
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	1.43	2.36	2.59	1.80	2.00	3.29	3.41	2.36	3.84	2.65	1.39	3.93	4.49	1.78	1.79
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
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PERIMETER CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	7	8A	8A	8B	8B	8C	9A	9B	9B	9C	10	10	FC AR Channel	FC AR Channel
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	Grass	Grass
CHANNEL TOP WIDTH @ D (FT)	7.40	10.02	10.98	17.00	18.40	28.51	14.94	17.80	19.95	24.06	17.56	16.52	8.05	9.35
CHANNEL TOP WIDTH @ d (FT)	5.40	8.02	8.98	15.00	16.38	26.39	12.94	15.80	17.88	22.01	15.56	14.52	5.55	6.85
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2.5	2.5
CHANNEL BOTTOM WIDTH (FT)	2.8	2.8	2.8	8.3	8.3	17.9	8.3	9.6	9.6	13.8	9.6	9.6	4	4
d (FLOW DEPTH IN FEET)	0.65	1.30	1.55	1.67	2.02	2.12	1.16	1.55	2.07	2.05	1.49	1.23	0.31	0.57
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	4.3	2.1	1.8	5.0	4.1	8.4	7.2	6.2	4.6	6.7	6.4	7.8	12.9	7.0
A (AREA IN SF)	2.66	7.06	9.11	19.50	24.92	47.02	12.32	19.69	28.44	36.73	18.74	14.83	1.48	3.09
R (HYDRAULIC RADIUS)	0.47	0.82	0.94	1.24	1.44	1.72	0.91	1.19	1.51	1.60	1.15	0.98	0.26	0.44
S (BED SLOPE, FT/FT) *	0.130	0.040	0.020	0.030	0.015	0.020	0.020	0.020	0.007	0.007	0.030	0.060	0.080	0.080
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.050	0.050
V (AT FLOW DEPTH d, FPS)	10.1	8.1	6.3	9.3	7.2	9.4	6.2	7.4	5.1	5.3	8.8	11.2	3.4	4.8
Q (AT FLOW DEPTH d, CFS)	26.8	57.3	57.3	180.5	180.5	442.6	76.2	145.3	145.3	195.1	165.7	166.7	5.1	15.0
Qr (REQUIRED CAPACITY, CFS)	26.8	57.3	57.3	180.5	180.5	444.6	76.4	145.3	145.3	195.1	164.9	164.9	5.0	15.0
Sc (CRITICAL SLOPE)	0.020	0.017	0.016	0.015	0.014	0.013	0.016	0.015	0.014	0.013	0.015	0.016	0.058	0.049
.7Sc	0.014	0.012	0.012	0.010	0.010	0.009	0.011	0.010	0.010	0.009	0.010	0.011	0.041	0.035
1.3Sc	0.026	0.022	0.021	0.019	0.018	0.017	0.021	0.019	0.018	0.017	0.019	0.020	0.076	0.064
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.16	0.33	0.39	0.42	0.50	0.53	0.29	0.39	0.52	0.51	0.37	0.31	0.08	0.14
MINIMUM REQUIRED FREEBOARD, FT	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
D (TOTAL DEPTH, FT)	1.15	1.80	2.05	2.17	2.52	2.65	1.66	2.05	2.59	2.56	1.99	1.73	0.81	1.07
PROVIDED DEPTH (FT)	2	2	2	2	2	2.2	2.6	2.6	2.6	2.6	2	2	1.5	1.5
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2	17.2
τd (SHEAR STRESS AT d, PSF)	5.27	3.26	1.93	3.13	1.89	2.65	1.45	1.93	0.90	0.90	2.79	4.61	1.55	2.85
τa (MAX ALLOWABLE, PSF)+	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
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DOWNCHUTE CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-1	DC-1	DC-2	DC-2	DC-3	DC-3	DC-4	DC-4	DC-5	DC-5	DC-6	DC-6	DC-7	DC-7	DC-8
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	18.62	17.78	17.12	16.28	21.22	20.38	17.00	16.20	17.04	16.24	21.18	20.34	21.10	20.34	21.02
CHANNEL TOP WIDTH @ d (FT)	17.42	16.58	15.92	15.08	20.02	19.18	15.80	15.00	15.84	15.04	19.98	19.14	19.90	19.14	19.82
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	15.30	15.30	13.80	13.80	17.90	17.90	13.8	13.8	13.8	13.8	17.9	17.9	17.9	17.9	17.9
d (FLOW DEPTH IN FEET) to meet Qr	0.53	0.32	0.53	0.32	0.53	0.32	0.5	0.3	0.51	0.31	0.52	0.31	0.501	0.31	0.48
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	28.87	47.81	26.04	43.13	33.77	55.94	27.6	46.0	27.1	44.5	34.4	57.7	35.7	57.7	37.3
A (AREA IN SF)	8.67	5.10	7.88	4.62	10.05	5.93	7.40	4.32	7.56	4.47	9.85	5.74	9.47	5.74	9.05
R (HYDRAULIC RADIUS)	0.49	0.30	0.49	0.30	0.50	0.31	0.46	0.29	0.47	0.29	0.49	0.30	0.47	0.30	0.45
S (BED SLOPE, FT/FT) *	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	7.08	12.08	7.04	12.04	7.12	12.14	6.8	11.6	6.9	11.8	7.0	11.9	6.9	11.9	6.7
Q (AT FLOW DEPTH d, CFS)	61.36	61.64	55.46	55.65	71.60	72.01	50.3	49.9	52.0	52.8	69.3	68.3	65.1	68.3	60.6
Qr (REQUIRED CAPACITY, CFS)	60.95	60.95	54.36	54.36	70.96	70.96	49.9	49.9	51.6	51.6	68.6	68.6	65.0	65.0	59.6
Sc (CRITICAL SLOPE)	0.02	0.02	0.02	0.02	0.02	0.02	0.020	0.023	0.019	0.023	0.019	0.023	0.019	0.023	0.020
.7Sc	0.01	0.02	0.01	0.02	0.01	0.02	0.014	0.016	0.014	0.016	0.013	0.016	0.014	0.016	0.014
1.3Sc	0.02	0.03	0.03	0.03	0.02	0.03	0.025	0.030	0.025	0.029	0.025	0.029	0.025	0.029	0.026
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.13	0.08	0.12
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.83	0.62	0.83	0.62	0.83	0.62	0.80	0.60	0.81	0.61	0.82	0.61	0.80	0.61	0.78
PROVIDED DEPTH (FT)	1.00	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2
τd (SHEAR STRESS AT d, PSF)	1.98	6.59	1.98	6.59	1.98	6.59	1.87	6.18	1.91	6.38	1.95	6.38	1.88	6.38	1.80
τa (MAX ALLOWABLE, PSF)+	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50

* Slopes may not be averaged.

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*** Minimum Freeboard, F, is 0.5 feet.

**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

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DOWNCHUTE CHANNEL DESIGN
25-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-8	DC-9	DC=9	DC-10	DC-10	DC-20	DC-20	DC-21	DC-21	DC-22	DC-22	DC-23	DC-23
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	20.26	15.68	14.84	19.70	18.90	14.08	13.32	18.30	17.50	12.60	11.88	14.28	13.48
CHANNEL TOP WIDTH @ d (FT)	19.06	14.48	13.64	18.50	17.70	12.88	12.12	17.10	16.30	11.40	10.68	13.08	12.28
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	17.9	12.4	12.4	16.5	16.5	11	11	15.1	15.1	9.6	9.6	11	11
d (FLOW DEPTH IN FEET) to meet Qr	0.29	0.52	0.31	0.5	0.3	0.47	0.28	0.5	0.3	0.45	0.27	0.52	0.32
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	61.7	23.8	40.0	33.0	55.0	23.4	39.3	30.2	50.3	21.3	35.6	21.2	34.4
A (AREA IN SF)	5.36	6.99	4.04	8.75	5.13	5.61	3.24	8.05	4.71	4.73	2.74	6.26	3.72
R (HYDRAULIC RADIUS)	0.28	0.47	0.29	0.47	0.29	0.43	0.26	0.46	0.29	0.41	0.25	0.47	0.30
S (BED SLOPE, FT/FT) *	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	11.4	6.9	11.8	6.8	11.6	6.5	11.0	6.8	11.6	6.2	10.7	6.9	11.9
Q (AT FLOW DEPTH d, CFS)	61.1	48.4	47.5	59.9	59.6	36.3	35.6	54.9	54.6	29.5	29.2	43.0	44.5
Qr (REQUIRED CAPACITY, CFS)	59.6	47.3	47.3	58.9	58.9	35.8	35.8	53.3	53.3	29.3	29.3	42.9	42.9
Sc (CRITICAL SLOPE)	0.023	0.019	0.023	0.019	0.023	0.020	0.023	0.020	0.023	0.020	0.024	0.020	0.023
.7Sc	0.016	0.014	0.016	0.014	0.016	0.014	0.016	0.014	0.016	0.014	0.017	0.014	0.016
1.3Sc	0.030	0.025	0.030	0.025	0.030	0.026	0.031	0.025	0.030	0.027	0.031	0.025	0.029
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.07	0.13	0.08	0.13	0.08	0.12	0.07	0.13	0.08	0.11	0.07	0.13	0.08
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.59	0.82	0.61	0.80	0.60	0.77	0.58	0.80	0.60	0.75	0.57	0.82	0.62
PROVIDED DEPTH (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1
τd (SHEAR STRESS AT d, PSF)	5.97	1.95	6.38	1.87	6.18	1.76	5.77	1.87	6.18	1.68	5.56	1.95	6.59
τa (MAX ALLOWABLE, PSF)+	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80

* Slopes may not be averaged.
** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.
*** Minimum Freeboard, F, is 0.5 feet.
**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.
\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

DOWNCHUTE CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-1	DC-1	DC-2	DC-2	DC-3	DC-3	DC-4	DC-4	DC-5	DC-5	DC-6	DC-6	DC-7	DC-7	DC-8
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	19.26	18.18	17.76	16.68	21.90	20.78	17.64	16.60	17.68	16.64	21.82	20.74	21.74	20.70	21.70
CHANNEL TOP WIDTH @ d (FT)	18.06	16.98	16.56	15.48	20.70	19.58	16.44	15.40	16.48	15.44	20.62	19.54	20.54	19.50	20.50
CHANNEL SIDE SLOPES (H:1V)	2.00	2.00	2.00	2.00	2.00	2.00	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	15.30	15.30	13.80	13.80	17.90	17.90	13.8	13.8	13.8	13.8	17.9	17.9	17.9	17.9	17.9
d (FLOW DEPTH IN FEET)	0.69	0.42	0.69	0.42	0.70	0.42	0.66	0.4	0.67	0.41	0.68	0.41	0.66	0.4	0.65
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	22.17	36.43	20.00	32.86	25.57	42.62	20.9	34.5	20.6	33.7	26.3	43.7	27.1	44.8	27.5
A (AREA IN SF)	11.51	6.78	10.47	6.15	13.51	7.87	9.98	5.84	10.14	5.99	13.10	7.68	12.69	7.48	12.48
R (HYDRAULIC RADIUS)	0.63	0.39	0.62	0.39	0.64	0.40	0.60	0.37	0.60	0.38	0.63	0.39	0.61	0.38	0.60
S (BED SLOPE, FT/FT) *	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	8.32	14.35	8.27	14.29	8.47	14.43	8.1	13.9	8.1	14.1	8.3	14.2	8.2	14.0	8.1
Q (AT FLOW DEPTH d, CFS)	95.80	97.29	86.66	87.88	114.41	113.60	80.4	81.0	82.4	84.4	108.9	109.1	103.6	104.7	101.0
Qr (REQUIRED CAPACITY, CFS)	94.79	94.79	85.88	85.88	113.02	113.02	80.1	80.1	82.9	82.9	107.4	107.4	103.6	103.6	100.2
Sc (CRITICAL SLOPE)	0.02	0.02	0.02	0.02	0.02	0.02	0.018	0.021	0.018	0.021	0.018	0.021	0.018	0.021	0.018
.7Sc	0.01	0.01	0.01	0.01	0.01	0.01	0.013	0.015	0.013	0.015	0.012	0.014	0.013	0.015	0.013
1.3Sc	0.02	0.03	0.02	0.03	0.02	0.03	0.023	0.027	0.023	0.027	0.023	0.027	0.023	0.027	0.023
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.17	0.11	0.17	0.11	0.18	0.11	0.17	0.10	0.17	0.10	0.17	0.10	0.17	0.10	0.16
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.99	0.72	0.99	0.72	1.00	0.72	0.96	0.70	0.97	0.71	0.98	0.71	0.96	0.70	0.95
PROVIDED DEPTH (FT)	1.00	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2
τd (SHEAR STRESS AT d, PSF)	2.58	8.65	2.58	8.65	2.62	8.65	2.47	8.24	2.51	8.44	2.55	8.44	2.47	8.24	2.43
τa (MAX ALLOWABLE, PSF)+	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50

* Slopes may not be averaged.

** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.

*** Minimum Freeboard, F, is 0.5 feet.

**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

DOWNCHUTE CHANNEL DESIGN
100-year, 24 hour storm event flows

CHANNEL OR CHANNEL SECTION	DC-8	DC-9	DC=9	DC-10	DC-10	DC-20	DC-20	DC-21	DC-21	DC-22	DC-22	DC-23	DC-23
PROTECTIVE LINING **	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB	ACB
CHANNEL TOP WIDTH @ D (FT)	20.66	16.28	15.24	20.30	19.30	14.68	13.72	18.90	17.90	13.16	12.24	14.88	13.84
CHANNEL TOP WIDTH @ d (FT)	19.46	15.08	14.04	19.10	18.10	13.48	12.52	17.70	16.70	11.96	11.04	13.68	12.64
CHANNEL SIDE SLOPES (H:1V)	2	2	2	2	2	2	2	2	2	2	2	2	2
CHANNEL BOTTOM WIDTH (FT)	17.9	12.4	12.4	16.5	16.5	11	11	15.1	15.1	9.6	9.6	11	11
d (FLOW DEPTH IN FEET)	0.39	0.67	0.41	0.65	0.4	0.62	0.38	0.65	0.4	0.59	0.36	0.67	0.41
BOTTOM WIDTH:DEPTH RATIO (12:1 MAX)	45.9	18.5	30.2	25.4	41.3	17.7	28.9	23.2	37.8	16.3	26.7	16.4	26.8
A (AREA IN SF)	7.29	9.21	5.42	11.57	6.92	7.59	4.47	10.66	6.36	6.36	3.72	8.27	4.85
R (HYDRAULIC RADIUS)	0.37	0.60	0.38	0.60	0.38	0.55	0.35	0.59	0.38	0.52	0.33	0.59	0.38
S (BED SLOPE, FT/FT) *	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33	0.060	0.33
VEGETATIVE LINING RETARDANCE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n (MANNING'S COEFFICIENT) **	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032
V (AT FLOW DEPTH d, FPS)	13.8	8.1	14.0	8.1	14.0	7.6	13.3	8.0	13.9	7.4	12.8	8.0	13.9
Q (AT FLOW DEPTH d, CFS)	100.3	74.3	76.0	93.2	96.6	58.0	59.4	85.5	88.5	46.8	47.5	66.2	67.5
Qr (REQUIRED CAPACITY, CFS)	100.2	74.7	74.7	93.0	93.0	57.4	57.4	85.6	85.6	47.1	47.1	65.7	65.7
Sc (CRITICAL SLOPE)	0.021	0.018	0.021	0.018	0.021	0.019	0.021	0.018	0.021	0.019	0.022	0.018	0.021
.7Sc	0.015	0.013	0.015	0.013	0.015	0.013	0.015	0.013	0.015	0.013	0.015	0.013	0.015
1.3Sc	0.027	0.023	0.027	0.023	0.027	0.024	0.028	0.023	0.027	0.025	0.028	0.024	0.027
STABLE FLOW? (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FREEBOARD (UNSTABLE FLOW, FT)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
FREEBOARD (STABLE FLOW, FT)	0.10	0.17	0.10	0.16	0.10	0.16	0.10	0.16	0.10	0.15	0.09	0.17	0.10
MINIMUM REQUIRED FREEBOARD, FT	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
D (TOTAL DEPTH, FT)	0.69	0.97	0.71	0.95	0.70	0.92	0.68	0.95	0.70	0.89	0.66	0.97	0.71
PROVIDED DEPTH (FT)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
d50 STONE SIZE (IN)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
DESIGN METHOD FOR PROTECTIVE **** LINING PERMISSIBLE VELOCITY (V) OR SHEAR STRESS (S)	S	S	S	S	S	S	S	S	S	S	S	S	S
Va (ALLOWABLE VELOCITY, FPS)+	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1	17.2	15.1
τd (SHEAR STRESS AT d, PSF)	8.03	2.51	8.44	2.43	8.24	2.32	7.82	2.43	8.24	2.21	7.41	2.51	8.44
τa (MAX ALLOWABLE, PSF)+	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80	7.50	9.80

* Slopes may not be averaged.

** For vegetated channels, provide data for temporary linings and vegetated conditions in separate columns.

*** Minimum Freeboard, F, is 0.5 feet.

**** Permissible velocity lining design method is not acceptable for channels with a bed slope of 10% or greater. Shear stress lining design method is recommended for channels with a bed slope of 10% or greater. Shear stress lining design method may be used for any channel bed slope.

\+ Maximum Allowable Velocity (fps) and Maximum Allowable Shear Stress (psf) are taken from cable concrete manufacturer.

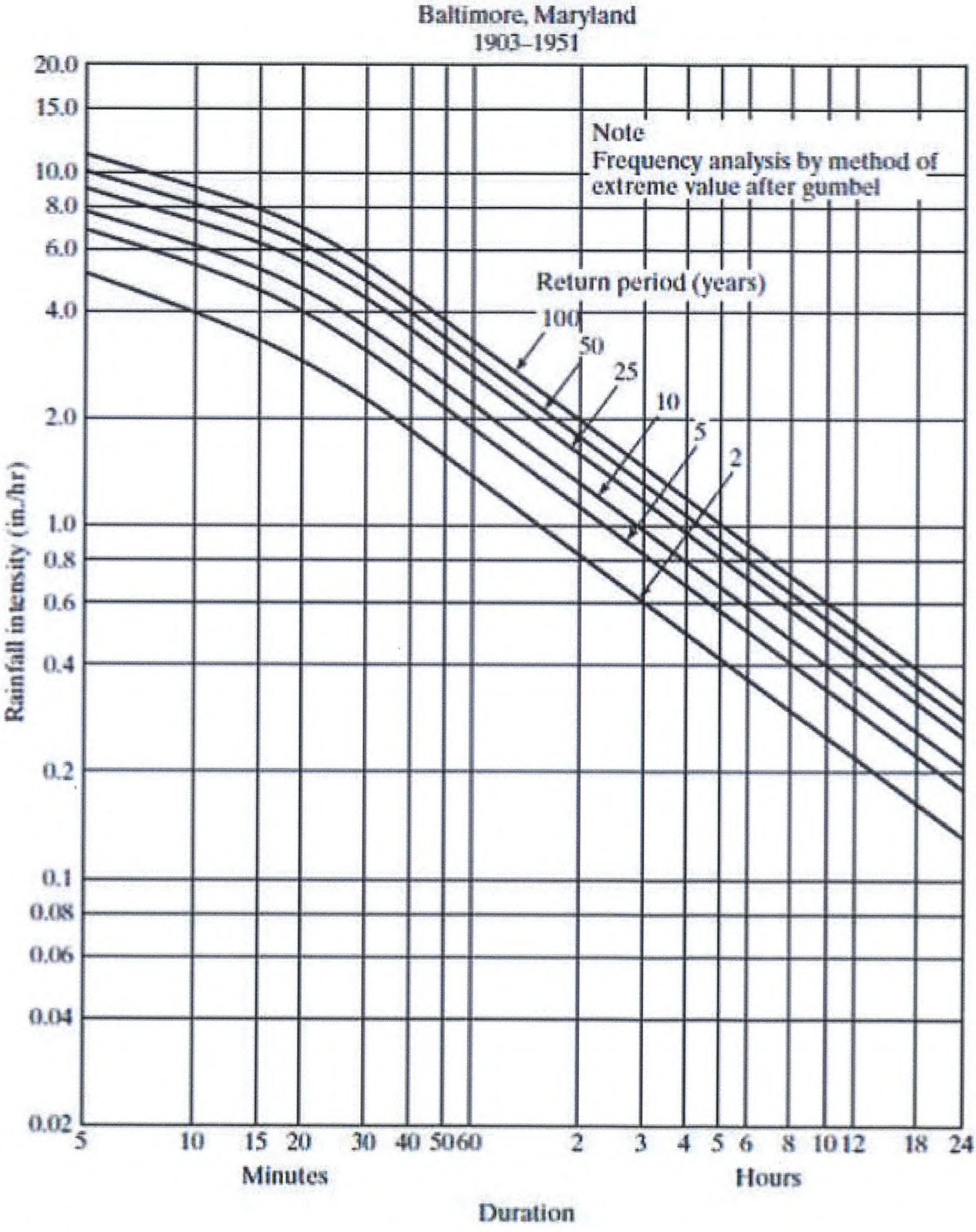


Figure 2.4 Rainfall intensity-duration-frequency (National Weather Service, 1961).

Title:	CHANNEL DESIGN	Site: CHESAPEAKE TERRACE	DATE: July 17, 2020
Prepared by:	VEF	Telephone Number:	Sheet 1 of 1

Design Calculations: PROPOSED CHANNEL DESIGN

Chan-nel Name	Design Storm (years)	Peak Discharge (cfs)	Channel Bed Slope (ft/ft)	Free-board (ft)	Channel Lining	Manning Coeff.	Channel Bottom Width (ft)	Left Side Slopes Inclintion	Right Side Slopes Inclintion	Flow Area (sq.ft.)	Rh = A/P	Flow Depth (ft)	Top Flow Width (ft.)	Flow Velocity (ft/s)	Actual Q (cfs)	With Freeboard		
																Channel Depth (ft)	Top Channel Width (ft)	Q Available (cfs)
Terrace	25	6.2	0.020	0.19	Grass	0.078	0.00	10.00	3.00	4.26	0.40	0.81	10.53	1.46	6.2	1.00	13.0	10.9
Terrace	25	6.2	0.030	0.30	Grass	0.065	0.00	10.00	3.00	3.19	0.34	0.70	9.10	1.95	6.2	1.00	13.0	16.0
Terrace	25	2.7	0.020	0.41	Grass	0.078	0.00	10.00	3.00	2.26	0.29	0.59	7.67	1.18	2.7	1.00	13.0	10.9
Terrace	25	2.7	0.030	0.49	Grass	0.065	0.00	10.00	3.00	1.69	0.25	0.51	6.63	1.58	2.7	1.00	13.0	16.0
AR Channel	25	3.3	0.040	1.06	Grass	0.080	3.00	3.00	2.00	1.83	0.31	0.45	5.23	1.81	3.3	1.50	10.5	35.4
AR Channel	25	3.3	0.080	1.13	Grass	0.080	3.00	3.00	2.00	1.45	0.30	0.37	4.85	2.31	3.3	1.50	10.5	50.0

 FROM Ref 3

TABLE 7-3 Runoff coefficients for the Rational method

Description of Area	Runoff Coefficients
Business	
Downtown	0.70–0.95
Neighborhood	0.50–0.70
Residential	
Single-family	0.30–0.50
Multiunits, detached	0.40–0.60
Multiunits, attached	0.60–0.75
Residental (suburban)	0.25–0.40
Apartment	0.50–0.70
Industrial	
Light	0.50–0.80
Heavy	0.60–0.90
Parks, cemeteries	0.10–0.25
Playgrounds	0.20–0.35
Railroad yard	0.20–0.35
Unimproved	0.10–0.30

It often is desirable to develop a composite runoff coefficient based on the percentage of different types of surface in the drainage area. This procedure often is applied to typical "sample" blocks as a guide to selection of reasonable values of the coefficient for an entire area. Coefficients with respect to surface type currently in use are:

Character of Surface	Runoff Coefficients
Pavement	
Asphaltic and Concrete	0.70–0.95
Brick	0.70–0.85
Roofs	0.75–0.95
Lawns, sandy soil	
Flat, 2%	0.05–0.10
Average, 2 to 7%	0.10–0.15
Steep, 7%	0.15–0.20
Lawns, heavy soil	
Flat, 2%	0.13–0.17
Average, 2 to 7%	0.18–0.22
Steep, 7%	0.25–0.35

The coefficients in these two tabulations are applicable for storms of 5- to 10-year frequencies. Less frequent, higher intensity storms will require the use of higher coefficients because infiltration and other losses have a proportionally smaller effect on runoff. The coefficients are based on the assumption that the design storm does not occur when the ground surface is frozen.

Source: Design and Construction of Sanitary and Storm Sewers, American Society of Civil Engineers, New York, p. 332, 1969.

7.3.1 *Runoff Coefficients for Nonhomogeneous Areas*

The runoff coefficients of Table 7-2 reflect the effect of land use, soil, and slope on runoff potential. The use of Eq. 7-4 assumes that the watershed is homogeneous in these characteristics so that the runoff coefficient used provides unbiased estimates.

Reference 4

TABLE 7a
Maximum Permissible Velocities for Channels Lined with Vegetation

Cover	Slope Range Percent	Erosion resistant Soil[1]	Easily Eroded Soil [2]
Kentucky Bluegrass Tall Fescue	<5 5-10 >10	7 [3] 6 [3] 5	5 4 3
Grass Mixture Reed Canarygrass	<5 5-10	5 4	4 3
Serecea Lespedeza Weeping Lovegrass Redtop Red Fescue	<5	3.5	2.5
Annuals Temporary cover only Sudangrass	<5	3.5	2.5

[1]Cohesive (clayey) fine grain soils and coarse grain soils with a plasticity index OF 10 TO 40 (CL,CH,SC and GC). Soils with K values less than 0.37.

[2]Soils with K values greater than 0.37.

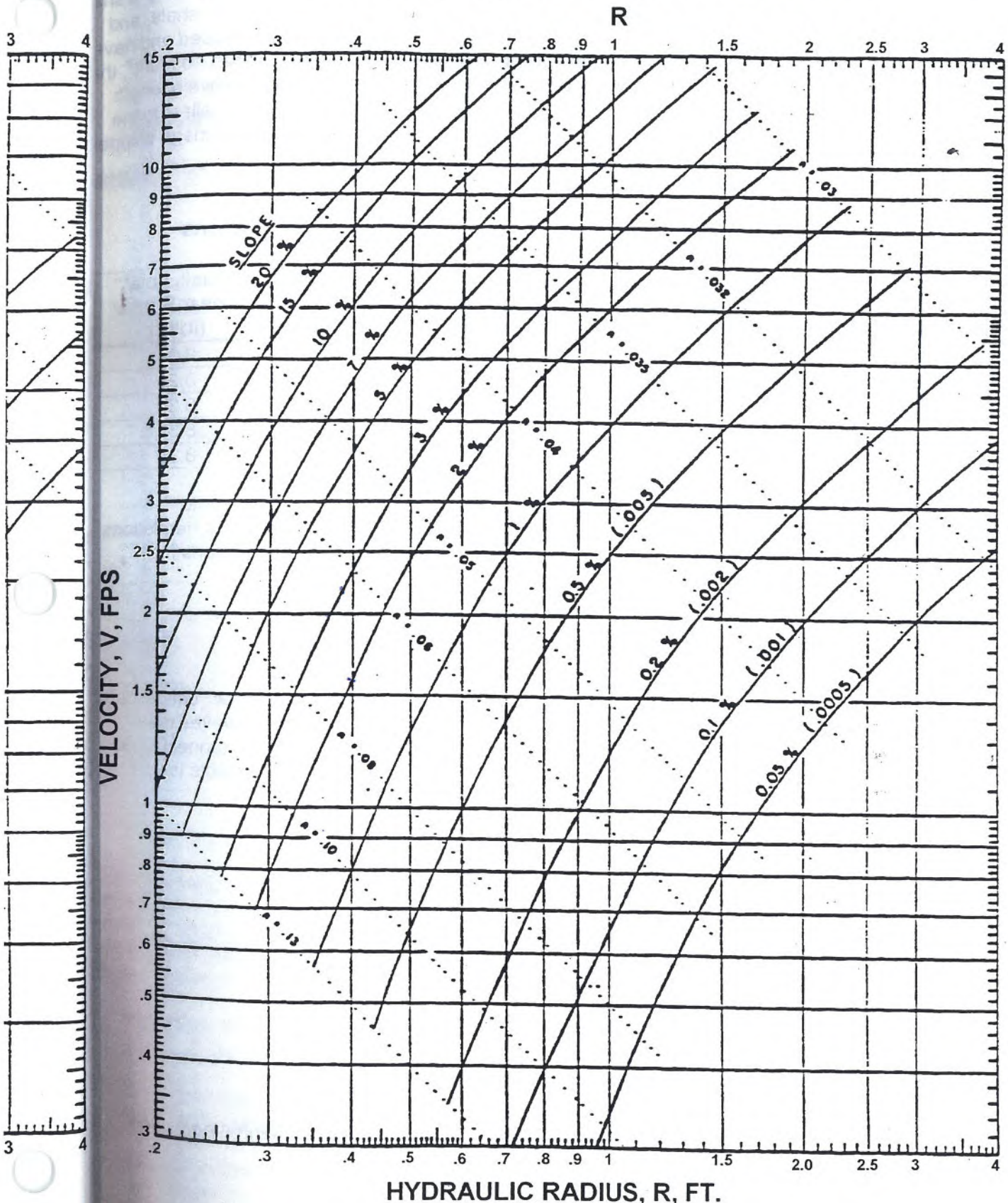
[3]Use velocities exceeding 5 ft/sec only where good cover and proper maintenance can be obtained.

ADDITIONAL NOTES REGARDING THE USE OF TABLE 7a

1. A velocity of 3.0 ft/sec should be the maximum if because of shade, soils or climate, only a sparse cover can be established or maintained.
2. A velocity of 3.0 to 4.0 ft/sec should be used under normal conditions if the vegetation is to be established by seeding.
3. A velocity of 4.0 to 5.0 ft/sec should be used only in areas if a dense, vigorous sod is obtained quickly or if water can be diverted out of the waterway while vegetation is being established.
4. A velocity of 5.0 to 6.0 ft/sec may be used on well established, good quality sod. Special maintenance may be required.
5. A velocity of 6.0 to 7.0 ft/sec may be used only on established, excellent quality sod, and only under special circumstances in which flow cannot be handled at a lower velocity. Under these conditions, special maintenance and appurtenant structures will be required.
6. If stone centers, or other erosion resistant materials supplement the vegetative lining, the velocities in the above table may be increased by 2.0 ft/sec.
7. When base flow exists, a rock lined low flow channel should be designed and incorporated into the vegetative lined channel section.

from Ref 4

Figure 3c
"n" Values for Vegetated Channels, D Retardance



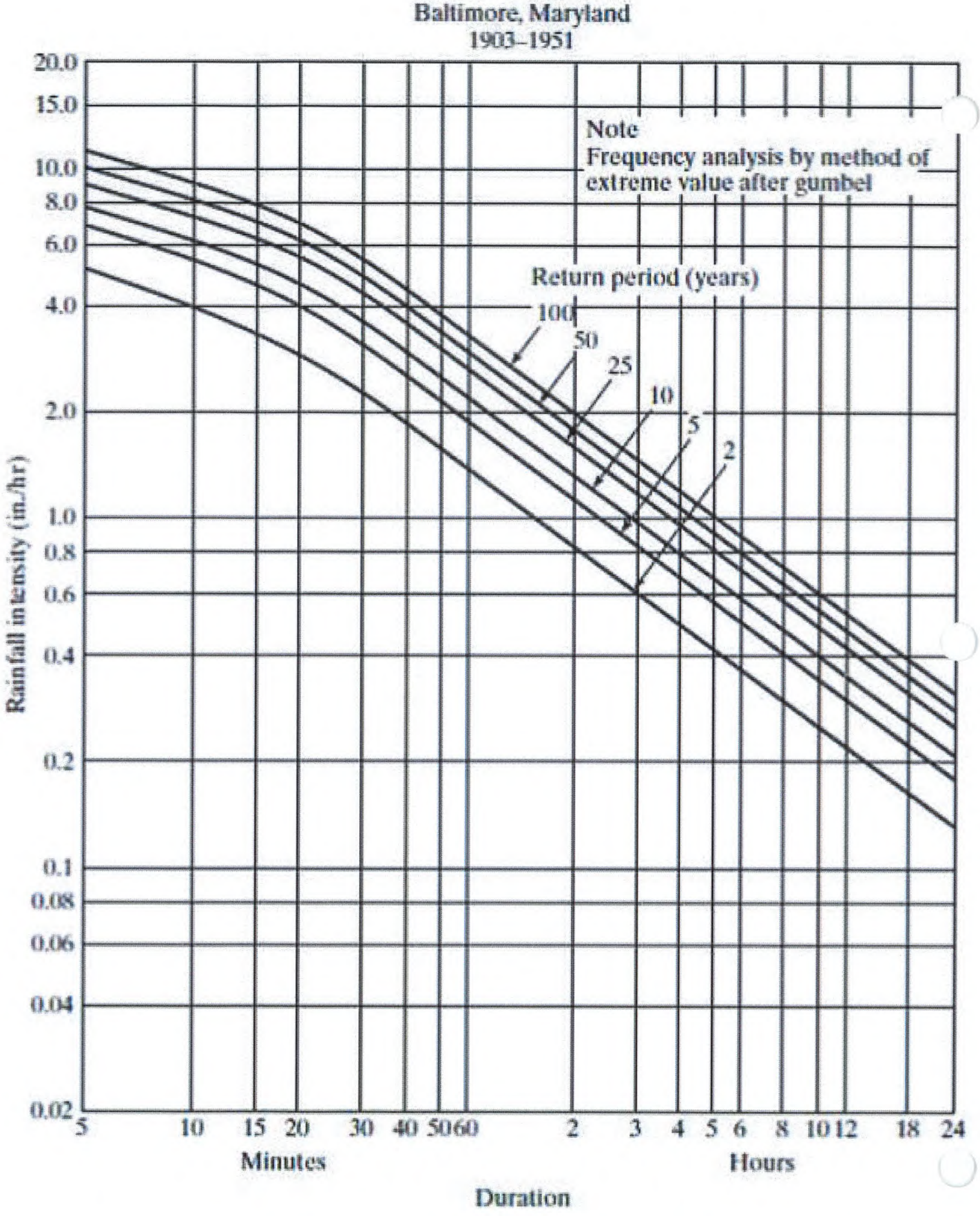


Figure 2.4 Rainfall intensity-duration-frequency (National Weather Service, 1961).

from Bethlehem Pre Cast for Cable Concrete lined Channel

Inte[illegible]nal Erosion Control Systems — Block [illegible]on Guide

IMPERIAL UNITS

	Block Type / Cell Type	CC20 Closed	CC35 Closed	CC45 Closed	CC70 Closed	CC45 OS Closed	CC90 OS Closed	CC35 Open	CC55 Open	CC35 OS Open	CC65 OS Open	CC95 OS Open
L1 (inches)		1.13	2.03	2.48	3.83	2.15	4.06	2.32	3.58	2.07	3.92	4.84
L2 and L4 (inches)		7.75	7.75	7.75	7.75	15.79	15.79	7.75	7.75	15.79	15.79	15.79
L3 (inches)		2.5	4.5	5.5	8.5	4.5	8.5	5.5	8.5	4.5	8.5	10.5
Submerged Weight (pounds)		21.01	37.82	46.22	71.43	180.55	341.03	35.03	54.14	145.93	271.67	335.84
ALLOWABLE SHEAR STRESSES (lb/sq. ft.) (Factor of Safety = 1.0)												
	Bed Slope											
Level Bed Critical Shear Stress - Failure by Over-Turning - No Cable Interaction	0.000	24.7	24.6	25.3	27.1	45.5	51.4	27.6	26.7	63.4	66	66.3
Level Bed Critical Shear Stress - Failure by Sliding - With Cable Interaction	0.000	10.1	18.1	22.1	34.2	21.6	40.8	16.8	26.0	17.3	32.6	40.3
Level Bed Critical Shear Stress - Failure by Sliding - No Cable Interaction	0.000	6.0	10.7	13.2	20.7	12.8	24.1	9.9	15.4	10.2	19.3	23.8
Bed Slope 1.5H:1V (34 degrees) - Failure by Over-Turning - No Cable Interaction	0.667	17.2	15.4	17.0	15.5	34.7	35.7	16.6	13.3	48.2	41.6	39.6
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - With Cable Interaction	0.667	1.8	3.3	4.0	6.2	3.9	7.4	14.0	21.6	14.4	27.2	33.6
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - No Cable Interaction	0.667	1.1	2.0	2.4	3.7	2.3	4.4	8.3	12.8	8.5	16.1	19.9
Bed Slope 2H:1V (26.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.500	20.0	18.5	19.5	18.8	38.2	40.3	20.3	17.5	55.8	50.1	46.5
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - With Cable Interaction	0.500	3.7	6.7	8.2	12.7	8.0	15.1	15.0	23.2	15.4	29.1	36.0
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - No Cable Interaction	0.500	2.2	4.0	4.8	7.5	4.7	8.9	8.9	13.7	9.1	17.2	21.3
Bed Slope 3H:1V (18.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.333	22.2	21.2	22.0	22.1	41.5	44.9	23.4	21.2	61.7	57.1	56.0
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - With Cable Interaction	0.333	5.8	10.4	12.7	19.6	12.4	23.4	15.7	24.3	16.1	30.5	37.6
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - No Cable Interaction	0.333	3.4	6.2	7.5	11.6	7.3	13.9	9.3	14.4	9.5	18.0	22.3
Bed Slope 4H:1V (14 degrees) - Failure by Over-Turning - No Cable Interaction	0.250	23.1	22.3	23.2	23.7	42.9	47.0	24.7	22.8	64.1	59.9	59.2
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - With Cable Interaction	0.250	6.9	12.4	15.2	23.4	14.8	28.0	16.0	24.7	16.4	31.0	38.3
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - No Cable Interaction	0.250	4.1	7.3	9.0	13.9	8.8	16.5	9.5	14.6	9.7	18.4	22.7
Bed Slope 5H:1V (11.3 degrees) - Failure by Over-Turning - No Cable Interaction	0.200	23.5	22.9	23.8	24.6	43.7	48.1	25.4	23.7	65.3	61.5	61.0
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - With Cable Interaction	0.200	7.5	13.5	16.5	25.5	16.1	30.4	16.5	25.5	16.9	32.0	39.5
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - No Cable Interaction	0.200	4.4	8.0	9.8	15.1	9.5	18.0	9.8	15.1	10.0	18.9	23.4
MAXIMUM ALLOWABLE VELOCITIES (ft./sec.)												
Note: Velocities above 25.0 feet per second are not recommended.												
Level Bed Maximum Velocity - Failure by Over-Turning - No Cable Interaction	0.000	26.0	25.9	26.3	27.2	38.0	39.0	22.7	22.3	35.8	35.2	35.2
Level Bed Maximum Velocity - Failure by Sliding - With Cable Interaction	0.000	17.4	23.4	25.9	32.2	25.6	35.1	19.7	24.5	20.0	27.4	30.5
Level Bed Maximum Velocity - Failure by Sliding - No Cable Interaction	0.000	13.5	18.0	20.0	25.0	19.7	27.0	15.2	18.8	15.4	21.1	23.5
Bed Slope 1.5H:1V (34 degrees) - Failure by Over-Turning - No Cable Interaction	0.667	21.7	20.5	21.6	20.6	30.8	31.2	17.6	15.8	30.0	28.0	27.2
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - With Cable Interaction	0.667	7.5	10.0	11.1	13.7	10.9	15.0	17.0	21.1	17.2	23.7	26.3
Bed Slope 1.5H:1V (34 degrees) - Failure by Sliding - No Cable Interaction	0.667	5.7	7.7	8.5	10.6	8.4	11.5	13.1	16.3	13.3	18.2	20.2
Bed Slope 2H:1V (26.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.500	23.4	22.5	23.1	22.6	32.3	33.2	22.0	18.1	32.3	30.6	30.1
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - With Cable Interaction	0.500	10.6	14.2	15.7	19.5	15.5	21.3	20.3	25.2	21.6	28.3	31.4
Bed Slope 2H:1V (26.5 degrees) - Failure by Sliding - No Cable Interaction	0.500	8.1	10.9	12.1	15.0	11.9	16.4	15.6	19.4	15.8	21.8	24.2
Bed Slope 3H:1V (18.5 degrees) - Failure by Over-Turning - No Cable Interaction	0.333	24.6	24.1	24.5	24.6	33.7	35.0	20.9	19.9	31.0	32.7	32.4
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - With Cable Interaction	0.333	13.3	17.8	19.7	24.5	19.4	26.7	19.0	23.6	19.3	26.5	29.4
Bed Slope 3H:1V (18.5 degrees) - Failure by Sliding - No Cable Interaction	0.333	10.2	13.7	15.1	18.8	15.0	20.6	14.6	18.2	14.8	20.4	22.6
Bed Slope 4H:1V (14 degrees) - Failure by Over-Turning - No Cable Interaction	0.250	25.1	24.7	25.2	25.5	34.3	35.8	21.5	20.7	34.6	33.5	33.3
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - With Cable Interaction	0.250	14.4	19.3	21.3	26.5	21.1	29.0	19.2	23.9	19.5	26.7	29.7
Bed Slope 4H:1V (14 degrees) - Failure by Sliding - No Cable Interaction	0.250	11.1	14.8	16.4	20.4	16.2	22.3	14.8	18.4	15.0	20.6	22.9
Bed Slope 5H:1V (11.3 degrees) - Failure by Over-Turning - No Cable Interaction	0.200	25.4	25.0	25.5	25.9	34.6	36.3	21.8	21.1	34.9	33.9	33.8
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - With Cable Interaction	0.200	15.1	20.2	22.3	27.8	22.1	30.3	19.5	24.2	19.8	27.2	30.2
Bed Slope 5H:1V (11.3 degrees) - Failure by Sliding - No Cable Interaction	0.200	11.6	15.5	17.2	21.4	17.0	23.3	15.0	18.6	15.2	20.9	23.2

Testing Authority -- Colorado State University, University of Minnesota, University of Windsor

Failure Mode -- Loss of intimate contact

max allowable Shear Stress

max allowable velocity

[illegible]

ATTACHMENT 17F

Proposed Culverts

ADVANCED GeoServices a Montrose Environmental Group company	**Subject:** Stormwater Management – Proposed Channel Flows		
	Job No. 2018-3854	**Made by:** VEF	**Date** 07-15-20
	Ref.	**Checked by:** VEF	**Sheet** 1 of 1

Revised by PGS 08/27/2021

Objective: The objective of this analysis is to estimate the flow in the proposed stormwater management channels under the design storms being considered.

Design Approach and Assumptions:

Use HydroCad, a computer software which implements the principles of TR-55 and TR-20 for larger drainage areas. The input data for each is as follows:

1) With proposed channel flows for the 25 year, 24 hour storm event, size the Culverts for road crossings.
2) Assume orifice flow, so use a nomograph developed by the HDPE pipe manufacturer.

Calculations:

See the attached nomographs.

References:

1. HydroCAD, V8.5.
2. Advanced GeoServices Corp, Calculations entitled "Stormwater Management – Proposed Channel Flow," dated July 15, 2020.

Conclusions:

A summary of the inflow and the culvert sizes provided in the table below.

Culvert ID	Inflow Channel	25 year, 24 hour Q (cfs)	100 year, 24 hour Q (cfs)	Culvert Dimensions		
				Culvert Dia	# Culverts	Material
1	PC-5	418.56	673.39	60 inches	2	HDPE
2	PC-4F	347.91	552.08	30-inches	4	HDPE
3	PC-10	68.46	164.87	48-inches	1	HDPE
4	PC-8C	279.9	444.63	54-inches	2	HDPE
5	PC-2	31.8	57.96	24-inches	2	HDPE
AR-1	DC-2	67	106	24-inches	3	HDPE
AR-2	1/2 DC-1	30	47	18-inches	2	HDPE
~~AR-3~~	~~1/3 DC-10~~	~~20~~	~~30~~	~~18-inches~~	~~2~~	~~HDPE~~
~~AR-4~~ 3	PC-8A	36.5	57.3	24-inches	2	HDPE

6 PC-1 44.0 101.3 30-inch 2 HDPE
7 PC-6 24.0 65.73 30-inch 1 HDPE
8 Off-site flow to Basin 4 186.05 399.01 48-inches 1 HDPE

$HW/D =$

$Inv_{up.} = 85$

$Inv_{down} = 81$

$H = 6'$

Rd. Elev = 92

Culvert #1 - Into Basin 1

$Q_{25} = 418.56$ cfs

$Q_{100} = 673.39$ cfs

Length x 120 $S = (85-81)/120 \Rightarrow 3\%$

Figure 3-1

Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]

Reviewed by PGS 08/27/2021

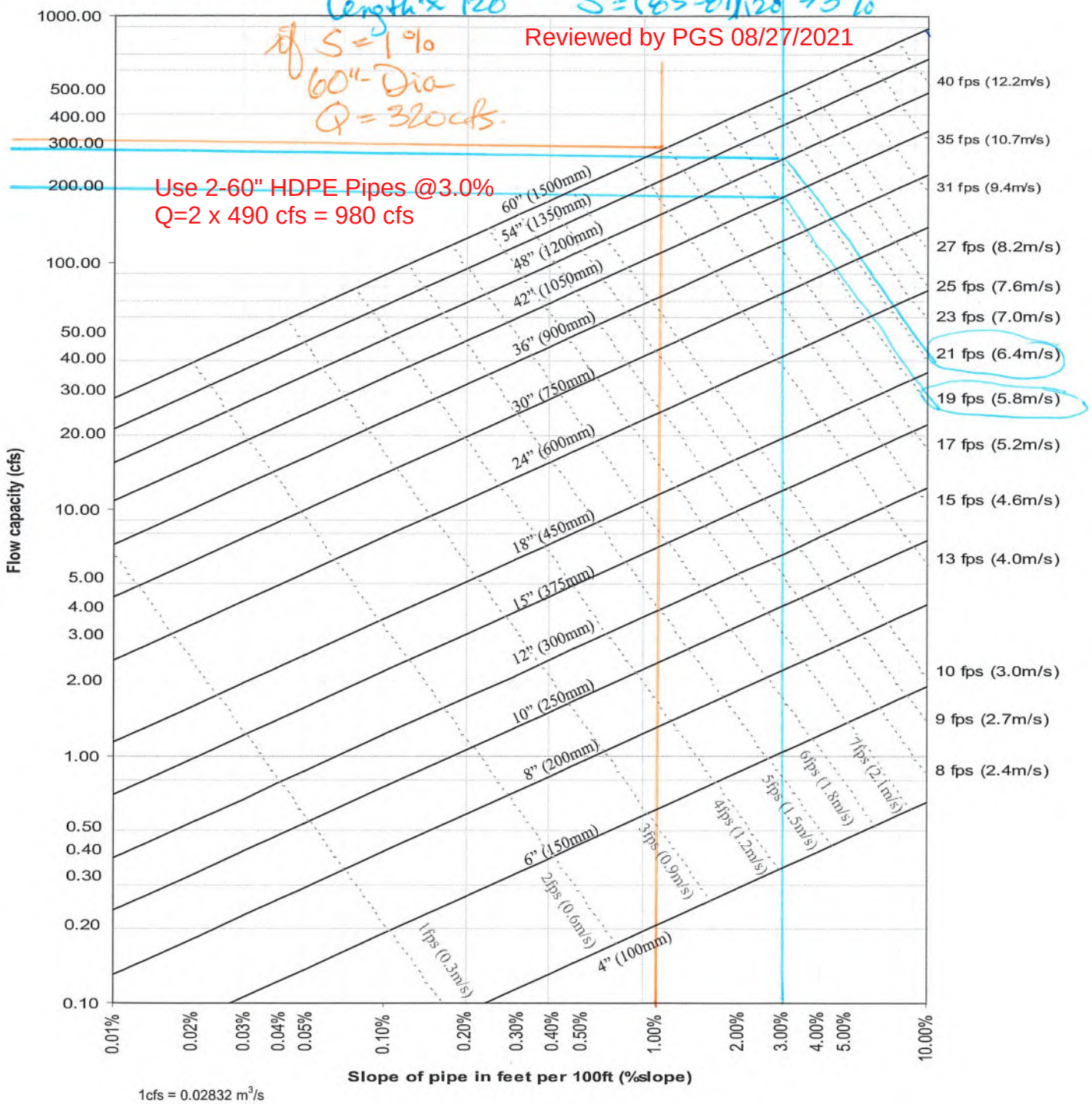
if S = 1%

60"-Dia

Q = 320 cfs.

Use 2-60" HDPE Pipes @3.0%

Q=2 x 490 cfs = 980 cfs



1cfs = 0.02832 m^3/s

1ft/s = 0.30480 m/s

1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

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Culvert #2 → Channel 4F
Q_{25} = 347.91
Q_{100} = 552.08
Channel Width 15.1 ft.

Inlet = 94
Outlet = 90
Culvert Length = 100 ft
S = 4%
Road Cost = 100 ft/LR

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]

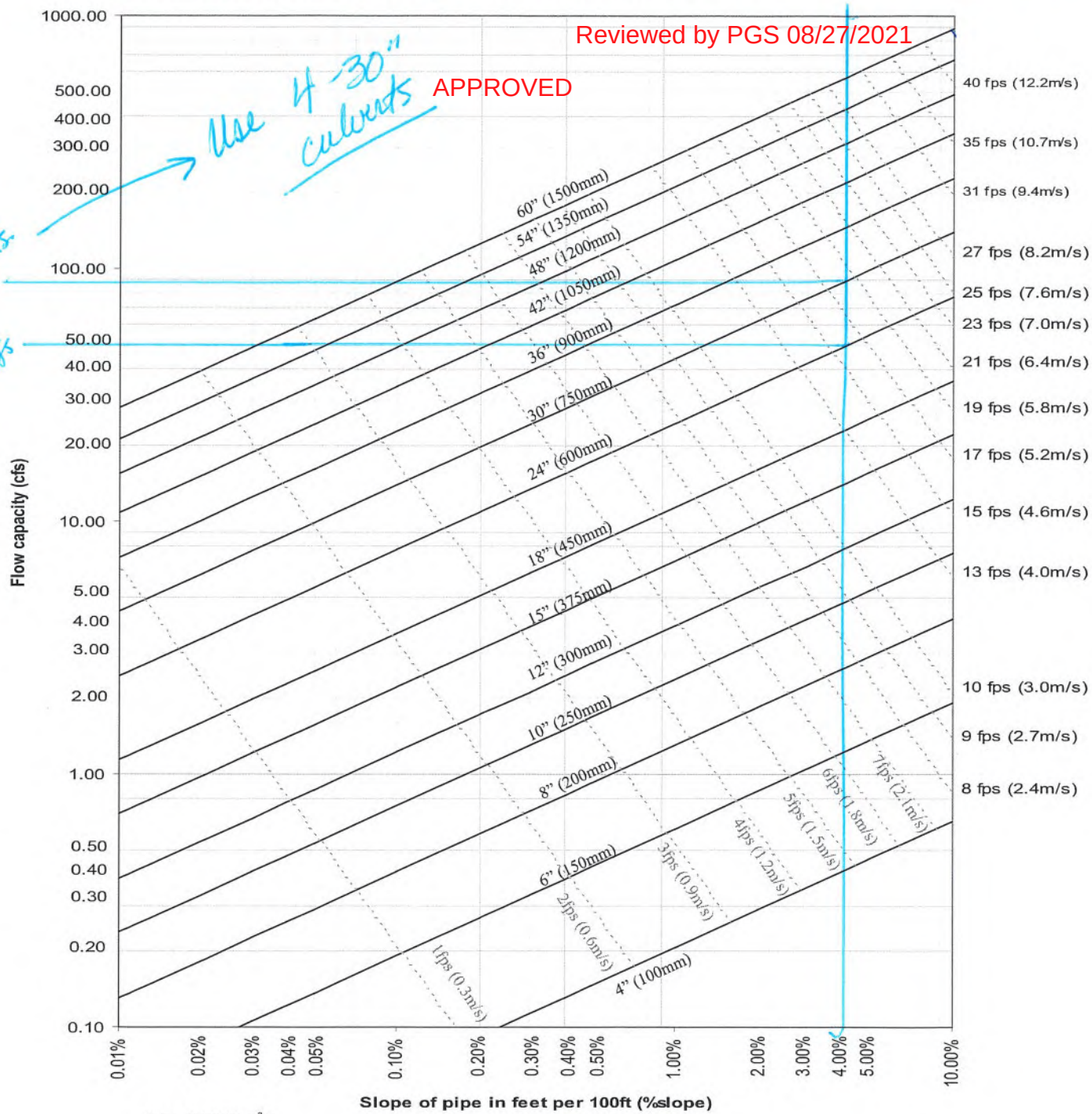
Reviewed by PGS 08/27/2021

APPROVED

Use 4 - 30" culverts

Q_{30} = 88 cfs

Q_{24} = 48 cfs



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
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from PC10 → Basin #2 Culvert #3

$Q_{25} = 68.46$ cfs

$Q_{100} = 164.87$ cfs

$S = 1\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]

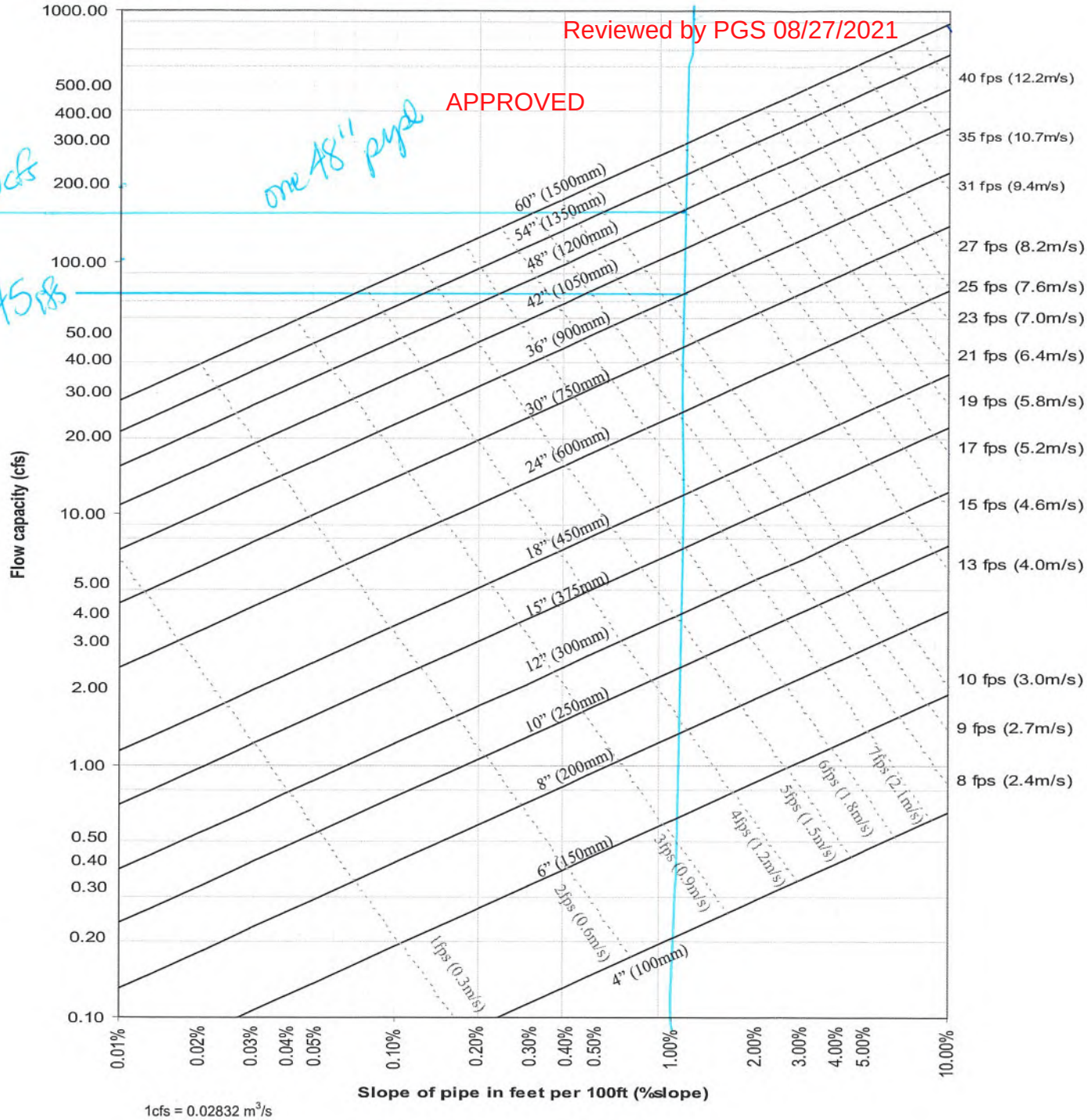
Reviewed by PGS 08/27/2021

APPROVED

one 48" pipe

$Q_{48"} = 170$ cfs

$Q_{36"} = 75.88$



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
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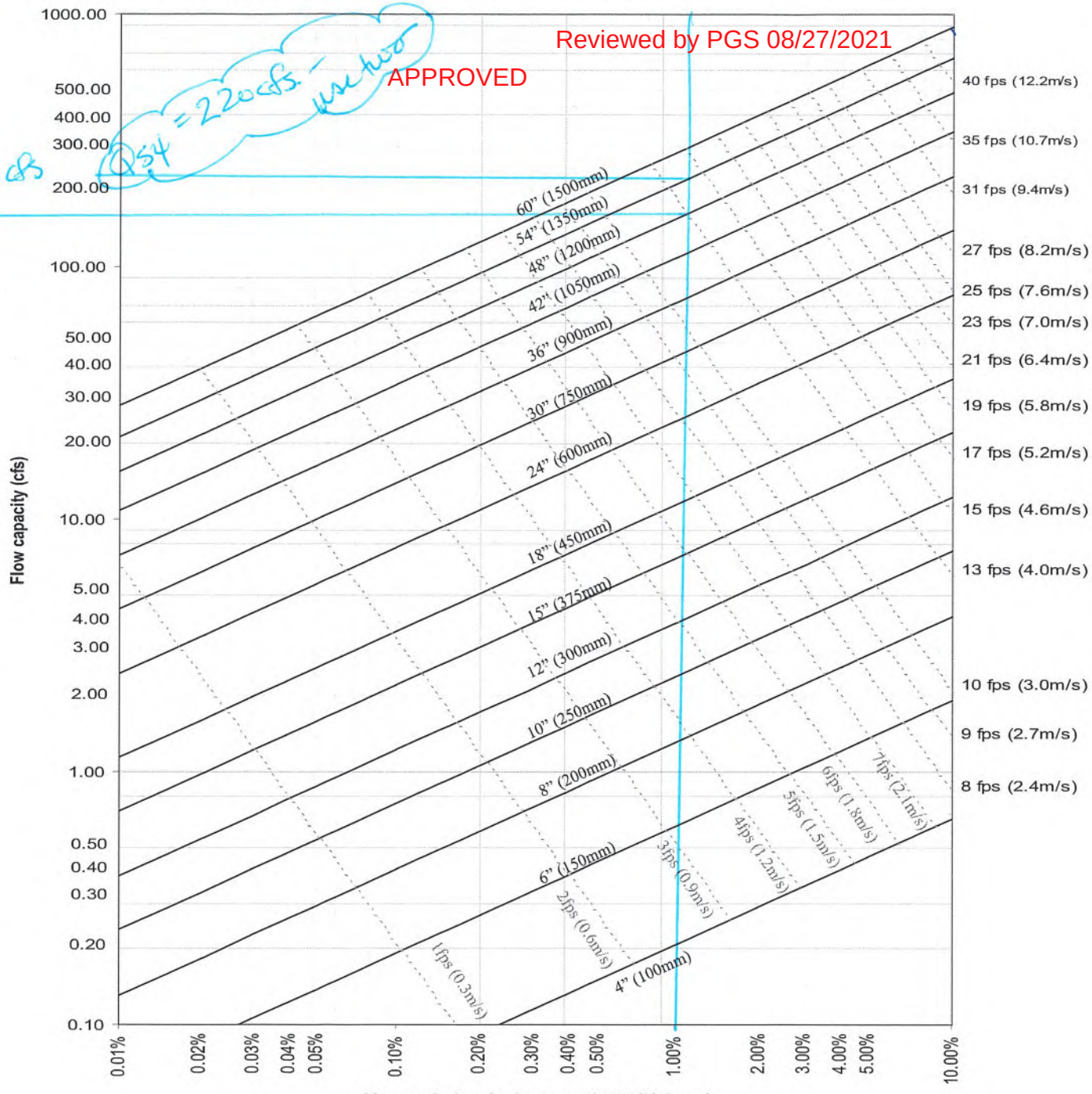
Culvert #4 → PC 8C → Basin #3

Road
Inlet = 76.8
Outlet = 72.0
S = 1%

Q_{25} = 279.9

Q_{100} = 44.63

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
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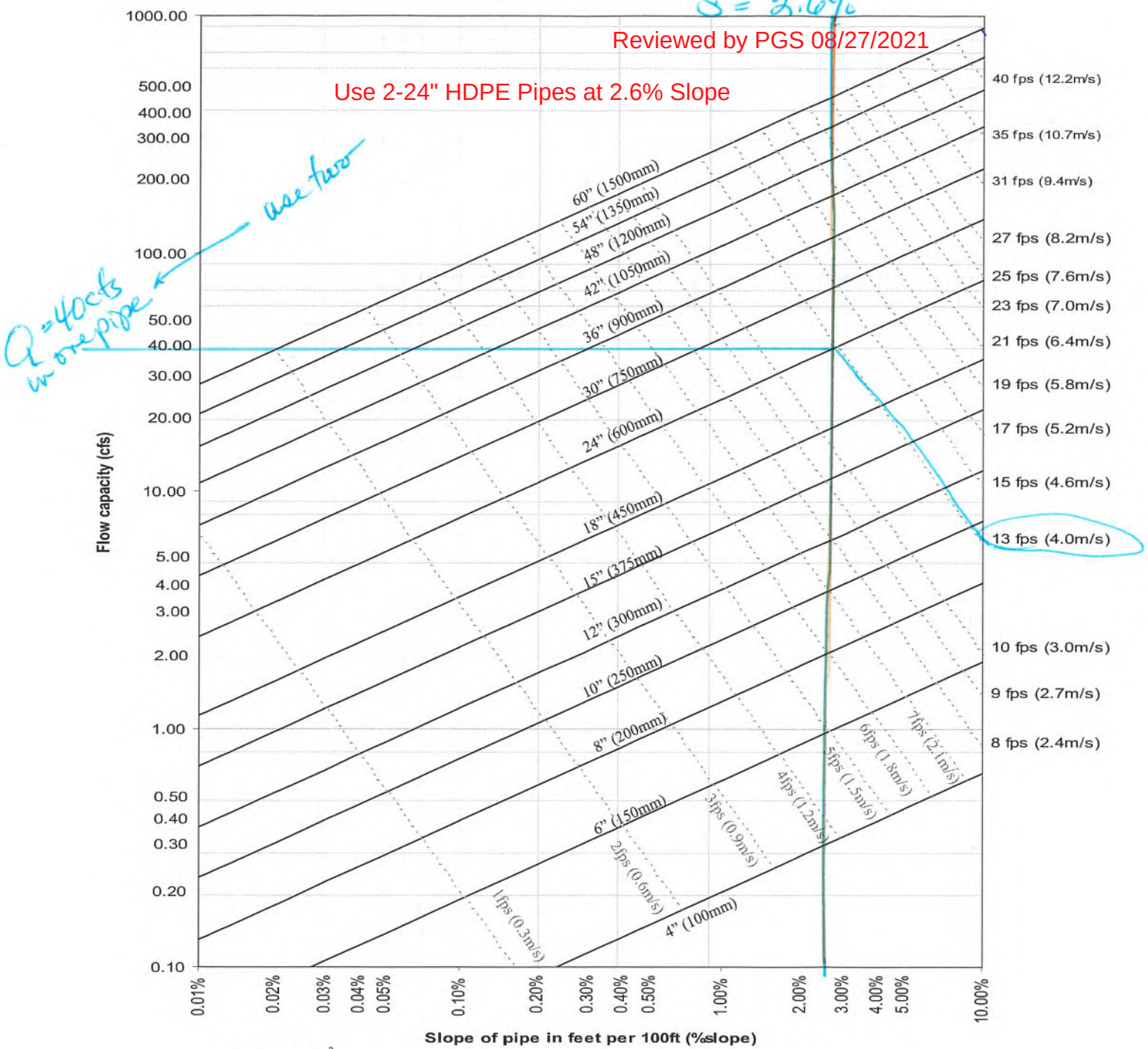
Swale 2 into Basin #1 $Q_{25} = 31.8$ $Q_{100} = 57.96$

Culvert #5 Invert ⇒ 87 Outlet ⇒ 81 Length = 195 S = 2.6%

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]

Reviewed by PGS 08/27/2021

Use 2-24" HDPE Pipes at 2.6% Slope



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
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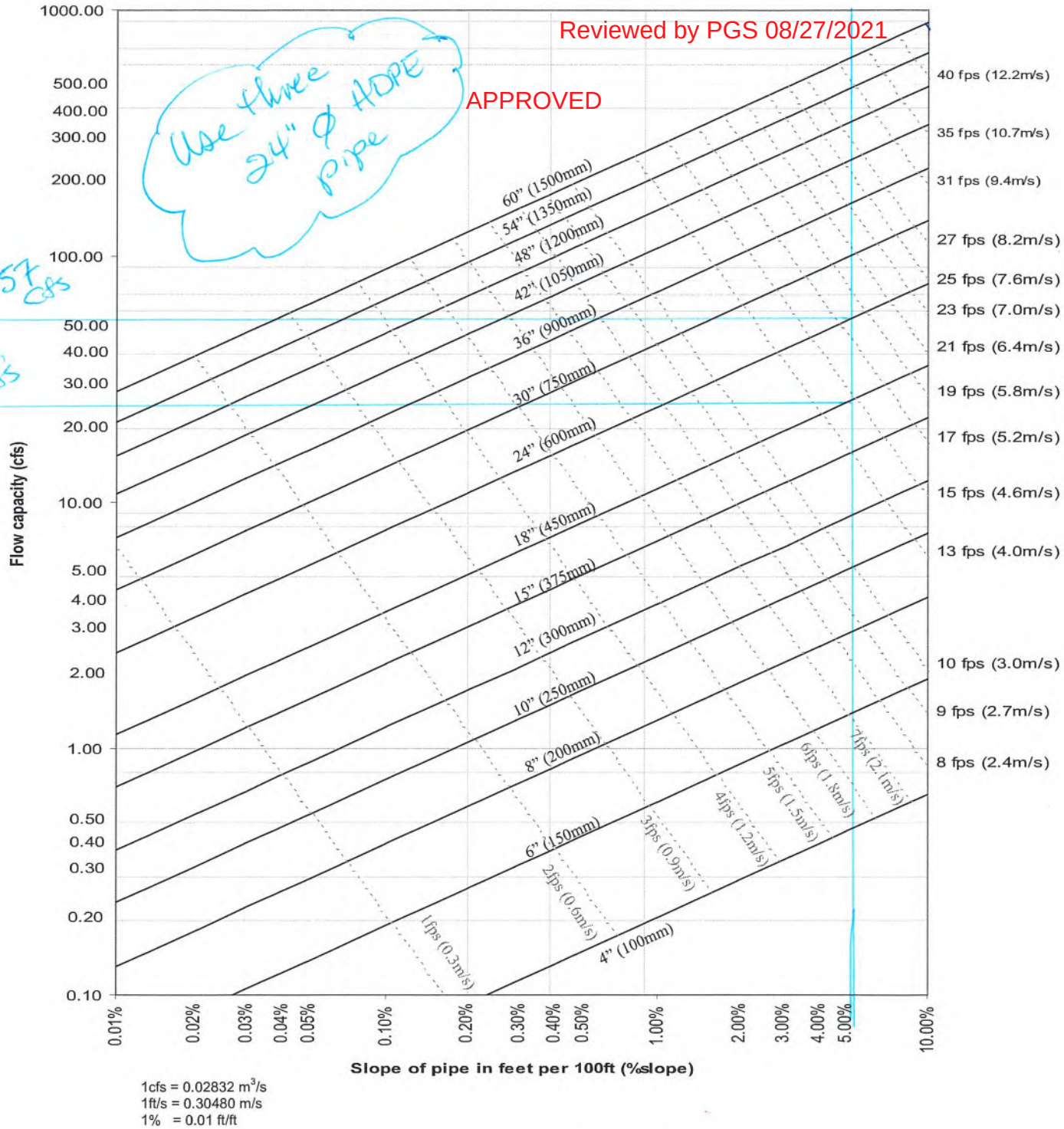
Final Crop Access Road Culvert AR-1 (DC-2)

$Q_{25} = 67$ cfs

$Q_{100} = 106$ cfs

$S = 6\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

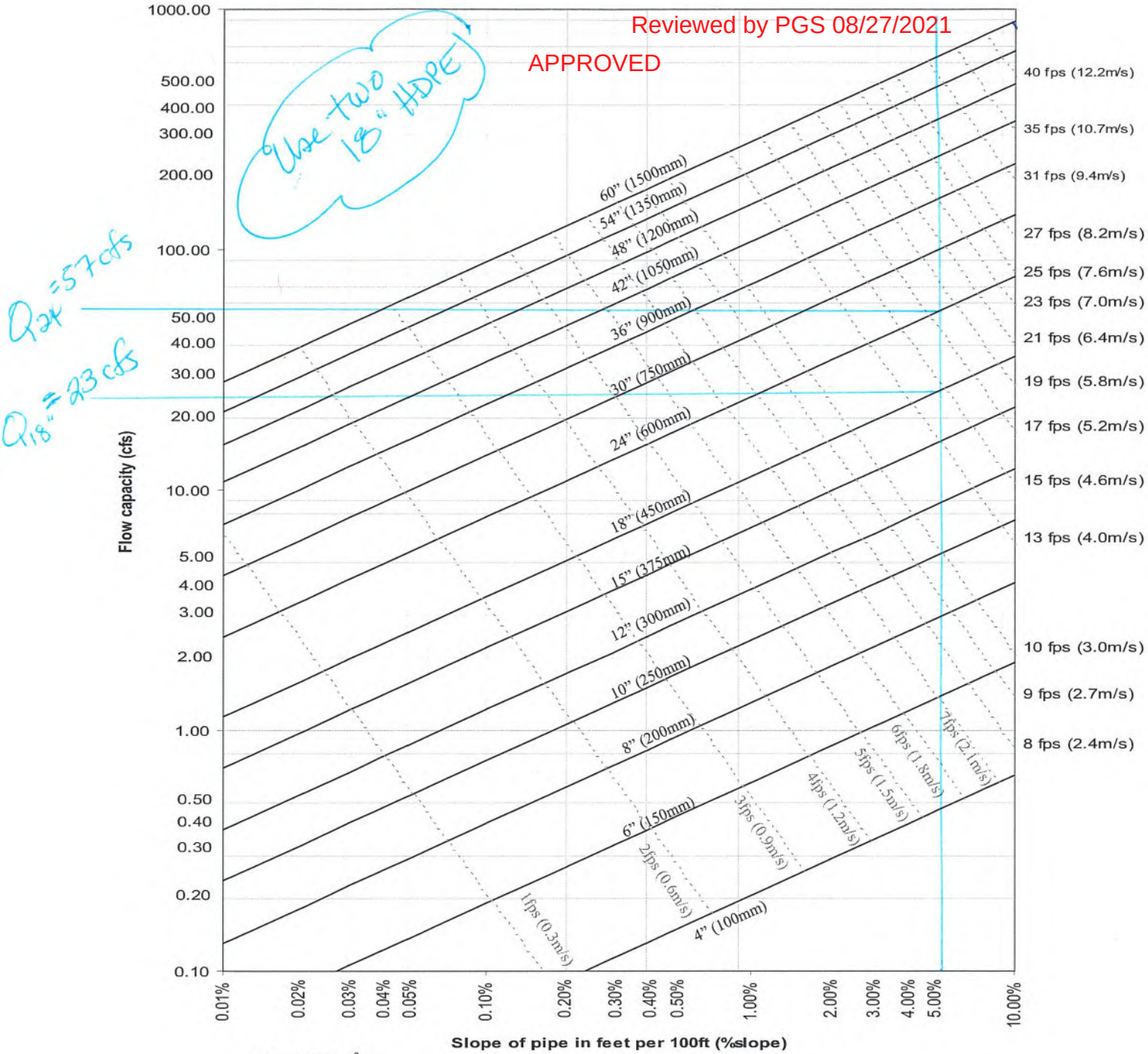
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Find Cap Access Road Culvert AR-2 (½ DC-1)

$Q_{25} = 30$ cfs

$Q_{100} = 47$ cfs $S = 6\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
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Final Cap Access Road Culvert AR-4 (PC 8A)

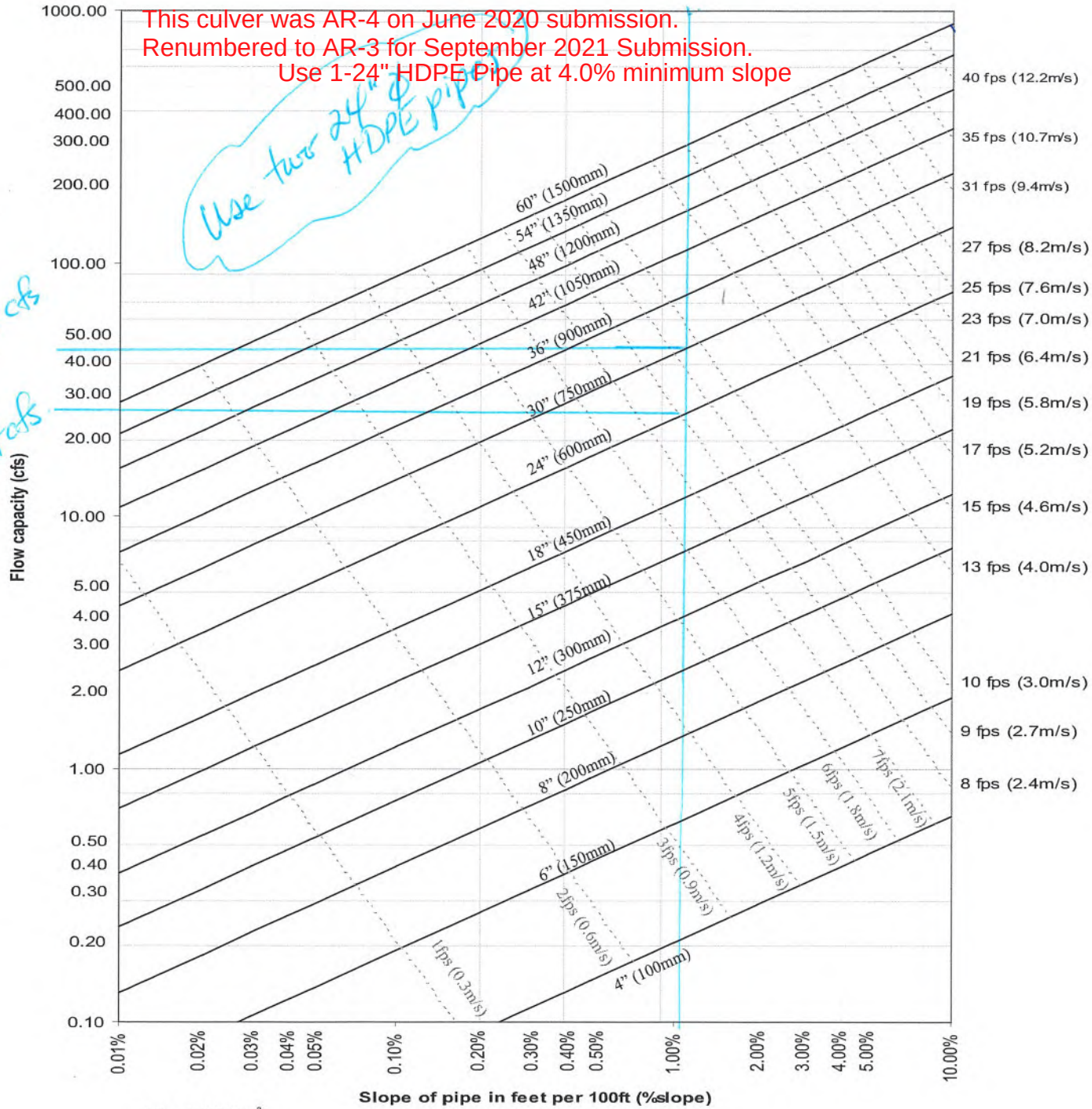
AR-3

$Q_{25} = 36.5$

$Q_{100} = 57.3$

$S = 1\%$

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, HP STORM, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
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CULVERT #6 Q_{25} = 44.0 cfs

IE (up) = 117.0

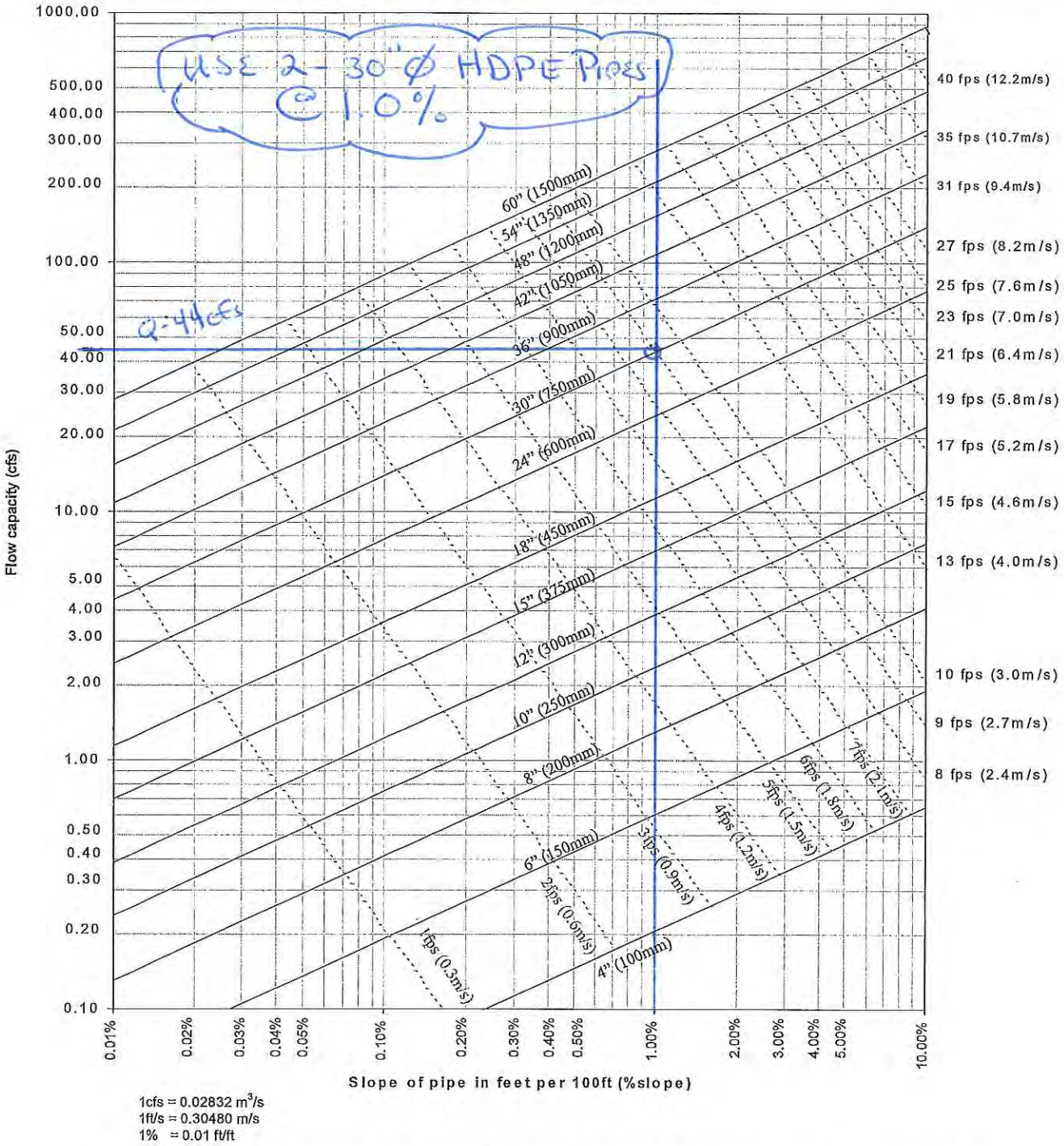
IE (down) = 115.8

L = 120 LF

S = 0.01 Ft/Ft

Figure 3-1

Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

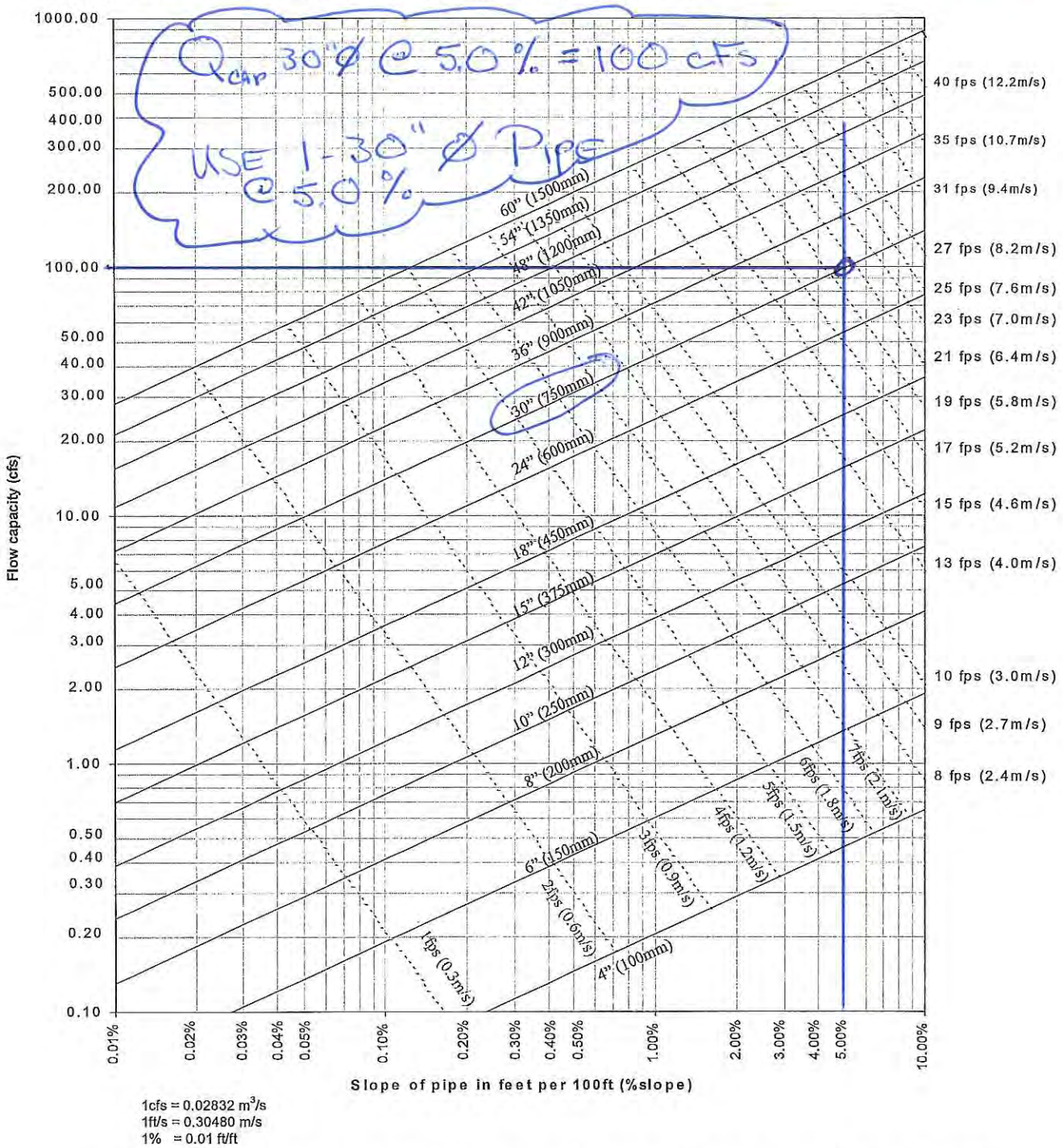
1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, N-12 HP, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

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CULVERT #7 Q_{25} = 29.0 cfs
IE(up) = 105.00 L = 100'
IE(down) = 100.00 S = 0.05 ft/ft

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, N-12 HP, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

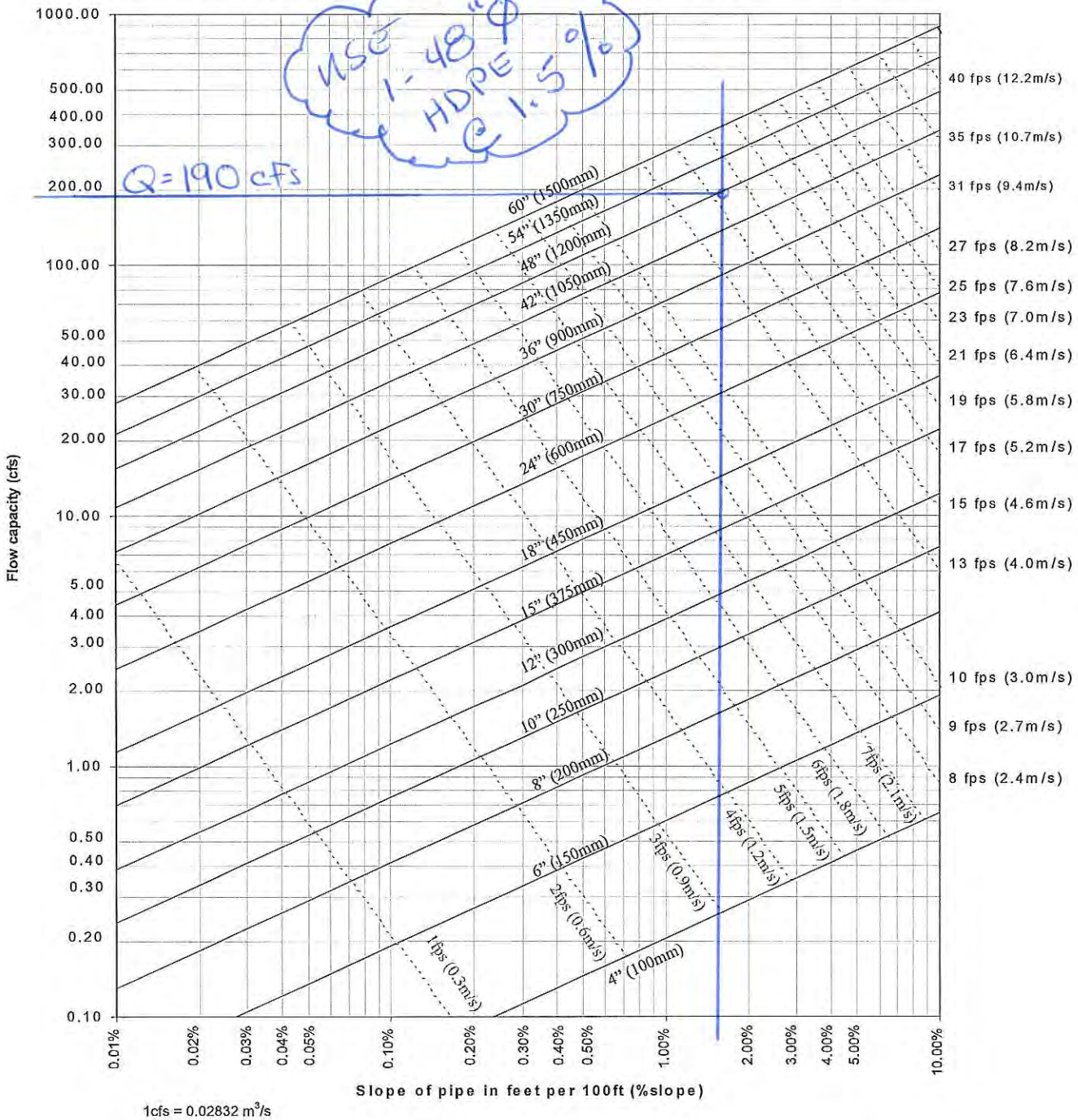
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CULVERT #8 $Q_{25} = 186$ cfs IE (up) = 82.72'
IE (Down) = 80.50'
L = 148 LF
S = 0.015 Ft/Ft

Figure 3-1
Discharge Rates for ADS Corrugated Pipe with Smooth Interior Liner[1]

USE 1-48" Ø HDPE @ 1.5%

Q = 190 cfs



1cfs = 0.02832 m^3/s
1ft/s = 0.30480 m/s
1% = 0.01 ft/ft

1. Applicable products: N-12®, MEGA GREEN®, N-12 STIB, N-12 WTIB, N-12 HP, SaniTIte®, SaniTite HP, N-12 Low Head

Note: Based on a design Manning's "n" of 0.012.
Solid lines indicate pipe diameters. Dashed lines indicate approximate flow velocity.
Redeveloped from FHWA HDS 3 – Design Charts for Open-Channel Flow[2]

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LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 6
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 4/35
- TERRACE, SEE DETAIL 4/35
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

1.) WHILE FEMA HAS RE-ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.

2.) FOR STORMWATER MANAGEMENT FEATURES, SEE DRAWINGS 38 & 39.

3.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER LAYER.

4.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

CULVERT AR-2

CULVERT #5

BASIN NO. 1 (SEE DRAWING 47)

CULVERT #1

CULVERT AR-1

FLARE PADDOCK 80' X 120' (SEE DRAWING 59)

CULVERT #2

CULVERT #3

BASIN NO. 2 (SEE DRAWING 48)

CULVERT #6

CULVERT #7

GRAPHIC SCALE

1 inch = 150 ft.

REVISION:

DATE:	
8/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION

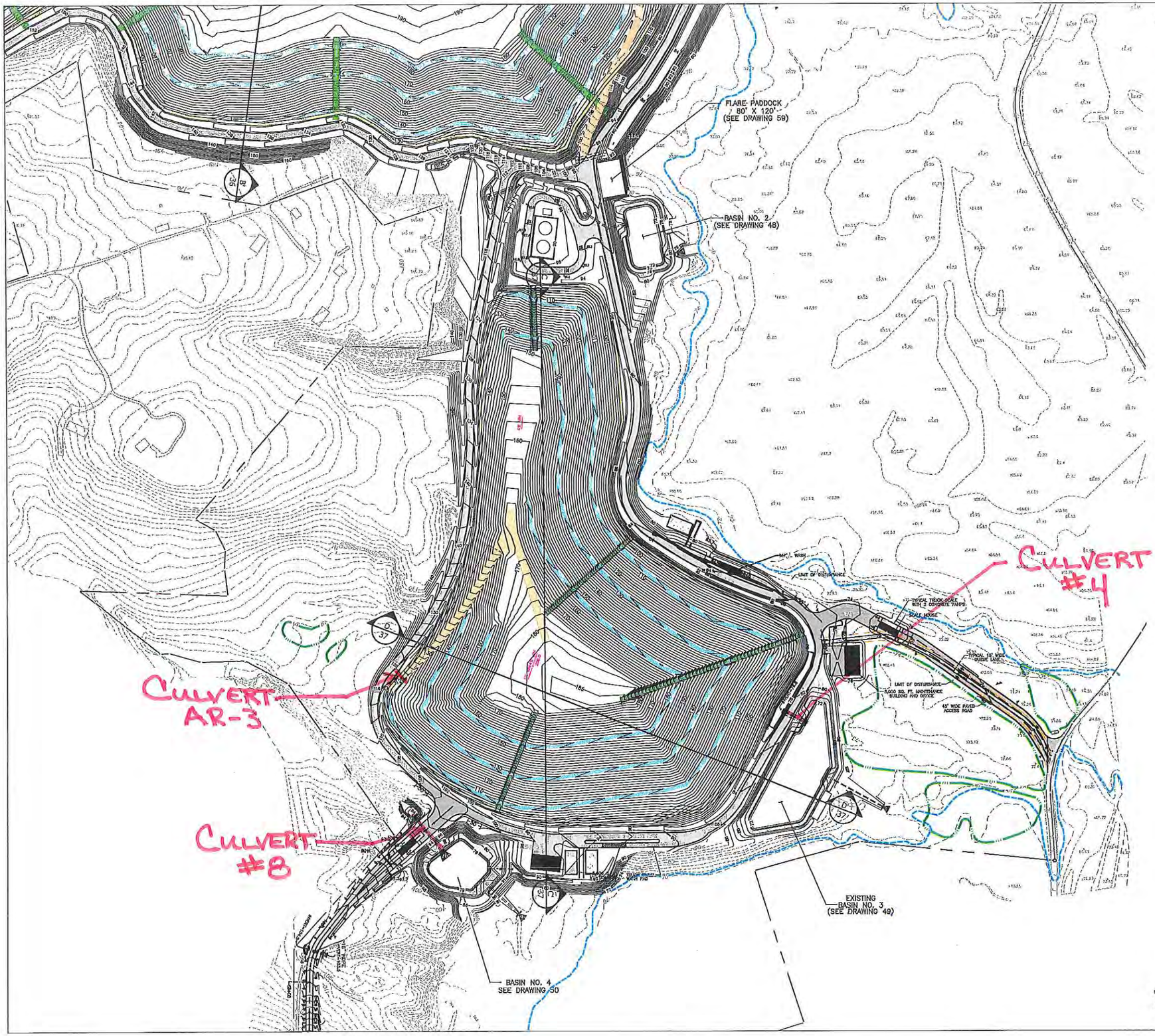
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1879 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
p: 856.354.2277 f: 856.354.1258 www.montrosegeoservices.com

TOP OF FINAL COVER GRADING PLAN - WEST (CELL 1-10)

PROJECT MANAGER:	POS
CHECKED BY:	POS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2015 - 2804
DATE:	08/03/2021

DRAWING 32



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 4/35
- TERRACE, SEE DETAIL 2/34
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

1.) WHILE FEMA HAS RE-ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.

2.) FOR STORMWATER MANAGEMENT FEATURES, SEE DRAWINGS 38 & 39.

3.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER LAYER.

4.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
A Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ, 08003
P: 856.354.2273 F: 856.354.2258 www.advancedgeoservices.com

TOP OF FINAL COVER
GRADING PLAN -
EAST (CELL 11-16)

PROJECT MANAGER:	PCS
CHECKED BY:	PCS
DRAWN BY:	DJF
SCALE(S):	NOTED
PROJECT NUMBER:	2015 - 3054
DATE:	04/03/09/03/2021

DRAWING 33

ADVANCED GeoServices

a Montrose Environmental Group company

ATTACHMENT 17G

WQv Facility Design

UNIFIED STORMWATER SIZING CRITERIA

WQV BASIN + UNMANAGED

RAINFALL DEPTH (INCHES) P=	1	IN	
VOLUMETRIC RUNOFF COEFFICIENT Rv=	0.2732	(0.05 + 0.009(I))	
PERCENT IMPERVIOUS COVER I=	24.80	%	
AREA (ACRES) A=	5.25	ACRES	
SOIL SPECIFIC RECHARGE FACTOR (INCHES) S=	0.21	INCHES (SEE BELOW)	
WATER QUALITY VOLUME (ACRE-FEET) WQv*=	**0.12**	ACRE-FEET	0.09 ACRE-FEET
RECHARGE VOLUME (ACRE-FEET) Rev=	0.02	ACRE-FEET	

*MINIMUM 0.2 INCHES/ACRE WQv FOR <15% IMPERVIOUS COVERAGE

COMPOSITE SOIL SPECIFIC RECHARGE FACTOR CALCULATION

SOIL TYPE	%	S	%*S
A	22.8%	0.38	0.087
B	18.6%	0.26	0.048
C	50.2%	0.13	0.065
D	8.5%	0.07	0.006
TOTAL	100.1%		**0.21 COMPOSITE S**

WQv PROVIDED=	0.12	ACRE-FEET	89.5 FEET

(<15% IMP*)

ATTACHMENT 17H

Soil Loss

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Final Cover Soil Loss Analysis		
	Job No. 2018-3854	Made by: VG	Date 07/11/19
	Ref. Phase III Report	Checked by:	Sheet 1 of 2

Objective:

Using the Universal Soil Loss Equation, estimate the amount of soil loss that can be expected to occur on the steepest section of the finished cap area and verify that it is below the Resource Conservation and Recovery Act (RCRA) standard of 2 tons/acre/year.

Design Criteria and Assumptions:

1.) The erosivity index, R, was obtained from Figure 20 of "Evaluating Cover Systems for Solid and Hazardous Waste," (Lutton). The erosivity index was determined to be 200.

2.) The soil erodibility factor, K, was obtained from Table 5 of "Evaluating Cover Systems for Solid and Hazardous Waste," (Lutton). The cap cover soil will consist of a sandy loam with an organic matter content of at least 2%. Therefore the soil erodibility factor was determined to be 0.24 tons/acre.

3.) From figures "Final Grading Plan West Section," Advanced GeoServices, Corp., July 2020, and "Final Grading Plan East Section," Advanced GeoServices, Corp., July 2020, the steepest slope of the final cover is 3:1 H:V, or approximately 33%, and the longest slope length is 100. Using this information, and Table 15-3 of "Hydrologic Analysis and Design," (McCuen), the topographic factor, T, was determined to be 9.5.

4.) The crop management factor, C, was obtained from Table 15-4 of "Hydrologic Analysis and Design," (McCuen). The landfill cover cap vegetation will be a high productivity grass and legume mix. Therefore the crop management factor was determined to be 0.004.

5.) The conservation practice factor, P, was obtained from Table 15-5 of "Hydrologic Analysis and Design," (McCuen). A conservation practice factor of 1.0 (no support practice) was selected in order to produce a more conservative estimate of soil loss.

Calculation:

The Universal Soil Loss Equation was used to determine the average annual soil loss:

$$E = RKTCP$$

Where:
- E = soil loss (tons/acre/year)
- R = erosivity index
- K = soil erodibility factor (tons/acre)
- T = topographic factor
- C = crop management factor
- P = conservation practice factor

Using the design criteria and assumptions stated above, the average annual soil loss is estimated to be:

$$E = 200 \times 0.24 \text{ tons/acre} \times 9.5 \times 0.004 \times 1.0 = 1.824 \text{ tons/acre/year}$$

ADVANCED GeoServices a Montrose Environmental Group company	Subject: Final Cover Soil Loss Analysis		
	Job No. 2018-3854	Made by:	Date 07/11/19
	Ref. Phase III Report	Checked by:	Sheet 2 of 2

Conclusion:

Using the Universal Soil Loss Equation and the design criteria and assumptions stated above, the average annual soil loss was estimated to be 1.824 tons/acre/year. This value is below the maximum allowable annual soil loss of 2.0 tons/acre/year per RCRA standards.

References:

1.) Lutton, R. J. *Evaluating Cover Systems for Solid and Hazardous Waste*. Municipal Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, 1982.

2.) McCuen, Richard H. *Hydrologic Analysis and Design*. Prentice-Hall, 1989.

3.) "Final Grading Plan West Section." Prepared by Advanced GeoServices, Corp., August 2019.

4.) "Final Grading Plan East Section." Prepared by Advanced GeoServices, Corp., August 2019.

Not only is erosion objectionable in itself but erosion can degrade the cover and seriously reduce its effectiveness.

Evaluate Erosion Potential — Step 19

The USDA universal soil loss equation (USLE) is a convenient tool for use in evaluating erosion potential. The USLE predicts average annual soil loss as the product of six quantifiable factors. The equation is:

$$A = R\ K\ L\ S\ C\ P$$

where A = average annual soil loss, in tons/acre
R = rainfall and runoff erosivity index
K = soil erodibility factor, tons/acre
L = slope-length factor
S = slope-steepness factor
C = cover-management factor
P = practice factor

The data necessary as input to this equation are available to the evaluator in a figure and tables included below. Note that the evaluations in Step 8 on soil composition and Steps 25-32 on vegetation all impact on the evaluation of erosion also.

Factor R in the USLE can be calculated empirically from climatological data. For average annual soil loss determinations, however, R can be obtained directly from Figure 20. Factor K, the average soil loss for a given

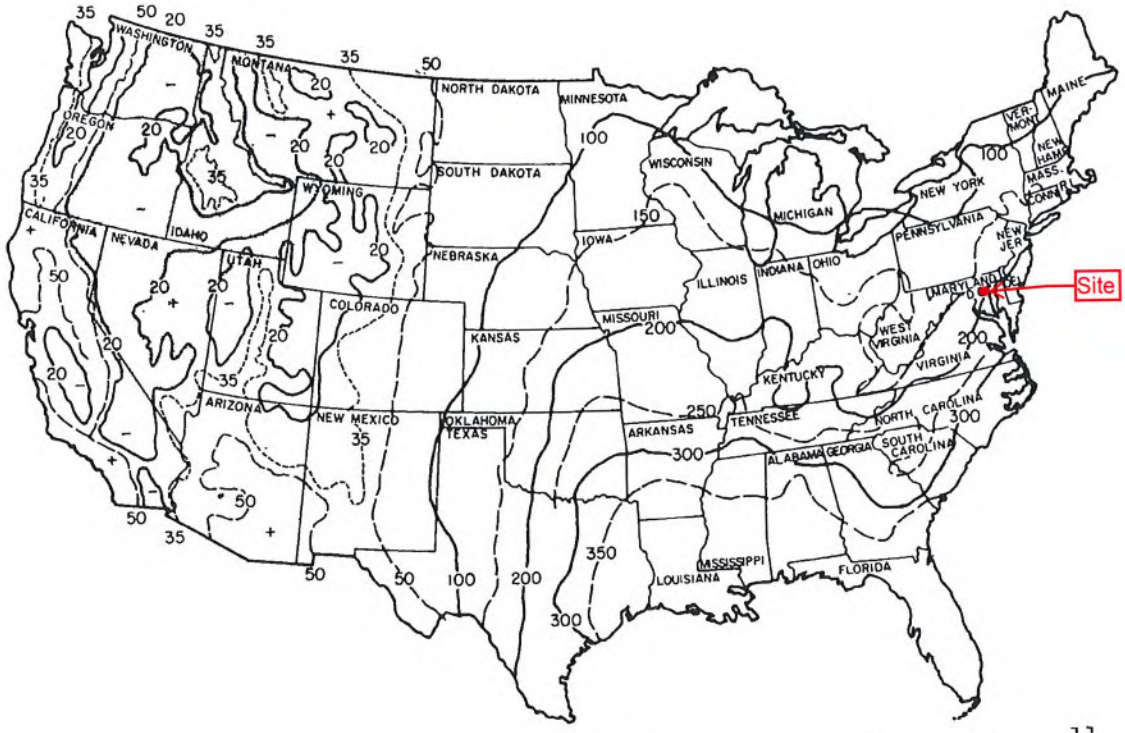


Figure 20. Average annual values of rainfall-erosivity factor R.[11]

soil in a unit plot, pinpoints differences in erosion according to differences in soil type. Long-term plot studies under natural rainfall have produced K values generalized in Table 5 for the USDA soil types.

TABLE 5. APPROXIMATE VALUES OF FACTOR K FOR USDA TEXTURAL CLASSES[11]

Texture class	Organic matter content		
	<0.5%	2%	4%
	K	K	K
Sand	0.05	0.03	0.02
Fine sand	.16	.14	.10
Very fine sand	.42	.36	.28
Loamy sand	.12	.10	.08
Loamy fine sand	.24	.20	.16
Loamy very fine sand	.44	.38	.30
Sandy loam	.27	.24	.19
Fine sandy loam	.35	.30	.24
Very fine sandy loam	.47	.41	.33
Loam	.38	.34	.29
Silt loam	.48	.42	.33
Silt	.60	.52	.42
Sandy clay loam	.27	.25	.21
Clay loam	.28	.25	.21
Silty clay loam	.37	.32	.26
Sandy clay	.14	.13	.12
Silty clay	.25	.23	.19
Clay		0.13-0.29	

The values shown are estimated averages of broad ranges of specific-soil values. When a texture is near the borderline of two texture classes, use the average of the two K values.

The evaluator must next consider the shape of the slope in terms of length and inclination. The appropriate LS factor is obtained from Table 6. A nonlinear slope may have to be evaluated as a series of segments, each with uniform gradient. Two or three segments should be sufficient for most engineered landfills, provided the segments are selected so that they are also of equal length (Table 6 can be used, with certain adjustments). Enter Table 6 with the total slope length and read LS values corresponding to the percent slope of each segment. For three segments, multiply the chart LS values for the upper, middle, and lower segments by 0.58, 1.06, and 1.37, respectively. The average of the three products is a good estimate of the

TABLE 15-3 Values of the erosion equation's topographic factor, LS, for specified combinations of slope length and steepness[a]

Percent Slope	Slope Length (ft)											
	25	50	75	100	150	200	300	400	500	600	800	1000
0.5	0.07	0.08	0.09	0.10	0.11	0.12	0.14	0.15	0.16	0.17	0.19	0.20
1	0.09	0.10	0.12	0.13	0.15	0.16	0.18	0.20	0.21	0.22	0.24	0.26
2	0.13	0.16	0.19	0.20	0.23	0.25	0.28	0.31	0.33	0.34	0.38	0.40
3	0.19	0.23	0.26	0.29	0.33	0.35	0.40	0.44	0.47	0.49	0.54	0.57
4	0.23	0.30	0.36	0.40	0.47	0.53	0.62	0.70	0.76	0.82	0.92	1.0
5	0.27	0.38	0.46	0.54	0.66	0.76	0.93	1.1	1.2	1.3	1.5	1.7
6	0.34	0.48	0.58	0.67	0.82	0.95	1.2	1.4	1.5	1.7	1.9	2.1
8	0.50	0.70	0.86	0.99	1.2	1.4	1.7	2.0	2.2	2.4	2.8	3.1
10	0.69	0.97	1.2	1.4	1.7	1.9	2.4	2.7	3.1	3.4	3.9	4.3
12	0.90	1.3	1.6	1.8	2.2	2.6	3.1	3.6	4.0	4.4	5.1	5.7
14	1.2	1.6	2.0	2.3	2.8	3.3	4.0	4.6	5.1	5.6	6.5	7.3
16	1.4	2.0	2.5	2.8	3.5	4.0	4.9	5.7	6.4	7.0	8.0	9.0
18	1.7	2.4	3.0	3.4	4.2	4.9	6.0	6.9	7.7	8.4	9.7	11.0
20	2.0	2.9	3.5	4.1	5.0	5.8	7.1	8.2	9.1	10.0	12.0	13.0
25	3.0	4.2	5.1	5.9	7.2	8.3	10.0	12.0	13.0	14.0	17.0	19.0
30	4.0	5.6	6.9	8.0	9.7	11.0	14.0	16.0	18.0	20.0	23.0	25.0
40	6.3	9.0	11.0	13.0	16.0	18.0	22.0	25.0	28.0	31.0	—	—
50	8.9	13.0	15.0	18.0	22.0	25.0	31.0	—	—	—	—	—
60	12.0	16.0	20.0	23.0	28.0	—	—	—	—	—	—	—

[a] Values given for slopes longer than 300 ft or steeper than 18% are extrapolations beyond the range of the research data, and therefore less certain than the others. Adjustments for irregularity of slope are available.

TABLE 15-4 Generalized values of the cover and management factor, C, in the 37 states east of the Rocky Mountains[a]

Line no.	Crop, Rotation, and Management[c,d]	Productivity Level[b]	
		High	Mod.
		C Value	
	Base value: continuous fallow, tilled up and down slope	1.00	1.00
CORN			
1	C, RdR, fall TP, conv (1)	0.54	0.62
2	C, RdR, spring TP, conv (1)	0.50	0.59
3	C, RdL, fall TP, conv (1)	0.42	0.52
4	C, RdR, wc seeding, spring TP, conv (1)	0.40	0.49
5	C, RdL, standing, spring TP, conv (1)	0.38	0.48
6	C, fall shred stalks, spring TP, conv (1)	0.35	0.44
7	C(silage)-W(RdL, fall TP) (2)	0.31	0.35
8	C, RdL, fall chisel, spring disk, 40-30% rc (1)	0.24	0.30
9	C(silage), W wc seeding, no-till pl in c-k W (1)	0.20	0.24
10	C(RdL)-W(RdL, spring TP) (2)	0.20	0.28
11	C, fall shred stalks, chisel pl, 40-30% rc (1)	0.19	0.26
12	C-C-C-W-M, RdL, TP for C, disk for W (5)	0.17	0.23
13	C, RdL, strip till row zones, 55-40% rc (1)	0.16	0.24
14	C-C-C-W-M-M, RdL, TP for C, disk for W (6)	0.14	0.20
15	C-C-W-M, RdL, TP for C, disk for W (4)	0.12	0.17
16	C, fall shred, no-till pl, 70-50% rc (1)	0.11	0.18
17	C-C-W-M-M, RdL, TP for C, disk for W (5)	0.087	0.14
18	C-C-C-W-M, RdL, no-till pl 2d & 3rd C (5)	0.076	0.13
19	C-C-W-M, RdL, no-till pl 2d C (4)	0.068	0.11
20	C, no-till pl in c-k wheat, 90-70% rc (1)	0.062	0.14
21	C-C-C-W-M-M, no-till pl 2d & 3rd C (6)	0.061	0.11
22	C-W-M, RdL, TP for C, disk for W (3)	0.055	0.095
23	C-C-W-M-M, RdL, no-till pl 2d C (5)	0.051	0.094
24	C-W-M-M, RdL, TP for C, disk for W (4)	0.039	0.074
25	C-W-M-M-M, RdL, TP for C, disk for W (5)	0.032	0.061
26	C, no-till pl in c-k sod, 95-80% rc (1)	0.017	0.053
COTTON[e]			
27	Cot, conv (Western Plains) (1)	0.42	0.49
28	Cot, conv (South) (1)	0.34	0.40
MEADOW			
29	Grass and legume mix	0.004	0.01
30	Alfalfa, lespedeza, or Sericia	0.020	
31	Sweet clover	0.025	
SORGHUM, GRAIN (Western Plains)[e]			
32	RdL, spring TP, conv (1)	0.43	0.53
33	No-till pl in shredded 70-50% rc	0.11	0.18

(Continued)

TABLE 15-4 Generalized values of the cover and management factor, C, in the 37 states east of the Rocky Mountains[a] (*Continued*)

Line no.	Crop, Rotation, and Management[c,d]	Productivity Level[b] High C Value	Productivity Level[b] Mod. C Value
Base value: continuous fallow, tilled up and down slope		1.00	1.00
SOYBEANS[e]			
34	B, RdL, spring TP, conv (1)	0.48	0.54
35	C-B, TP annually, conv (2)	0.43	0.51
36	B, no-till pl	0.22	0.28
37	C-B, no-till pl, fall shred C stalks (2)	0.18	0.22
WHEAT			
38	W-F, fall TP after W (2)	0.38	
39	W-F, stubble mulch, 500 lbs rc (2)	0.32	
40	W-F, stubble mulch, 1000 lbs rc (2)	0.21	
41	Spring W, RdL, Sept TP, conv (N. Dak. and S. Dak.) (1)	0.23	
42	Winter W, RdL, Aug TP, conv (Kans.) (1)	0.19	
43	Spring W, stubble mulch, 750 lb rc (1)	0.15	
44	Spring W, stubble mulch, 1250 lb rc (1)	0.12	
45	Winter W, stubble mulch, 750 lb rc (1)	0.11	
46	Winter W, stubble mulch, 1250 lb rc (1)	0.10	
47	W-M, conv (2)	0.054	
48	W-M-M, conv (3)	0.026	
49	W-M-M-M, conv (4)	0.021	

[a] This table is for illustrative purposes only and is not a complete list of cropping systems or potential practices. Values of *C* differ with rainfall pattern and planting dates. These generalized values show approximately the relative erosion-reducing effectiveness of various crop systems, but locationally derived *C* values should be used for conservation planning at the field level. Tables of local values are available from the Soil Conservation Service.

[b] High level is exemplified by long-term yield averages greater than 75 bu of corn or 3 tons of grass-and-legume hay; or cotton management that regularly provides good stands and growth.

[c] Numbers in parentheses indicate number of years in the rotation cycle. (1) designates a continuous one-crop system.

[d] Abbreviations

B	soybeans	F	fallow
C	corn	M	grass and legume hay
c-k	chemically killed	pl	plant
conv	conventional	W	wheat
cot	cotton	wc	winter cover

lb rc pounds of crop residue per acre remaining on surface after new crop seeding
% rc percentage of soil surface covered by residue mulch after new crop seeding
70-50% rc 70% cover for C values in first column; 50% for second column
RdR residues (corn stover, straw, etc.) removed or burned
RdL all residues left on field (on surface or incorporated)
TP turn plowed (upper 5 or more inches of soil inverted, covering residues)

[e] Grain sorghum, soybeans, or cotton may be substituted for corn in lines 12, 14, 15, 17–19, 21–15 to estimate *C* values for sod-based rotations.

TABLE 15-5 Values of support-practice factor, *P*

Practice	Land Slope (%) 1.1–2	2.1–7	7.1–12	12.1–18	18.1–24
	Factor *P*				
Contouring, P_c	0.60	0.50	0.60	0.80	0.90
Contour strip cropping,[a] P_{sc}					
R-R-M-M	0.30	0.25	0.30	0.40	0.45
R-W-M-M	0.30	0.25	0.30	0.40	0.45
R-R-W-M	0.45	0.38	0.45	0.60	0.68
R-W	0.52	0.44	0.52	0.70	0.90
R-O	0.60	0.50	0.60	0.80	0.90
Contour listing or ridge planting, P_{c1}	0.30	0.25	0.30	0.40	0.45
Contour terracing,[b,c] P_t	$0.6/\sqrt{n}$	$0.5/\sqrt{n}$	$0.6/\sqrt{n}$	$0.8/\sqrt{n}$	$0.9/\sqrt{n}$
No support practice	1.0	1.0	1.0	1.0	1.0

[a] R, rowcrop; W, fall-seeded grain; O, spring-seeded grain; M, meadow. The crops are grown in rotation and so arranged on the field that rowcrop strips are always separated by a meadow or winter-grain strip.

[b] These P_t values estimate the amount of soil eroded to the terrace channels and are used for conservation planning. For prediction of off-field sediment, the P_t values are multiplied by 0.2.

[c] n, number of approximately equal-length intervals into which the field slope is divided by the terraces. Tillage operations must be parallel to the terraces.

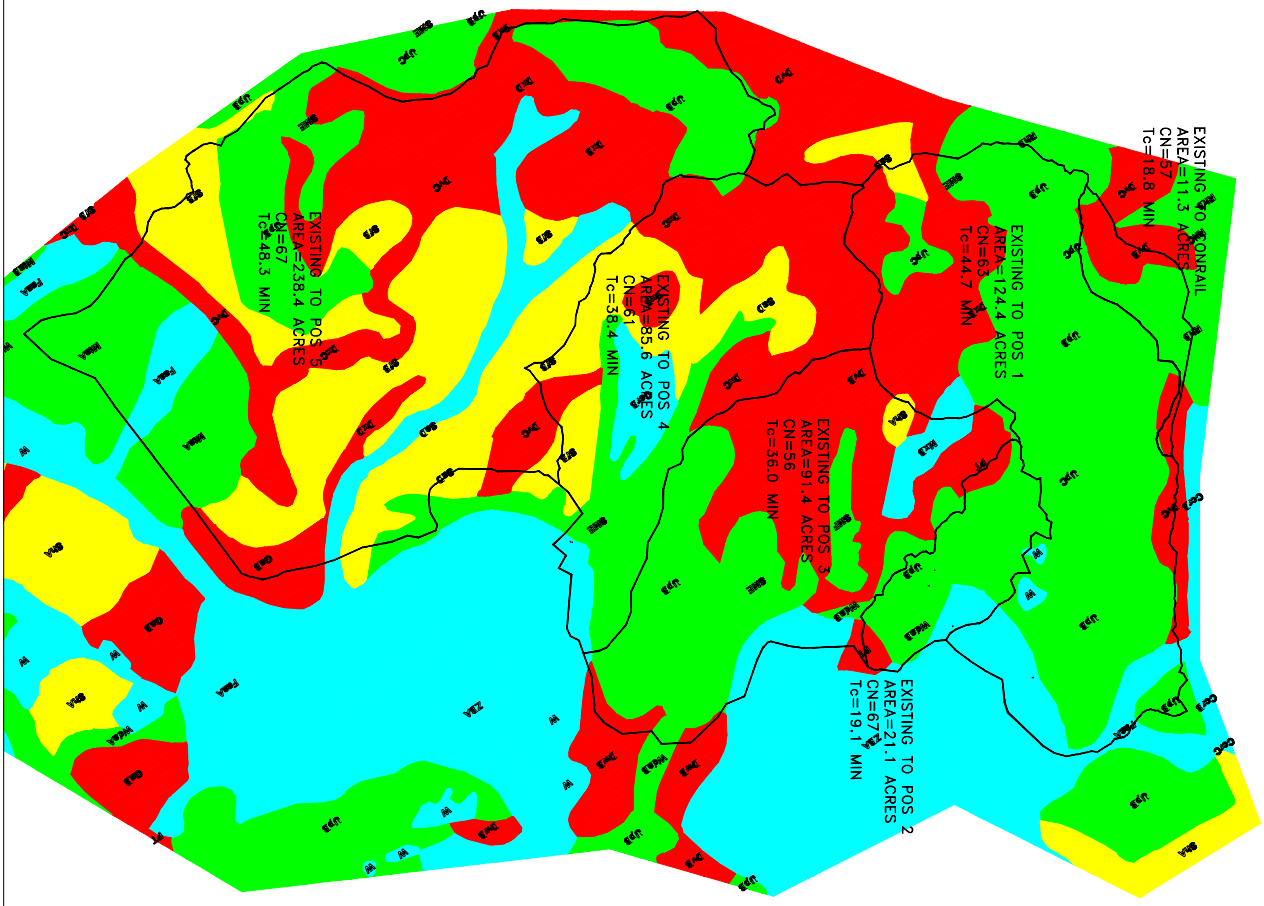
Predicted values of E represent average, time-invariant estimates. Given that R is based on an average number and distribution of storms per year, actual values of E would vary from year to year depending on the number, size, and timing of erosive rainstorms and other weather conditions. Although any one predicted value of E may not be highly accurate, the USLE should be more reliable when it is used to measure either relative effects or long-term sheet and rill erosion rates.

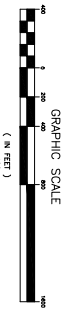
Example 15-1: Soil Loss Estimation with USLE. The general data requirements for making soil loss estimates with the USLE equation are (1) site location (to get R); (2) soil properties (to get K); (3) flow length and slope (to get T); (4) crop, rotation, and management practices (to get C); and (5) slope and support practice (to get P). The estimation process will be illustrated using a hypothetical example. The site, which has a drainage area of 2 acres, is located in central Illinois. The site of interest has an average slope of 2.5% and a flow length of 300 ft. A soil analysis indicates 25% sand, 2% organic matter, 35% silt and very fine sand, a medium granular structure, and moderate permeability. The plot is used for corn, with a crop management value of 0.31, which was determined from information published locally. No support practice is provided.

ATTACHMENT 17I

Soil Survey Map

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\RC 8_Phase III Application\PDRA.dwg









DA-7

EXISTING SOILS
AREA PLAN

PROJECT MANAGER:	VEF	SCALE:	AS SHOWN
CHECKED BY:	VEF	PROJECT NUMBER:	2018-3854
DRAWN BY:	EEE	DATE:	

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NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

DATE:	REVISION:

VERONICA E. FOSTER
LICENSED PROFESSIONAL ENGINEER
MD # 35645

ADVANCED GeoServices

a Montrose Environmental Group company

SECTION 18

DRAWINGS

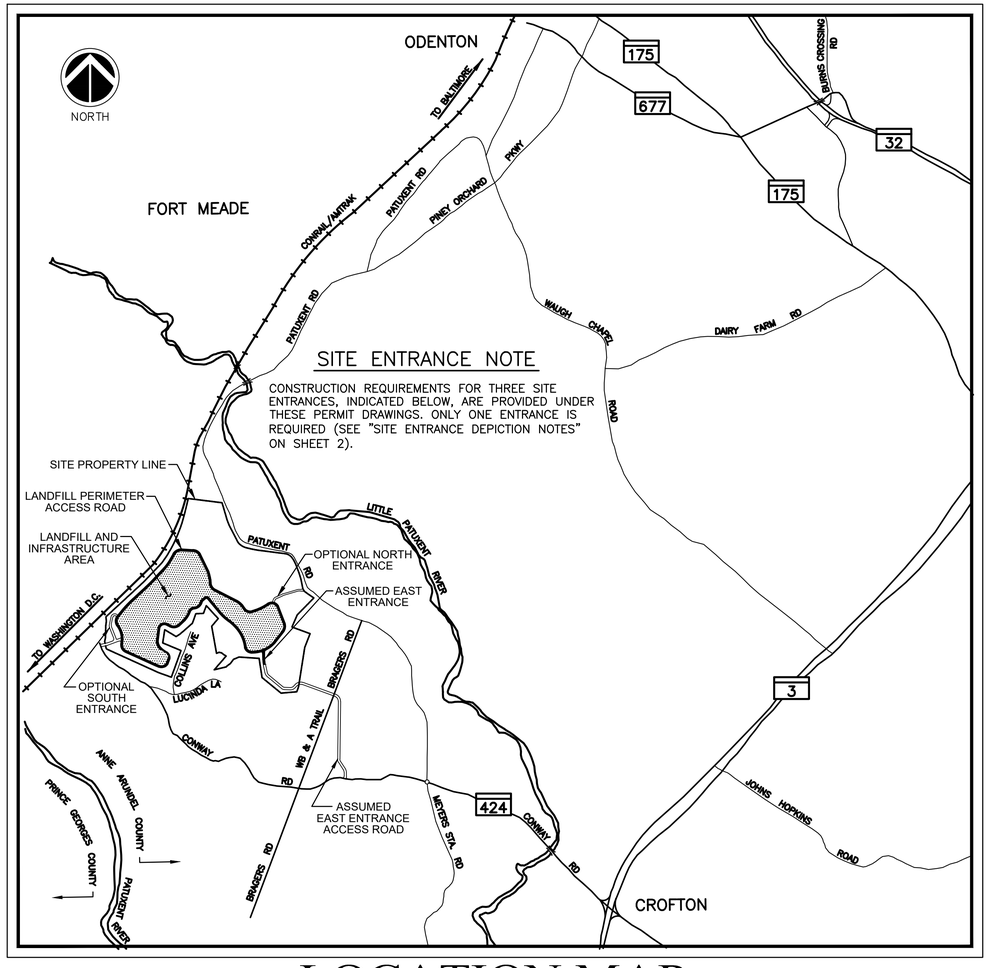
PHASE III REPORT PERMIT DRAWINGS FOR CHESAPEAKE TERRACE RUBBLE LANDFILL

ANNE ARUNDEL COUNTY, MARYLAND

REVISED SEPTEMBER 3, 2021

INDEX OF DRAWINGS

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2	EXISTING CONDITIONS
3	PROPOSED CONDITIONS
4	EAST ENTRANCE – ACCESS ROAD PLAN
5	EAST ENTRANCE – SCALEHOUSE AND INFRASTRUCTURE
6	BOTTOM OF SUBBASE GRADING PLAN – WEST (CELL 1–10)
7	BOTTOM OF SUBBASE GRADING PLAN – EAST (CELL 11–16)
8	ENTRANCE – ACCESS ROAD DETAILS
9	SITE SECURITY DETAILS
10	TOP OF SUBBASE GRADING PLAN – WEST (CELL 1–10)
11	TOP OF SUBBASE GRADING PLAN – EAST (CELL 11–16)
12	TOP OF SELECT WASTE GRADING PLAN – WEST (CELL 1–10)
13	TOP OF SELECT WASTE GRADING PLAN – EAST (CELL 11–16)
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15	LINER SYSTEM DETAILS (SHEET 2 OF 3)
16	LINER SYSTEM DETAILS (SHEET 3 OF 3)
17	TOP OF LEACHATE COLLECTION LAYER – WEST (CELL 1–10)
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19	LEACHATE COLLECTION SYSTEM DETAILS (SHEET 1 OF 3)
20	LEACHATE COLLECTION SYSTEM DETAILS (SHEET 2 OF 3)
21	LEACHATE COLLECTION SYSTEM DETAILS (SHEET 3 OF 3)
22	LEACHATE FORCE MAIN DETAILS (SHEET 1 OF 2)
23	LEACHATE FORCE MAIN DETAILS (SHEET 2 OF 2)
24	LEACHATE FORCE MAIN PROFILES (SHEET 1 OF 2)
25	LEACHATE FORCE MAIN PROFILES (SHEET 2 OF 2)
26	LEACHATE PUMP HOUSE DETAILS
27	LEACHATE CONTROL PANEL LAYOUT
28	LEACHATE STORAGE TANK DETAILS (SHEET 1 OF 2)
29	LEACHATE STORAGE TANK DETAILS (SHEET 2 OF 2)
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40	STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 1 OF 4)
41	STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 2 OF 4)
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43	STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 4 OF 4)
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LOCATION MAP

SCALE: 1"= 2,000'

INDEX OF DRAWINGS

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49	BASIN NO. 3 PLAN AND SECTION
50	BASIN NO. 4 PLAN AND SECTION
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STATE OF MARYLAND · LEONARD STRICKMAN · 21615 · EXPIRATION DATE: 07/31/2022 · PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

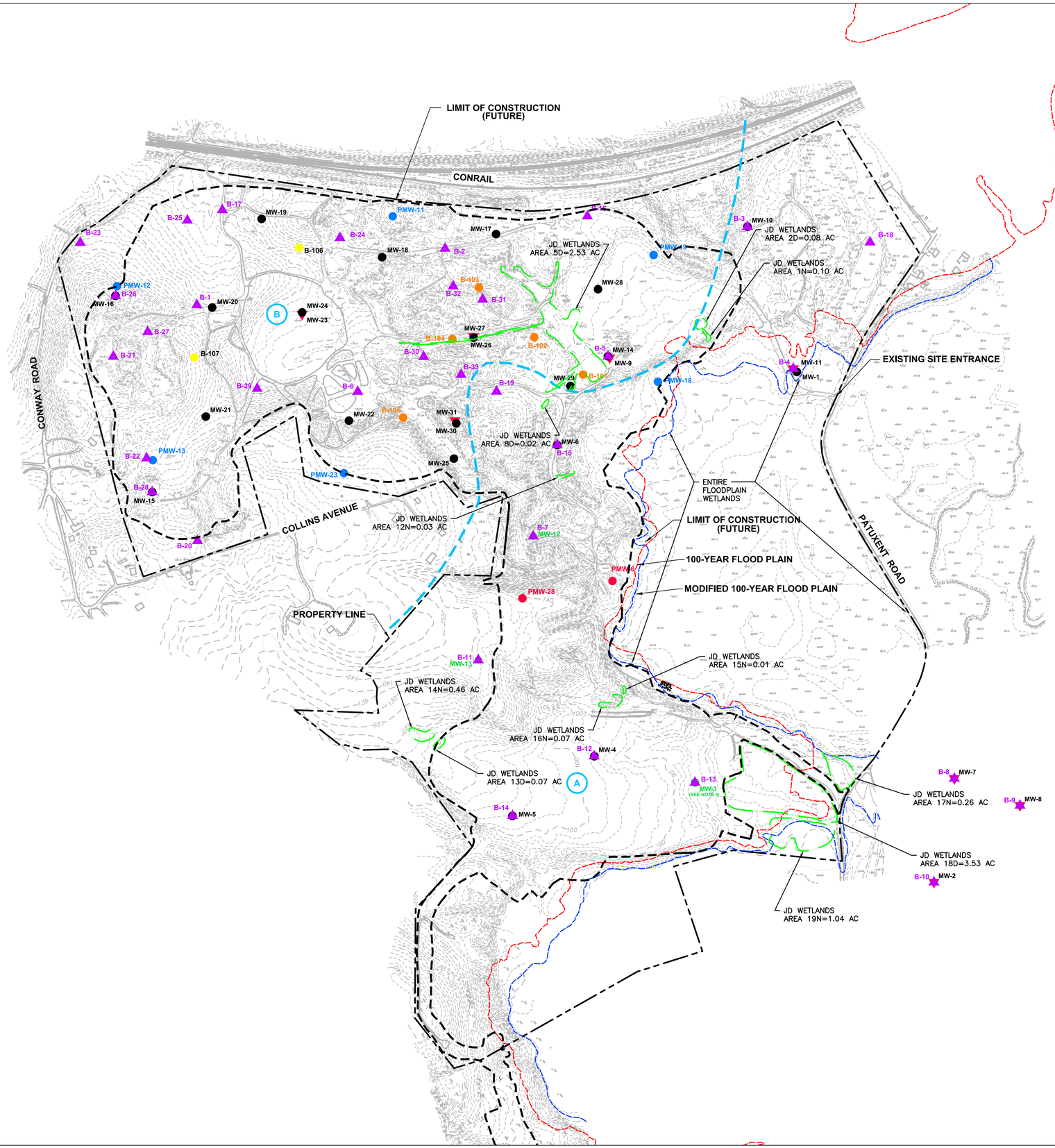
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TITLE SHEET

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

DRAWING 1

N:\Projects\2018\3018854 - Chesapeake Terrace LF\CAD\ACAD\C & E Phase III Application\Drawings\Final_2021\3854 B001 - TITLE SHEET.dwg



LEGEND

- PROPERTY LINE
- LIMIT OF DISTURBANCE (FUTURE)
- 100-YEAR FLOODPLAIN (SEE REFERENCE 5)
- MODIFIED 100-YEAR FLOODPLAIN (SEE NOTE 5)
- EXISTING MONITORING WELL (SEE REFERENCE 2)
- FORMER MONITORING WELLS DAMAGED BY VANDALS (NOT USEABLE) (SEE REFERENCE 2)
- HISTORICAL BOREHOLES (SEE REFERENCE 3)
- EXISTING GROUNDWATER MONITORING WELLS THAT WERE UNABLE TO BE LOCATED (SEE NOTE 5)
- PERMANENT MONITORING WELL INSTALLED IN 2013 (SCREENED ABOVE CLAY CONFINING UNIT) (SEE REFERENCE 2)
- PERMANENT MONITORING WELL INSTALLED IN 2013 (SCREENED BELOW CLAY CONFINING UNIT) (SEE REFERENCE 2)
- BORING LOCATIONS ALONG TA/B/TB TRANSITION (B-101 TO B-105) COMPLETED APRIL/MAY 2013
- ADDITIONAL BORINGS LOCATIONS REQUESTED BY MDE (B-106 AND B-107) COMPLETED APRIL/MAY 2013
- HYDROGEOLOGIC AREA DIVIDE (SEE REFERENCE 2)
- (A) HYDROGEOLOGIC AREA (SEE REFERENCE 2)
- JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE REFERENCE 6)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

4.) HYDROGEOLOGIC AREAS & BOUNDARIES TAKEN FROM "PHASE II PERMIT APPLICATION", PREPARED BY ADVANCED GEOSERVICES CORP DATED JUNE 2020.

5.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE "PHASE II PERMIT APPLICATION", PREPARED BY ADVANCED GEOSERVICES CORP DATED JUNE 2020.

6.) JURISDICTIONAL WETLAND BOUNDARIES OBTAINED FROM FIGURES ATTACHED TO THE ARMY CORPS OF ENGINEERS PUBLIC NOTICE DATED NOVEMBER 22, 1991, AND AS SUBSEQUENTLY AMENDED IN WRITING BY MCCARTHY AND ASSOCIATES ON APRIL 2, 1997

NOTES

1.) HYDROLOGIC AREAS AND THEIR MAPPING IS BASED ON FORMATIONS MAPPED IN FIELD BOREHOLES, SURFACE OBSERVATION, HISTORICAL AERIAL PHOTOGRAPHS, AND REGIONAL GEOLOGIC MAPS AS DESCRIBED IN THE PHASE III APPLICATION.

2.) THE CONRAIL TRACKS ARE ALSO SHARED WITH AMTRAK FOR HIGH-SPEED COMMUTER TRAINS BETWEEN BOSTON, MASSACHUSETTS AND WASHINGTON, D.C.

3.) THE PROPERTY WAS PREVIOUSLY USED FOR SAND AND GRAVEL MINING ACTIVITIES. PORTIONS OF THE SITE CURRENTLY HAVE NO VEGETATION AND ARE BARREN.

4.) WATER LEVELS IN WELLS MW-2, MW-7, MW-8, MW-9, MW-11, MW-23, MW-26, AND MW-31 WERE NOT OBTAINED DURING FIELD ACTIVITIES BY GOLDER ASSOCIATES IN 2014 AND ADVANCED GEOSERVICES IN 2019 AS THE WELLS COULD NOT BE LOCATED.

5.) THE RED 100-YEAR FLOODPLAIN LINE REPRESENTS THE BOUNDARY IMPORTED DIRECTLY FROM REFERENCE 5. SINCE THE ACTUAL BASE FLOOD ELEVATIONS WERE DETERMINED ON REFERENCE 5, THE BOUNDARY WAS ADJUSTED TO ALIGN WITH THE ACTUAL ELEVATIONS CONSISTENT WITH THE ACTUAL ON-SITE TOPOGRAPHIC INFORMATION. THE BLUE FLOODPLAIN LINE REFLECTS THIS ADJUSTED LINE.

GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch =300 ft.

STATE OF MARYLAND — LEONARD STEVEN KAPLAN — No. 21708 — PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

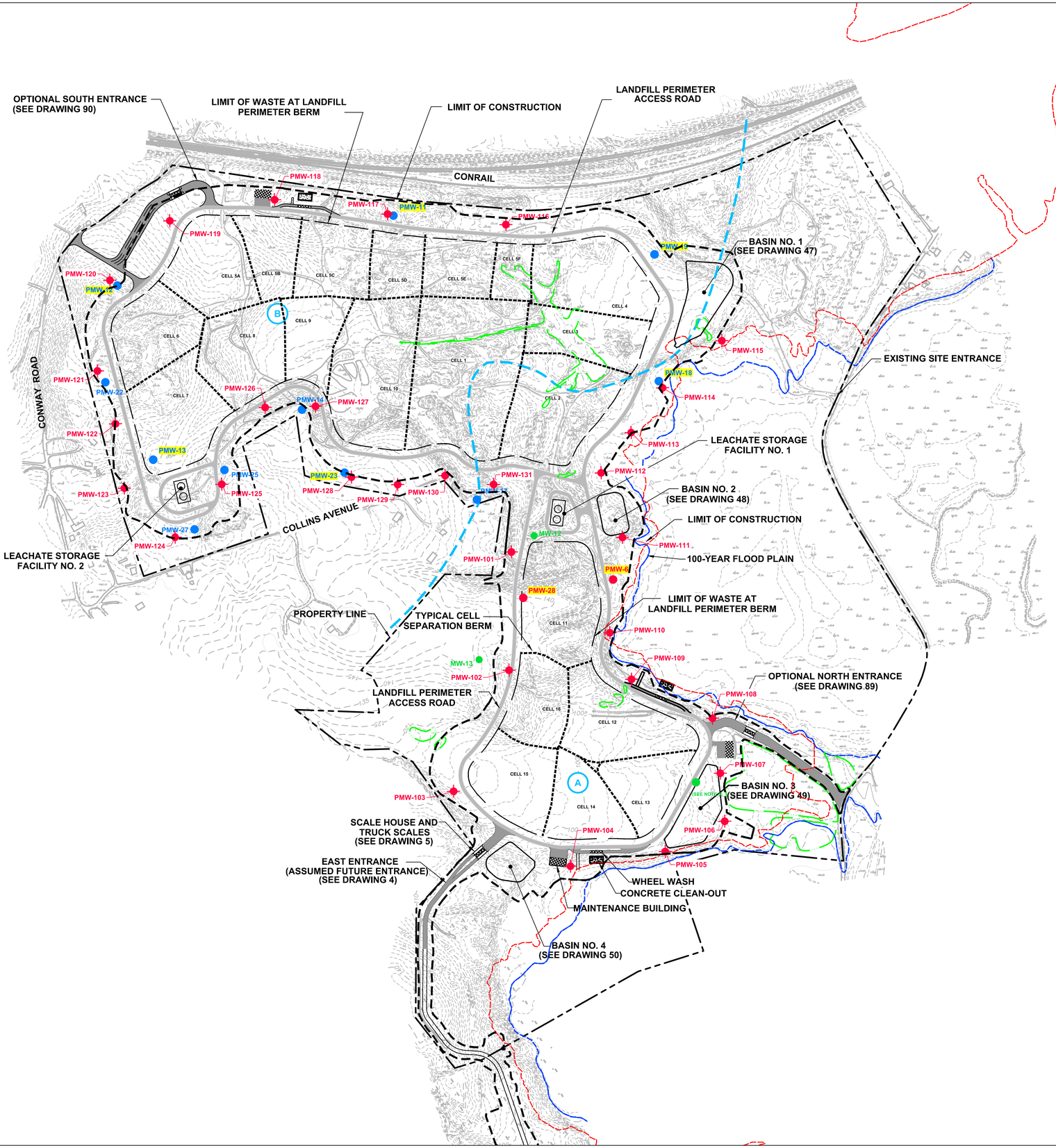
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1978 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
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EXISTING CONDITIONS

PROJECT MANAGER:	POS
CHECKED BY:	POS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 2

N:\Projects\2018\2018854 - Chesapeake Terrace LF\ACAD\MXD\RC & Phase III Application\Drawings\Final\2018854.MXD - EXISTING CONDITIONS.dwg



LEGEND

- PROPERTY LINE
- LANDFILL PERIMETER ACCESS ROAD (FUTURE)
- SITE ENTRANCE (FUTURE)
- LANDFILL LIMITS (FUTURE)
- LANDFILL CELL SEPARATION BERM (FUTURE)
- LIMIT OF DISTURBANCE (FUTURE)
- 100-YEAR FLOODPLAIN (SEE REFERENCE 5)
- MODIFIED 100-YEAR FLOODPLAIN (SEE NOTE 6)
- MW-12 — FORMER MONITORING WELLS DAMAGED BY VANDALS (NOT USEABLE) (SEE REFERENCE 2) (SEE NOTE 5)
- PMW-6 — EXISTING PERMANENT MONITORING WELL (SCREENED ABOVE MCU) (INSTALLED IN 2013)
- PMW-112 — PROPOSED PERMANENT MONITORING WELL (SCREENED ABOVE MCU)
- PMW-19 — EXISTING PERMANENT MONITORING WELL (SCREENED BELOW MCU) (INSTALLED IN 2013)
- PMW-28 — EXISTING MONITORING WELL (SCREENED ABOVE CLAY CONFINING UNIT) (SEE REFERENCE 2)
- PMW-23 — EXISTING MONITORING WELL (SCREENED BELOW CLAY CONFINING UNIT) (SEE REFERENCE 2)
- HYDROGEOLOGIC AREA DIVIDE (SEE REFERENCE 4)
- (A) HYDROGEOLOGIC AREA (SEE REFERENCE 4)
- JURISDICTIONAL DETERMINATION (JD) WETLANDS BOUNDARY (APPROX.) WITH IDENTIFICATION AND AREA (SEE REFERENCE 6)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

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GRAPHIC SCALE

300 0 150 300 600 1200

(IN FEET)
1 inch =300 ft.

STATE OF MARYLAND — RICHARD STRASHNAY — No. 21585 — PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

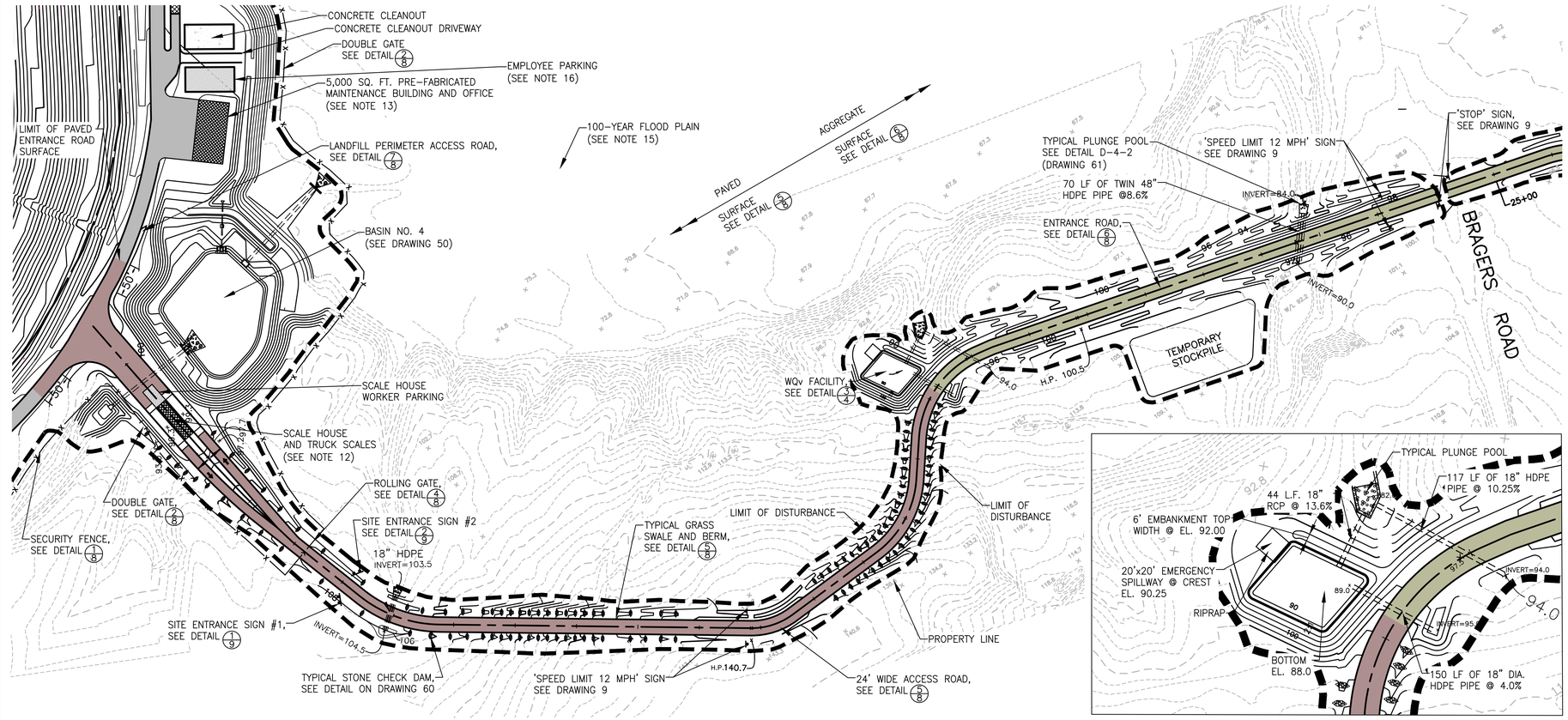
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a Montrose Environmental Group company
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PROPOSED CONDITIONS

PROJECT MANAGER: PGS
CHECKED BY: PGS
DRAWN BY: KHF
SCALE: AS NOTED
PROJECT NUMBER: 2018 - 3854
DATE: 09/03/2021

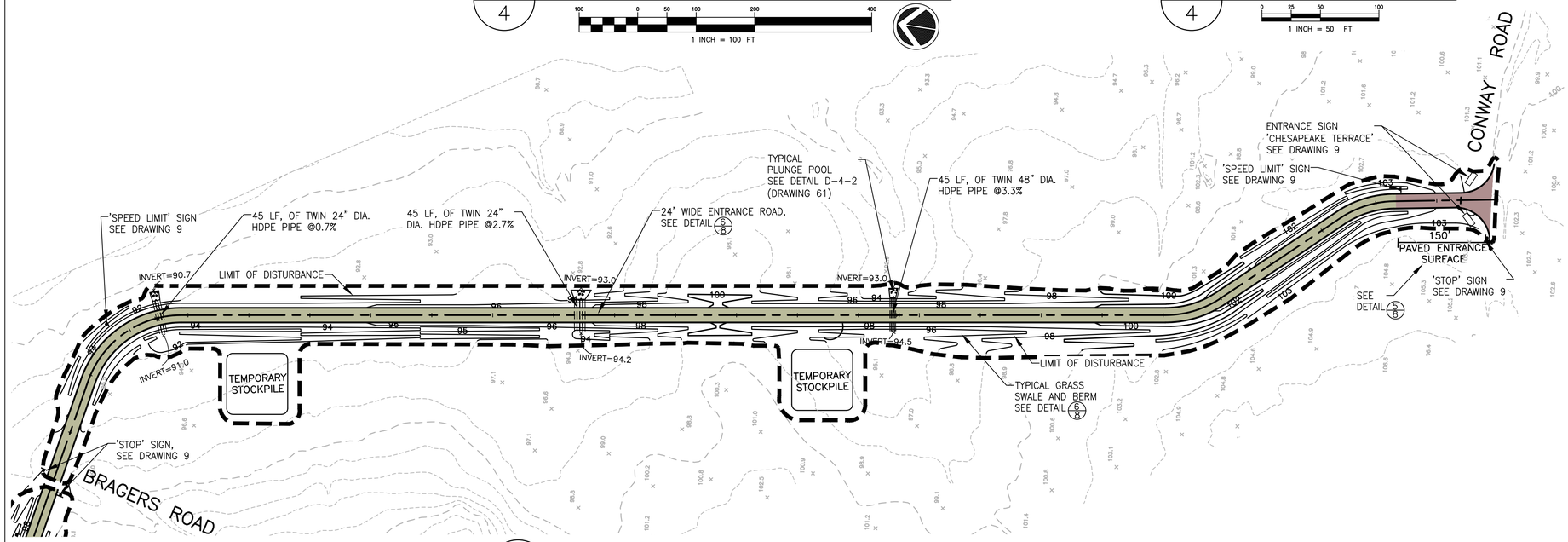
DRAWING 3

N:\Projects\2018\3854 - Chesapeake Terrace\05\CAD\MXD\PE & Phase III Application\Drawings\Final\3854_B003 - PROPOSED CONDITIONS.dwg



1/4 BRAGERS ROAD TO LANDFILL PERIMETER ACCESS ROAD

1 INCH = 100 FT



2/4 CONWAY ROAD TO BRAGERS ROAD

1 INCH = 100 FT

3/4 WQv FACILITY PLAN

1 INCH = 50 FT

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN (SEE REFERENCE 3 & NOTE 15)
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 7/8
- PIPE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8 AND NOTE 14
- ENTRANCE ROAD, AGGREGATE SURFACE, SEE DRAWING 6/8
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) EAST ENTRANCE ROAD ALIGNMENT, PAVING, WQ_v FACILITY AND GRASS SWALE IS FROM DIGITAL FILE (3 OF 8) TITLED "EAST SECTION ACCESS RD GRADING PLAN" PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012.

NOTES

1.) WQ_v IS AN ABBREVIATION WHICH STANDS FOR "WATER QUALITY VOLUME." IT IS A BASIC REQUIREMENT OF THE MARYLAND STORMWATER MANAGEMENT LAW AS DOCUMENTED IN THE MARYLAND STORMWATER DESIGN MANUAL, SECTION 2.1.

2.) THE PURPOSE OF THIS PLAN IS TO SHOW GRADING REQUIRED TO INSTALL THE STORMWATER MANAGEMENT FEATURES, FUTURE EAST ENTRANCE FACILITIES, FUTURE ACCESS ROADS, AND PERIMETER ROAD AS SHOWN.

3.) SEE PROPOSED CONDITIONS ON DRAWING 3 FOR ASSUMED EAST ENTRANCE LOCATION.

4.) SEE DRAWING 5 FOR ASSUMED EAST ENTRANCE INFRASTRUCTURE AND SCALE HOUSE LAYOUT.

5.) SEE DRAWING 55 FOR EAST ENTRANCE INITIAL GRADING SEDIMENT CONTROL PLAN.

6.) SEE DRAWING 89 FOR OPTIONAL NORTH ENTRANCE PLAN.

7.) SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.

8.) SEE DRAWING 50 FOR CONSTRUCTION OF BASIN NO. 4, EAST ENTRANCE FACILITIES, ACCESS ROADS AND PERIMETER CHANNEL NO. 8, IN THE AREA SHOWN HEREON.

9.) SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELL CONSTRUCTION REQUIREMENTS.

10.) WHEEL WASH SHALL HAVE WATER STORAGE COMPARTMENT WITH PIPE DRAIN CONNECTED TO CONCRETE CLEANOUT (SEE CONCRETE CLEANOUT DETAIL ON DRAWING 60). LANDFILL OPERATOR SHALL PUMP WATER FROM CLEANOUT TO TANKER TRUCK AS NECESSARY TO MAINTAIN WATER LEVEL <18 INCHES. WATER FROM CLEANOUT MAY BE USED FOR DUST SUPPRESSION IN ACTIVE WASTE FILL AREAS OR SHALL BE TRANSFERRED TO LEACHATE TANKS. SEDIMENT SHALL BE REMOVED WHEN LEVELS REACH 12 INCHES.

11.) ENTRANCE ROAD SHALL BE PAVED FROM PROPERTY LINE TO LANDFILL PERIMETER ACCESS ROAD. SEE ASSUMED EAST ENTRANCE ACCESS ROAD PLAN, "TYPICAL SECTION FROM SITE PROPERTY LINE TO LANDFILL", ON DRAWING 8 FOR ENTRANCE ROAD PAVEMENT CROSS SECTION. SEE PLAN BELOW FOR PAVEMENT WIDTH.

12.) SCALE HOUSE IS CONFIGURED AS SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.

13.) MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND FINAL ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.

14.) FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE TO BE VISIBLE, BUT SHALL BE CONSTRUCTED AT LIMIT OF DISTURBANCE.

15.) THE 100-YEAR FLOODPLAIN ELEVATION BETWEEN 71-72 FEET MSL IN THIS AREA OF THE SITE; BASED UPON MODELING BY FEMA SHOWN ON FIRM MAO NO 24003C0136E DATED OCTOBER 16, 2012, MODIFIED TO ALIGN WITH SITE TOPOGRAPHY BASED UPON DETERMINED BASE FLOOD ELEVATIONS.

16.) EMPLOYEE PARKING SHALL BE "BACK-IN" ONLY.

STATE OF MARYLAND — RICHARD STRICKMAN — No. 21708 — PROFESSIONAL ENGINEER

REVISION: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

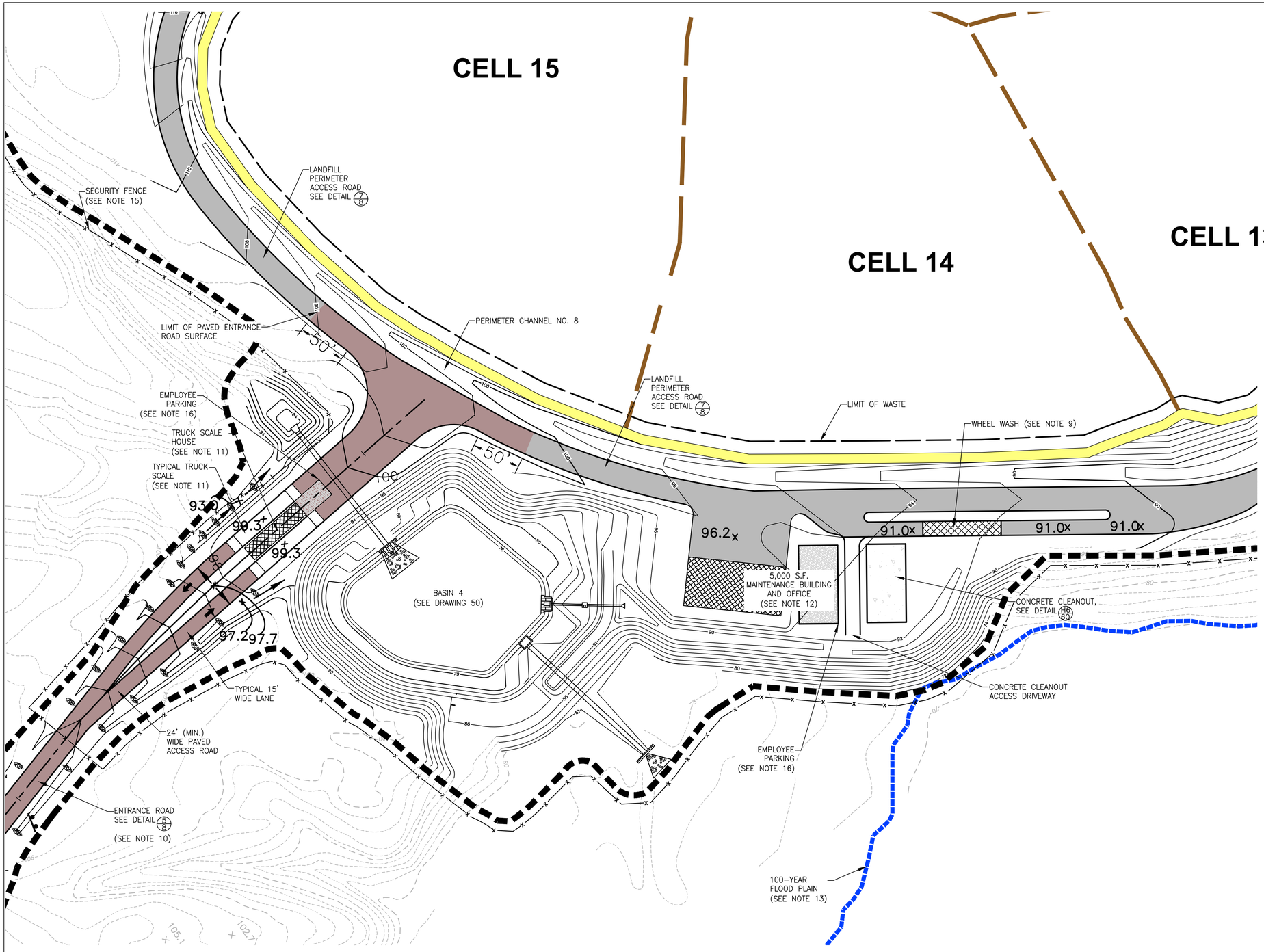
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EAST ENTRANCE - ACCESS ROAD PLAN

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 4

N:\Projects\2018\3854 - Chesapeake Terrace LF\CAD\WORK\E & P\Final Application\Drawings\Final\3854004 - EAST ENTRANCE ACCESS ROAD.PLAN.dwg



EAST ENTRANCE PLAN

50 0 25 50 100 200

1 INCH = 50 FT

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN (SEE REFERENCE 3 & NOTE 13)
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION LINE
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/67
- PIPE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 7
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- PERIMETER BERM, SEE DETAIL 2/16

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) EAST ENTRANCE ROAD ALIGNMENT, PAVING, WQ_f FACILITY BASIN NO.4, AND ASSOCIATED GRADING IS FROM DIGITAL FILE (4 OF 68) TITLED "ASSUMED SITE ACCESS EAST ENTRANCE MASS GRADING," PREPARED BY CENTURY ENGINEERING INC., DATED MAY 2018

3.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3.

NOTES

1.) THE PURPOSE OF THIS PLAN IS TO SHOW GRADING REQUIRED TO INSTALL THE STORMWATER MANAGEMENT FEATURES, FUTURE EAST ENTRANCE FACILITIES, FUTURE ACCESS ROADS, AND PERIMETER ROAD AS SHOWN.

2.) SEE PROPOSED CONDITIONS ON DRAWING 2 FOR ASSUMED EAST ENTRANCE LOCATION.

3.) SEE DRAWING 4 FOR ASSUMED EAST ENTRANCE LAYOUT.

4.) SEE DRAWING 55 FOR EAST ENTRANCE INITIAL GRADING SEDIMENT CONTROL PLAN.

5.) SEE DRAWING 89 FOR OPTIONAL NORTH ENTRANCE PLAN.

6.) SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.

7.) SEE DRAWING 50 FOR CONSTRUCTION OF BASIN NO. 4, EAST ENTRANCE FACILITIES, ACCESS ROADS AND PERIMETER CHANNEL NO. 8, IN THE AREA SHOWN HEREON.

8.) SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELL CONSTRUCTION REQUIREMENTS.

9.) WHEEL WASH SHALL HAVE WATER STORAGE COMPARTMENT WITH PIPE DRAIN CONNECTED TO CONCRETE CLEANOUT (SEE CONCRETE CLEANOUT DETAIL ON DRAWING 60). LANDFILL OPERATOR SHALL PUMP WATER FROM CLEANOUT TO TANKER TRUCK AS NECESSARY TO MAINTAIN WATER LEVEL <18 INCHES. WATER FROM CLEANOUT MAY BE USED FOR DUST SUPPRESSION IN ACTIVE WASTE FILL AREAS OR SHALL BE TRANSFERRED TO LEACHATE TANKS. SEDIMENT SHALL BE REMOVED WHEN LEVEL REACH 12 INCHES.

10.) ENTRANCE ROAD SHALL BE PAVED FROM PROPERTY LINE TO LANDFILL PERIMETER ACCESS ROAD. SEE ASSUMED EAST ENTRANCE ACCESS ROAD PLAN, "TYPICAL SECTION FROM SITE PROPERTY LINE TO LANDFILL", ON DRAWING 8 FOR ENTRANCE ROAD PAVEMENT CROSS SECTION. SEE PLAN BELOW FOR PAVEMENT WIDTH.

11.) SCALE HOUSE IS CONFIGURED AS SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.

12.) MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND FINAL ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.

13.) THE 100-YEAR FLOODPLAIN ELEVATION BETWEEN 71-72 FEET MSL IN THIS AREA OF THE SITE; BASED UPON MODELING BY FEMA SHOWN ON FIRM MAO NO 24003C0136E DATED OCTOBER 16, 2012, MODIFIED TO ALIGN WITH SITE TOPOGRAPHY BASED UPON DETERMINED BASE FLOOD ELEVATIONS.

14.) THE EAST ENTRANCE IS PLANNED AS THE MAIN SITE ENTRANCE. AS WITH EVERY ITEM AT A LANDFILL, THE OPTIONAL NORTH OR SOUTH ENTRANCE ARE PRESENTED FOR CONSTRUCTION IN THE EVENT THE EAST ENTRANCE IS NOT CONSTRUCTED AND ONE OF THE OTHER ENTRANCES IS PURSUED.

15.) FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE TO BE VISIBLE, BUT SHALL BE CONSTRUCTED AT LIMIT OF DISTURBANCE.

16.) EMPLOYEE PARKING SHALL BE "BACK-IN" ONLY.

17.) SEE DRAWINGS 10 AND 11 FOR TOP OF SUBGRADE ELEVATIONS IN THE CELLS.

STATE OF MARYLAND — RAYMOND STOCKMAN — 21615 — REGISTERED PROFESSIONAL ENGINEER

REVISION: REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
DATE: 9/03/2021

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

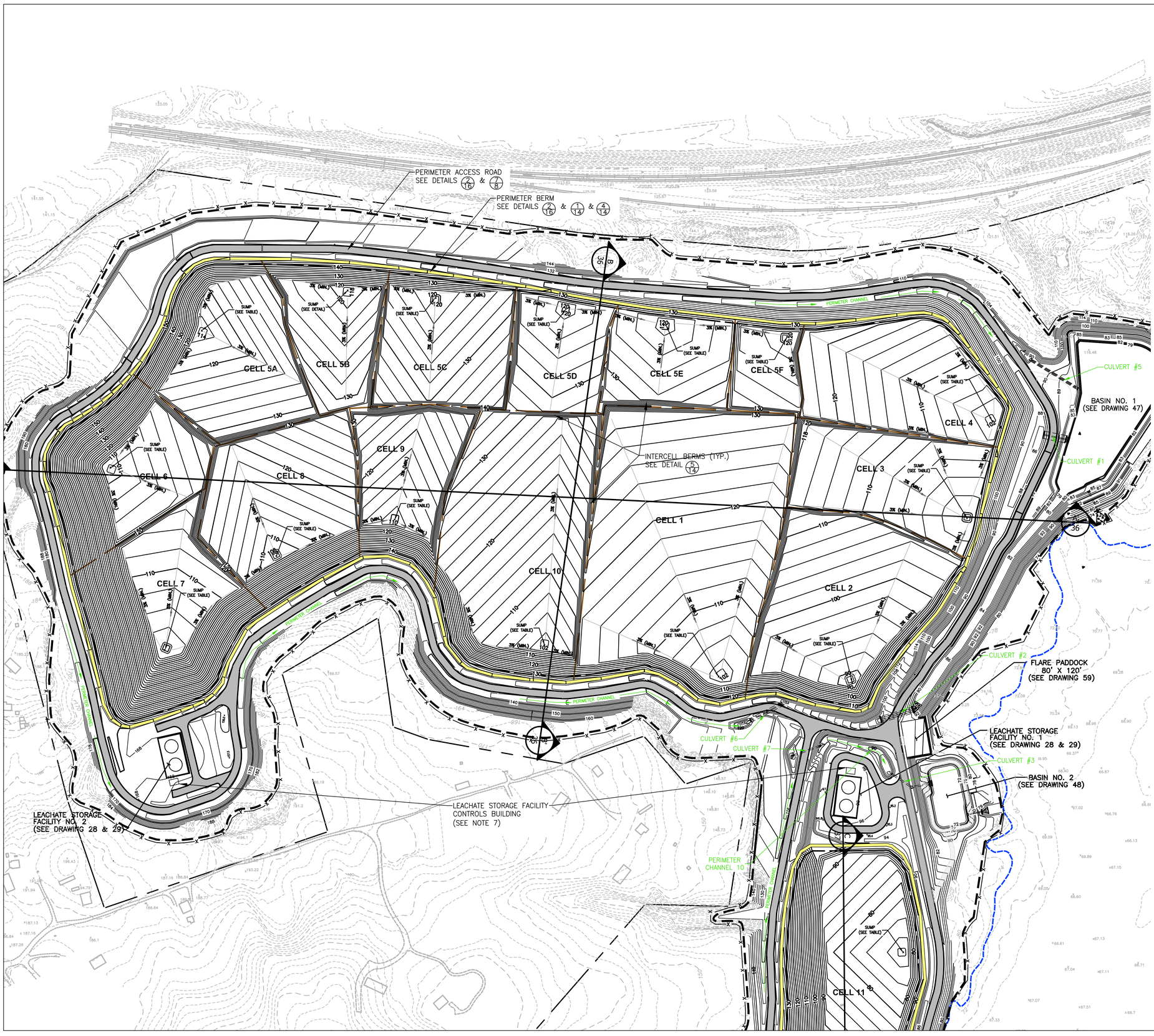
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EAST ENTRANCE - SCALE HOUSE AND INFRASTRUCTURE

PROJECT MANAGER:	POS	SCALE:	AS NOTED
CHECKED BY:	POS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 5

N:\Projects\2018\3854 - Chesapeake Terrace\07-CAD\DWG\IC & Phase III Application\Drawings\Final\20180854 BOD - EAST ENTRANCE SCALEHOUSE AND INFRASTRUCTURE.dwg



LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REFERENCE 2 & NOTE 6)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PIPE
- PERIMETER CHANNEL FLOW DIRECTION
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ACCESS ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- SIGNS, SEE DRAWING 9
- TYPICAL WETLANDS SEE REFERENCE 3

REFERENCES

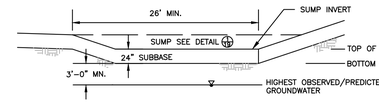
1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2.) THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.
3.) JURISDICTIONAL WETLAND BOUNDARIES OBTAINED FROM FIGURES ATTACHED TO THE ARMY CORPS OF ENGINEERS PUBLIC NOTICE DATED NOVEMBER 22, 1991, AND AS SUBSEQUENTLY AMENDED IN WRITING BY MCCARTHY AND ASSOCIATES ON APRIL 2, 1997

NOTES

1.) WHILE FEMA HAS RE–ASSESSED AND MODIFIED THE 100 YEAR FLOODPLAIN IN THE VICINITY OF THE SITE, THE REVISED 100–YEAR FLOODPLAIN BASE ELEVATIONS NEARS CELLS 2, 3 AND 4 ARE BETWEEN 72 AND 73 FEET MSL. THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2.) THE GRADES SHOWN ON THIS DRAWING REPRESENT THE BOTTOM OF THE 24" THICK PREPARED SUBBASE LAYER. REFER TO DRAWING 14 FOR LINER SYSTEM DETAILS.
3.) MINIMUM SLOPE AT BOTTOM OF CELL IS 3%. INTERIOR SIDESLOPES ARE 33% MAX.
4.) FOR STORMWATER MANAGEMENT FEATURES, REFER TO DRAWINGS 38 THROUGH 44.
5.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.
6.) THE 100–YEAR FLOODPLAIN ELEVATION BETWEEN 71–72 FEET MSL IN THIS AREA OF THE SITE; BASED UPON MODELING BY FEMA SHOWN ON FIRM MAO NO 24003C0136E DATED OCTOBER 16, 2012, MODIFIED TO ALIGN WITH SITE TOPOGRAPHY BASED UPON DETERMINED BASE FLOOD ELEVATIONS.
7.) THE LEACHATE STORAGE FACILITY CONTROL BUILDING SHALL HOUSE MASTER CONTROL PANELS SHOWN ON DRAWING 27.
8.) THE CELL FLOOR SHALL HAVE A MINIMUM OF 2 PERCENT SLOPE POST–SETTLEMENT AT ALL LOCATIONS.

CELL AREAS AND CRITICAL SUMP ELEVATION

CELL No	CELL AREA (AC)	BOTTOM OF SUBBASE AT SUMP	SUMP INVERT ELEV.	HIGHEST OBSERVED/ PREDICTED GW BELOW SUMP
1	13.2	101.0	103.0	87.5
2	7.5	86.0	88.0	78.5
3	4.9	98.0	100.0	94.5
4	5.5	100.5	102.5	97.5
5A	5.6	113.0	115.0	110.0
5B	3.4	116.5	118.5	113.5
5C	4.4	118.0	120.0	115.0
5D	2.9	119.5	121.5	116.5
5E	3.2	119.5	121.5	116.5
5F	1.7	118.0	120.0	115.0
6	5.2	107.0	109.0	103.8
7	6.7	100.0	102.0	97.0
8	6.0	106.0	108.0	103.0
9	4.0	109.2	111.2	106.2
10	9.6	101.0	103.0	98.0



GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND
RAYMOND STEVEN KAY
No. 21708
PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

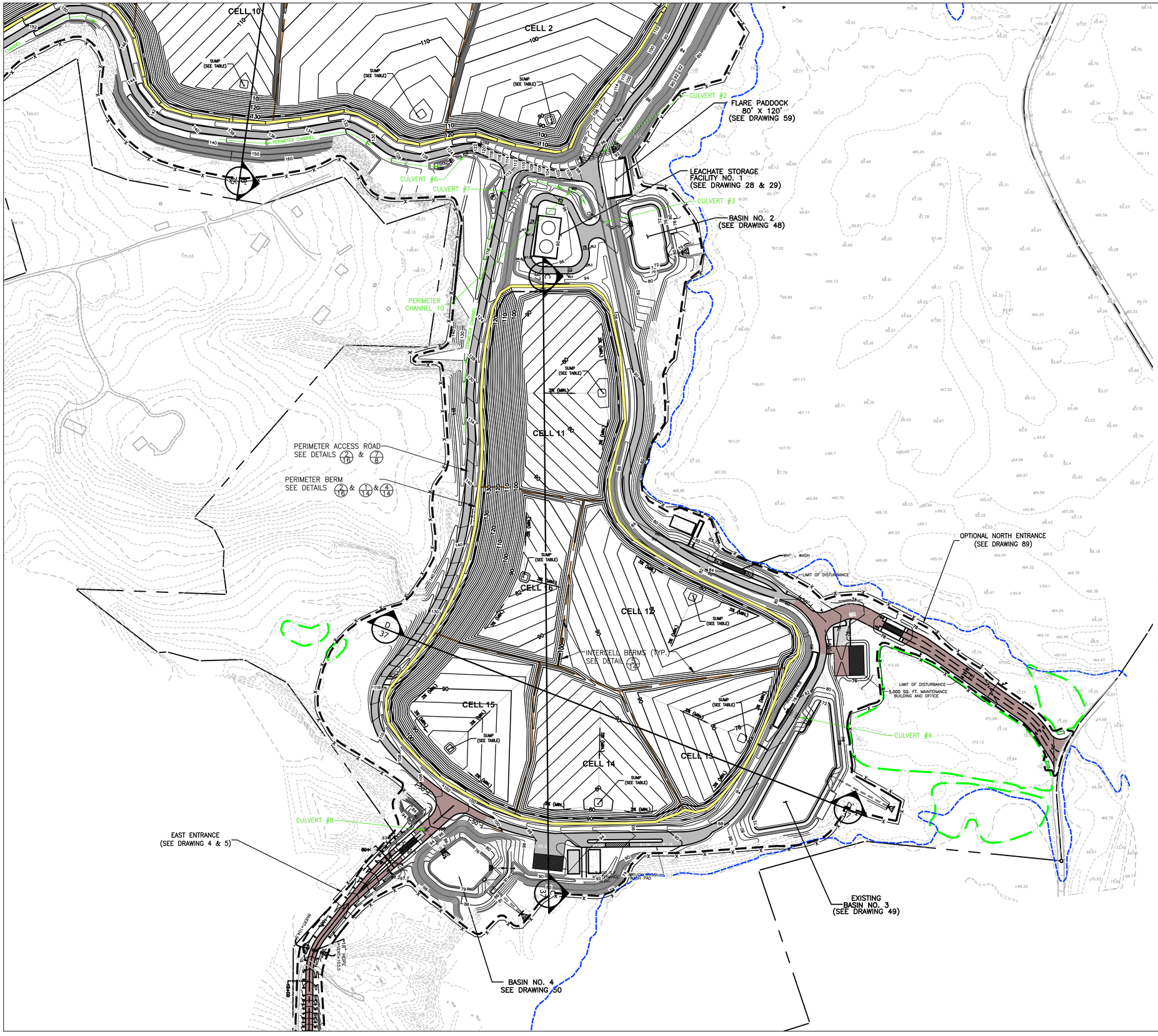
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a Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

BOTTOM OF SUBBASE GRADING PLAN – WEST (CELL 1–10)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 6

G:\Projects\2018\2018854 - Chesapeake Terrace\11\CAD\WORK & Phase III Application\Drawings\Final\2018854 BSN - BOTTOM OF SUBBASE GRADING PLAN - WEST (CELL 1-10).dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN SEE REFERENCE 2
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PIPE
- PERIMETER CHANNEL FLOW DIRECTION
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 3/8 AND 8/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- TYPICAL WETLANDS SEE REFERENCE 3

REFERENCES

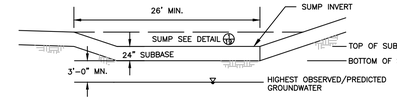
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3.) JURISDICTIONAL WETLAND BOUNDARIES OBTAINED FROM FIGURES ATTACHED TO THE ARMY CORPS OF ENGINEERS PUBLIC NOTICE DATED NOVEMBER 22, 1991, AND AS SUBSEQUENTLY AMENDED IN WRITING BY MCCARTHY AND ASSOCIATES ON APRIL 2, 1997

NOTES

1.) WHILE FEMA HAS RE-ASSESSED AND MODIFIED THE 100 YEAR FLOODPLAIN IN THE VICINITY OF THE SITE, THE REVISED 100-YEAR FLOODPLAIN BASE ELEVATIONS NEARS CELLS 2, 3 AND 4 ARE BETWEEN 72 AND 73 FEET MSL. THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2.) THE GRADES SHOWN ON THIS DRAWING REPRESENT THE BOTTOM OF THE 24" THICK PREPARED SUBBASE LAYER. REFER TO DRAWING 14 FOR LINER SYSTEM DETAILS.
3.) MINIMUM SLOPE AT BOTTOM OF CELL IS 3%. INTERIOR SIDESLOPES ARE 33% MAX.
4.) FOR STORMWATER MANAGEMENT FEATURES, REFER TO DRAWINGS 38 THROUGH 44.
5.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.
6.) THE 100-YEAR FLOODPLAIN ELEVATION BETWEEN 71-72 FEET MSL IN THIS AREA OF THE SITE, BASED UPON MODELING BY FEMA SHOWN ON FIRM MAO NO 24003C0136E DATED OCTOBER 16, 2012, MODIFIED TO ALIGN WITH SITE TOPOGRAPHY BASED UPON DETERMINED BASE FLOOD ELEVATIONS.
7.) THE LEACHATE STORAGE FACILITY CONTROL BUILDING SHALL HOUSE MASTER CONTROL PANELS SHOWN ON DRAWING 27.
8.) THE CELL FLOOR SHALL HAVE A MINIMUM OF 2 PERCENT SLOPE POST-SETTLEMENT AT ALL LOCATIONS.

CELL AREAS AND CRITICAL SUMP ELEVATION

CELL No	CELL AREA (AC)	BOTTOM OF SUBBASE AT SUMP	SUMP INVERT ELEV.	HIGHEST OBSERVED/ PREDICTED GW BELOW SUMP
11	7.0	71.0	73.0	68.0
12	6.7	71.5	73.5	68.5
13	3.4	75.0	77.0	72.0
14	4.3	77	79.0	74.0
15	4.7	79.0	82.0	76.0
16	4.5	78.0	80.0	75.0



GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
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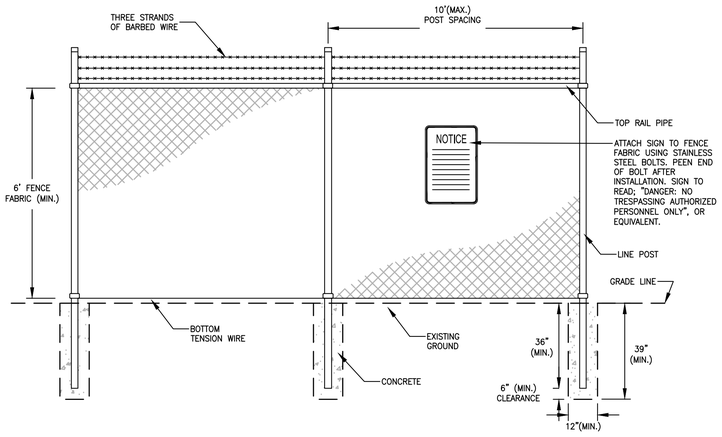
BOTTOM OF SUBBASE GRADING PLAN - EAST (CELL 11-16)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE: AS NOTED	
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

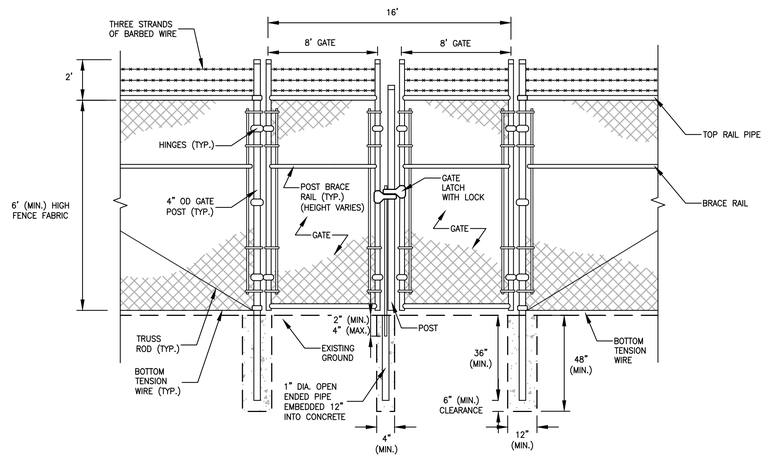
DRAWING 7

STATE OF MARYLAND
RICHARD STICKMAN
No. 21708
PROFESSIONAL ENGINEER

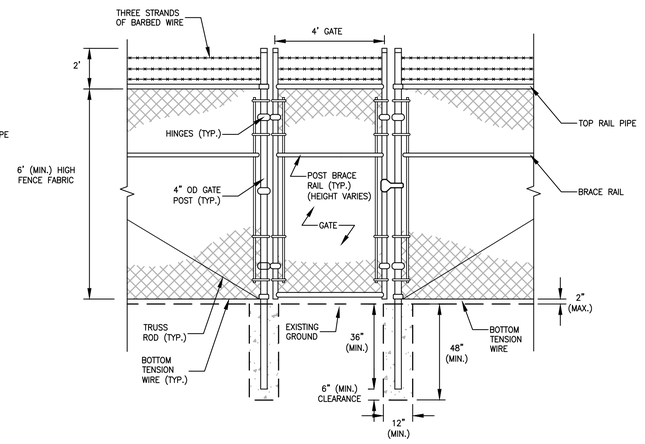
G:\Projects\2018\3854 - Chesapeake Terrace LFC\ACDWG\SC & Phase III Application\Drawings\Final\3854004 8007 - BOTTOM OF SUBBASE GRADING PLAN - EAST (CELL 11-16).dwg



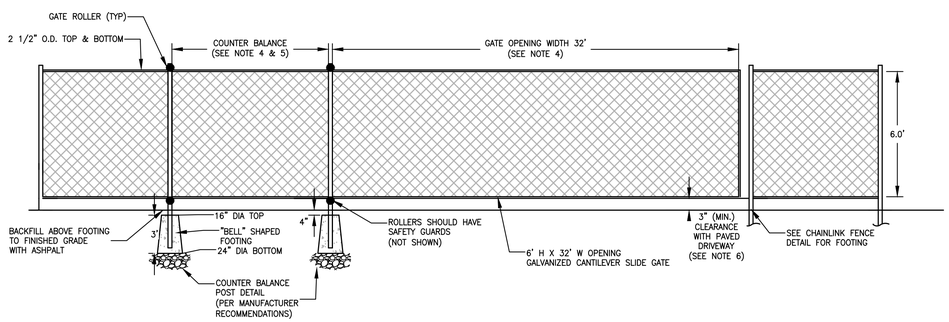
1/8 SECURITY FENCE
NOT TO SCALE



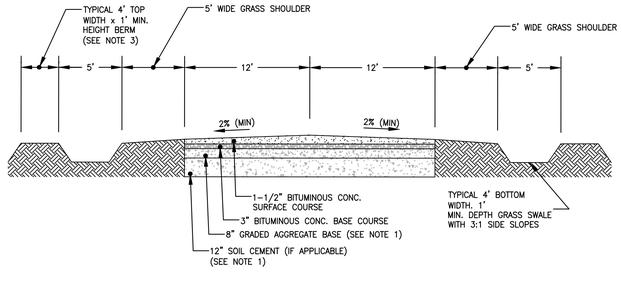
2/8 DOUBLE-WIDE GATE
NOT TO SCALE



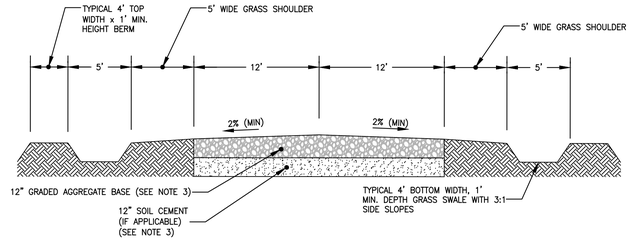
3/8 SINGLE (MAN) GATE
NOT TO SCALE



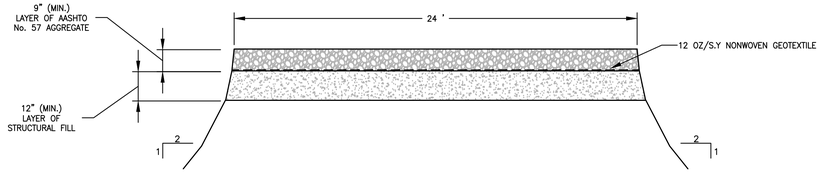
4/8 ROLLING ENTRANCE FENCE
NOT TO SCALE



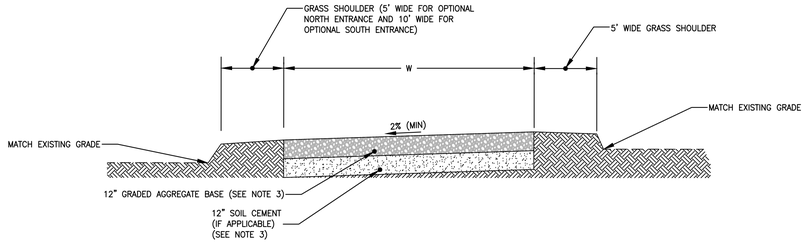
5/8 PAVED EAST ENTRANCE ROAD WITH GRASS SWALE AND BERM (SITE PROPERTY LINE TO LANDFILL)
NOT TO SCALE



6/8 STONE EAST ENTRANCE ROAD WITH GRASS SWALE AND BERM (CONWAY ROAD TO SITE PROPERTY LINE)
NOT TO SCALE



7/8 LANDFILL PERIMETER ACCESS ROAD
NOT TO SCALE



8/8 OPTIONAL ENTRANCE ROADS
NOT TO SCALE

ROAD WIDTH "W" WILL BE 45' FOR OPTIONAL NORTH ENTRANCE OR 60' FOR OPTIONAL SOUTH ENTRANCE QUEUE LANES

NOTES

1.) PROVIDE 8" GRADED AGGREGATE BASE ON ROAD SUBGRADE WHICH HAS BEEN COMPACTED TO 95 PERCENT MODIFIED PROCTOR (AASHTO T-180). FOR POOR SUBGRADE, 12" SOIL CEMENT MAY BE USED. ALL ROAD CONSTRUCTION SHALL BE PER RECOMMENDATION OF A PROFESSIONAL GEOTECHNICAL ENGINEER REGISTERED IN THE STATE OF MARYLAND.
2.) OPTIONAL NORTH ENTRANCE PAVEMENT CONSTRUCTION SHALL BE PER THE TYPICAL SECTION ON DETAIL 8 ON THIS DRAWING. OPTINAL SOUTH ENTRACNE PAVEMENT CONSTRUCTION SHALL BE SAME AS DETIAL 6 ON THIS PAGE FROM CONWAY ROAD.
3.) PROVIDE GRADED AGGREGATE BASE ON ROAD SUBGRADE WHICH HAS BEEN COMPACTED TO 95 PERCENT MODIFIED PROCTOR (AASHTO T-180). FOR POOR SUBGRADE, 12" SOIL CEMENT MAY BE USED. ALL ROAD CONSTRUCTION SHALL BE PER RECOMMENDATION OF A PROFESSIONAL GEOTECHNICAL ENGINEER REGISTERED IN THE STATE OF MARYLAND.
4.) SEE MANUFACTURER (HOOVER FENCE OR APPROVED EQUAL) FOR MAXIMUM GATE OPENING AND COUNTER BALANCE SIZE.
5.) ALLOW ROOM FOR OPENING PLUS COUNTER BALANCE WHEN IN OPEN POSITION. (GATE WIDTH + COUNTER BALANCE).
6.) CONFIRM CLEARANCE TO FINISHED GRADE PRIOR TO INSTALLATION.

STATE OF MARYLAND
KEVIN K. SMITH
No. 21708
PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

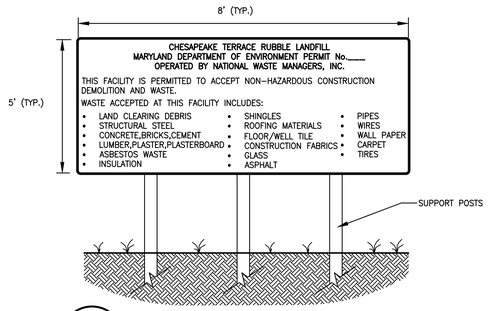
ADVANCED GeoServices
a Montrose Environmental Group company
1978 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

ENTRANCE ACCESS ROAD DETAILS

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 – 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

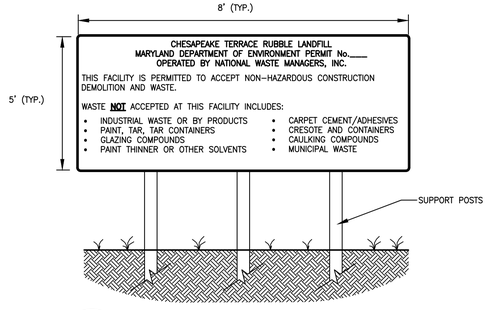
DRAWING 8

N:\Projects\2018\3018854 - Chesapeake Terrace\1.0\CAD\ARGISC & Phase III Application\Drawings\Final\3018854 8008 - ENTRANCE ACCESS ROAD DETAILS.dwg



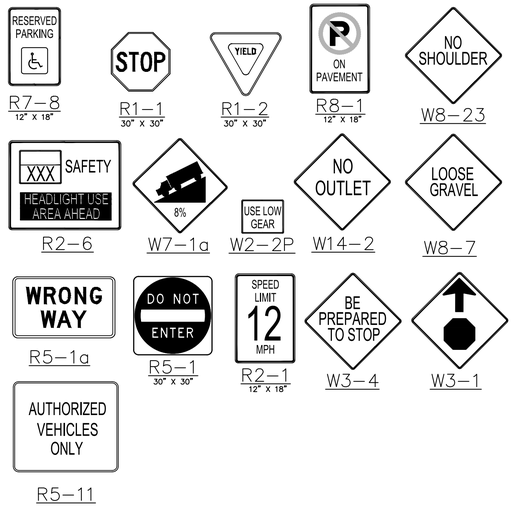
1/9 SITE ENTRANCE SIGN #1

NOT TO SCALE



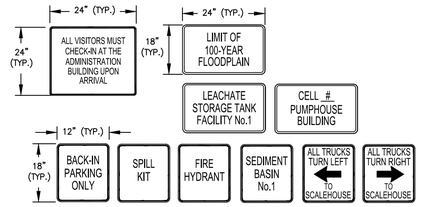
2/9 SITE ENTRANCE SIGN #2

NOT TO SCALE



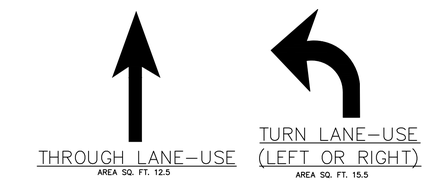
3/9 MARYLAND DOT SPECIFIED SIGNS

NOT TO SCALE



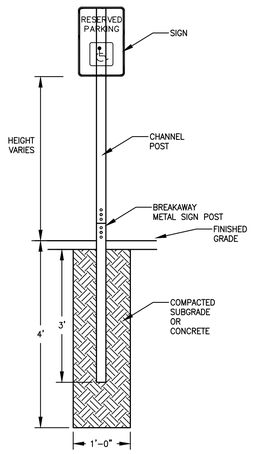
4/9 SITE SPECIFIED SIGNS

NOT TO SCALE



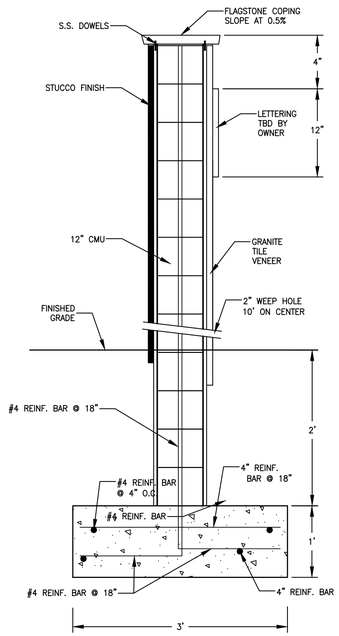
5/9 TRAFFIC ARROWS

NOT TO SCALE



6/9 SIGN INSTALLATION DETAIL

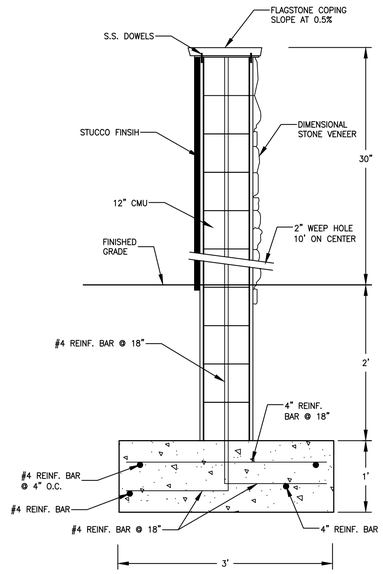
NOT TO SCALE



FORMAL ENTRANCE SIGN - WALL #4 (UPPER)

7/9

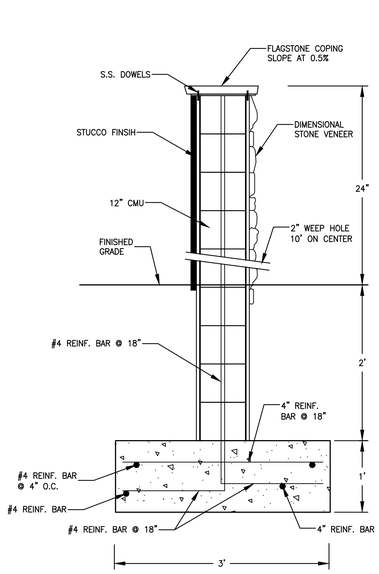
NOT TO SCALE



FORMAL ENTRANCE SIGN - WALLS #2&3 (MID)

8/9

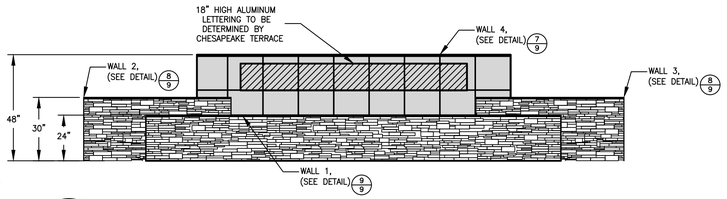
NOT TO SCALE



FORMAL ENTRANCE SIGN - WALL #1 (LOWER)

9/9

NOT TO SCALE



10/9 FORMAL ENTRANCE SIGN - ELEVATION

NOT TO SCALE

STATE OF MARYLAND
RAYMOND STEVEN KAWA
No. 21615
PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

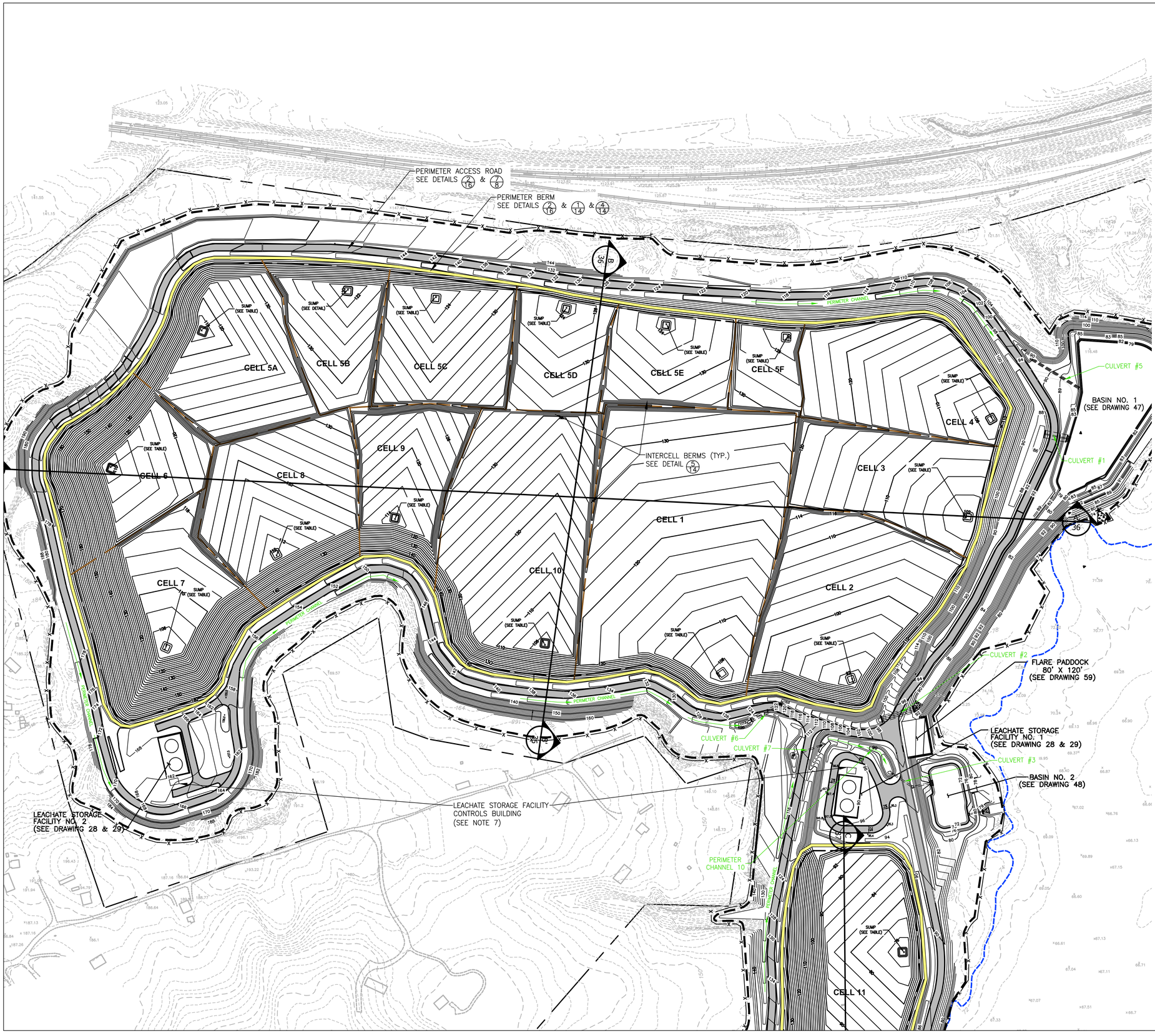
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T: 856.354.2273, F: 856.354.8236 www.advancedgeoservices.com

SITE SECURITY DETAILS

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE: AS NOTED	
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 9

N:\Projects\2018\3854 - Chesapeake Terrace LFC\ADV\DWG\IC & P\Issued for Application\Drawings\Final\3854 IC&P - SITE SECURITY DETAILS.dwg



LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN SEE REFERENCE 2
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PIPE
- PERIMETER CHANNEL FLOW DIRECTION
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8 AND 6/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- TYPICAL WETLANDS SEE REFERENCE 3

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

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3.) JURISDICTIONAL WETLAND BOUNDARIES OBTAINED FROM FIGURES ATTACHED TO THE ARMY CORPS OF ENGINEERS PUBLIC NOTICE DATED NOVEMBER 22, 1991, AND AS SUBSEQUENTLY AMENDED IN WRITING BY MCCARTHY AND ASSOCIATES ON APRIL 2, 1997

NOTES

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2.) THE GRADES SHOWN ON THIS DRAWING REPRESENT THE TOP OF THE 24" THICK PREPARED SUBBASE LAYER. REFER TO DRAWING 14 FOR LINER SYSTEM DETAILS.

3.) MINIMUM CONSTRUCTED SLOPE AT BOTTOM OF CELL IS 3%. INTERIOR SIDESLOPES ARE 33% MAX.

4.) FOR STORMWATER MANAGEMENT FEATURES, REFER TO DRAWINGS 38 THROUGH 44.

5.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.

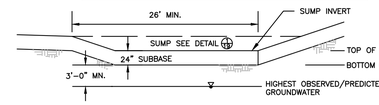
6.) THE 100–YEAR FLOODPLAIN ELEVATION BETWEEN 71–72 FEET MSL IN THIS AREA OF THE SITE; BASED UPON MODELING BY FEMA SHOWN ON FIRM MAO NO 24003C0136E DATED OCTOBER 16, 2012, MODIFIED TO ALIGN WITH SITE TOPOGRAPHY BASED UPON DETERMINED BASE FLOOD ELEVATIONS.

7.) THE LEACHATE STORAGE FACILITY CONTROL BUILDING SHALL HOUSE MASTER CONTROL PANELS SHOWN ON DRAWING 27.

8.) THE CELL FLOOR SHALL HAVE A MINIMUM OF 2 PERCENT SLOPE POST–SETTLEMENT AT ALL LOCATIONS.

CELL AREAS AND CRITICAL SUMP ELEVATION

CELL No	CELL AREA (AC)	BOTTOM OF SUBBASE AT SUMP	SUMP INVERT ELEV.	HIGHEST OBSERVED/ PREDICTED GW BELOW SUMP
1	13.2	101.0	103.0	87.5
2	7.5	86.0	88.0	78.5
3	4.9	98.0	100.0	94.5
4	5.5	100.5	102.5	97.5
5A	5.6	113.0	115.0	110.0
5B	3.4	116.5	118.5	113.5
5C	4.4	118.0	120.0	115.0
5D	2.9	119.5	121.5	116.5
5E	3.2	119.5	121.5	116.5
5F	1.7	118.0	120.0	115.0
6	5.2	107.0	109.0	103.8
7	6.7	100.0	102.0	97.0
8	6.0	106.0	108.0	103.0
9	4.0	109.2	111.2	106.2
10	9.6	101.0	103.0	98.0



GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND · RALPH OSBORNE STARKMAN · 21585 · REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

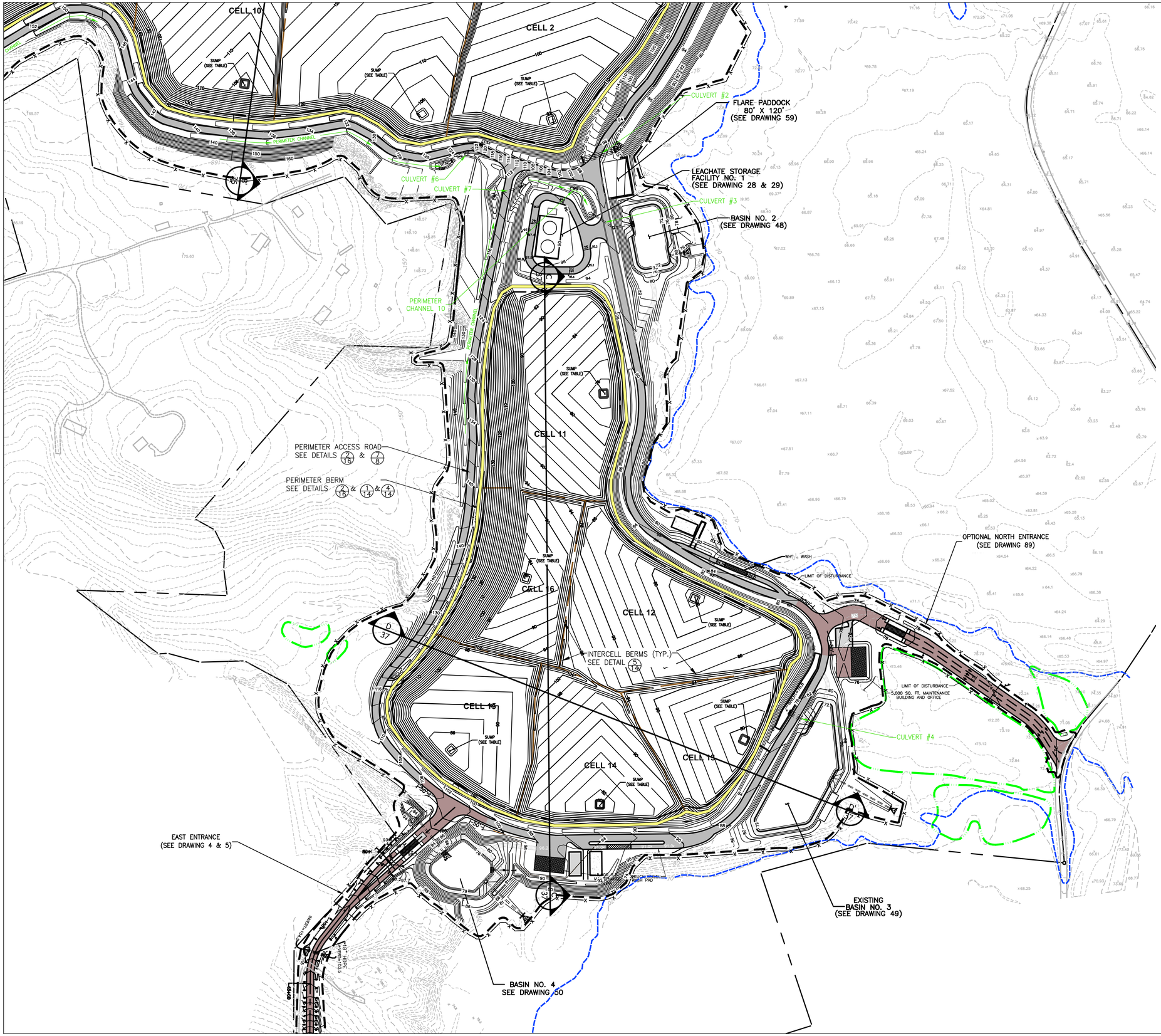
ADVANCED GeoServices
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1879 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 FX: 856.354.8236 www.advancedgeoservices.com

TOP OF SUBBASE GRADING PLAN – WEST (CELL 1–10)

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 10

G:\Projects\2018\3854 - Chesapeake Terrace LF\CAD\DWG\BE & Phase III Application\Drawings\Final\20181854 BOD - TOP OF SUBBASE GRADING PLAN - WEST (CELL 1-10).dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN SEE REFERENCE 2
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PIPE
- PERIMETER CHANNEL FLOW DIRECTION
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8 AND 8/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- TYPICAL WETLANDS SEE REFERENCE 3

REFERENCES

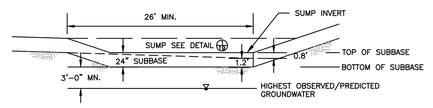
1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.
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NOTES

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2.) THE GRADES SHOWN ON THIS DRAWING REPRESENT THE TOP OF THE 24" THICK PREPARED SUBBASE LAYER. REFER TO DRAWING 14 FOR LINER SYSTEM DETAILS.
3.) MINIMUM CONSTRUCTED SLOPE AT BOTTOM OF CELL IS 3%. INTERIOR SIDESLOPES ARE 33% MAX.
4.) FOR STORMWATER MANAGEMENT FEATURES, REFER TO DRAWINGS 38 THROUGH 44.
5.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.
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8.) THE CELL FLOOR SHALL HAVE A MINIMUM OF 2 PERCENT SLOPE POST-SETTLEMENT AT ALL LOCATIONS.

CELL AREAS AND CRITICAL SUMP ELEVATION

CELL No	CELL AREA (AC)	BOTTOM OF SUBBASE AT SUMP	SUMP INVERT ELEV.	HIGHEST OBSERVED/ PREDICTED GW BELOW SUMP
11	7.0	71.0	73.0	68.0
12	6.7	71.5	73.5	68.5
13	3.4	75.0	77.0	72.0
14	4.3	77	79.0	74.0
15	4.7	79.0	82.0	76.0
16	4.5	78.0	80.0	75.0



GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1973 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 | F: 856.354.8236 | www.advancedgeoservices.com

TOP OF SUBBASE GRADING PLAN - EAST (CELL 11-16)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 11

I:\Projects\2018\3018354 - Chesapeake Terrace\4-PC\ADVENGR\C & P Phase III Application\Drawings\Final\3018354-B011 - TOP OF SUBBASE GRADING PLAN - EAST (CELL 11-16).dwg

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN SEE REFERENCE 2
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PIPE
- PERIMETER CHANNEL FLOW DIRECTION
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8 AND 8/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- TYPICAL WETLANDS SEE REFERENCE 3

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2.) LANDFILL CROSS-SECTIONS ARE PRESENTED ON DRAWINGS 45 AND 46.

3.) THE GRADES ON THIS DRAWING REPRESENT THE TOP OF SELECT WASTE (48" THICK). REFER TO DRAWING 14 FOR DETAILS

4.) LEACHATE COLLECTION SYSTEM LAYOUT AND DETAILS ARE PROVIDED ON DRAWINGS 17 THROUGH 21.

5.) MINIMUM SLOPES ON THE CELL FLOOR ARE 3%. MAXIMUM SLOPE ON INTERIOR SIDESLOPES IS 33% PRIOR TO FILLING.

6.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
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ANNE ARUNDEL COUNTY, MARYLAND

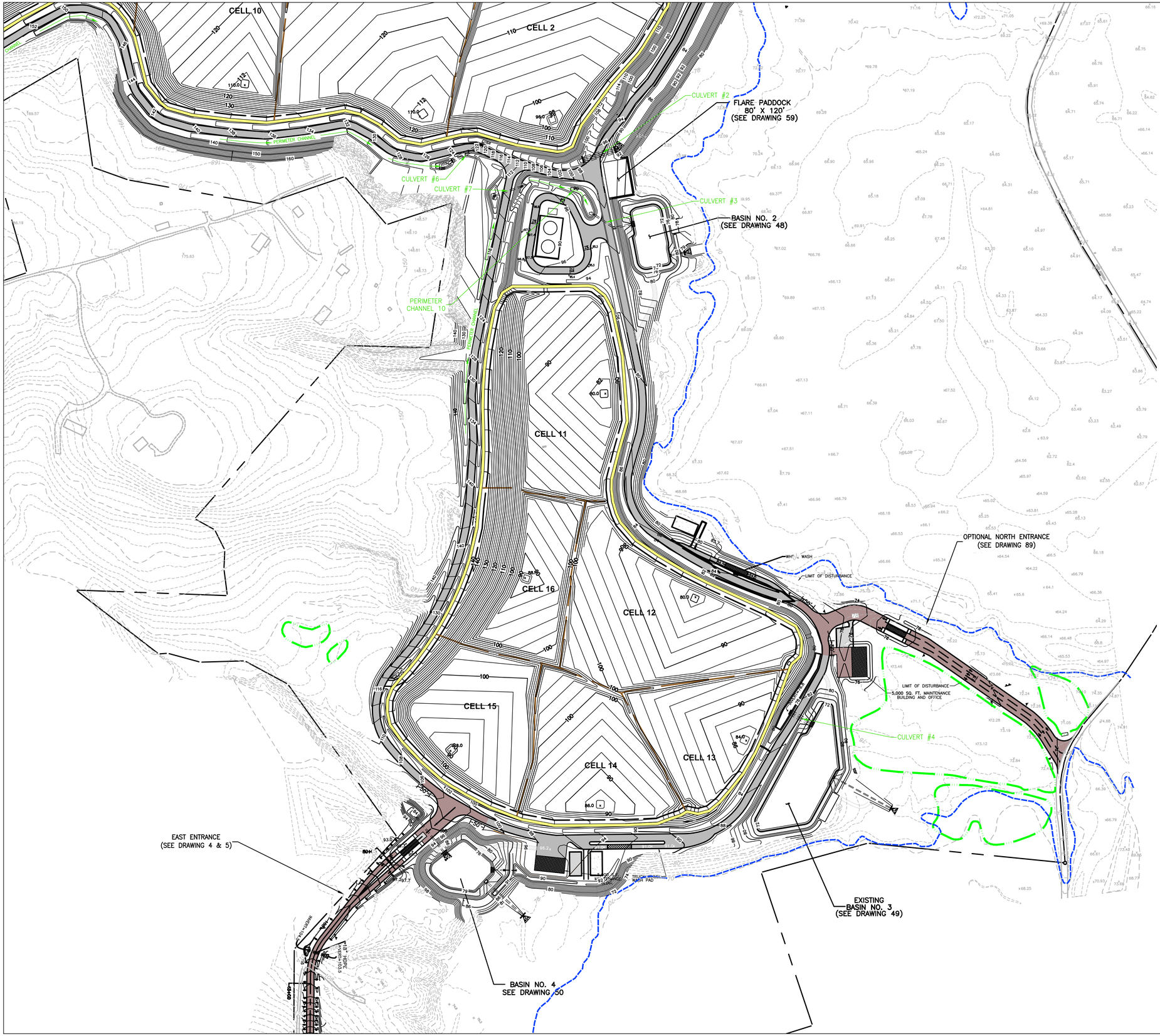
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TOP OF SELECT WASTE
GRADING PLAN -
WEST (CELL 1-10)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 - 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

DRAWING 12

N:\Projects\2018\3854 - Chesapeake Terrace\CAD\ENGR\C&I_Phase III Application\Drawings\Final\3854SM04.MXD - TOP OF SELECT WASTE GRADING PLAN - 9/8/2021 8:53:11 - 1:50 plotted



LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN SEE REFERENCE 2
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
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GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — RAYMOND STEVEN KRAWCZYK — 21615 — PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
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PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

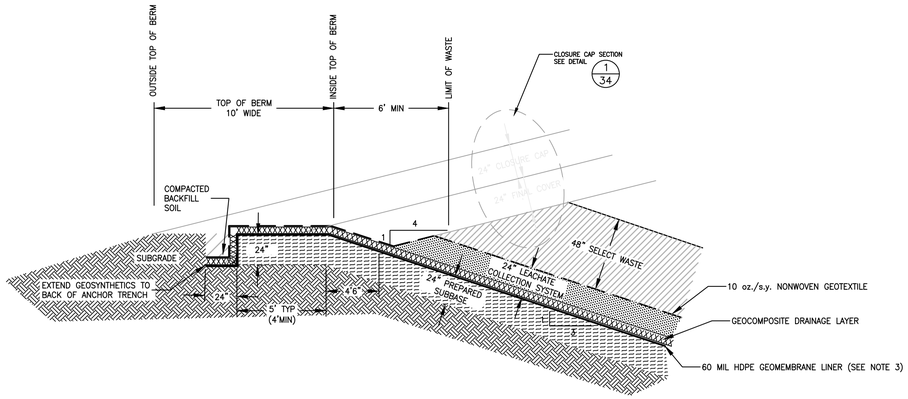
ADVANCED GeoServices
a Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

TOP OF SELECT WASTE
GRADING PLAN –
EAST (CELL 11–16)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

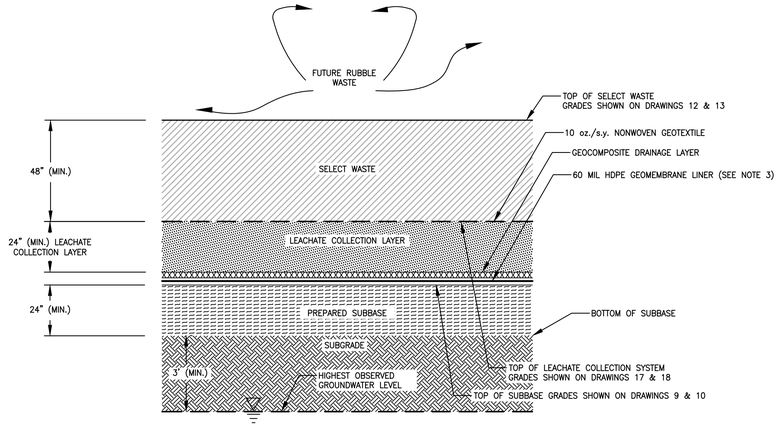
DRAWING 13

G:\Projects\2018\2018854 - Chesapeake Terrace II\CAD\DWG\SE 3\Phase III Application\Drawings\Final\2018854 #013 - TOP OF SELECT WASTE GRADING PLAN - EAST (CELL 11-16).dwg



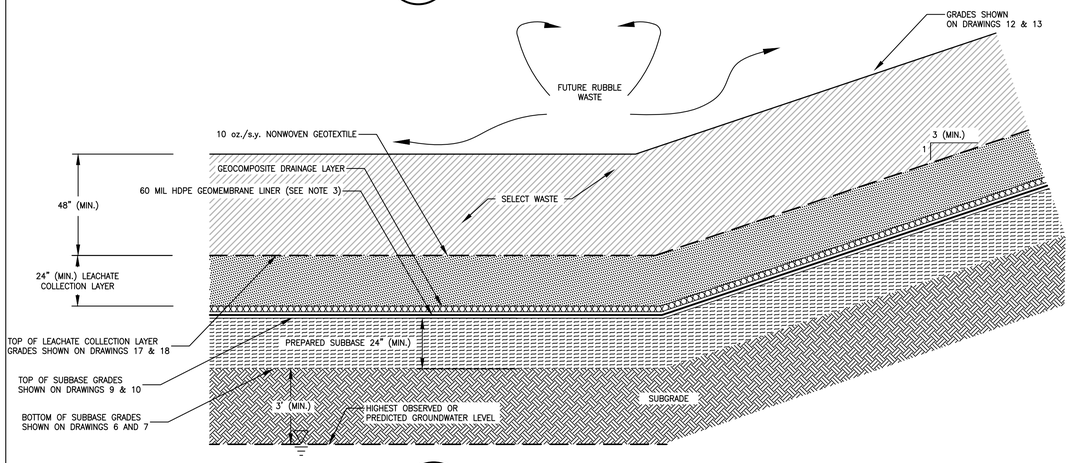
1/14 DETAIL: TOP OF PERIMETER BERM / LINER ANCHOR TRENCH

NOT TO SCALE



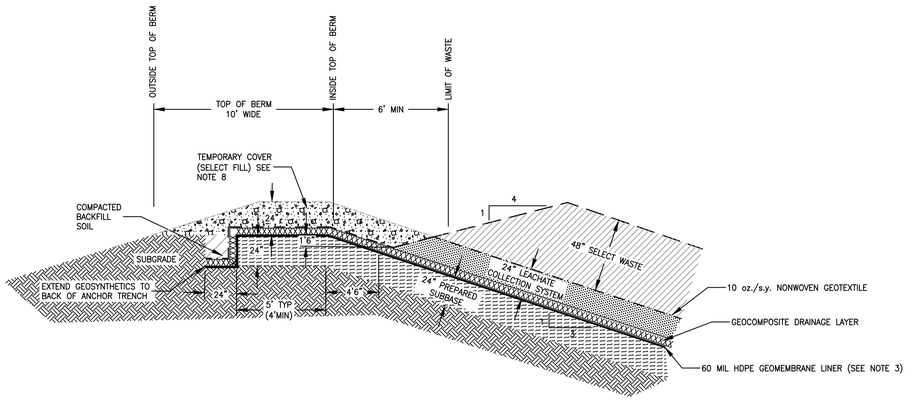
2/14 DETAIL: LINER SYSTEM - FLOOR

NOT TO SCALE



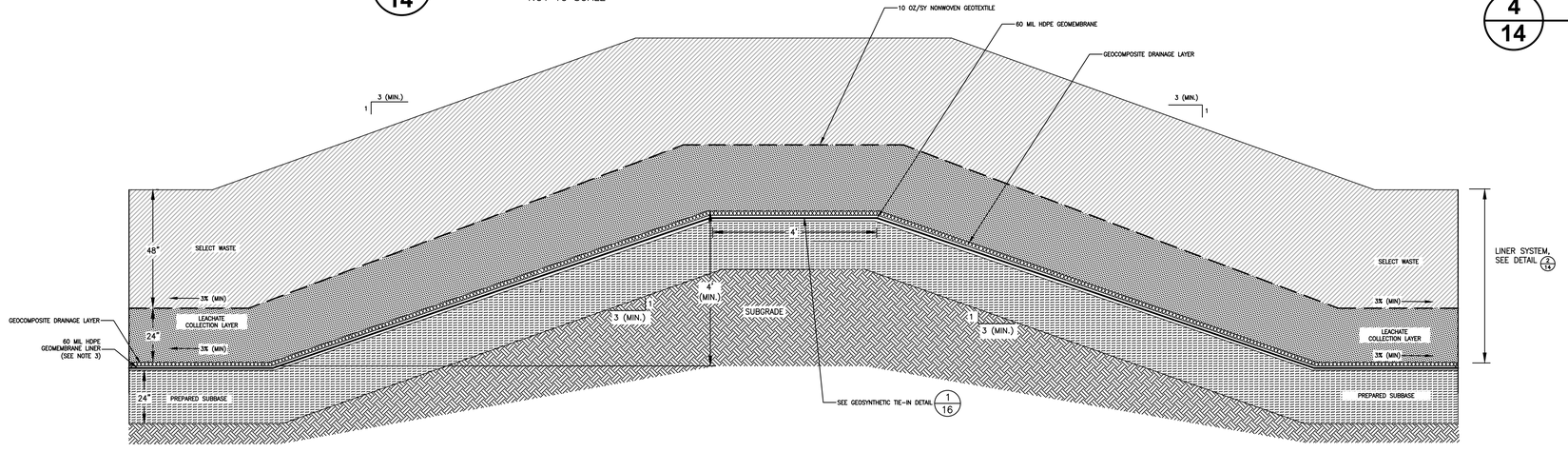
3/14 LINER SYSTEM - SLOPES

NOT TO SCALE



4/14 DETAIL: TOP OF PERIMETER BERM / WITH TEMPORARY COVER

NOT TO SCALE



5/14 TYPICAL INTER-CELL BERM

NOT TO SCALE

NOTES

1. THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2. FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT
3. THE HDPE LINER SHALL BE TEXTURED ON BOTH SIDES, ON SLOPES EXCEEDING 8%. FOR SLOPES FLATTER THAN 8%, THE HDPE LINER MAY BE SMOOTH.
4. CODE OF MARYLAND REGULATIONS (COMAR) 26.04.07.16C REQUIRES THE USE OF THE LINER SYSTEM SHOWN ON THIS DETAIL (SHOWN WITH ALTERNATE GEOMEMBRANE BARRIER LAYER).
5. COMAR 26.04.07.16C (3)(b) ALLOWS THE USE OF A 50 MIL (MIN. THICKNESS) SYNTHETIC MEMBRANE WITH A PERMEABILITY OF LESS THAN OR EQUAL TO $1x10^{-10}$ cm/sec, FOR THE BARRIER LAYER.
6. COMAR 26.04.07.16C (8) IMPOSES A PERFORMANCE SPECIFICATION FOR THE LEACHATE COLLECTION LAYER SO THAT THE DEPTH OF LEACHATE OVER THE LINER DOES NOT EXCEED 1 FOOT (30 CM).
7. CONSTRUCTION QUALITY ASSURANCE REQUIREMENTS ARE DETAILED IN THE CONSTRUCTION QUALITY ASSURANCE PLAN, INCLUDED IN SECTION 13 OF THE PHASE III PERMIT APPLICATION.
8. TEMPORARY COVER IS REQUIRED FOR SUPPORT AT WELL COMPACTED CLEANOUTS AND LEACHATE COLLECTION RISERS. TEMPORARY COVER SHALL BE WELL COMPACTED STRUCTURAL FILL.

STATE OF MARYLAND — RICHARD STEKMAN — No. 21705 — PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

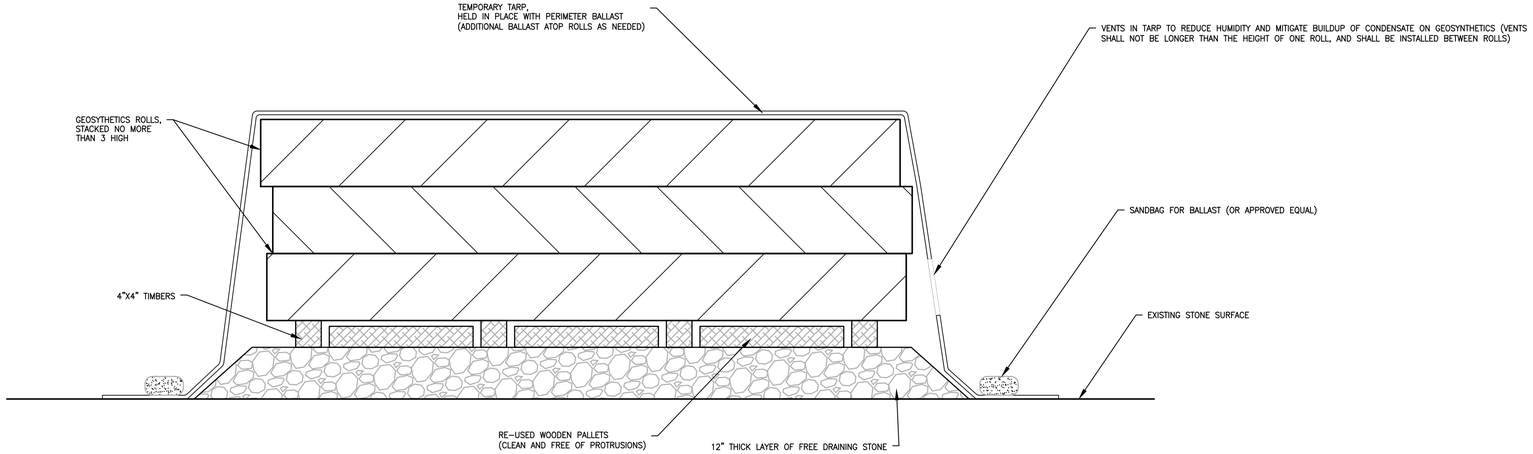
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LINER SYSTEM DETAILS
(SHEET 1 OF 3)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE: AS NOTED	
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

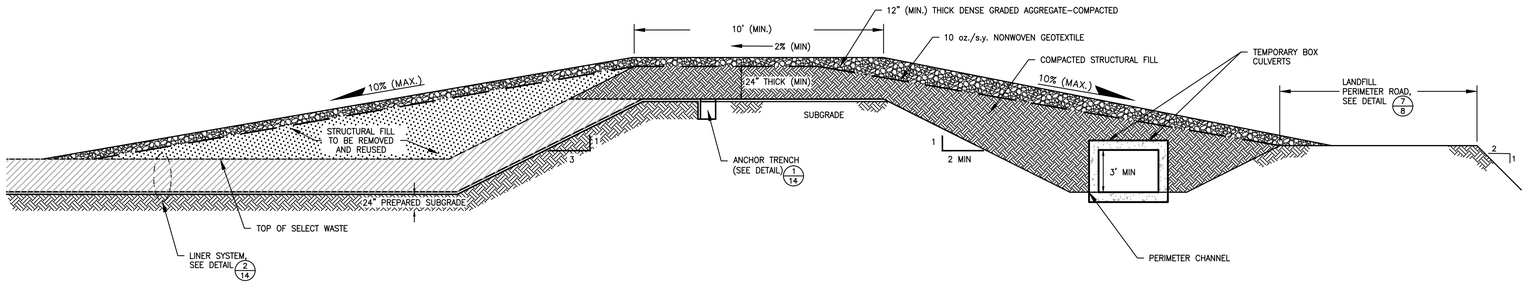
DRAWING 14

W:\Projects\2018\3854 - Chesapeake Terrace LFG\ACAD\MXDMC & Phase III Application\Drawings\Final\20180854 B014 - LINER SYSTEM DETAILS SHEET 1 OF 3.dwg



1/15 GEOSYNTHETICS STAGING PAD

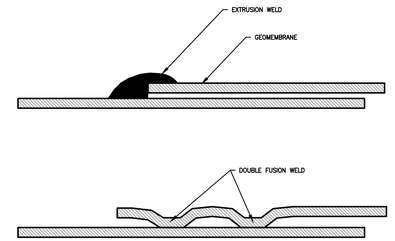
NOT TO SCALE



2/15 TEMPORARY ACCESS ROAD INTO LANDFILL CELLS

NOT TO SCALE

(TO BE USED WHERE A HAUL ROAD ENTERS A CELL; CONTRACTOR TO COORDINATE LOCATION WITH OWNER)
TEMPORARY ACCESS ROAD AND TEMPORARY BOX CULVERTS SHALL BE REMOVED AT TIME OF CAPPING



3/15 GEOMEMBRANE WELDS

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT
3.) MINIMUM AND MAXIMUM CELL SLOPES ARE 3% AND 33%, RESPECTIVELY, AT THE TIME OF CONSTRUCTION.
4.) THE TEMPORARY CULVERTS SHALL BE CLASS V CONCRETE, CAPABLE OF SUPPORTING H520 LOADING.
5.) GEOMEMBRANE SHALL BE TEXTURED ON BOTH SIDES WHEN PLACED ON SLOPES STEEPER THAN 8%.

STATE OF MARYLAND
LEONARD STEVEN MAY
No. 21708
PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

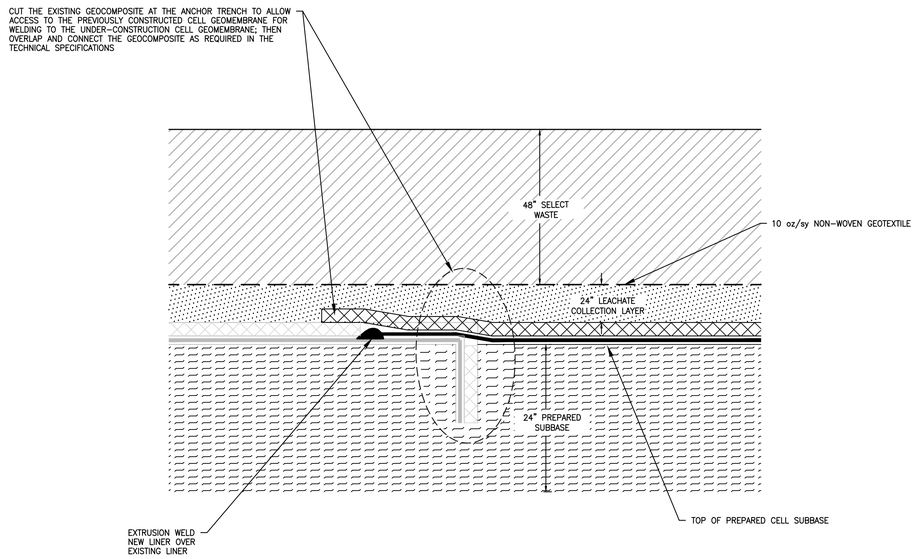
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LINER SYSTEM DETAILS
(SHEET 2 OF 3)

PROJECT MANAGER:	POS
CHECKED BY:	POS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

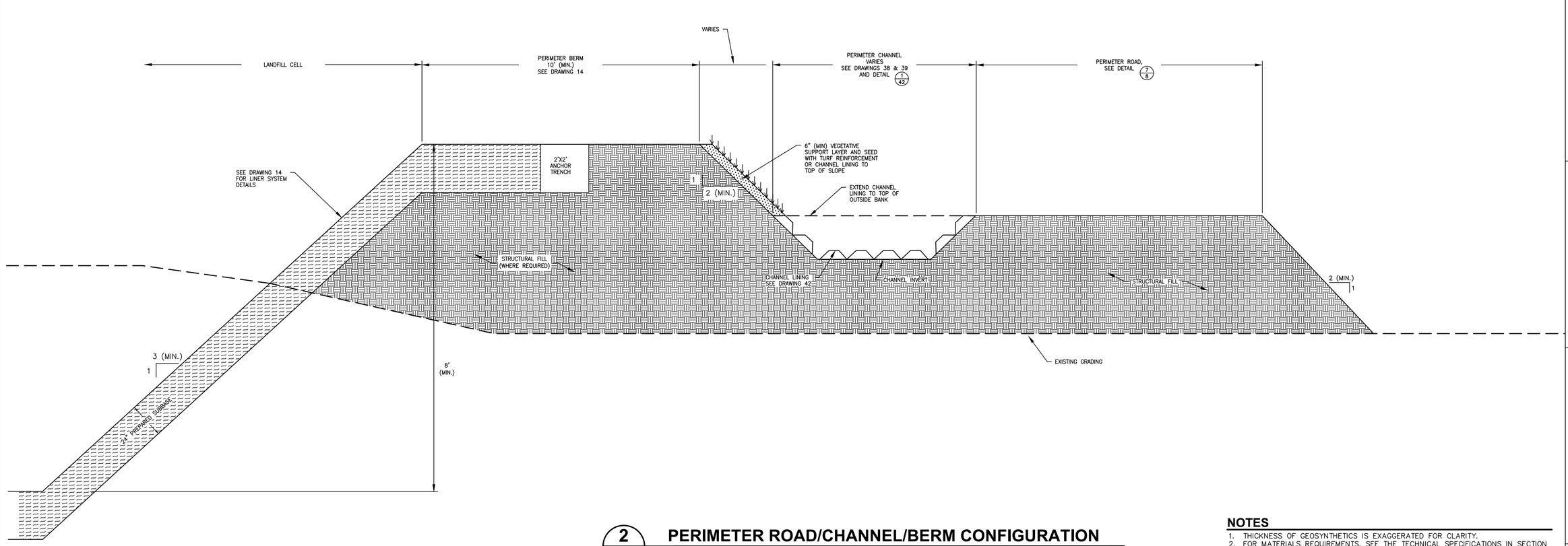
DRAWING 15

N:\Projects\2018\2018854 - Chesapeake Terrace\1\ACAD\MXD\MC & Phase III Application\Drawings\Final\2018854.MXD - LINER SYSTEM DETAILS SHEET 2 OF 3.dwg



1/16 GEOSYNTHETIC CELL LINER TIE-IN AT INTER-CELL BERM

NOT TO SCALE



2/16 PERIMETER ROAD/CHANNEL/BERM CONFIGURATION

NOT TO SCALE

NOTES

1. THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2. FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT.
3. STRUCTURAL FILL SHALL BE UTILIZED TO RAISE EXISTING GRADES TO PROPOSED SUBGRADES (SEE SPECIFICATIONS).

STATE OF MARYLAND
RICHARD STRAKHMAN
No. 21615
PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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LINER SYSTEM DETAILS
(SHEET 3 OF 3)

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 16

N:\Projects\2018\2018854 - Chesapeake Terrace\ACAD\ANACAD\C & P\Phase III Application\Drawings\Final\PLOT\2018854 #016 - LINER SYSTEM DETAILS (SHEET 3 OF 3).dwg

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- 6" LEACHATE COLLECTION LATERAL AT TOE OF SLOPE, SEE DETAIL 3/20
- LEACHATE CLEANOUT LINES, SEE DETAIL 2/20
- 6" LEACHATE COLLECTION LATERALS, SEE DETAIL 1/20
- 8" LEACHATE COLLECTION HEADERS, SEE DETAIL 1/20
- LEACHATE FORCE MAINS
- LEACHATE SIDE SLOPE RISER & PUMPHOUSE, SEE DRAWING 19

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) PERIMETER MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

NOTES

1.) FOR MATERIALS REQUIREMENTS SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT.

2.) LEACHATE COLLECTION HEADERS AND TOE OF SLOPE LATERALS SHALL HAVE A MINIMUM SLOPE OF 3%. CROSS-SLOPE LATERAL SHALL HAVE MINIMUM SLOPE OF 2%.

3.) LEACHATE COLLECTION LATERALS SHALL BE SPACED AT A MINIMUM FREQUENCY OF EVERY 250 FEET.

4.) LEACHATE FORCE/MAINS SHALL HAVE CLEANOUT VAULTS LOCATED EVERY 400 FEET ALONG THEIR LENGTH. CLEANOUT VAULT DETAILS ARE ON DRAWING 22.

5.) DOUBLE WALL FORCE MAIN LINES SHALL BE 6" SDR-11 HDPE INSIDE 10" SDR-17 HDPE CONTAINMENT PIPES.

6.) PREPONDERANCE OF FORCE MAINS SHALL BE LOCATED ALONG THE PERIMETER ACCESS ROAD SHOULDER AS SHOWN ON DRAWINGS 17 & 18. PROFILES OF FORCE MAIN ARE SHOWN ON DRAWINGS 24 & 25.

7.) A LEACHATE VALVE IS LOCATED WHERE EACH CELL PUMP HOUSE DISCHARGE LINE TIES INTO THE FORCE MAIN SO THAT THE LEACHATE FROM EACH CELL CAN BE ISOLATED FROM THE HEADER FOR REPAIRS, AS MAY BE NEEDED.

8.) ACCESS TO PUMP HOUSE FOR PUMP AND FORCE MAIN MAINTENANCE EQUIPMENT SHALL BE PROVIDED BY CROSSING THE PERIMETER CHANNEL WHERE BOX CULVERTS ARE LOCATED, AS SHOWN ON DRAWINGS 38 & 39.

9.) THE LEACHATE STORAGE FACILITY MASTER CONTROLS BUILDING SHALL BE HEATED AND COOLED, AND MONITORED FOR METHANE. THE CONTROL PANELS FOR THE LEACHATE TANKS AND MASTER PANEL FOR CELL PUMPS, AS SHOWN ON DRAWING 27.

10.) LEACHATE FORCE MAINS (SHON IN PURPLE) ARE SHOWN ALONG OUTSIDE EDGE OF ROAD FOR CLARITY. ACTUAL LOCATION WILL BE ON EDGE OF ROAD.

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — RICHARD STRICKMAN — No. 21658 — PROFESSIONAL ENGINEER

REVISION: REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE: 9/03/2021

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

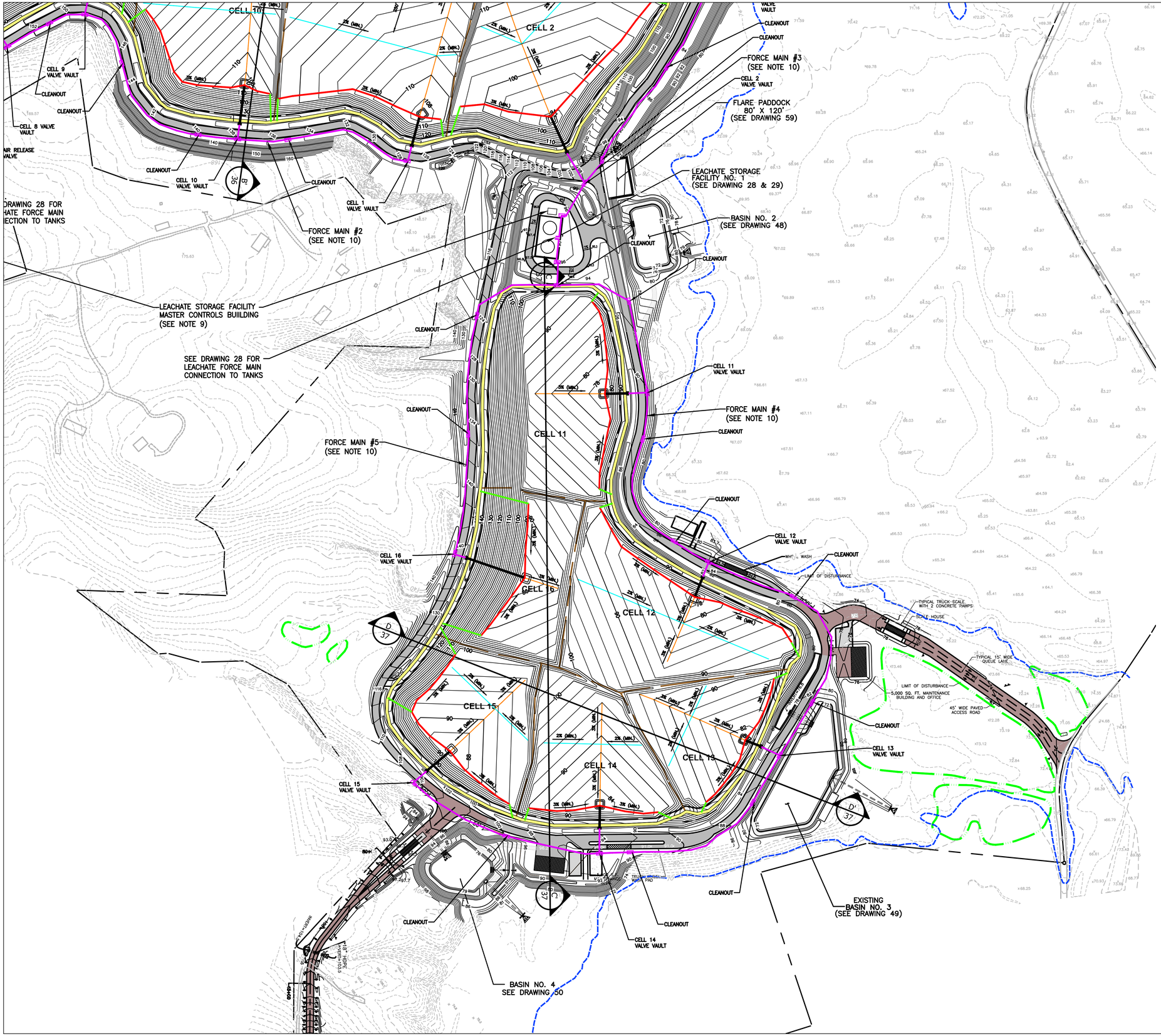
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TOP OF LEACHATE COLLECTION LAYER WEST (1-10)

PROJECT MANAGER:	POS	SCALE:	AS NOTED
CHECKED BY:	POS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 17

N:\Projects\2018\2018385A - Chesapeake Terrace\01\ACAD\MSW\SC & Phase III Application\Drawings\Final\2018385A MXD - TOP OF LEACHATE COLLECTION LAYER - WEST (CELLS 1-10).dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- 6" LEACHATE COLLECTION LATERAL AT TOE OF SLOPE, SEE DETAIL 3/20
- LEACHATE CLEANOUT LINES, SEE DETAIL 2/20
- 6" LEACHATE COLLECTION LATERALS, SEE DETAIL 1/20
- 8" LEACHATE COLLECTION HEADERS, SEE DETAIL 1/20
- LEACHATE FORCE MAINS
- LEACHATE SIDE SLOPE RISER & PUMPHOUSE, SEE DRAWING 19

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) PERIMETER MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

NOTES

1.) FOR MATERIALS REQUIREMENTS SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT.

2.) LEACHATE COLLECTION HEADERS AND TOE OF SLOPE LATERALS SHALL HAVE A MINIMUM SLOPE OF 3%. CROSS-SLOPE LATERAL SHALL HAVE MINIMUM SLOPE OF 2%.

3.) LEACHATE COLLECTION LATERALS SHALL BE SPACED AT A MINIMUM FREQUENCY OF EVERY 250 FEET.

4.) LEACHATE FORCE/MAINS SHALL HAVE CLEANOUT VAULTS LOCATED EVERY 400 FEET ALONG THEIR LENGTH. CLEANOUT VAULT DETAILS ARE ON DRAWING 22.

5.) DOUBLE WALL FORCE MAIN LINES SHALL BE 6" SDR-11 HDPE INSIDE 10" SDR-17 HDPE CONTAINMENT PIPES.

6.) PREPONDERANCE OF FORCE MAINS SHALL BE LOCATED ALONG THE PERIMETER ACCESS ROAD SHOULDER AS SHOWN ON DRAWINGS 17 & 18. PROFILES OF FORCE MAIN ARE SHOWN ON DRAWINGS 24 & 25.

7.) A LEACHATE VALVE IS LOCATED WHERE EACH CELL PUMP HOUSE DISCHARGE LINE TIES INTO THE FORCE MAIN SO THAT THE LEACHATE FROM EACH CELL CAN BE ISOLATED FROM THE HEADER FOR REPAIRS, AS MAY BE NEEDED.

8.) ACCESS TO PUMP HOUSE FOR PUMP AND FORCE MAIN MAINTENANCE EQUIPMENT SHALL BE PROVIDED BY CROSSING THE PERIMETER CHANNEL WHERE BOX CULVERTS ARE LOCATED, AS SHOWN ON DRAWINGS 38 & 39.

9.) THE LEACHATE STORAGE FACILITY MASTER CONTROLS BUILDING SHALL BE HEATED AND COOLED, AND MONITORED FOR METHANE. THE CONTROL PANELS FOR THE LEACHATE TANKS AND MASTER PANEL FOR CELL PUMPS, AS SHOWN ON DRAWING 27.

10.) LEACHATE FORCE MAINS (SHON IN PURPLE) ARE SHOWN ALONG OUTSIDE EDGE OF ROAD FOR CLARITY. ACTUAL LOCATION WILL BE ON EDGE OF ROAD.

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND
LEONARD STEKMAN
FAIRFAX, VA
No. 18
PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

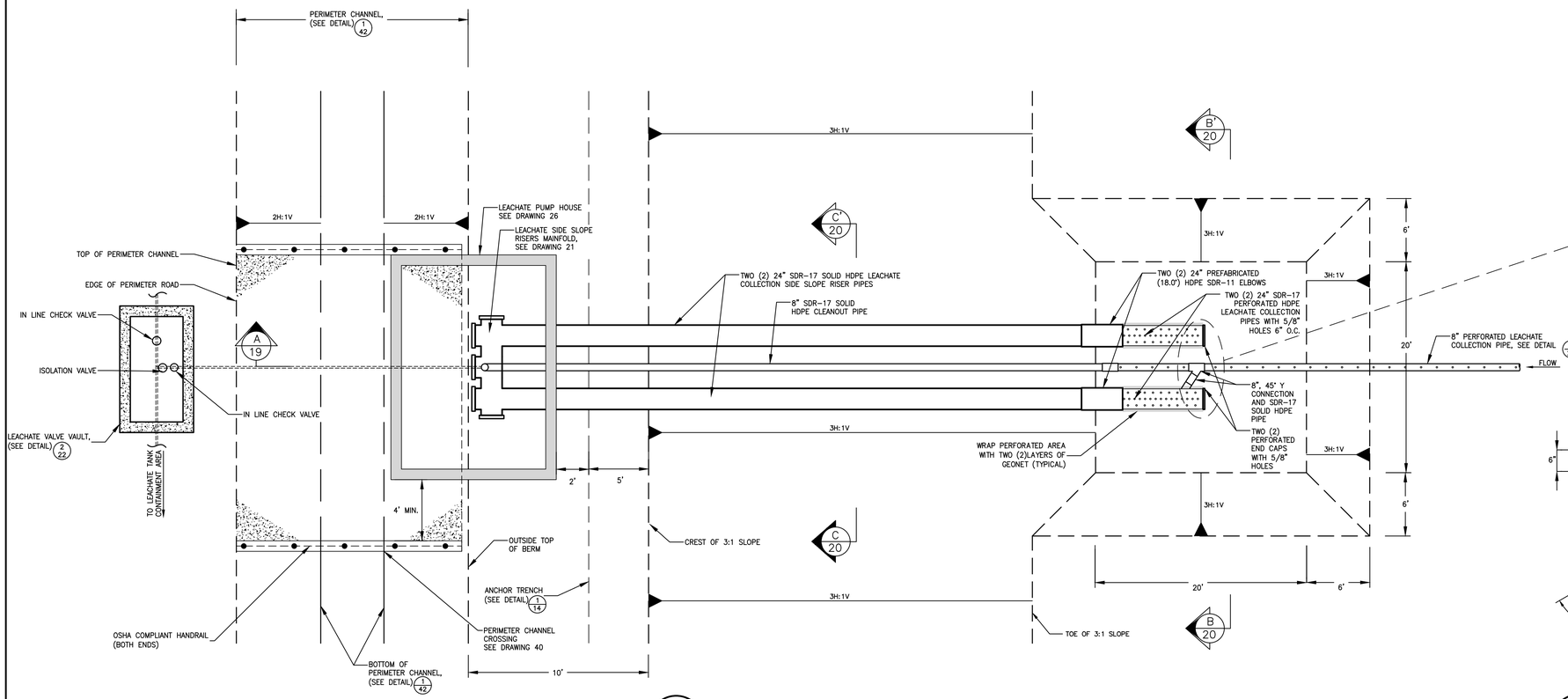
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TOP OF LEACHATE COLLECTION LAYER EAST (11-16)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	PROJECT NUMBER: 2018 - 3854
CHECKED BY:	PGS		DATE: 09/03/2021
DRAWN BY:	KHF		

DRAWING 18

N:\Projects\2018\2018854 - Chesapeake Terrace III\CAD\DWG\SE 5 (Phase III Application)\Drawings\Final\2018854 #18 - TOP OF LEACHATE COLLECTION LAYER - EAST (CELL 11-16).dwg

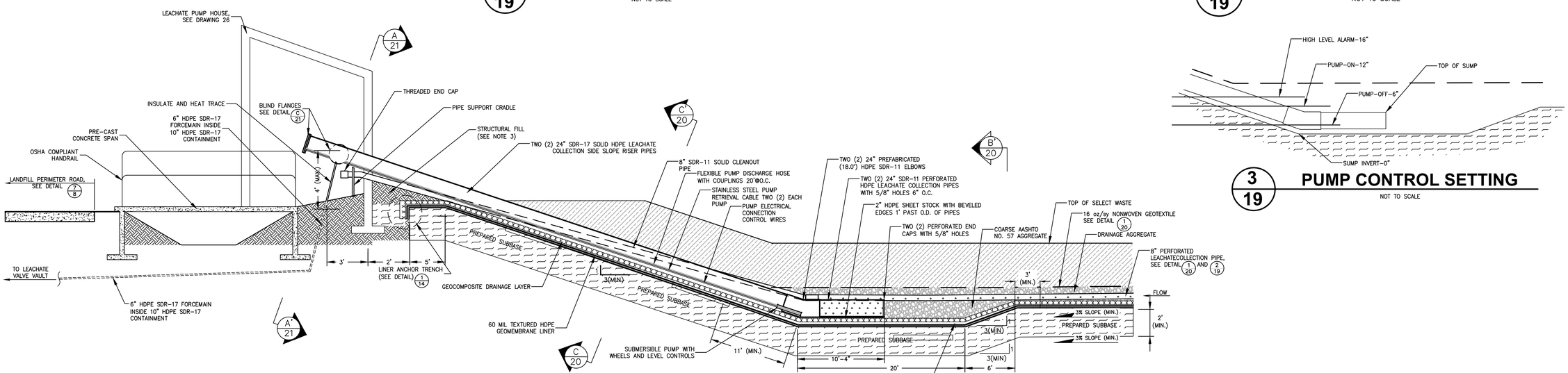


1/19 LEACHATE COLLECTION SUMP

NOT TO SCALE

2/19 LEACHATE COLLECTION AND SUMP PIPE PERFORATION

NOT TO SCALE



A/19 SECTION A-A'

NOT TO SCALE

3/19 PUMP CONTROL SETTING

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT.
3.) STRUCTURAL FILL SHALL BE PLACED AS SUPPORT BENEATH 24" HDPE RISER PIPES. STRUCTURAL FILL SHALL BE REMOVED AT TIME OF FINAL COVER/CLOSURE CAP CONSTRUCTION.
4.) FOR PUMP SPECIFICATIONS, REFER TO SPECIFICATION SECTION 02652.

STATE OF MARYLAND — RAYMOND STEVEN RATAY — 21581 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

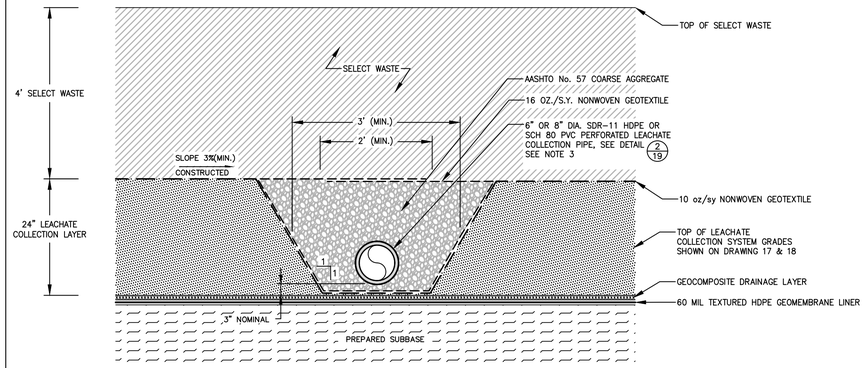
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LEACHATE COLLECTION SYSTEM DETAILS (SHEET 1 OF 4)

PROJECT MANAGER:	POS	SCALE:	AS NOTED
CHECKED BY:	POS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

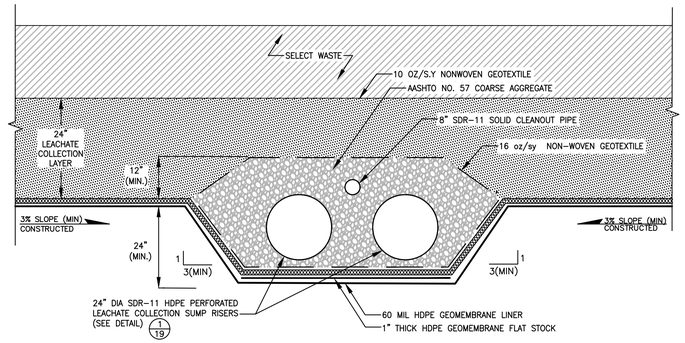
DRAWING 19

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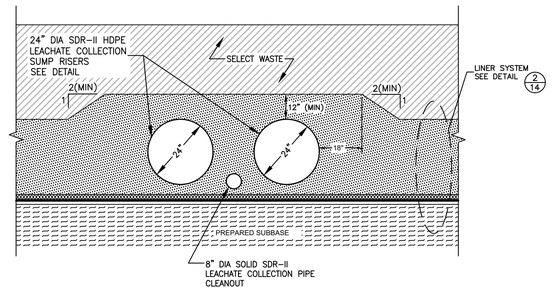
1/20 LEACHATE COLLECTION PIPE

NOT TO SCALE



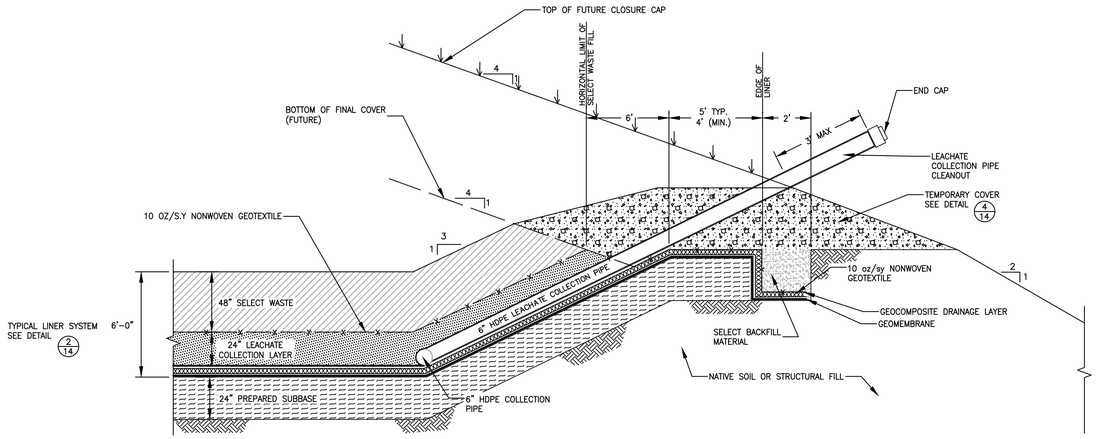
B/20 SECTION B-B'

NOT TO SCALE



C/20 SECTION C-C'

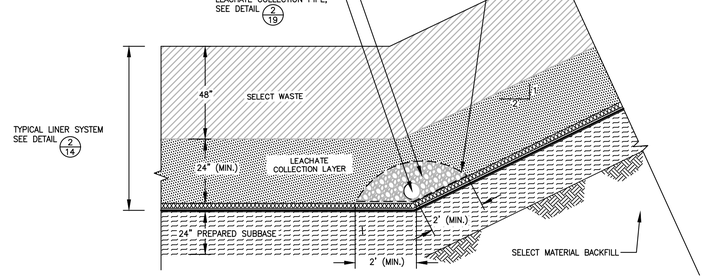
NOT TO SCALE



TYPICAL LEACHATE CLEANOUT ALONG PERIMETER BERM (DURING FILLING) SEE NOTE

2/20

NOT TO SCALE



3/20 LEACHATE COLLECTION AT TOE OF PERIMETER BERM

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.

2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT.

3.) LEACHATE COLLECTION HEADERS (8" DIA) AND LATERALS (6"DIA) SHALL BE CONSTRUCTED AT A MINIMUM SLOPE OF 3% AND 2%, RESPECTIVELY.

4.) SEE DETAIL 3/35 FOR TYPICAL LEACHATE CLEANOUT ALONG PERIMETER BERM AFTER CAP COMPLETION.

STATE OF MARYLAND — RICHARD STEVEN KAUFMAN — No. 21615 — PROFESSIONAL ENGINEER

REVISION:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

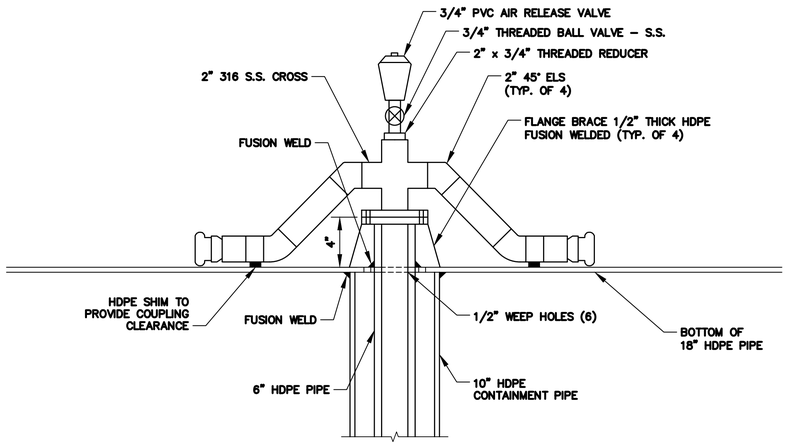
ADVANCED GeoServices
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1870 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ, 08003
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LEACHATE COLLECTION SYSTEM DETAILS (SHEET 2 OF 3)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:AS NOTED	
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

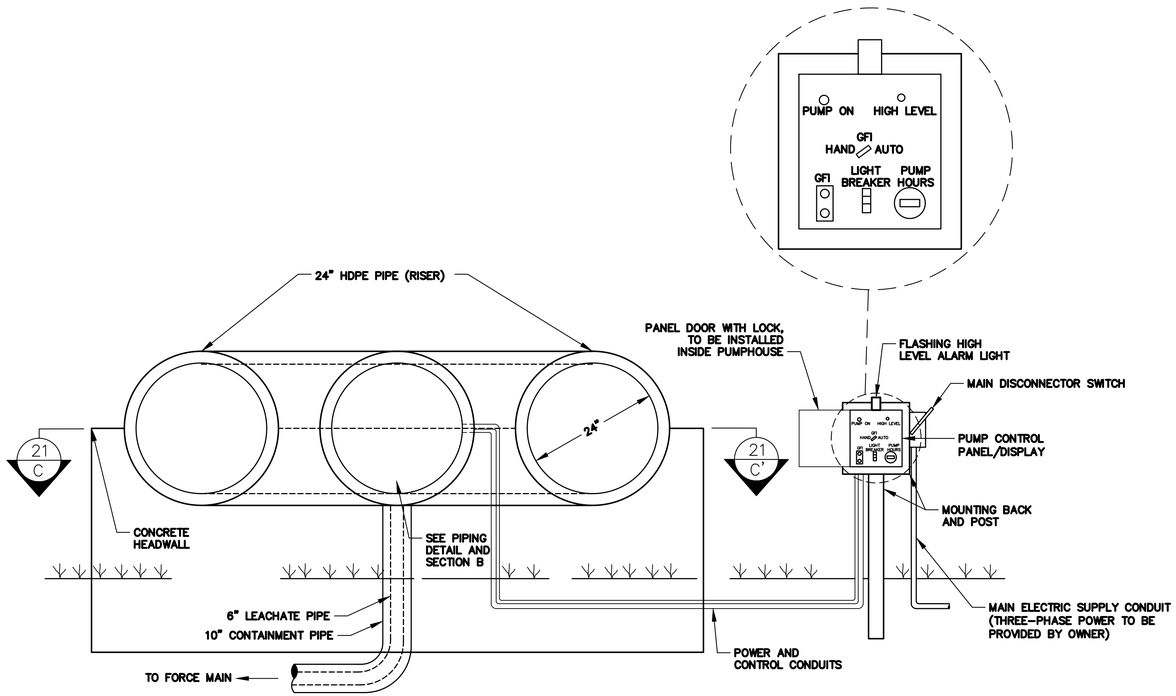
DRAWING 20

G:\Projects\2018\2018854 - Chesapeake Terrace I-IV\ACAD\WORK & Phase III Application\Drawings\Final\2018854 ROD - LEACHATE COLLECTION SYSTEM DETAILS.SHEET 2 OF 3.dwg



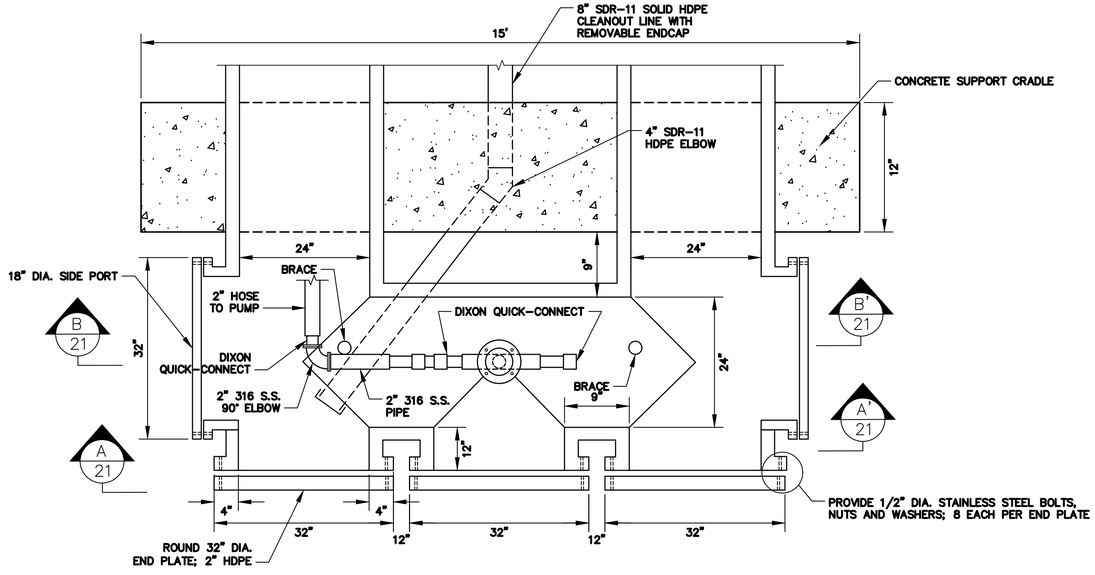
1/21 PUMP HOSE CONNECTION TO LEACHATE FORCE MAIN

NOT TO SCALE



A/21 SECTION A-A'

NOT TO SCALE



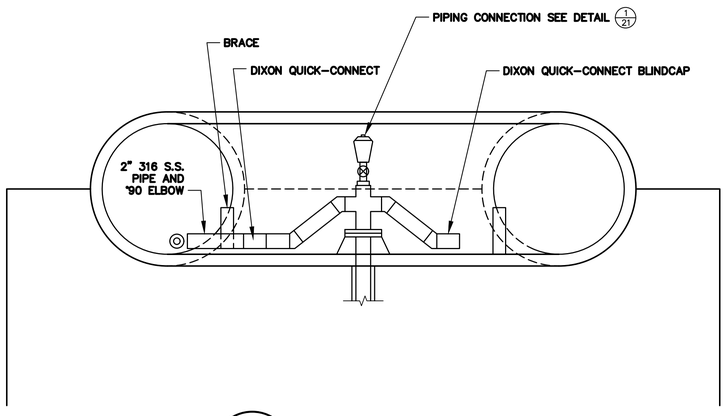
C/21 SECTION C-C' SIDESLOPE RISER MANIFOLD - TOP END

NOT TO SCALE

NOTES

1.) BRACE TO BE 2" HDPE PIPE, 6" TALL FUSION WELDED ON BOTTOM OF PIPE TO KEEP TENSION OFF HARD PIPING.

2.) SEE DRAWING 19 FOR SIDESLOPE RISER/SUMP DETAILS.



B/21 SECTION B-B'

NOT TO SCALE

NOTES

1. THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2. FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT

STATE OF MARYLAND — RICHARD STARKMAN — LICENSE NO. 19981 — PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

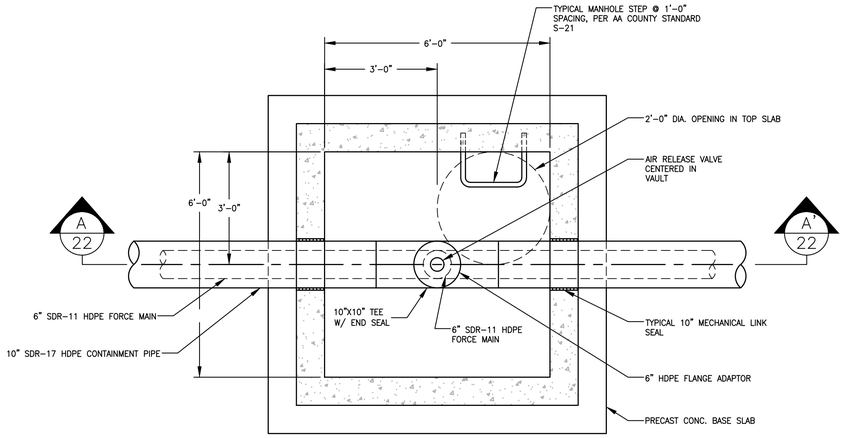
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LEACHATE COLLECTION SYSTEM DETAILS (SHEET 3 OF 3)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

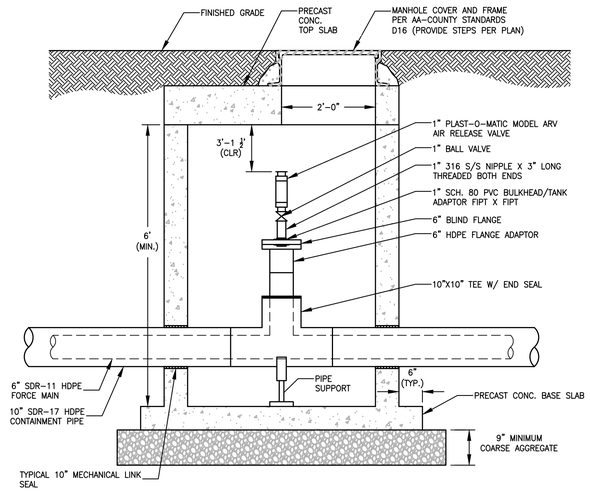
DRAWING 21

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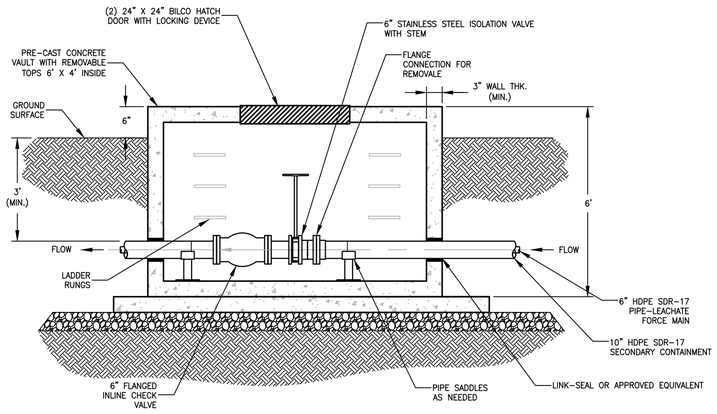
1/22 AIR RELEASE VALVE AND VAULT PLANS

NOT TO SCALE



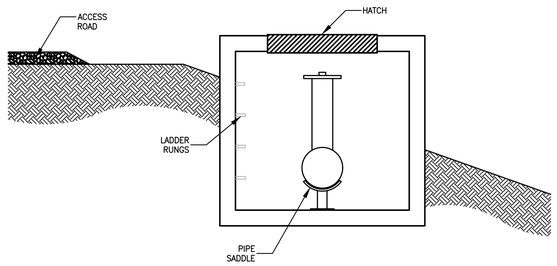
A/22 AIR RELEASE VALVE AND VAULT PLANS - SECTION A-A'

NOT TO SCALE



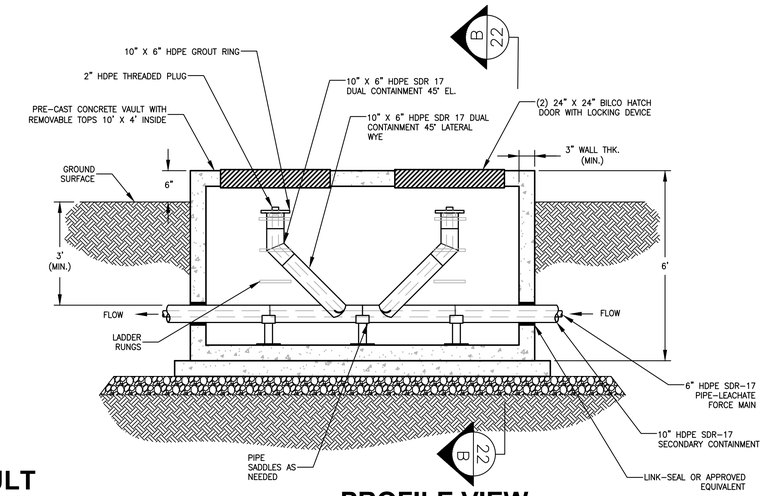
2/22 VALVE VAULT

NOT TO SCALE



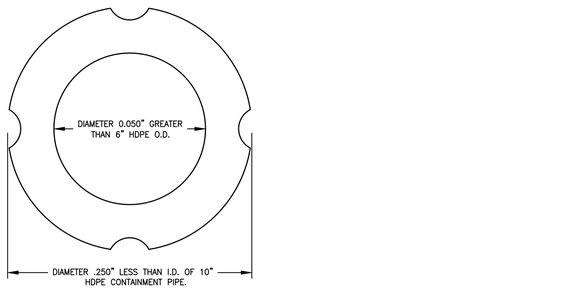
SECTION VIEW
B/22 TYPICAL FORCEMAIN CLEAN-OUT VAULT

NOT TO SCALE
NOTE: 400 FEET MAXIMUM SPACING ALONG FORCEMAIN



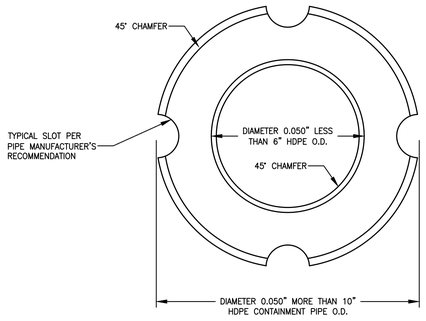
PROFILE VIEW
3/22 FORCE MAIN CLEAN-OUT VAULT

NOT TO SCALE
NOTE: 400 FEET MAXIMUM SPACING ALONG FORCEMAIN



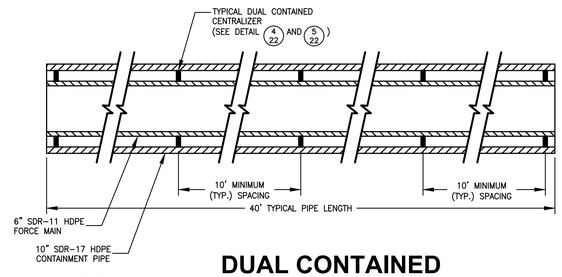
LOOSE FIT
4/22 DUAL CONTAINED CENTRALIZER

NOT TO SCALE



PRESS FIT
5/22 DUAL CONTAINED CENTRALIZER

NOT TO SCALE



DUAL CONTAINED
6/22 CENTRALIZED PLAN

NOT TO SCALE

STATE OF MARYLAND
RAYMOND STEVEN KAMMAN
No. 21583
PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

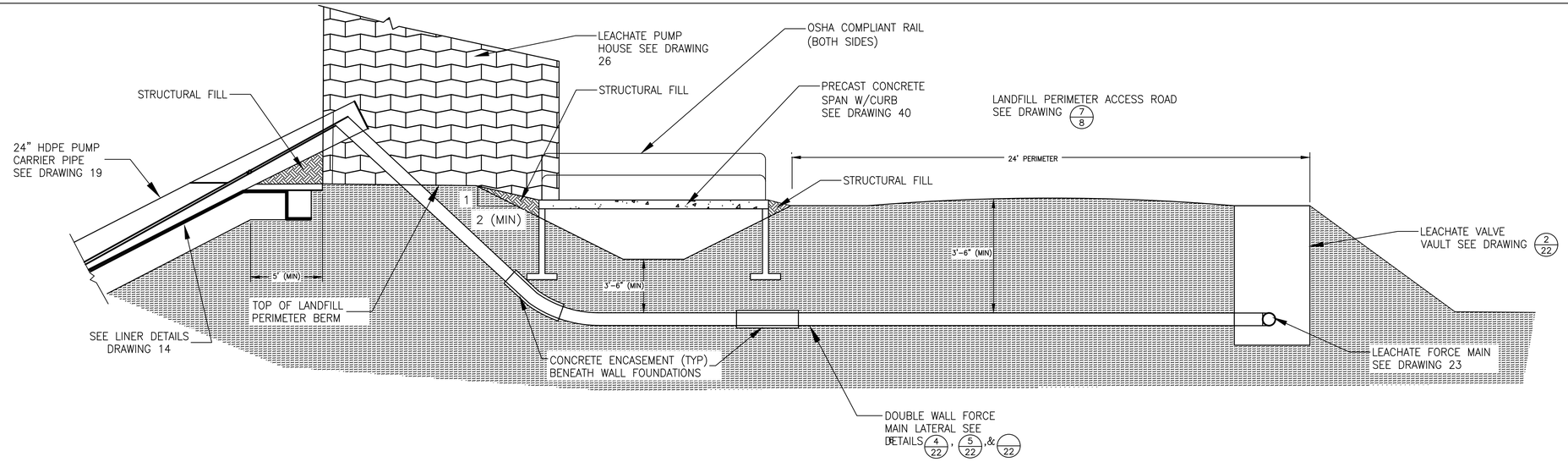
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LEACHATE FORCE MAIN
DETAILS (SHEET 1 OF 2)

PROJECT MANAGER:	PCS
CHECKED BY:	PCS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

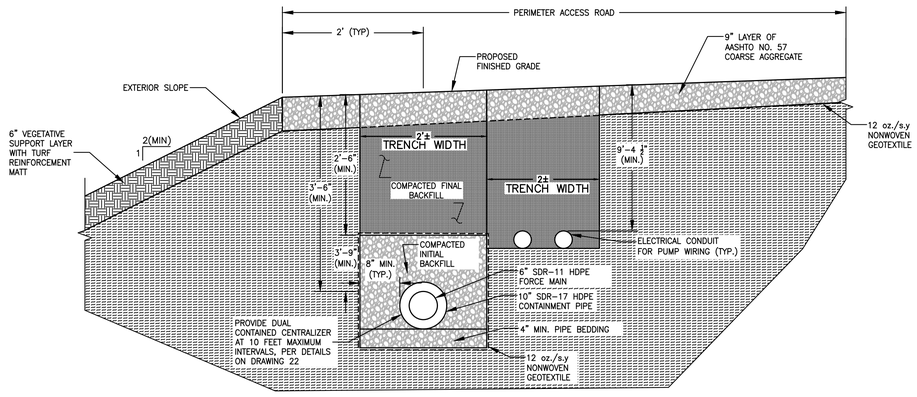
DRAWING 22

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\SC & Phase III Application\Drawings\Final\2018854 #22 - LEACHATE FORCE MAIN DETAILS (SHEET 1 OF 2).dwg



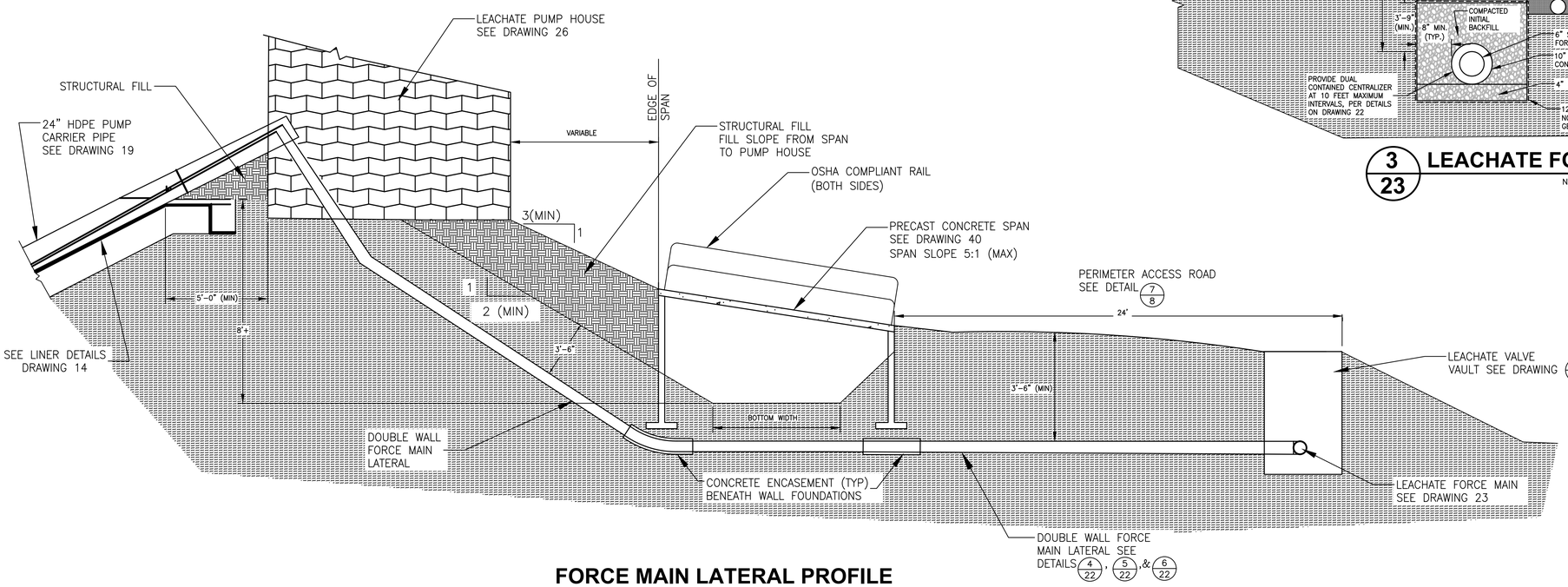
1/23 FORCE MAIN LATERAL PROFILE (TYPICAL)

NOT TO SCALE



3/23 LEACHATE FORCE MAIN BEDDING

NOT TO SCALE



2/23 FORCE MAIN LATERAL PROFILE (CELLS 2, 3, 4, 5E, 5F, 12, AND 13)

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.

2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT

STATE OF MARYLAND — BERARD STEKLI MAY — 21611 — PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

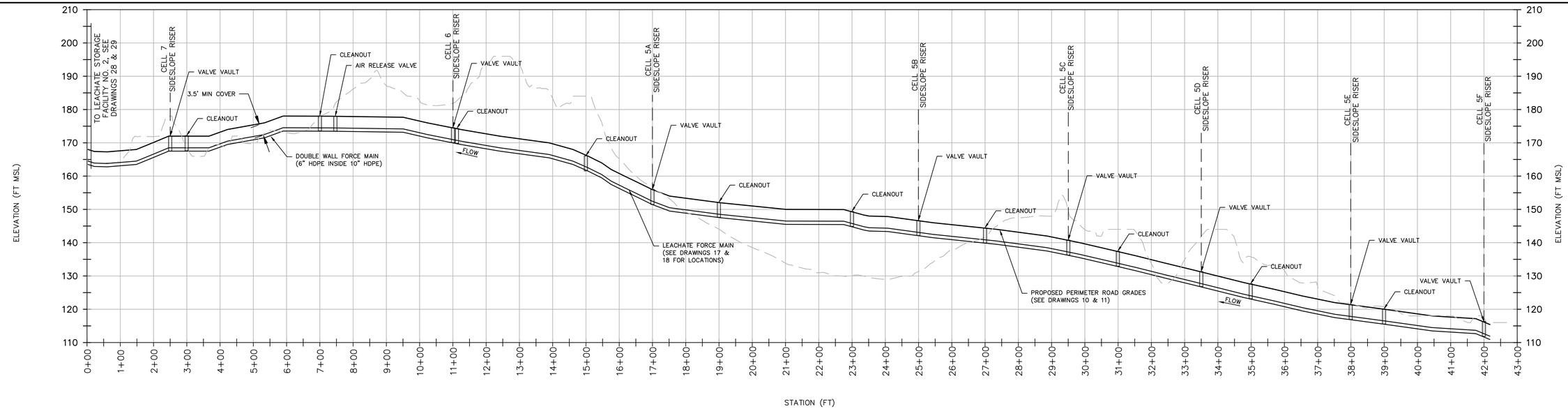
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1979 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

LEACHATE FORCE MAIN DETAILS (SHEET 2 OF 2)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

DRAWING 23

G:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\NC & Phase III Application\Drawings\Final\20180854 #023 - LEACHATE FORCE MAIN DETAILS (SHEET 2 OF 2).dwg

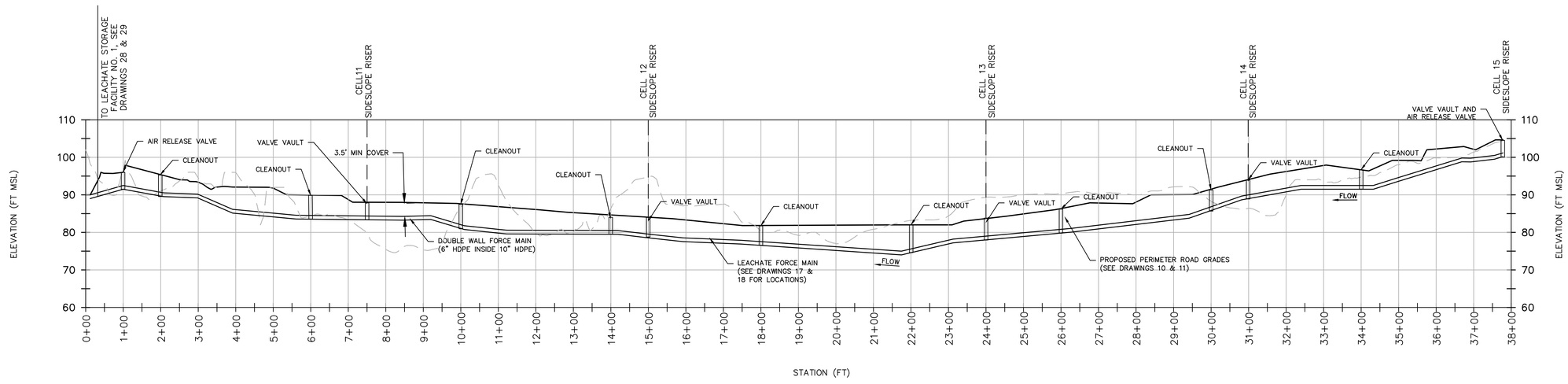


1 / 24

PROFILE- LEACHATE FORCE MAIN NO. 1

SCALE: VERTICAL— 0 7.5 15 30 — 1 INCH = 15 FT

HORIZONTAL— 0 75 150 300 — 1 INCH = 150 FT



2 / 24

PROFILE- LEACHATE FORCE MAIN NO. 4

SCALE: VERTICAL— 0 7.5 15 30 — 1 INCH = 15 FT

HORIZONTAL— 0 75 150 300 — 1 INCH = 150 FT

NOTES

1.) THE CELL SIDESLOPE RISER LOCATION RELATIVE TO THE FORCE MAIN ALIGNMENT IS APPROXIMATE.
2.) CLEAN OUT VAULTS SHALL BE FELD LOCATED EVERY 400 FEET ALONG THE LENGTH OF EACH FORCE MAIN.
3.) FOR FORCE MAIN DETAILS, SEE DRAWINGS 22 & 23.
4.) AIR RELEASE VALVES SHALL BE LOCATED AT HIGH POINTS IN ALIGNMENT.
5.) CLEANOUT, AIR RELEASE VALVE AND VALVE VAULT LOCATIONS ARE APPROXIMATE AND SHALL BE FIELD LOCATED.

STATE OF MARYLAND — RAYMOND STRICKLAND MAY — No. 21708 — PROFESSIONAL ENGINEER

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

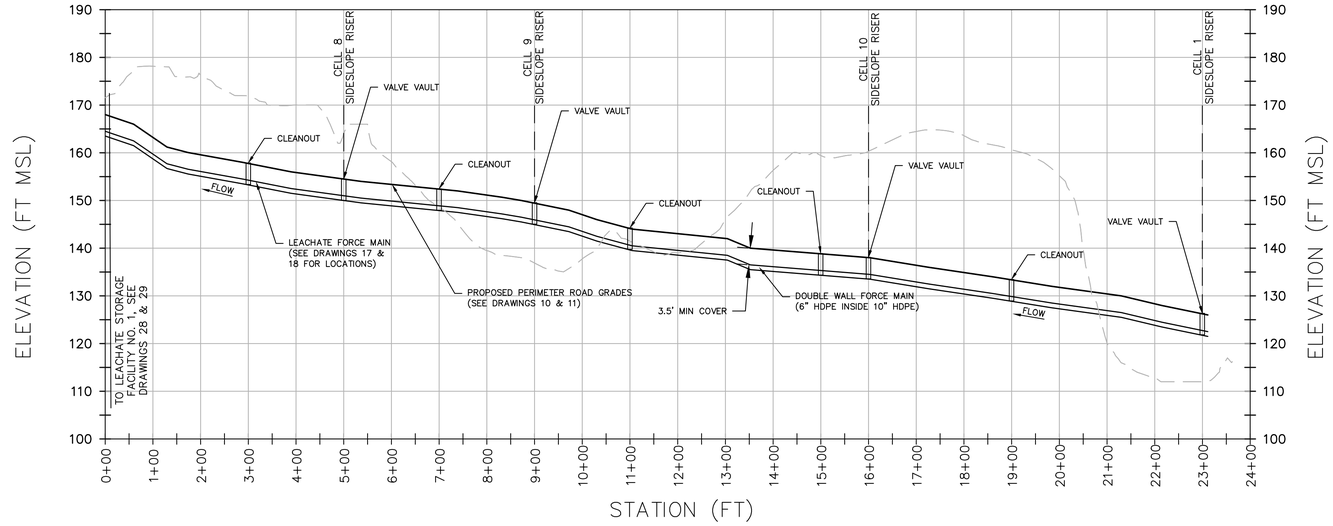
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LEACHATE FORCE MAIN PROFILES (SHEET 1 OF 2)

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF	DATE:09/03/2021

DRAWING 24

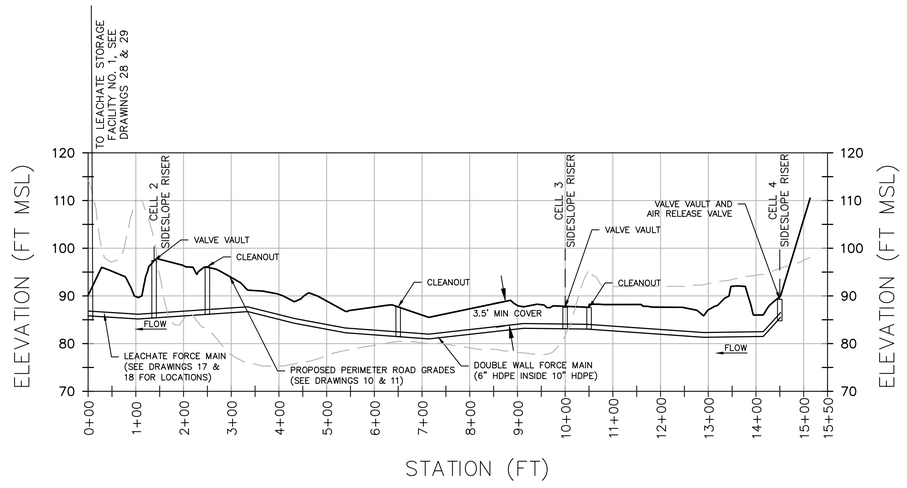
N:\Projects\2018\3018854 - Chesapeake Terrace\1.0\CAD\ENGR\C & P\Leachate Force Main Profiles\3018854 BD24 - LEACHATE FORCE MAIN PROFILES SHEET 1 OF 2.dwg



1/25 **PROFILE- LEACHATE FORCE MAIN NO. 2**

SCALE: VERTICAL— 0 7.5 15 30 — 1 INCH = 15 FT

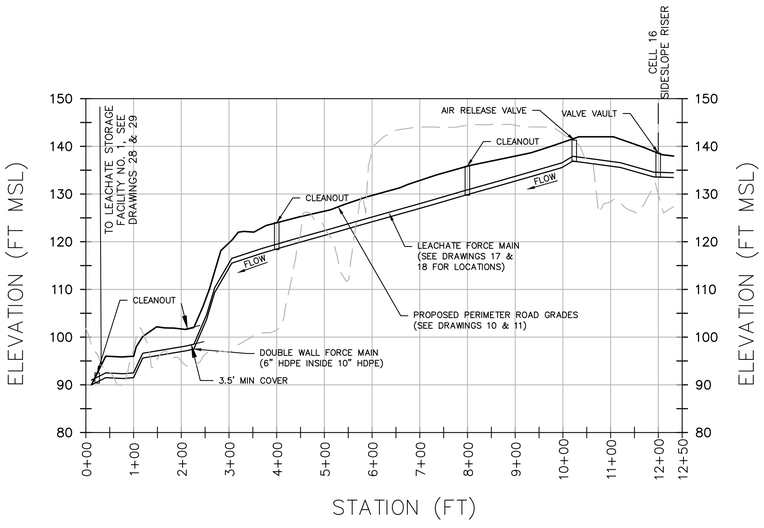
HORIZONTAL— 0 75 150 300 — 1 INCH = 150 FT



2/25 **PROFILE- LEACHATE FORCE MAIN NO. 3**

SCALE: VERTICAL— 0 7.5 15 30 — 1 INCH = 15 FT

HORIZONTAL— 0 75 150 300 — 1 INCH = 150 FT



3/25 **PROFILE- LEACHATE FORCE MAIN NO. 5**

SCALE: VERTICAL— 0 7.5 15 30 — 1 INCH = 15 FT

HORIZONTAL— 0 75 150 300 — 1 INCH = 150 FT

NOTES

1.) THE CELL SIDESLOPE RISER LOCATION RELATIVE TO THE FORCE MAIN ALIGNMENT IS APPROXIMATE.
2.) CLEAN OUT VAULTS SHALL BE FELD LOCATED EVERY 400 FEET ALONG THE LENGTH OF EACH FORCE MAIN.
3.) FOR FORCE MAIN DETAILS, SEE DRAWINGS 22 & 23.
4.) AIR RELEASE VALVES SHALL BE LOCATED AT HIGH POINTS IN ALIGNMENT.
5.) CLEANOUT, AIR RELEASE VALVE AND VALVE VAULT LOCATIONS ARE APPROXIMATE AND SHALL BE FIELD LOCATED.

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STATE OF MARYLAND — EDWARD STRICKMAN — LICENSED PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
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LEACHATE FORCE MAIN PROFILES (SHEET 2 OF 2)

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 25









NOTES

1.) PUMP HOUSE IS INTENDED TO PROVIDE SHELTER FOR WORKERS PERFORMING O&M ACTIVITIES IN INCLEMENT WEATHER.
2.) THE CONTROL PANELS SHALL BE INSTALLED ON THE INSIDE OF THE PUMP HOUSE.
3.) THE PUMP ACCESS PLATFORM SHALL BE CONSTRUCTED IN ACCORDANCE WITH OSHA REQUIREMENTS, IF NEEDED.
4.) THE PUMP HOUSE SHALL BE EQUIPPED WITH LIGHTING, AND HEATING AND COOLING CAPACITY.
5.) THE CELL PUMP HOUSE SHALL HAVE THE FOLLOWING MINIMUM DIMENSIONS: 8 FT WIDE X 16 FT LONG X 10 FT TALL.
6.) THE DOUBLE-SWING DOORS MAY BE REPLACED WITH A SLIDING DOOR OR A TRADITIONAL, COMMERCIAL OVERHEAD GARAGE DOOR.

STATE OF MARYLAND
SUMNER D. STRAYMAN
No. 21681
PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

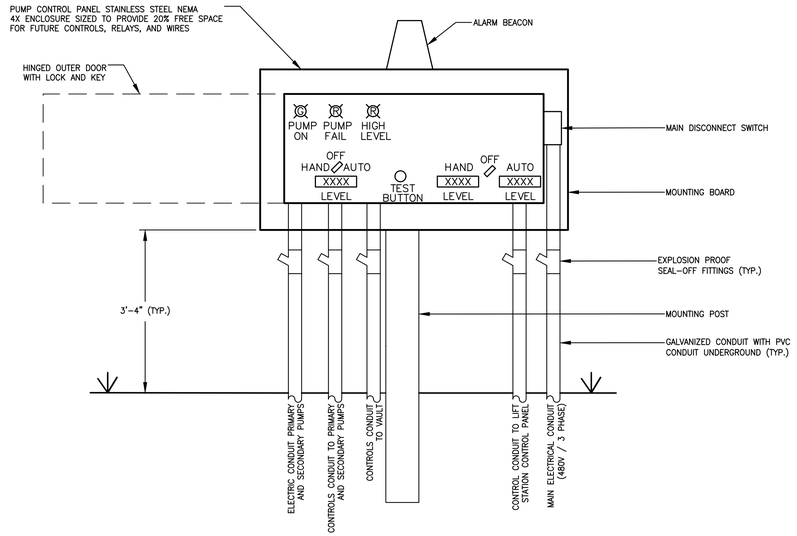
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T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

LEACHATE PUMP
HOUSE DETAILS

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 26

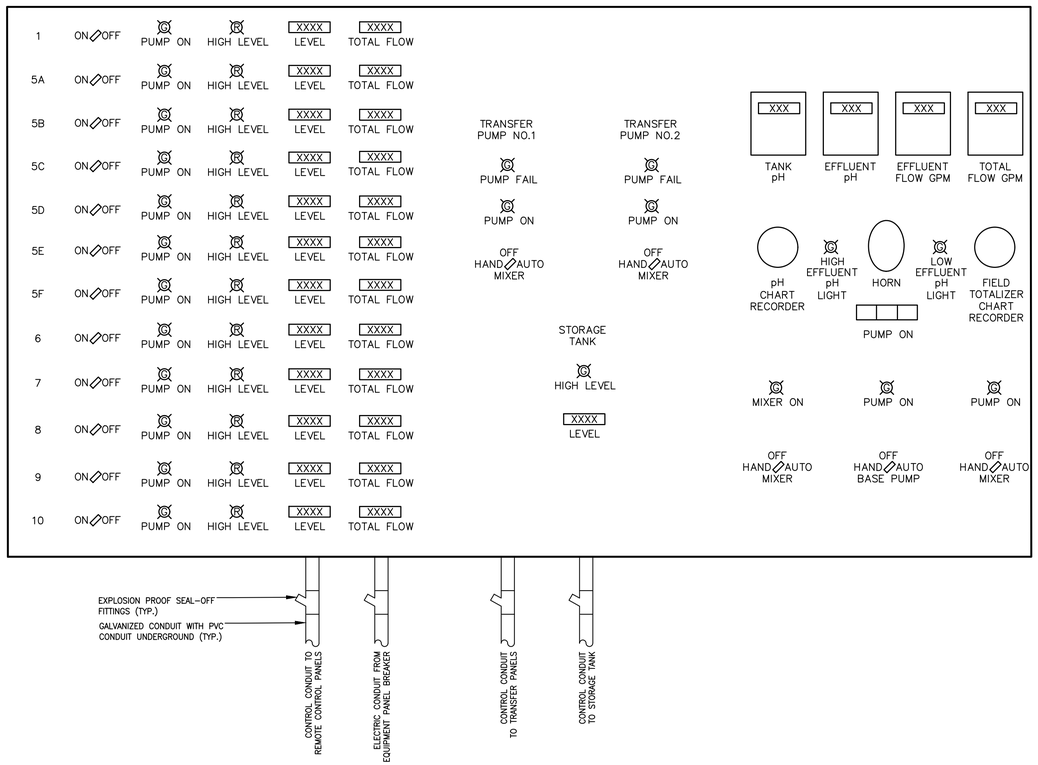
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LEACHATE CONTROL SUMP PUMP CONTROL PANEL AT EACH CELL

1/27

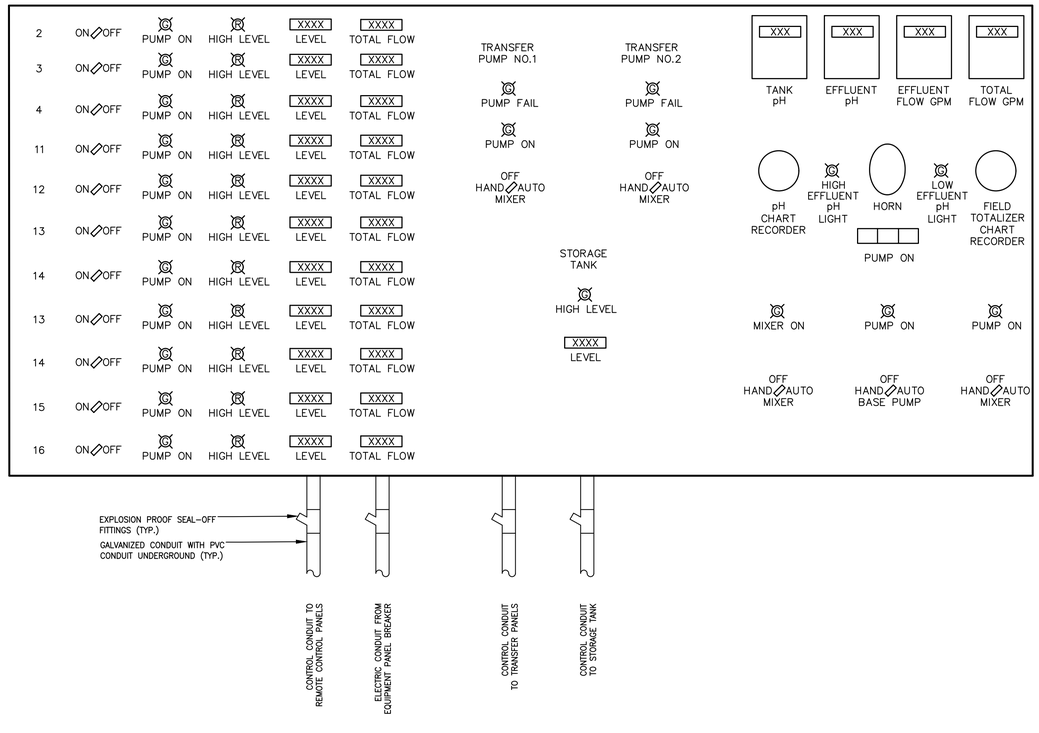
NOT TO SCALE



MAIN CONTROL PANEL AT LEACHATE STORAGE FACILTY No. 2

3/27

NOT TO SCALE



MAIN CONTROL PANEL AT LEACHATE STORAGE FACILTY No. 1

2/27

NOT TO SCALE

Cell or Sub-cell ID	Peak Leachate Generation (gpm)	Total Head (ft)	Selected Pump
1	91.8	108.9	Model 18-4 HP 5.0
2	54.8	50.2	Model 18-2 HP 3.0
3	34.1	35.2	Model 18-1 HP 1.5
4	38.1	35.3	Model 18-1 HP 1.5
5A	41.4	93.4	Model 18-2 HP 3.0
5B	24.5	89.2	Model 18-2 HP 3.0
5C	31.5	89.4	Model 18-2 HP 3.0
5D	20.3	87.2	Model 18-2 HP 3.0
5E	23.5	89.3	Model 18-2 HP 3.0
5F	11.7	87.1	Model 18-3 HP 5.0
6	40.8	101.3	Model 18-3 HP 5.0
7	53.4	107.1	Model 18-3 HP 5.0
8	43.3	99.1	Model 18-3 HP 5.0
9	28.7	97.1	Model 18-2 HP 3.0
10	68.2	107.8	Model 18-3 HP 5.0
11	53.4	59.2	Model 18-2 HP 3.0
12	44.8	59.3	Model 18-2 HP 3.0
13	27.5	55.2	Model 18-1 HP 1.5
14	23.9	53.2	Model 18-1 HP 1.5
15	37.9	51.5	Model 18-2 HP 3.0
16	33.3	51.2	Model 18-1 HP 1.5

NOTES

1.) FOR PUMP SPECIFICATIONS, REFER TO TECHNICAL SPECIFICATION SECTION 02652.
2.) THE MAIN CONTROL PANELS AT EACH LEACHATE STORAGE FACILITY SHALL BE LOCATED IN A SMALL BUILDING TO PROVIDE SHELTER DURING INCLEMENT WEATHER AND STORAGE OF BACKUP PUMPS AND RELATED EQUIPMENT.



REVISION:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

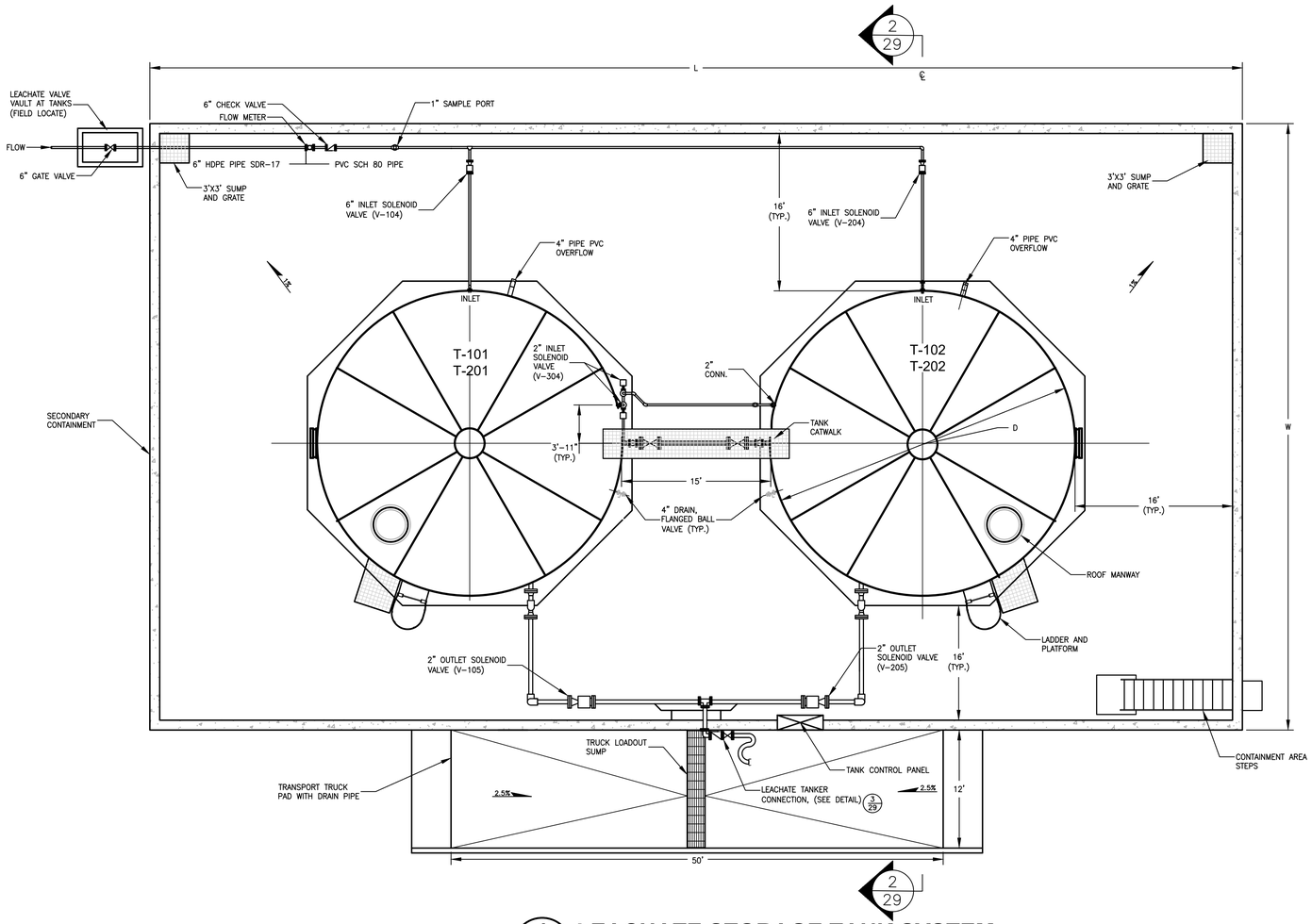
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LEACHATE CONTROL PANEL LAYOUT

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 – 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

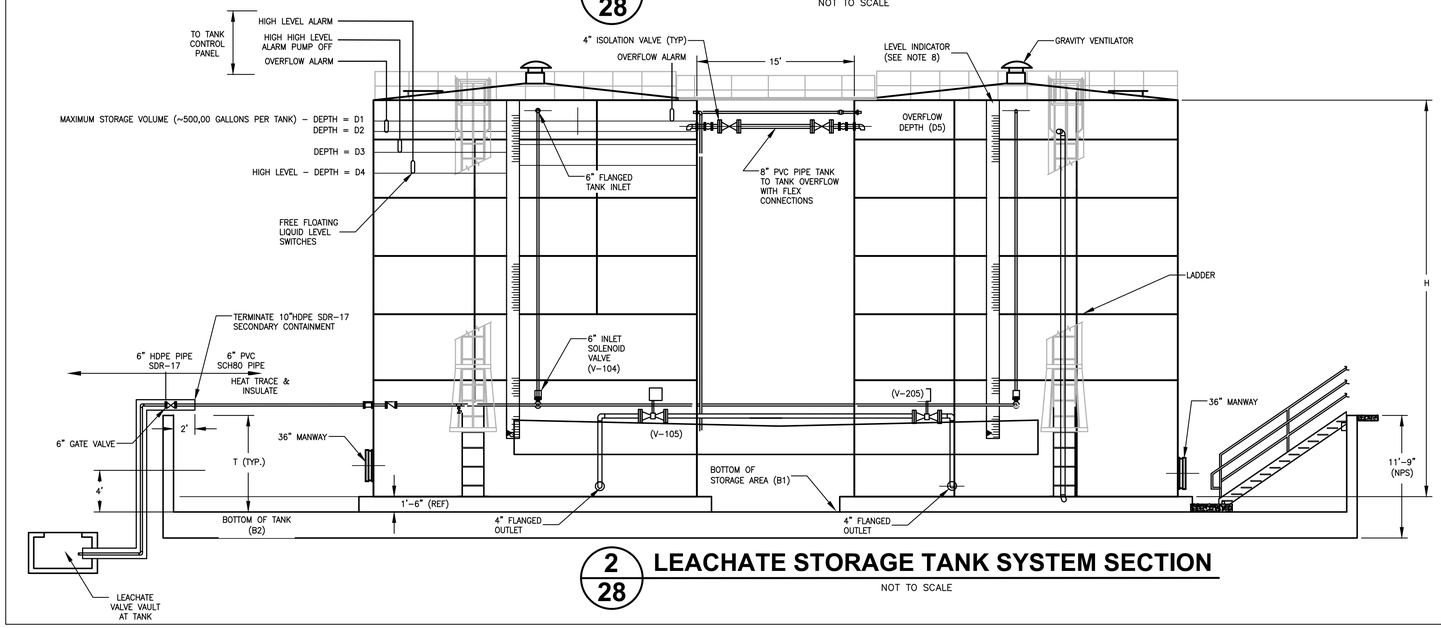
DRAWING 27

N:\Projects\2018\3854 - Chesapeake Terrace LF\CAD\MXD\MDE 9_Phase III Application\Drawings\Final\3854_27 - LEACHATE CONTROL PANEL LAYOUT.dwg



1/28 LEACHATE STORAGE TANK SYSTEM

NOT TO SCALE



2/28 LEACHATE STORAGE TANK SYSTEM SECTION

NOT TO SCALE

PARAMETER	LECHATE STORAGE AREA NO. 1	LEACHATE STORAGE AREA NO. 2
# OF TANKS	2	2
STORAGE IN EACH TANK	500,000 GALLONS	500,000 GALLONS
TANK DIAMETER (D)	45 FT	45 FT
TANK HEIGHT (H)	46 FT (MIN)	46 FT (MIN)
STORAGE AREA LENGTH (L)	140 FT	140 FT
STORAGE AREA WIDTH (W)	80 FT	80 FT
STORAGE AREA HEIGHT (T)	9 FT	9 FT
BOTTOM OF STORAGE AREA (B1)	90	162
BOTTOM OF TANK (B2)	92	164
TOP OF TANK ELEV	138	208
MAXIMUM STORAGE VOLUME DEPTH (D1)	43 FT	43 FT
OVERFLOW ALARM (D2)	40 FT	40 FT
HIGH HIGH LEVEL ALARM (D3)	37 FT	37 FT
HIGH LEVEL ALARM (D4)	33 FT	33 FT
OVERFLOW (D5)	39 FT	39 FT
TANK REFERENCE ID.	T-101 & T-102	T-201 & T-202

LEGEND

- 1" SAMPLE PORT
- 2" CHECK VALVE
- FLOW METER
- 2" GATE VALVE
- 2" INLET SOLENOID VALVE (V-104)
- 4" DRAIN, FLANGED BALL VALVE (TYP.)
- 4" OTLET SOLENOID VALVE (V-205)
- OVERFLOW ALARM
- 4" FLANGED OUTLET

NOTES

1.) ALL PIPING FROM SITE CELL PUMPING STATIONS TO LEACHATE TANK FARM CONTAINMENT WALL TO BE 6" HDPE, SDR-17, THEN FLANGED CONNECTED TO PVC SCH 80 PIPE TO STORAGE TANKS.
2.) STORAGE TANKS HAVE DESIGN STORAGE VOLUMES OF APPROXIMATELY 500,000 GALLONS EACH. THE SYSTEM FLOW RATES ARE DESIGNED FOR FOR AN AVERAGE FLOW OF 82,000 GPD. THE OVERFLOW IS DESIGNED FOR A PEAK RATE OF 41,000 GPD.
3.) SEAL 4" PVC PIPE PENETRATION THROUGH SECONDARY CONTAINMENT FROM TRUCK LOADOUT PAD.
4.) STORAGE TANK OUTLET QUICK DISCONNECT FITTING TO MATCH TANKER TRUCK FITTING.
5.) SEE DRAWING 10 & 11 FOR SITE PLAN LAYOUT.
6.) ANY PIPING LESS THEN 3.5 FEET BELOW GROUND SURFACE, SHALL BE HEAT TRACED AND INSULATED.
7.) LEVEL INDICATOR TO BE INSTALLED IN FRONT OF STORAGE TANKS AS SHOWN, IN SIGHT OF OFF TRUCK LOADING RAMP.
8.) A STRUCTURAL ENGINEER WILL BE REQUIRED TO DEVELOP THE STRUCTURAL DESIGN OF CONCRETE SECONDARY CONTAINMENT RELATIVE TO REINFORCEMENT, TYPE, SIZE, AND LOCATION WITHIN THE CONCRETE SLAB.

STATE OF MARYLAND — FRED STRICKMAN — LICENSE NO. 21615 — PROFESSIONAL ENGINEER

DATE: 9/03/2021 | REVISION: REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

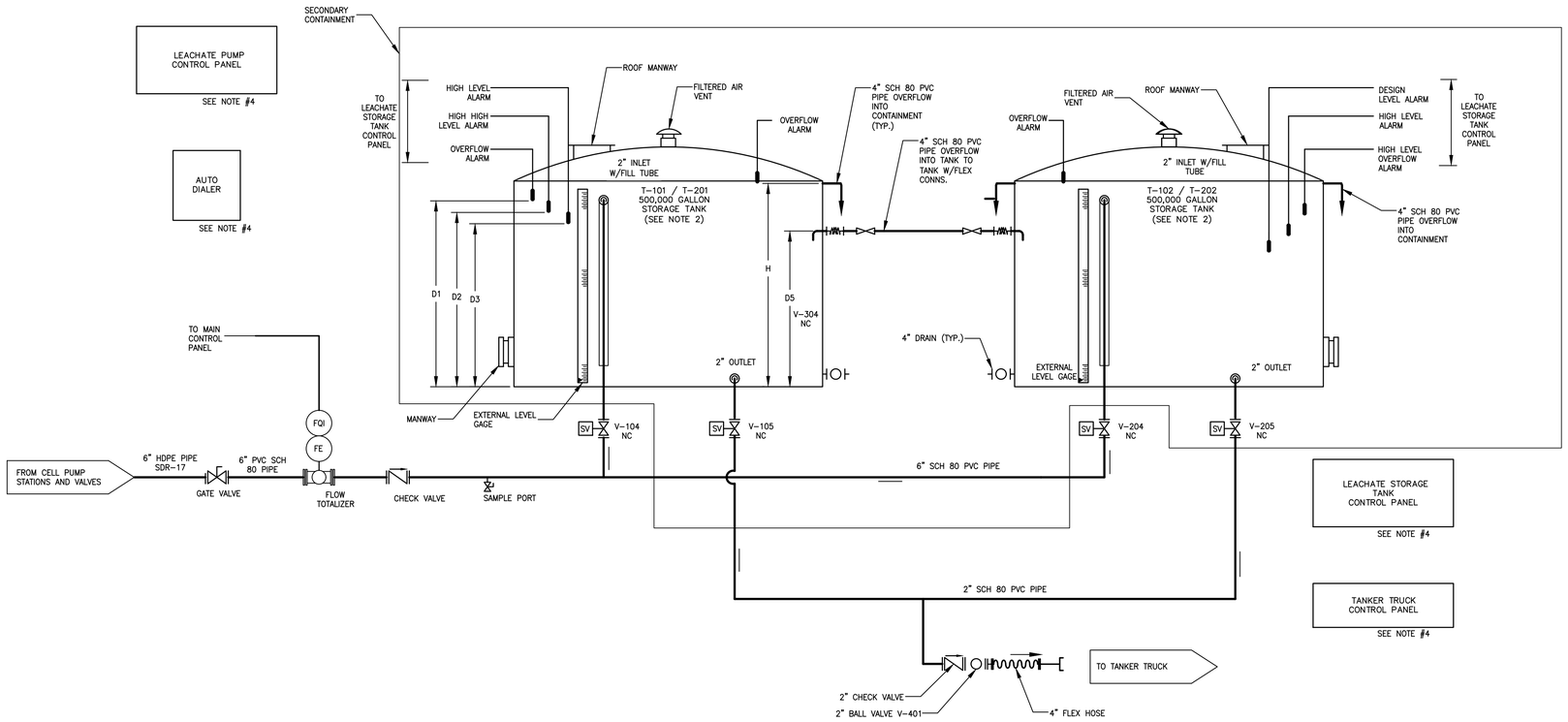
ADVANCED GeoServices
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1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
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LEACHATE STORAGE TANK DETAILS (SHEET 1 OF 2)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 28

G:\Projects\2018\2018854 - Chesapeake Terrace II\CAD\ACAD\CIVIL 3 Phase III Application\Drawings\Final\2018854 BD28 - LEACHATE STORAGE TANK DETAILS (SHEET 1 OF 2).dwg



LEACHATE STORAGE TANKS
1/29 PROCESS & INSTRUMENTATION DIAGRAM

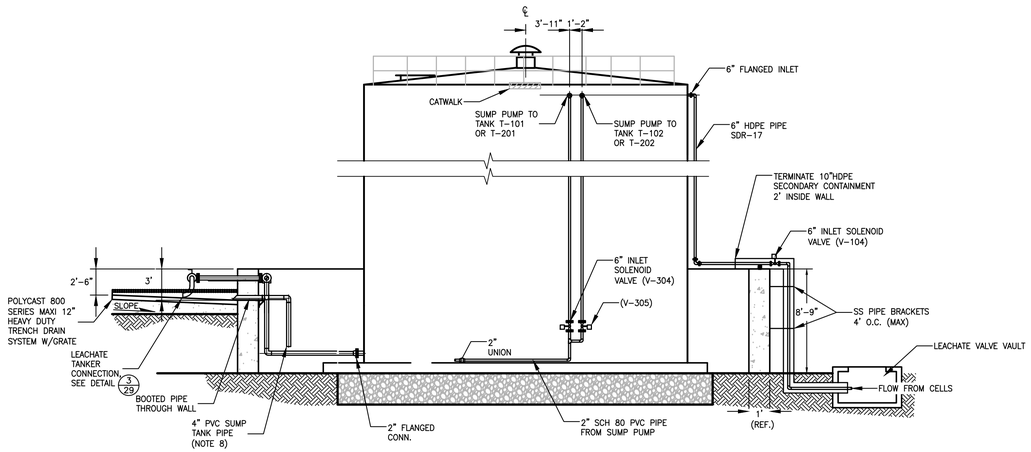
NOT TO SCALE

LEGEND

- LEACHATE PIPE LINE
- FQI — FLOW TOTALIZING INDICATOR
- FE — FLOW ELEMENT
- SV — SOLENOID VALVE
- LH — HIGH LEVEL
- LL — LOW LEVEL
- NC — NORMALLY CLOSE
- NO — NORMALLY OPEN
- T — TANK
- QUICK CONNECT COUPLING
- DIRECTION OF FLOW
- ENTRY AND EXIT FLOW
- MAGNETIC FLOW METER
- LEVEL SWITCH
- SUMP PUMP
- GATE VALVE
- BALL VALVE
- CHECK VALVE

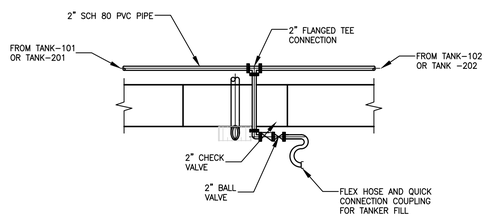
NOTES

1.) ALL PIPING FROM SITE CELL PUMPING STATIONS TO LEACHATE TANK FARM CONTAINMENT WALL TO BE 6" HDPE, SDR-17, THEN FLANGED CONNECTED TO PVC SCH 80 PIPE TO STORAGE TANKS.
2.) STORAGE TANKS HAVE DESIGN STORAGE VOLUMES OF APPROXIMATELY 500,000 GALLONS EACH. THE SYSTEM FLOW RATES ARE DESIGNED FOR FOR AN AVERAGE FLOW OF 82,000 GPD. THE OVERFLOW IS DESIGNED FOR A PEAK RATE OF 41,000 GPD.
3.) FLOW RATES:
82,000 GPD (GALLON PER DAY) HIGHEST AVERAGE FLOW
246,000 GPD – HIGHEST PEAK FLOW
4.) SEE SYSTEM CONTROL SPECIFICATIONS 13214-1 FOR SYSTEM OPERATIONS AND CONTROLS.
5.) SEE SPECIFICATION SECTION 13215 FOR SEQUENCE OF OPERATIONS OF LEACHATE COLLECTION, CONVEYANCE AND STORAGE SYSTEM.
6.) ALL PIPING FROM SITE CELL PUMPING STATIONS TO LEACHATE TANK FARM CONTAINMENT WALL TO BE 6" HDPE, SDR-17, THEN FLANGED CONNECTED TO PVC SCH 80 PIPE TO STORAGE TANKS.
7.) ANY PIPING LESS THEN FOUR FEET BELOW GROUND SURFACE, SHALL BE HEAT TRACED AND INSULATED.
8.) LEACHATE SPILLED DURING TRUCK LOADING SHALL BE DIRECTED/WASHED TO SECONDARY CONTAINMENT SUMPS AND TRANSFERRED INTO LEACHATE TANKS



2/29 LEACHATE STORAGE TANK PROFILE

NOT TO SCALE



3/29 LEACHATE TANKER CONNECTION

NOT TO SCALE

STATE OF MARYLAND — KAVEH STEPHEN KARIMI — 21615 — PROFESSIONAL ENGINEER

REVISION: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1979 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
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LEACHATE STORAGE TANK DETAILS (SHEET 2 OF 2)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 29

N:\Projects\2018\3018854 - Chesapeake Terrace LF\CAD\CIVIL\E & P\Issued for Application\Drawings\Final\3018854 BIZIS - LEACHATE STORAGE TANK DETAILS (SHEET 2 OF 2).dwg

PERIMETER ACCESS ROAD SEE DETAILS 2/16 & 7/8

PERIMETER BERM SEE DETAILS 2/16 & 4/14

CELL 5A

CELL 5B

CELL 5C

CELL 5D

CELL 5E

CELL 9

CELL 6

CELL 8

CELL 7

CELL 1

CELL 10

CELL 3

CELL 4

CELL 2

CELL 11

BASIN NO. 1

BASIN NO. 2 (SEE DRAWING 48)

FLARE PADDOCK 80' X 120'

LEACHATE STORAGE FACILITY NO. 1 (SEE DRAWING 28 & 29)

LEACHATE STORAGE FACILITY NO. 2 (SEE DRAWING 28 & 29)

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/61
- PIPE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- SIGNS, SEE DRAWING 8

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2.) PERIMETER MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

NOTES

1.) WHILE FEMA HAS RE-ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2.) THE GRADES SHOWN ON THIS DRAWING REPRESENT TOP OF WASTE GRADES WITHIN THE PERIMETER BERM. REFER TO DRAWING 34 FOR FINAL COVER SYSTEM DETAILS.
3.) MINIMUM AND MAXIMUM TOP OF WASTE SLOPES WITHIN THE LIMIT OF WASTE ARE 4% AND 25% RESPECTIVELY.
4.) FOR STORMWATER MANAGEMENT FEATURES, REFER TO DRAWINGS 38 THROUGH 44.
5.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

STATE OF MARYLAND — EDWARD STRICKMAN — 21583 — PROFESSIONAL ENGINEER

REVISION:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1976 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

TOP OF WASTE PLAN - WEST (CELL 1-10)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 30

N:\Projects\2018\2018854 - Chesapeake Terrace\CAD\ENGINEERING & Permit Applications\Drawings\Final\2018854 BOW - TOP OF WASTE PLAN - WEST (CELL 1-10).dwg

CELL 10

CELL 2

FLARE PADDOCK
80' X 120'

LEACHATE STORAGE
FACILITY NO. 1
(SEE DRAWING 28 & 29)

BASIN NO. 2
(SEE DRAWING 48)

CELL 11

CELL 16

CELL 12

CELL 15

CELL 14

CELL 13

EMERGENCY ACCESS ROAD
ALIGNMENT IF NORTH ENTRANCE IS
NOT USED AS MAIN ENTRANCE

OPTIONAL NORTH ENTRANCE
(SEE DRAWING 89)

WHEEL WASH

LIMIT OF DISTURBANCE

TYPICAL TRUCK SCALE
WITH 2 CONCRETE RAMPS

SCALE HOUSE

TYPICAL 15' WIDE
QUEUE LANE

LIMIT OF DISTURBANCE
5,000 SQ. FT. MAINTENANCE
BUILDING AND OFFICE

45' WIDE PAVED
ACCESS ROAD

EAST ENTRANCE
(SEE DRAWINGS 4 &5)

EXISTING
BASIN NO. 3
(SEE DRAWING 49)

BASIN NO. 4
SEE DRAWING 50

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN SEE REFERENCE 2
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 10/61
- PIPE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ROAD, SEE DRAWING 6/8
- SIGNS, SEE DRAWING 8
- TYPICAL WETLANDS SEE REFERENCE 3

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) PERIMETER MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

NOTES

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2.) THE GRADES SHOWN ON THIS DRAWING REPRESENT TOP OF WASTE GRADES WITHIN THE PERIMETER BERM. REFER TO DRAWING 34 FOR FINAL COVER SYSTEM DETAILS.

3.) MINIMUM AND MAXIMUM TOP OF WASTE SLOPES WITHIN THE LIMIT OF WASTE ARE 4% AND 25% RESPECTIVELY.

4.) FOR STORMWATER MANAGEMENT FEATURES, REFER TO DRAWINGS 38 THROUGH 44.

5.) THE FENCELINE IS SHOWN JUST OUTSIDE THE LIMIT OF DISTURBANCE, SO THAT IT IS VISIBLE. IT IS INTENDED TO BE BUILT AT THE LIMIT OF DISTURBANCE.

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

STATE OF MARYLAND
KEVIN H. POSS
No. 21583
REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1979 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

TOP OF WASTE PLAN - EAST (CELL 11-16)

PROJECT MANAGER:	POSS	SCALE:AS NOTED
CHECKED BY:	POSS	PROJECT NUMBER: 2018 - 3854
DRAWN BY:	KHF	DATE:09/03/2021

DRAWING 31

J:\Projects\2018\2018854 - Chesapeake Terrace II\CAD\ADVGEOS & Phase III Application\Drawings\Final\2018854 B031 - TOP OF WASTE PLAN - EAST (CELL 11-16).dwg

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 2/35
- TERRACE, SEE DETAIL 2/34
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

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2.) FOR STORMWATER MANAGEMENT FEATURES, SEE DRAWINGS 38 & 39.

3.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER LAYER.

4.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

CULVERT AR-2
CULVERT #5
BASIN NO. 1 (SEE DRAWING 47)
CULVERT #1
CULVERT AR-1
CULVERT #2
FLARE PADDOCK 80' X 120' (SEE DRAWING 59)
CULVERT #6
CULVERT #7
CULVERT #3
BASIN NO. 2 (SEE DRAWING 48)
PERIMETER CHANNEL 10
PERIMETER CHANNEL

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

STATE OF MARYLAND · RALPH C. GEISTWEIT · 21583 · REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

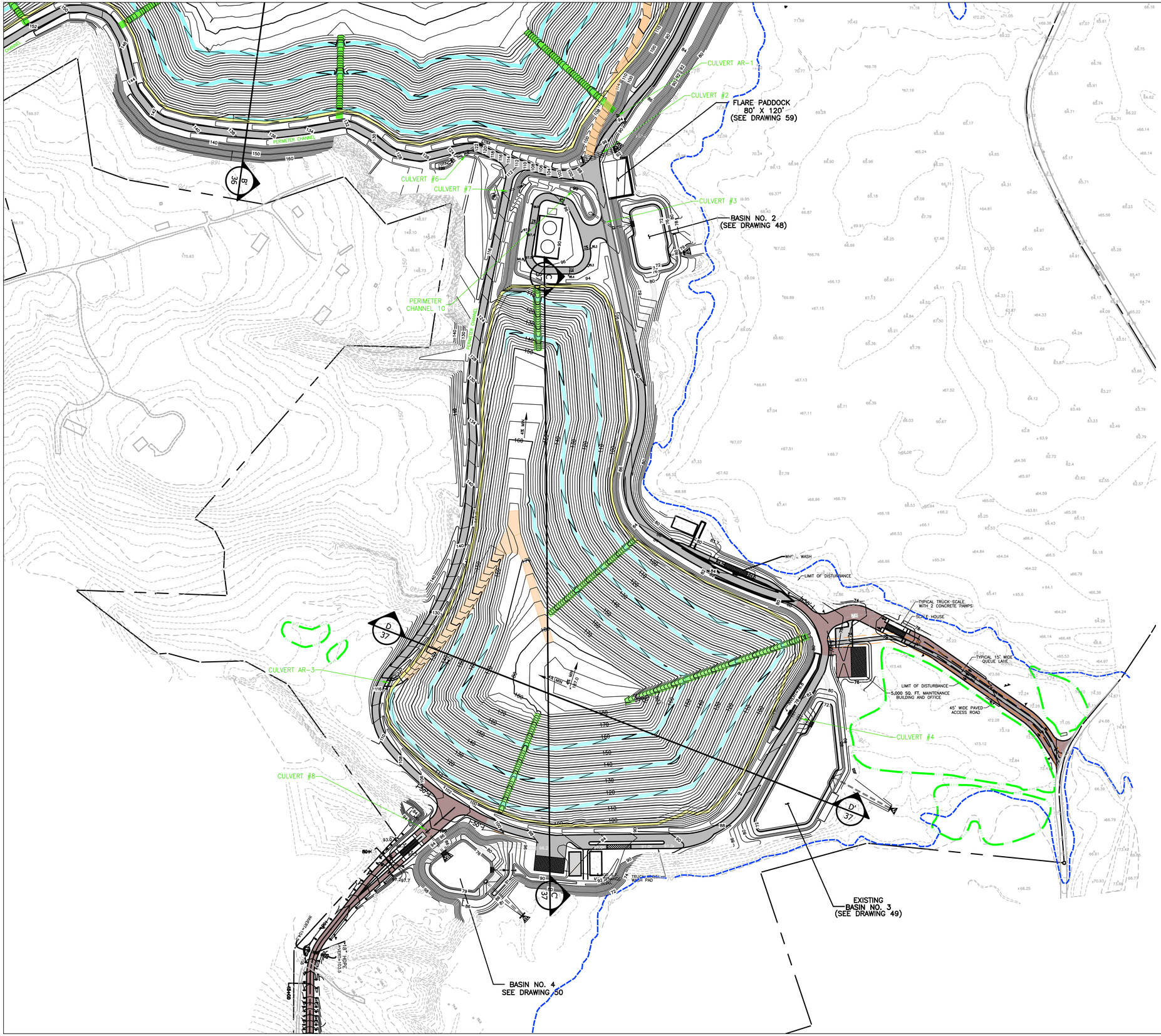
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TOP OF CLOSURE CAP
GRADING PLAN -
WEST (CELL 1-10)

PROJECT MANAGER:	PCS	SCALE:	AS NOTED
CHECKED BY:	PCS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 32

N:\Projects\2018\2018854 - Chesapeake Terrace\07-CAD\DWG\BC & Phase III Application\Drawings\Final\2018854_BC32 - CLOSURE CAP GRADING Plan - WEST (CELL 1-10).dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 2/35
- TERRACE, SEE DETAIL 2/34
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

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2.) FOR STORMWATER MANAGEMENT FEATURES, SEE DRAWINGS 38 & 39.

3.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER LAYER.

4.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND
LEONARD STRICKMAN
No. 21583
PROFESSIONAL ENGINEER

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

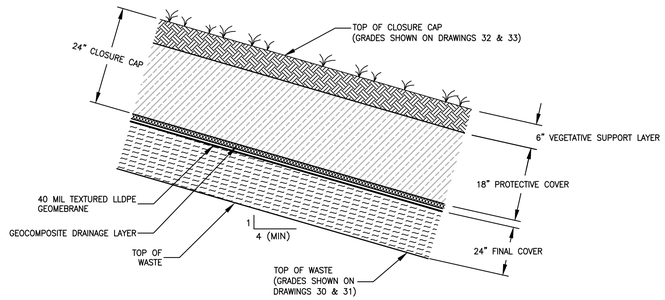
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TOP OF CLOSURE CAP
GRADING PLAN -
EAST (CELL 11-16)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

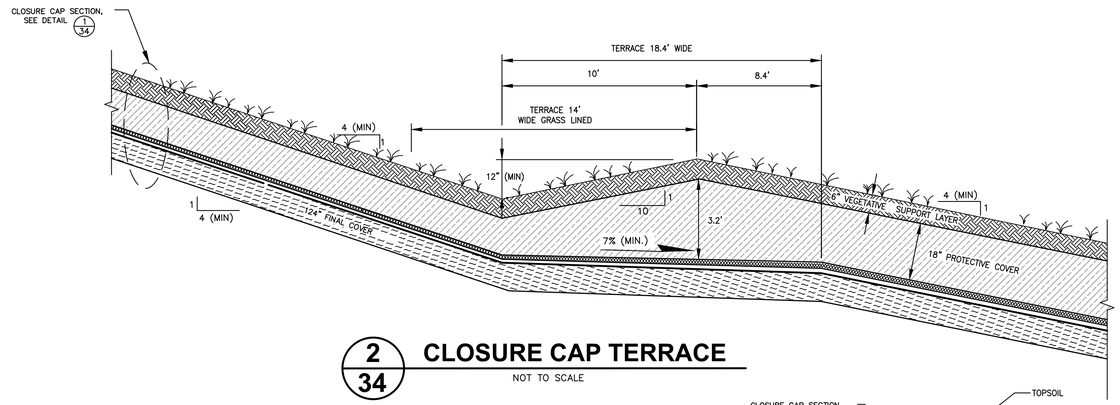
DRAWING 33

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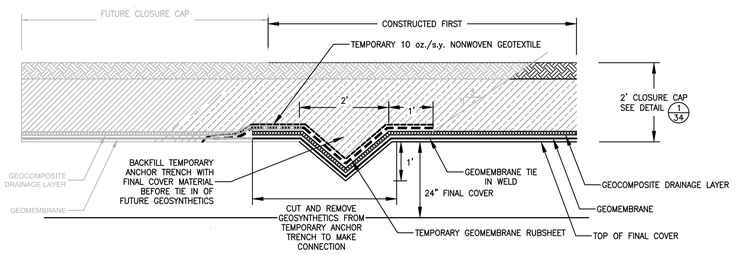
1/34 CLOSURE CAP SECTION

NOT TO SCALE



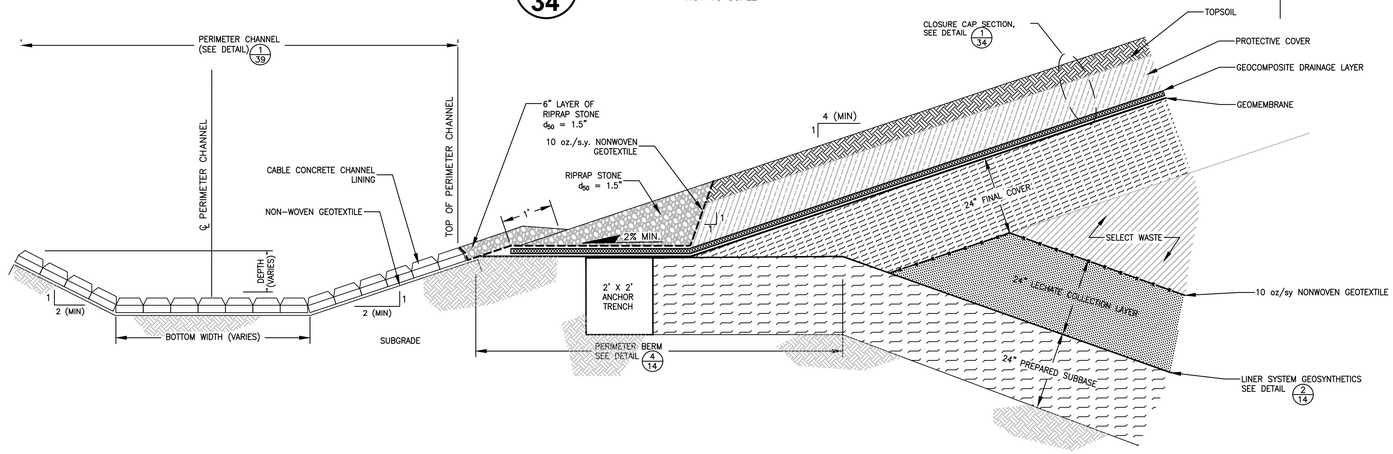
2/34 CLOSURE CAP TERRACE

NOT TO SCALE



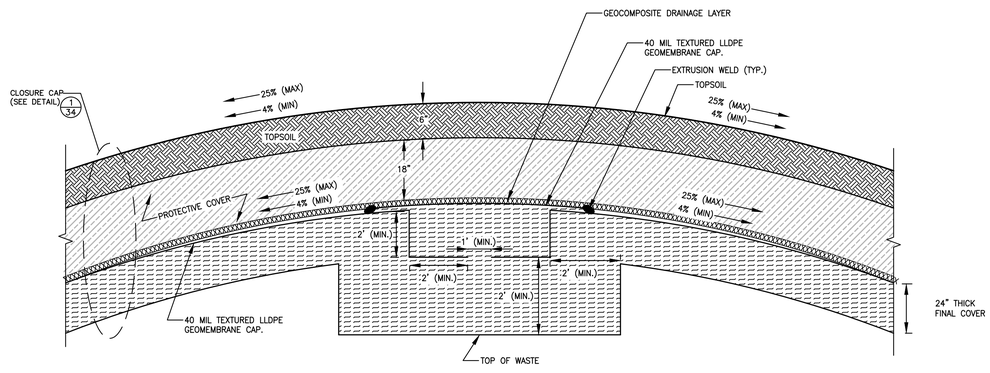
3/34 TEMPORARY CAP TERMINATION (FOR PHASED CONSTRUCTION)

NOT TO SCALE



4/34 CAP TOE DRAIN

NOT TO SCALE



5/34 CROWN GEOSYNTHETICS TIE-IN

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT
3.) THE 40 MIL GEOMEMBRANE SHALL BE TEXTURED ON BOTH SIDES IN ALL AREAS.

STATE OF MARYLAND — KATHY OSBORNE STACKMAN — LICENSE NO. 19810 — PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

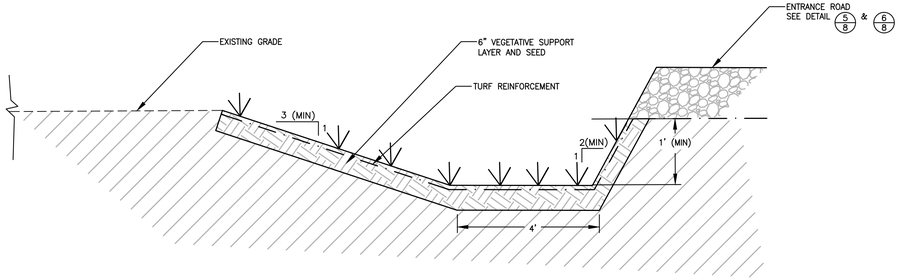
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FINAL COVER DETAILS
(SHEET 1 OF 2)

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

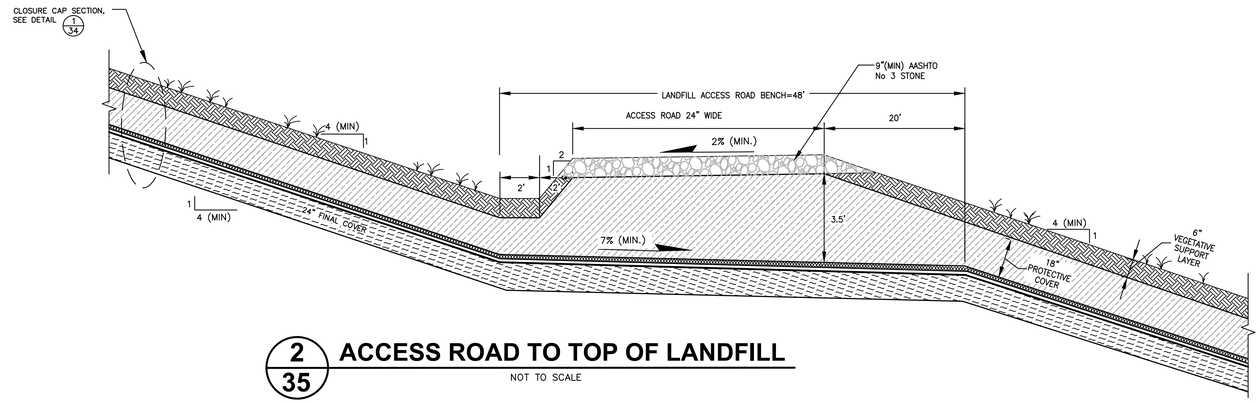
DRAWING 34

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\GWS\MC & Phase III Application\Drawings\Final\20180854 MXD - FINAL COVER DETAILS SHEET 1 OF 2.dwg



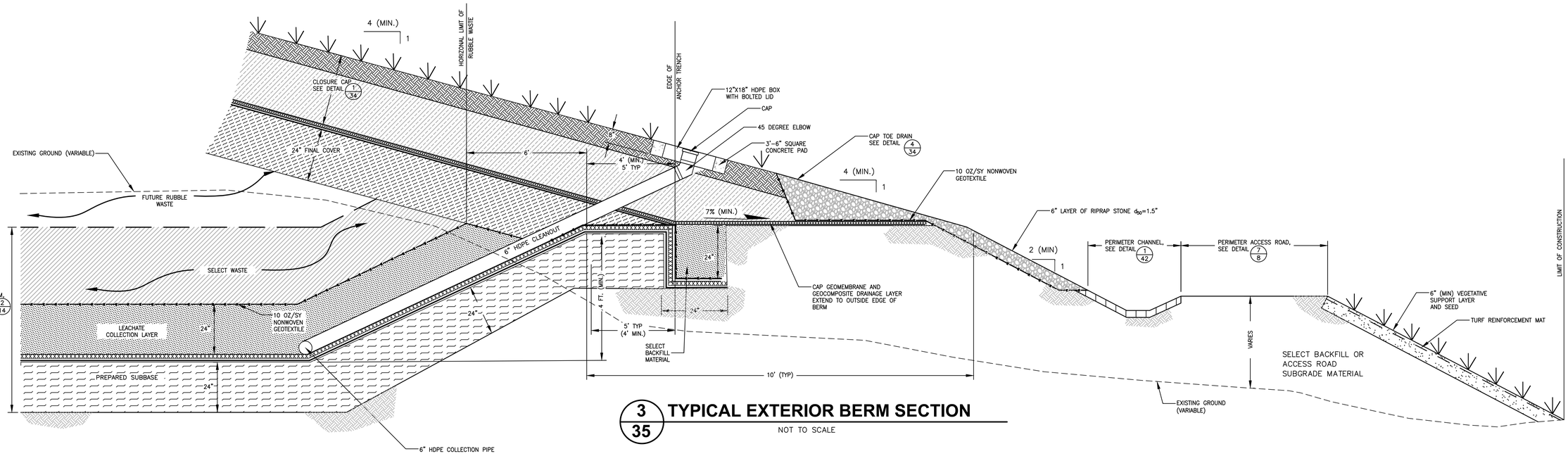
1/35 ENTRANCE ROAD CHANNEL

NOT TO SCALE



2/35 ACCESS ROAD TO TOP OF LANDFILL

NOT TO SCALE



3/35 TYPICAL EXTERIOR BERM SECTION

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT

STATE OF MARYLAND — RAYMOND E. STEWART — 21655 — PROFESSIONAL ENGINEER

REVISION:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

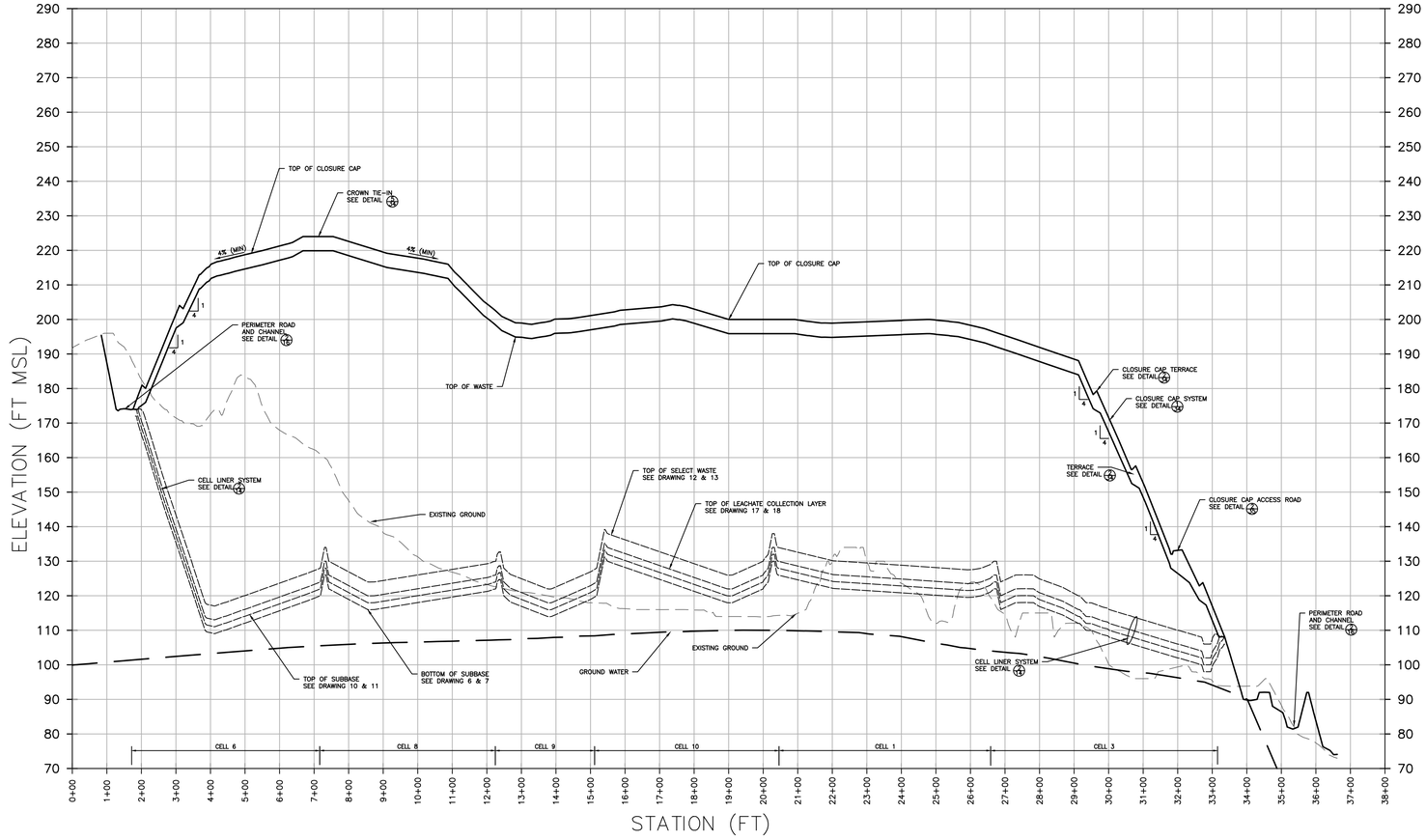
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1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273, F: 856.354.8236 www.advancedgeoservices.com

FINAL COVER DETAILS
(SHEET 2 OF 2)

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY: KHF	DATE:09/03/2021

DRAWING 35

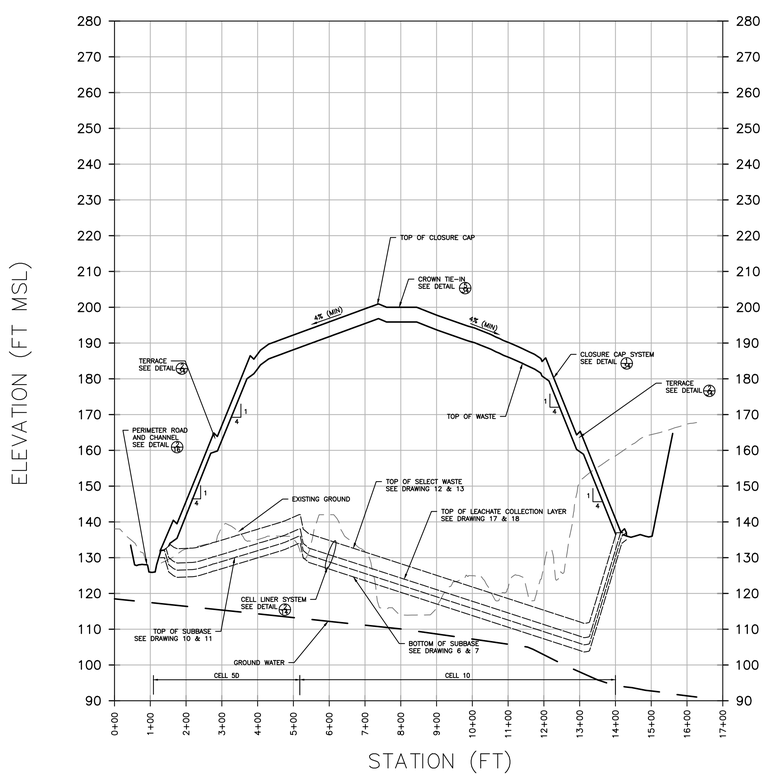
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A/36 LANDFILL CROSS SECTION A-A'

SCALE: VERTICAL— 0 10 20 40 — 1 INCH = 20 FT

HORIZONTAL— 0 100 200 400 — 1 INCH = 200 FT



B/36 LANDFILL CROSS SECTION B-B'

SCALE: VERTICAL— 0 10 20 40 — 1 INCH = 20 FT

HORIZONTAL— 0 100 200 400 — 1 INCH = 200 FT

NOTES

1.) TOP OF CLOSURE CAP. SEE DRAWINGS 38 & 39.
2.) TOP OF FINAL COVER LAYER FOR CLOSURE CAP, SEE DRAWINGS 32 & 33.
3.) TOP OF SUBBASE, SEE DRAWINGS 10 & 11.
4.) TOP OF SELECT WASTE, SEE DRAWINGS 12 & 13.
5.) THE MINIMUM AND MAXIMUM SLOPES ON THE FINAL COVER AND CLOSURE CAP ARE 4% AND 25%, RESPECTIVELY, AT THE TIME OF CONSTRUCTION.
6.) THE MINIMUM AND MAXIMUM SLOPES FOR THE BOTTOM LINER SYSTEM ARE 3% AND 33%, RESPECTIVELY, AT THE TIME OF CONSTRUCTION.

STATE OF MARYLAND
LEONARD STRICKMAN
No. 21583
EXPIRATION DATE: FRIDAY, OCTOBER 31, 2021
PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

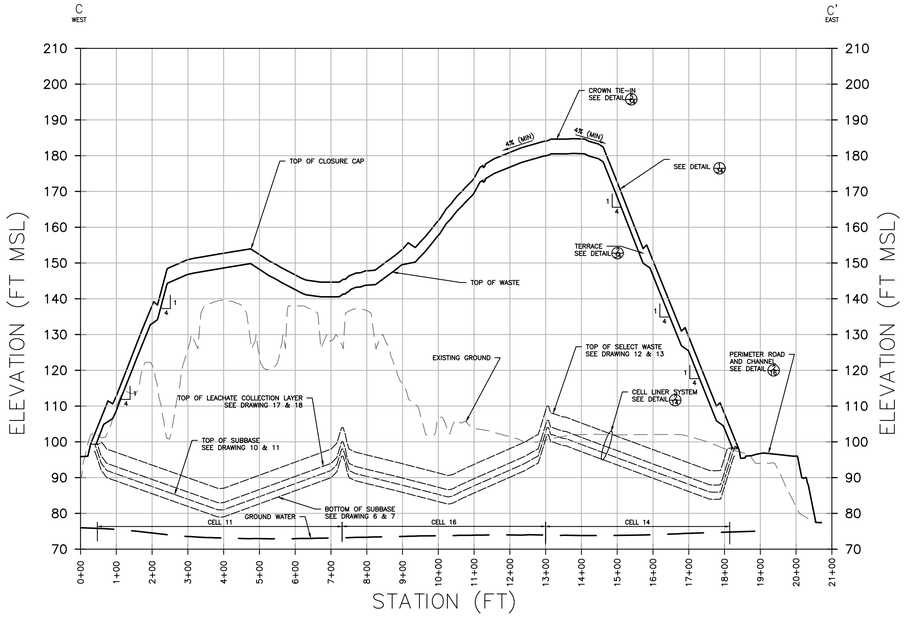
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LANDFILL CROSS-SECTION (SHEET 1 OF 2)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

DRAWING 36

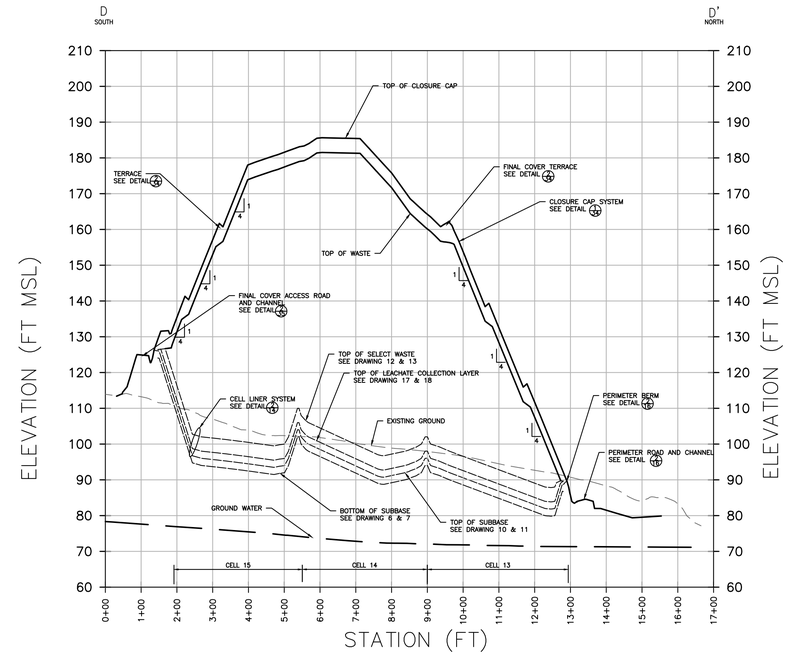
N:\Projects\2018\2018854 - Chesapeake Terrace\1-CAD\DWGS\MC & Phase III Application\Drawings\Final\2018854 BSB - LANDFILL CROSS SECTION (SHEET 1 OF 2).dwg



C 37 LANDFILL CROSS SECTION C-C'

SCALE: VERTICAL— 0 10 20 40 — 1 INCH = 20 FT

HORIZONTAL— 0 100 200 400 — 1 INCH = 200 FT



D 37 LANDFILL CROSS SECTION D-D'

SCALE: VERTICAL— 0 10 20 40 — 1 INCH = 20 FT

HORIZONTAL— 0 100 200 400 — 1 INCH = 200 FT

NOTES

1.) TOP OF CLOSURE CAP. SEE DRAWINGS 38 & 39.
2.) TOP OF FINAL COVER LAYER FOR CLOSURE CAP, SEE DRAWINGS 32 & 33.
3.) TOP OF SUBBASE, SEE DRAWINGS 10 & 11.
4.) TOP OF SELECT WASTE, SEE DRAWINGS 12 & 13.
5.) THE MINIMUM AND MAXIMUM SLOPES ON THE FINAL COVER AND CLOSURE CAP ARE 4% AND 25%, RESPECTIVELY, AT THE TIME OF CONSTRUCTION.
6.) THE MINIMUM AND MAXIMUM SLOPES FOR THE BOTTOM LINER SYSTEM ARE 3% AND 33%, RESPECTIVELY, AT THE TIME OF CONSTRUCTION.

STATE OF MARYLAND — RICHARD STRICKMAN — EXPIRATION DATE: 07/31/2022 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
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1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ, 08003
T: 856.354.2271, F: 856.354.8226, www.advancedgeoservices.com

LANDFILL CROSS-SECTION (SHEET 2 OF 2)

PROJECT MANAGER: PGS	SCALE: AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY: KHF	DATE: 09/03/2021

DRAWING 37

N:\Projects\2018\2018854 - Chesapeake Terrace\11CAD\WORK & Phase III Application\Drawings\Final\2018854 B37 - LANDFILL CROSS-SECTION (SHEET 2 OF 2).dwg

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 2/35
- TERRACE, SEE DETAIL 2/34
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

1.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER/CLOSURE CAP.

2.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

3.) STORMWATER MANAGEMENT DETAILS ARE SHOWN ON DRAWINGS 40 THROUGH 44.

4.) PERIMETER CHANNEL DETAIL ARE SHOWN ON DRAWING 42.

CULVERT AR 2
CULVERT #5
BASIN NO. 1 (SEE DRAWING 47)
CULVERT #1
CULVERT AR 1
CULVERT #2
FLARE PADDOCK 80' X 120' (SEE DRAWING 59)
CULVERT #3
BASIN NO. 2 (SEE DRAWING 48)
CULVERT #6
CULVERT #7

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

STATE OF MARYLAND — RICHARD STRICKMAN — LICENSED PROFESSIONAL ENGINEER — 21583

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

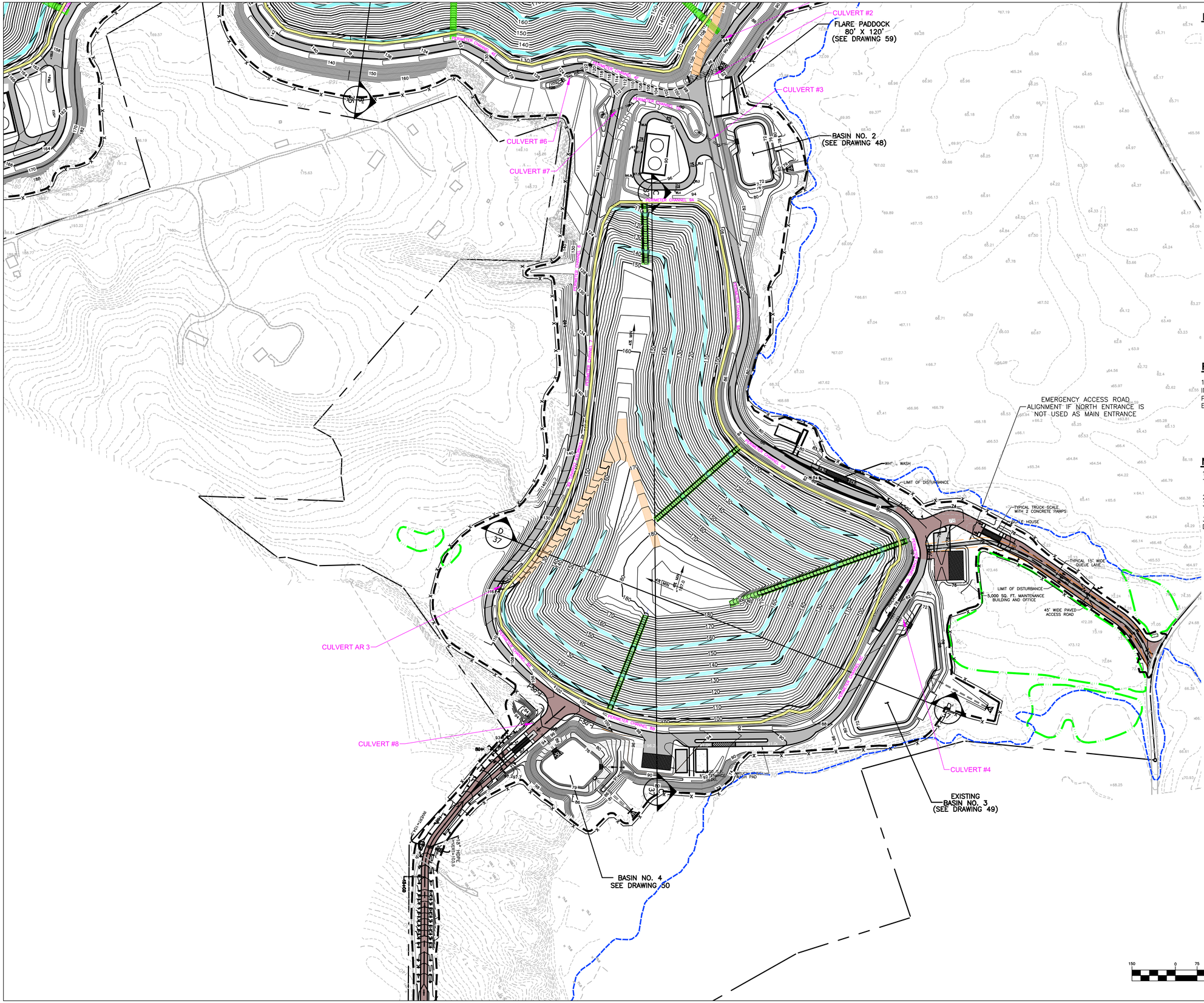
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1978 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
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STORMWATER MGMT SYSTEM LAYOUT – WEST (CELL 1–10)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 38

G:\Projects\2018\2018854 - Chesapeake Terrace\CAD\ENGINEERING & Permit Application\Drawings\Final\20180854 BSB - STORMWATER MANAGEMENT LAYOUT PLAN - WEST CELL 1-10.dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- ACCESS ROAD TO THE TOP, SEE DETAIL 2/35
- TERRACE, SEE DETAIL 2/34
- PERIMETER BERM, SEE DETAIL 3/35
- DOWNCHUTE, SEE DETAIL 1/20

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

NOTES

1.) THE GRADES SHOWN ON THIS REPRESENT THE TOP OF THE FINAL COVER/CLOSURE CAP.

2.) FINAL COVER/CLOSURE CAP DETAILS ARE ON DRAWINGS 34 & 35.

3.) STORMWATER MANAGEMENT DETAILS ARE SHOWN ON DRAWINGS 40 THROUGH 44.

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — KAVEH KHOSHNEVISAN — No. 21583 — REGISTERED PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

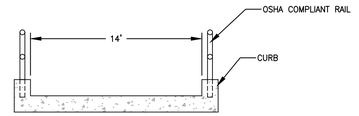
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T: 856.354.2273, F: 856.354.8236 www.advancedgeoservices.com

STORMWATER MGMT
SYSTEM LAYOUT -
EAST (CELL 11-16)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

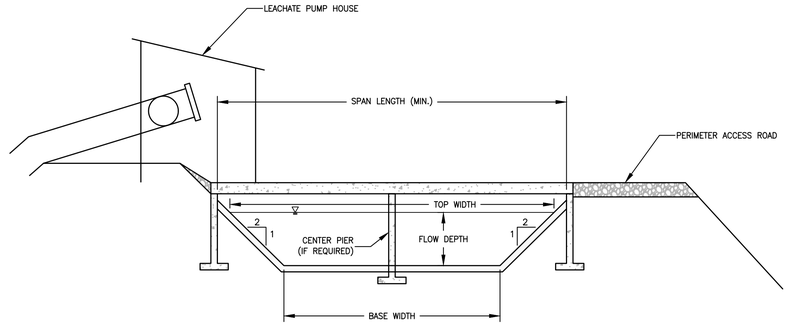
DRAWING 39

N:\Projects\2018\2018854 - Chesapeake Terrace\CAD\MXSMC & Phase III Application\Drawings\Final\2018854 #039 - STORMWATER MANAGEMENT LAYOUT PLAN - EAST (CELL 11-16).dwg



A/40 SECTION A-A'

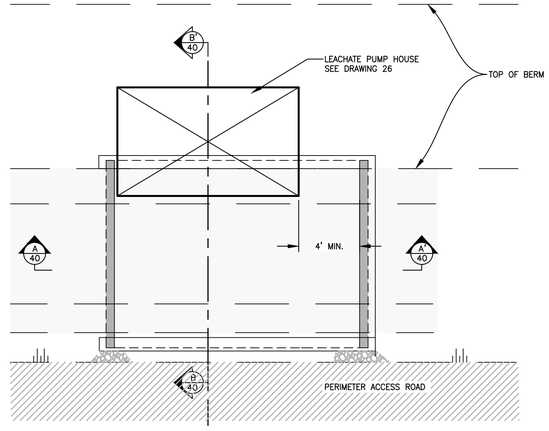
NOT TO SCALE



LEACHATE PUMP HOUSE EXTENDS ONTO CHANNEL CROSSING SPAN
FOR ALL CELLS EXCEPT 2, 3, 4, 5E, 5F, 12, AND 13

B/40 SECTION B-B'

NOT TO SCALE



1/40 PERIMETER CHANNEL CROSSING (AT PUMP HOUSES)

NOT TO SCALE

CELL/PUMP HOUSE NUMBER	BASE WIDTH (FT)	FLOW DEPTH (FT)	TOP WIDTH (FT)	MINIMUM SPAN LENGTH (FT)
1	15.1	3.3	28.3	32.3
2	15.1	3.5	29.1	33.1
3	9.6	2.2	18.4	22.4
4	9.6	2.2	18.4	22.4
5A	9.6	2	17.6	21.6
5B	13.8	2.6	24.2	28.2
5C	13.8	2.6	24.2	28.2
5D	15.1	2.6	25.5	29.5
5E	15.1	3.2	27.9	31.9
5F	15.1	3.2	27.9	31.9
6	4.1	2	12.1	16.1
7	NA	NA	NA	NA
8	13.8	2	21.8	28.8
9	13.8	2.5	23.8	27.8
10	15.1	2.8	26.3	26.3
11	8.3	2.6	18.7	22.7
12	9.6	2.6	20	24
13	17.9	2.2	26.7	30.7
14	8.3	2	16.3	20.3
15	2.8	2	10.8	14.8
16	2.8	2	10.8	14.8

TABLE: CHANNEL CROSSING TO PUMP HOUSE

CHANNEL CROSSING END FOUNDATIONS MUST BE PLACED OUTSIDE OF CHANNEL FLOW

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT.
3.) FLOW DEPTH BASED ON 25 YEAR–24 HOUR DESIGN STORM EVENT.
4.) PRECAST CONCRETE BRIDGE SPAN AND FOUNDATION SUPPORTS SHALL BE DESIGNED BY A MARYLAND LICENSED STRUCTURAL ENGINEER.
5.) SPAN LENGTH >18 FT MAY BE CONSTRUCTED WITH A CENTER PIER, PROVIDED WIDTH OF PIER IS LESS THAN 5% OF SPAN WIDTH.
6.) LEACHATE PUMP HOUSE EXTENDS ONTO CHANNEL CROSSING SPAN FOR ALL CELLS EXCEPT 2, 3, 4, 5E, 5F, 12, AND 13.
7.) CHANNEL CROSSING END FOUNDATIONS MUST BE PLACED OUTSIDE OF CHANNEL FLOW.

STATE OF MARYLAND · EDWARD STRICKMAN · 21581 · PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

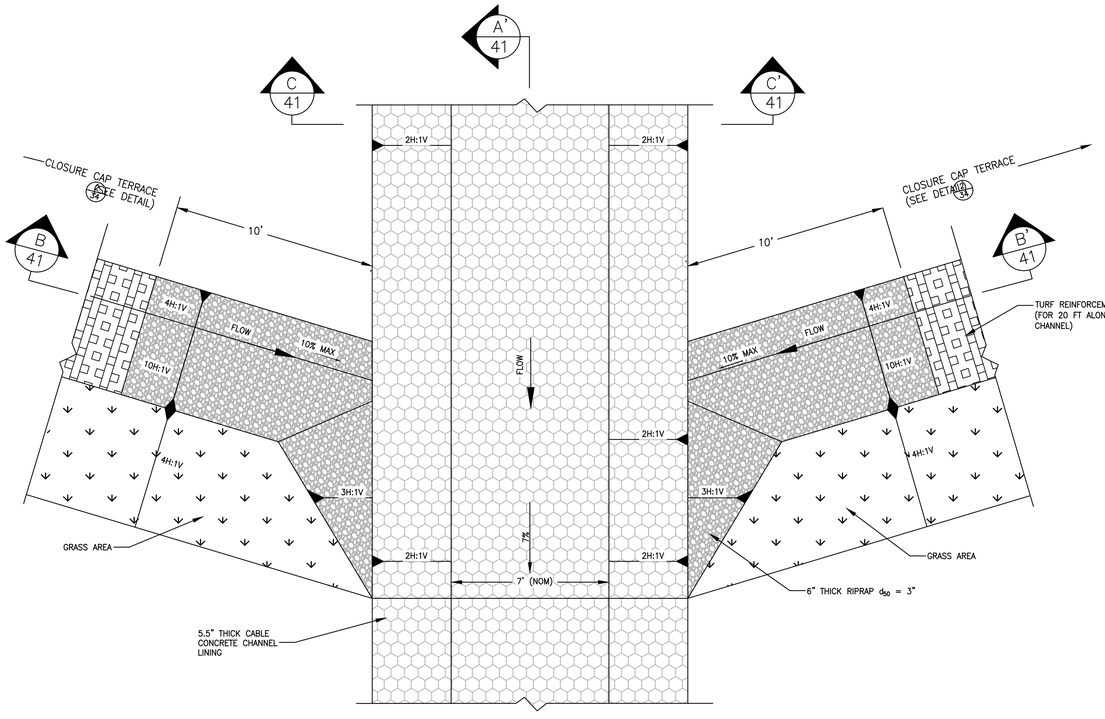
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STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 1 OF 4)

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF	DATE:09/03/2021

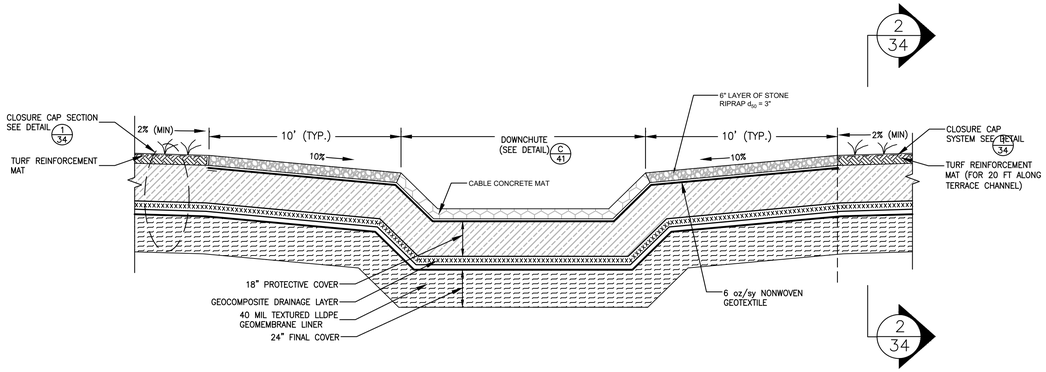
DRAWING 40

N:\Projects\2018\3018854 - Chesapeake Terrace\CAD\ENGINEER_& Permit #1 Application\Drawings\Final\3018854 BMP - STORMWATER MANAGEMENT SYSTEM DETAILS SHEET 1 OF 4.dwg



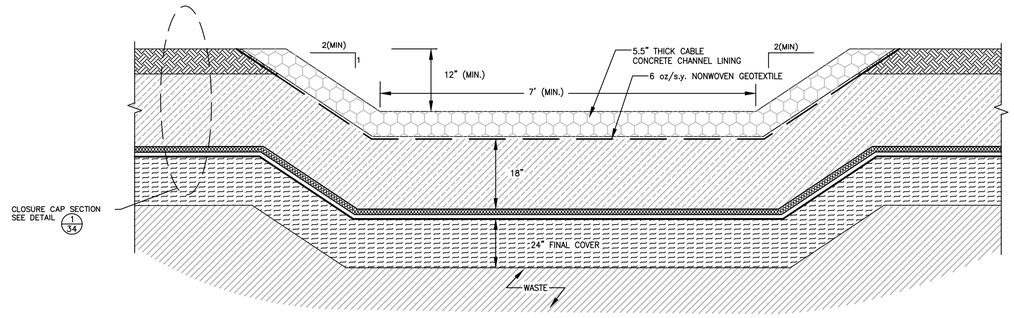
1/41 DOWNCHUTE CHANNEL

NOT TO SCALE



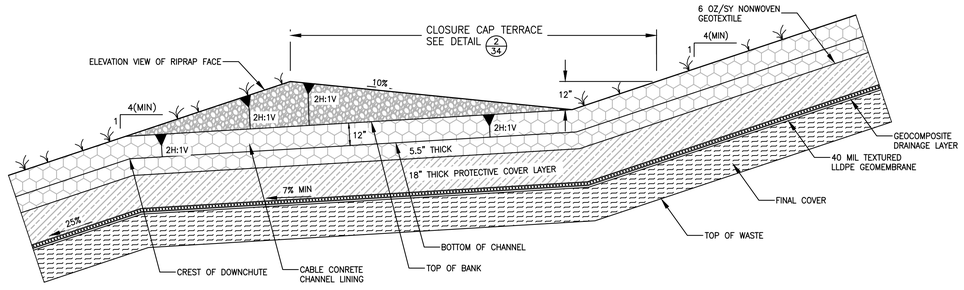
B/41 SECTION B-B'

NOT TO SCALE



C/41 SECTION C-C'

NOT TO SCALE



A/41 SECTION A-A'

NOT TO SCALE

NOTES

1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIREMENTS, SEE THE TECHNICAL SPECIFICATIONS IN SECTION 14 OF THE PHASE III REPORT

STATE OF MARYLAND · RICHARD STRAKHMAN · LICENSE NO. 21581 · PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

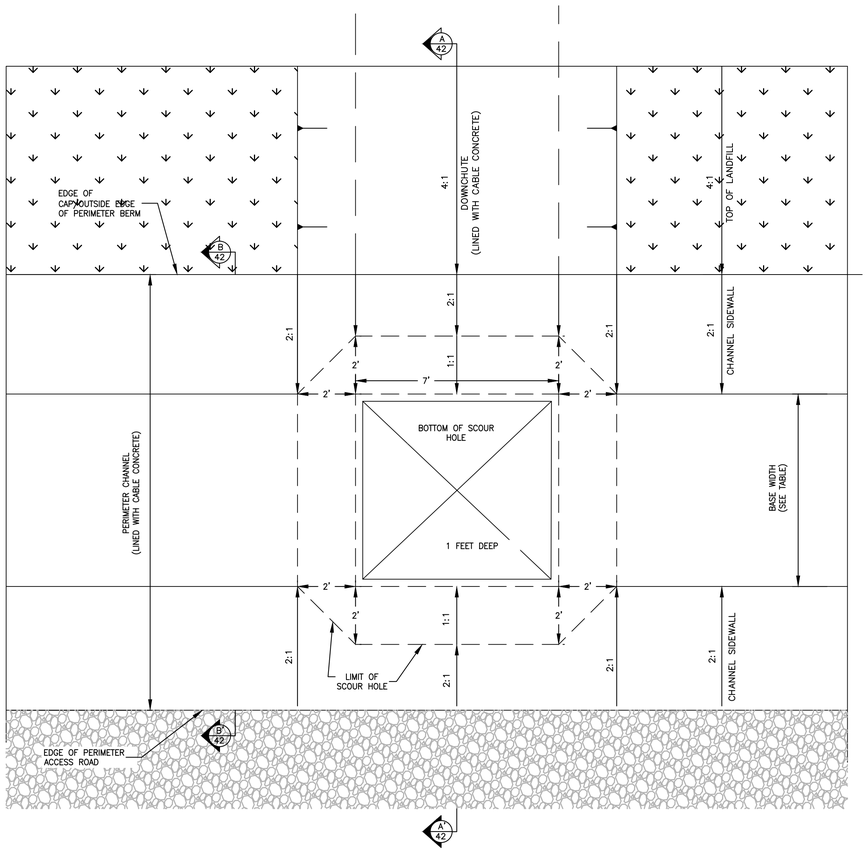
ADVANCED GeoServices
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STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 2 OF 4)

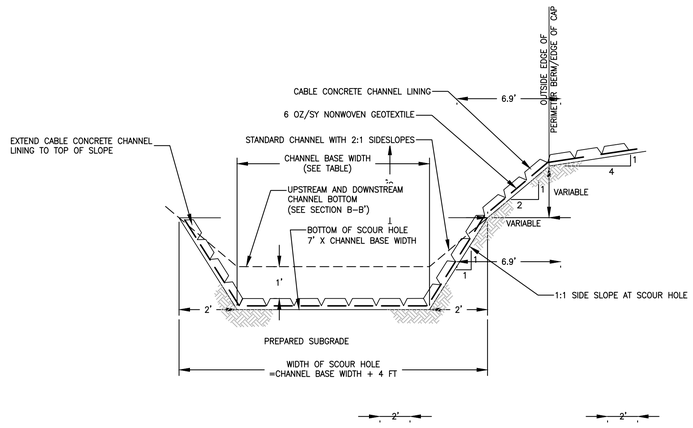
PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 - 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

DRAWING 41

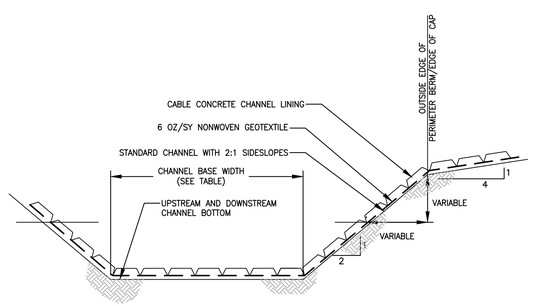
N:\Projects\2018\2018854 - Chesapeake Terrace\CAD\ANCHOR, & Phase III Application\Drawings\Final\SHEETS\2018854 BM1 - STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 2 OF 4).dwg



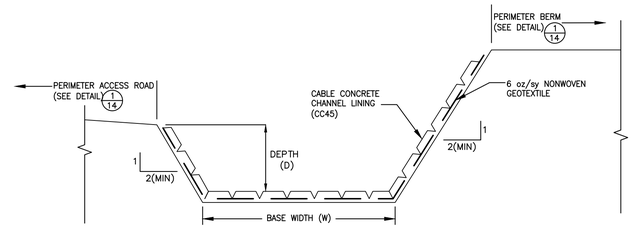
PLAN VIEW
2/42 TYPICAL DOWNCHUTE SCOUR HOLE
NOT TO SCALE



A/42 SECTION A-A'
NOT TO SCALE



B/42 SECTION B-B'
NOT TO SCALE



1/42 PERIMETER CHANNEL
NOT TO SCALE

SWALE ID	BASE WIDTH (W) (FT)	DEPTH (D) (FT)	DISCHARGE (25 YR/24 HRS) (Q)(CFS)	LINING
1A	9.6	2.5	64.6	CC45
1B	9.6	2.0	64.6	CC45
2	4.1	2.0	31.8	CC45
3A	4.1	2.0	16.0	CC45
3B	9.6	2.0	80.8	CC45
3C	13.8	2.6	140.3	CC45
3D	15.1	2.6	197.6	CC45
3E	15.1	32.0	282.9	CC45
4A	4.1	2.0	40.7	CC45
4B	13.8	2.0	109.2	CC45
4C	13.8	2.5	160.6	CC45
4D	15.1	2.8	210.3	CC45
4E	15.1	3.3	281.1	CC45
4F	15.1	3.5	347.9	CC45
5	9.6	2.2	81.0	CC45
6	8.3	2.0	24.0	CC45
7	2.8	2.0	17.3	CC45
8A	2.8	2.0	36.5	CC45
8B	8.3	2.0	113.8	CC45
8C	17.9	2.2	279.9	CC45
9A	8.3	2.6	48.2	CC45
9B	9.6	2.6	91.1	CC45
9C	13.8	2.6	122.8	CC45
10	9.6	2.0	68.5	CC45

NOTES
1.) THICKNESS OF GEOSYNTHETICS IS EXAGGERATED FOR CLARITY.
2.) FOR MATERIALS REQUIERMENTS, SEE THE TECHNICAL SPECIFICAITONS IN SECTION 14 OF THE PHASE III REPORT

STATE OF MARYLAND · RICHARD STOCKMAN · 19581 · PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

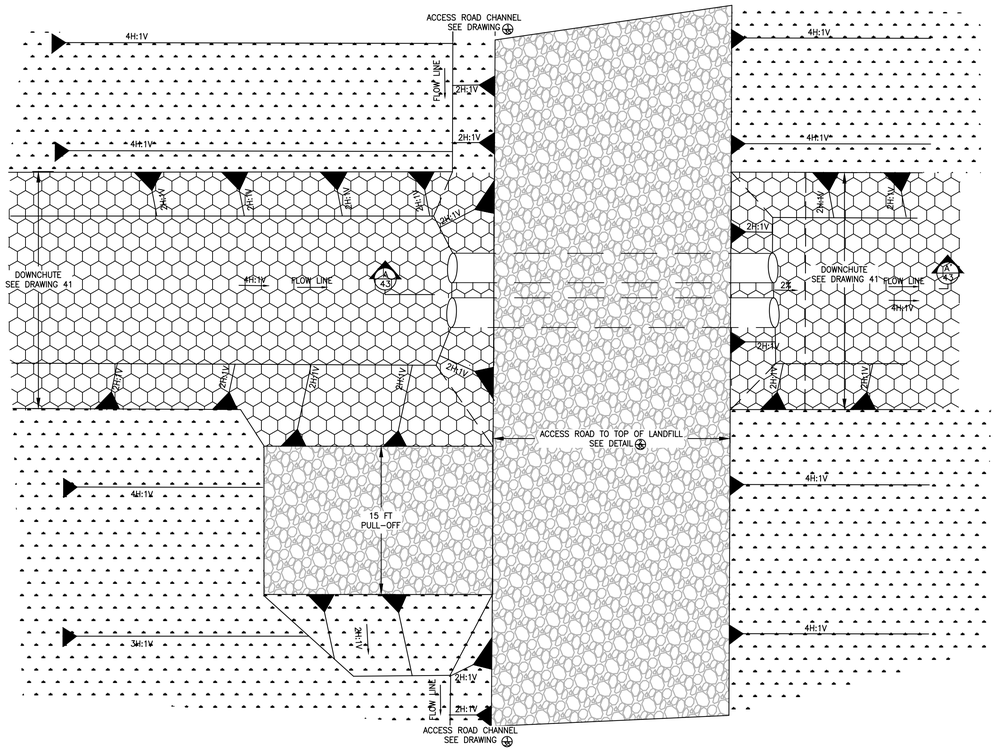
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STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 3 OF 4)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:AS NOTED	
PROJECT NUMBER:	2018 - 3854
DATE:09/03/2021	

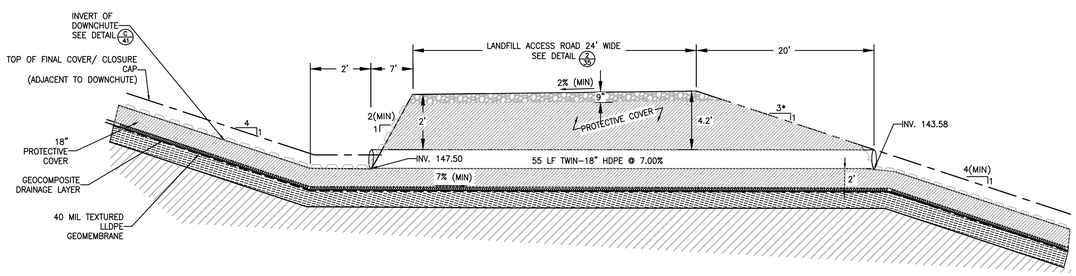
DRAWING 42

N:\Projects\2018\3018854 - Chesapeake Terrace\1\FCA\ZONING\BC & Phase III Application\Drawings\Final\3018854 BNZ - STORMWATER MANAGEMENT SYSTEM DETAILS (SHEET 3 OF 4).dwg



1/43 DOWNCHUTE ACCESS CROSSING ROAD

NOT TO SCALE



* 3:1 SLOPE AT PIPE CROSSING ONLY. ALL OTHER OUTSIDE SLOPE OF ACCESS ROAD TO TOP OF LANDFILL SHALL BE 4:1

A/43 SECTION A-A' (CULVERT AR-2)

NOT TO SCALE

STATE OF MARYLAND
RAYMOND STOCKMAN
No. 19981
PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

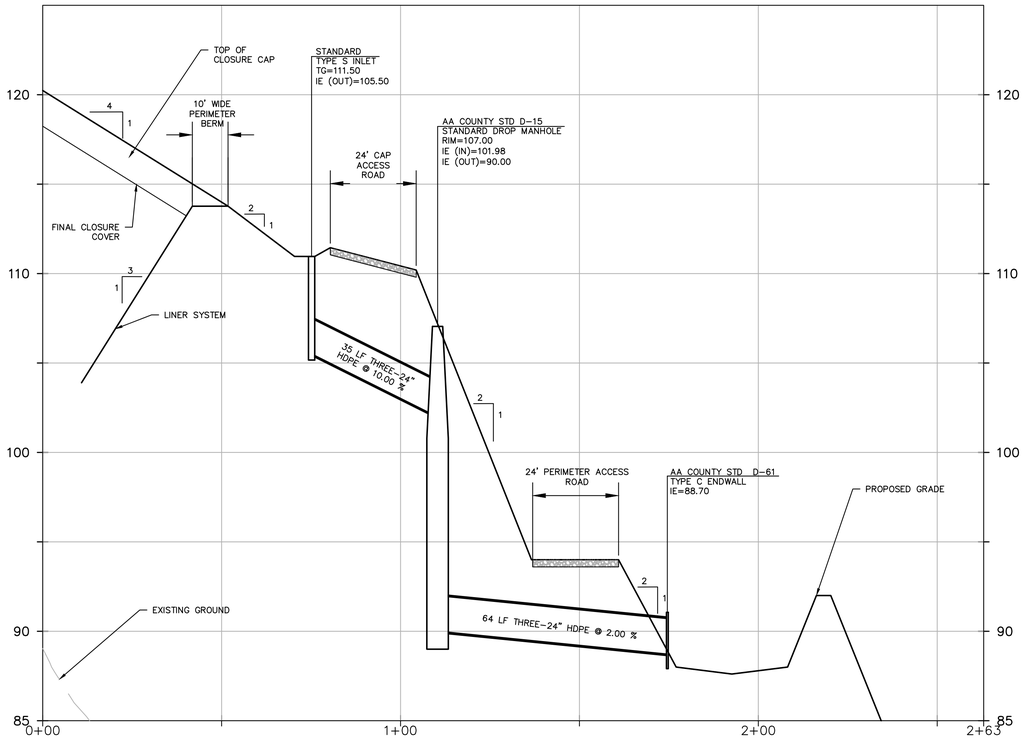
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STORMWATER
MANAGEMENT SYSTEM
DETAILS (SHEET 4 OF 4)

PROJECT MANAGER:	POS
CHECKED BY:	POS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

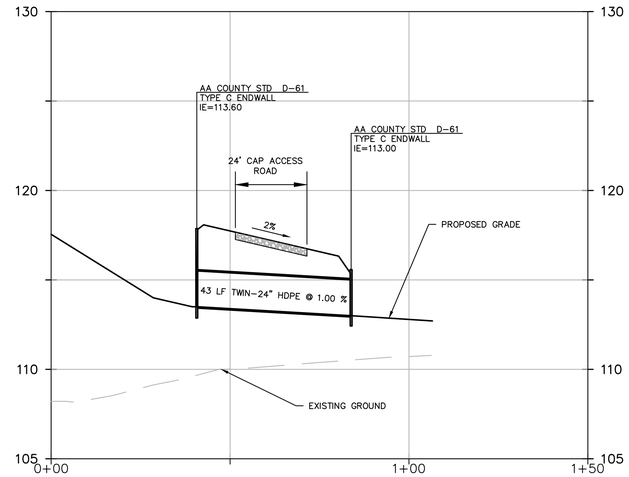
DRAWING 43

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\NC & Phase III Application\Drawings\Final\2018854.MK3 - STORMWATER MANAGEMENT SYSTEM DETAILS - SHEET 4 OF 4.dwg



1/44 PROFILE- CULVERT AR-1

SCALE: 1"=20' HOR
1"=4' VERT



2/44 PROFILE- CULVERT AR-3

SCALE: 1"=20' HOR
1"=4' VERT

REVISION:

DATE:	
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NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

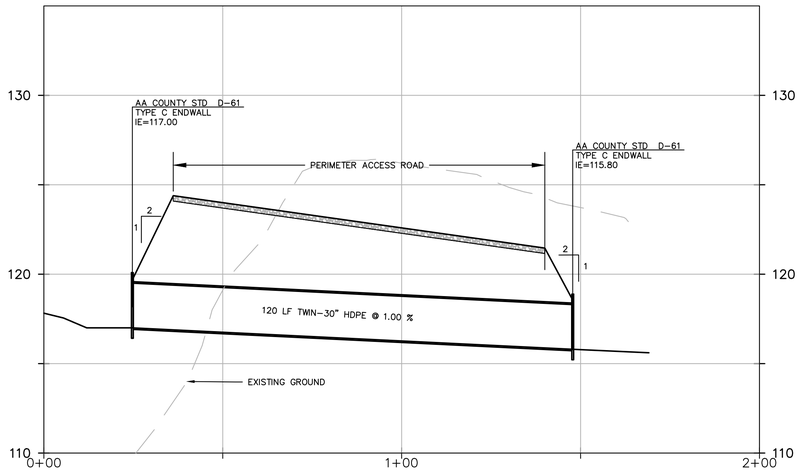
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STORMWATER
CULVERT PROFILES
(SHEET 1 OF 2)

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY: KHF	DATE:09/03/2021

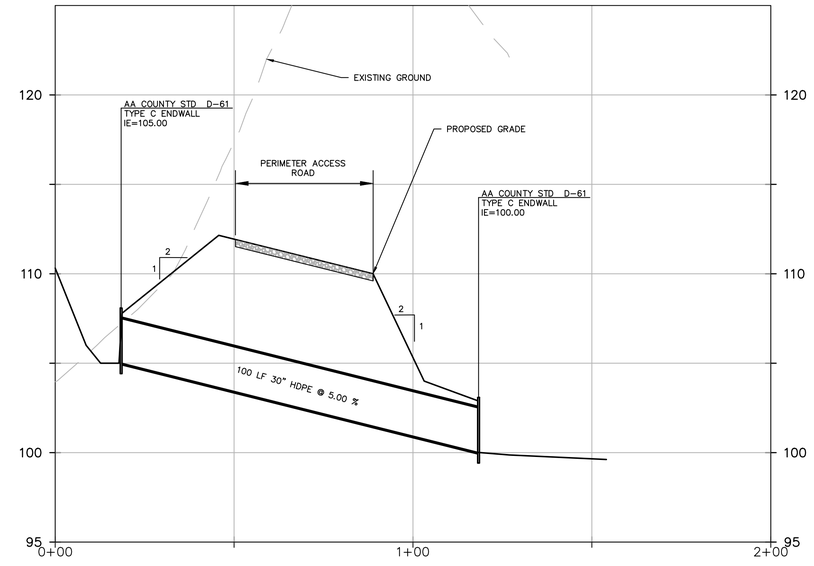
DRAWING 44

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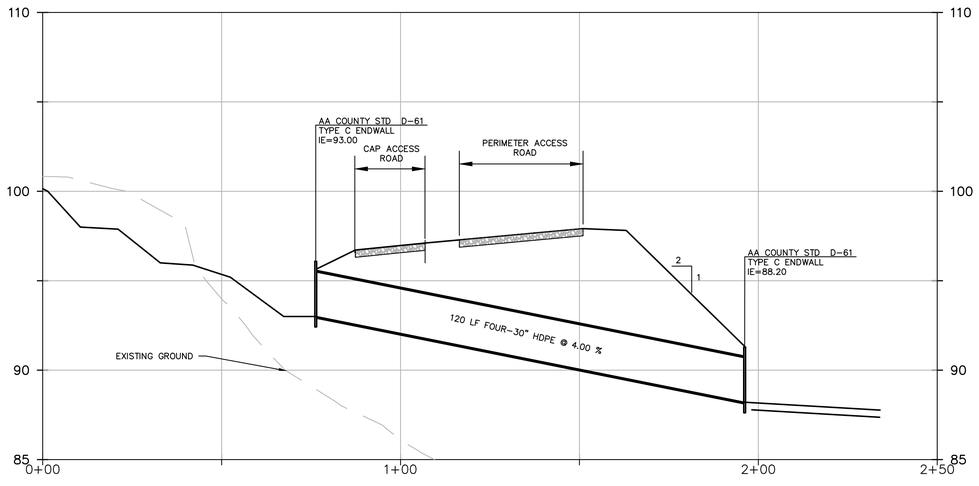
1/45 PROFILE- CULVERT #6

SCALE: 1"=20' HOR
1"=4' VERT



2/45 PROFILE- CULVERT #7

SCALE: 1"=20' HOR
1"=4' VERT



2/45 PROFILE- CULVERT #2

SCALE: 1"=20' HOR
1"=4' VERT

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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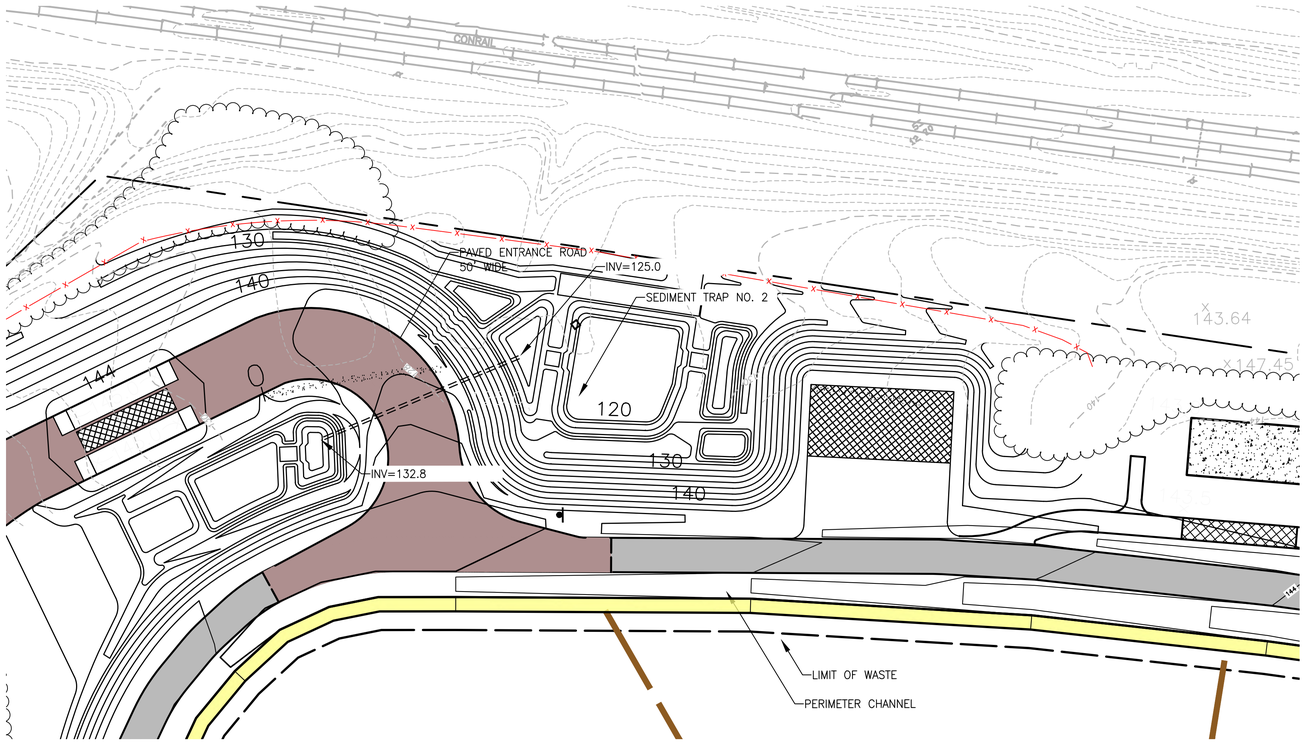
STORMWATER
CULVERT PROFILES
(SHEET 2 OF 2)

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY: KHF	DATE:09/03/2021

DRAWING 45

STATE OF MARYLAND
RICHARD STRICKMAN
No. 21708
PROFESSIONAL ENGINEER

N:\Projects\2018\3854 - Chesapeake Terrace\CAD\ENGINEER & Phase III Application\Drawings\Final\3854 BMA - STORMWATER CULVERT PROFILES (SHEET 2 OF 2).dwg



SEDIMENT TRAP No 2 (CONRAIL R.O.W).

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

LEGEND

- PROPERTY LINE
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION LINE
- LIMIT OF DISTURBANCE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- SIGNS, SEE DRAWING 9
- ALTERNATE LIMIT OF DISTURBANCE
- ALTERNATE PROPOSED CHAIN LINK FENCE
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 8/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- NEW TREE LINE
- CONCRETE HATCH
- PERIMETER BERM, SEE DETAIL 2/16

SEDIMENT TRAP NO. 2 STONE OUTLET SEDIMENT TRAP–ST–II	
DRAINAGE AREA	8.5 AC.
REQUIRED "WET" STORAGE AREA	15,300 CF
REQUIRED "DRY" STORAGE AREA	15,300 CF
BOTTOM ELEVATION	120.0
EXISTING GROUND @ C/L EMBANKMENT	124.0
LIMIT OF WET STORAGE	123.5
WET STORAGE VOLUME PROVIDED	23,500 CF
WEIR LENGTH	40 FT
WEIR CREST ELEVATION	127.0
DRY STORAGE VOLUME PROVIDED	31,080 CF
CLEANOUT ELEVATION	122.0
TOP EMBANKMENT ELEVATION	128.0
ALL SIDE SLOPES ARE 2:1	
SEE PLAN FOR BOTTOM DIMENSIONS.	

PLAN DEPICTION NOTES

1.) THE SEDIMENT TRAP AT CONRAIL R.O.W. IS DESIGNED TO ACCOMMODATE AN 8.5–ACRE DRAINAGE AREA FOR OPTIONAL SOUTH ENTRANCE CONSTRUCTION (SEE SHEET 54). DRAINAGE AREA TO TRAP IF SOUTH ENTRANCE IS NOT CONSTRUCTED IS 3.8 ACRES.

2.) THE SEDIMENT TRAP SHALL REMAIN IN–PLACE AND SHALL BE MAINTAINED THROUGHOUT THE LIFE OF LANDFILL CONSTRUCTION AND OPERATION.

STATE OF MARYLAND · RICHARD STRICKMAN · 21585 · REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

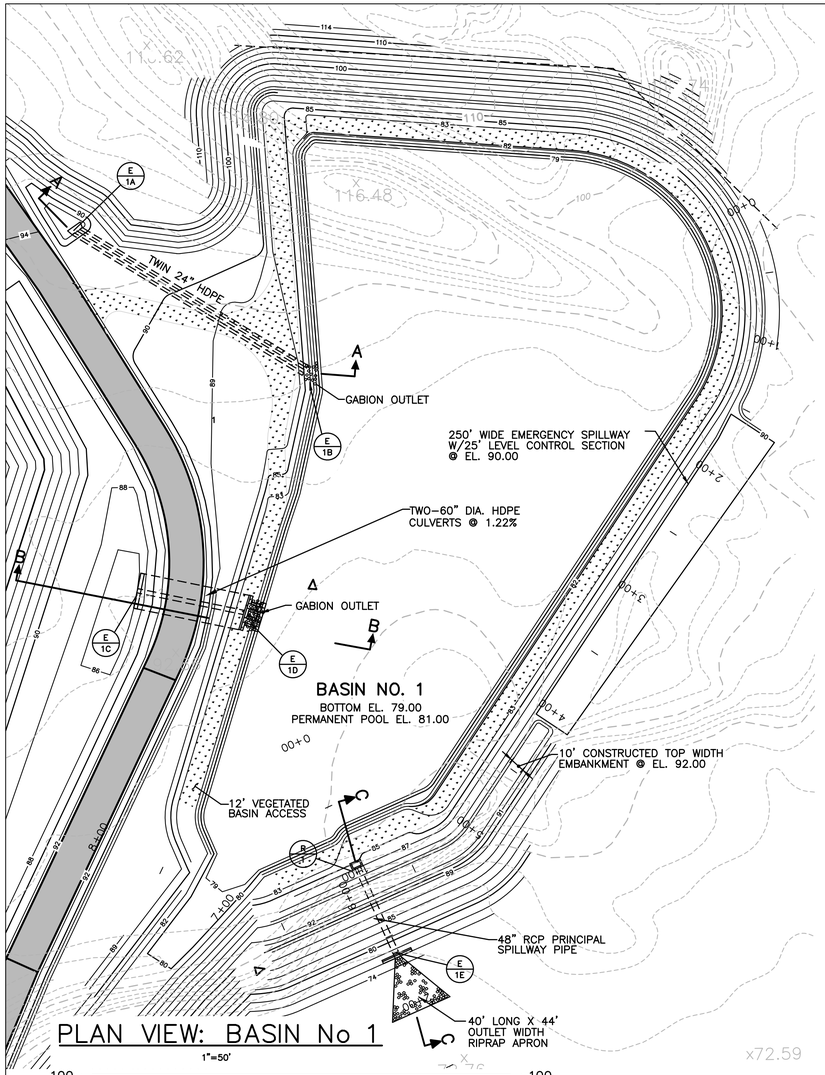
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SEDIMENT TRAP PLAN

PROJECT MANAGER: POS | SCALE: AS NOTED
CHECKED BY: POS | PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF | DATE: 09/03/2021

DRAWING 46

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\8C $ Phase III Application\Drawings\Final\20180854.MXB - SEDIMENT TRAP.dwg

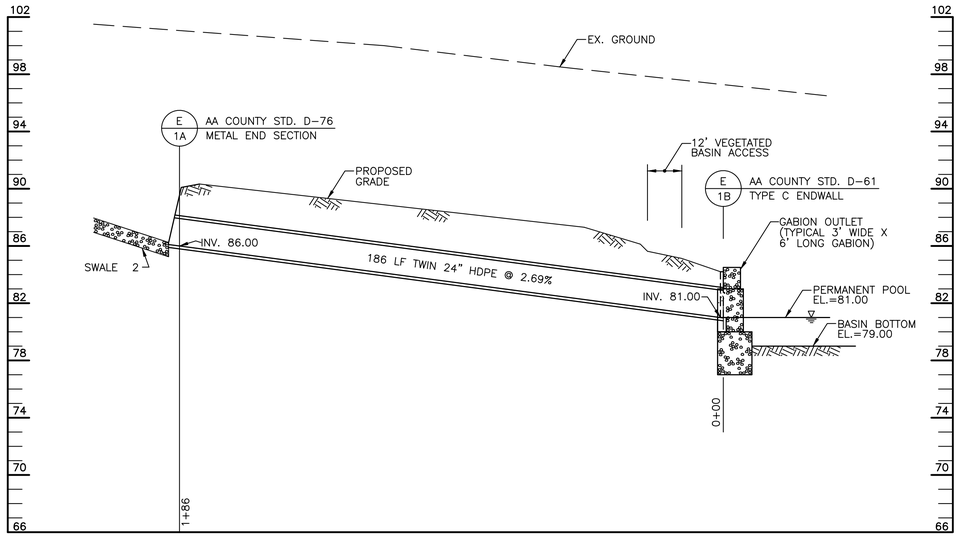


PLAN VIEW: BASIN No 1

SEQUENCE OF CONSTRUCTION

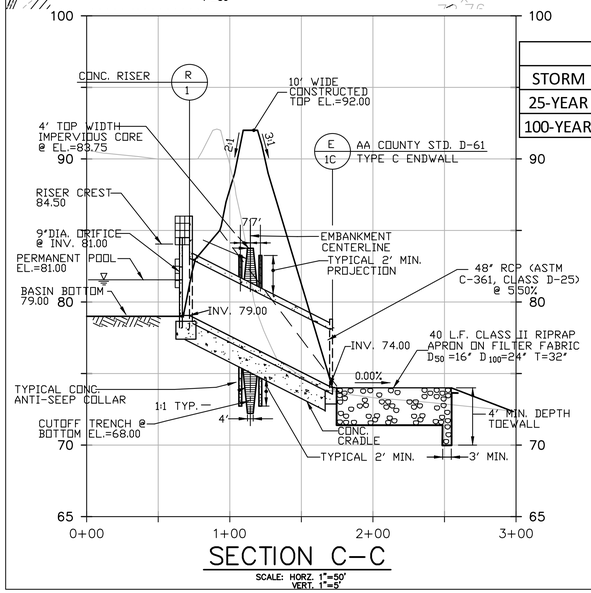
1. PROPOSED CONTOURS HEREON DEPICT BASIN NO. 1, LANDFILL PERIMETER ACCESS ROAD, PERIMETER DITCH AND GRADING CONTOURS, AS SHOWN ON DRAWING 6.
2. SEE DRAWING 6 FOR LIMIT OF DISTURBANCE FOR BASIN NO. 1 CONSTRUCTION.
3. FOLLOWING INSTALLATION OF SUPER SILT FENCE, BASIN NO. 1 SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS ON THESE PERMIT DRAWINGS. SEE DRAWING 63 "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION" ITEM V(B)(I) FOR TYPICAL BASIN REQUIREMENTS.
4. PROVIDE 4" TOPSOIL ON BASIN NO. 1 EMBANKMENT TOP WIDTH AND SIDE SLOPES. VEGETATIVELY STABILIZE ALL DISTURBED AREAS.
5. BASIN NO. 1 WILL SERVE AS A SEDIMENT CONTROL FACILITY UNTIL LANDFILL CELLS WITHIN THE CONTRIBUTING DRAINAGE AREA HAVE BEEN CLOSED AND VEGETATED IN ACCORDANCE WITH MARYLAND DEPARTMENT OF ENVIRONMENT REGULATIONS, SEE DRAWING 53 FOR CONCRETE RISER CONNECTIONS DURING THE SEDIMENT CONTROL PHASE.
6. TO CONVERT BASIN NO. 1 TO A PERMANENT STORMWATER MANAGEMENT POND, CONCRETE RISER CONNECTIONS DURING THE SEDIMENT CONTROL PHASE WILL BE REMOVED, THE BASIN WILL BE DEWATERED AND THE RISER ORIFICE WILL BE UTILIZED FOR SWM PURPOSE. SEE DRAWING 54 FOR RISER ORIFICE DETAILS. SEE DRAWING 54 FOR BASIN CONVERSION TO SWM POND.

50 0 25 50 100 200
(IN FEET)
1 inch = 50 ft.



SECTION A–A (CULVERT #5)

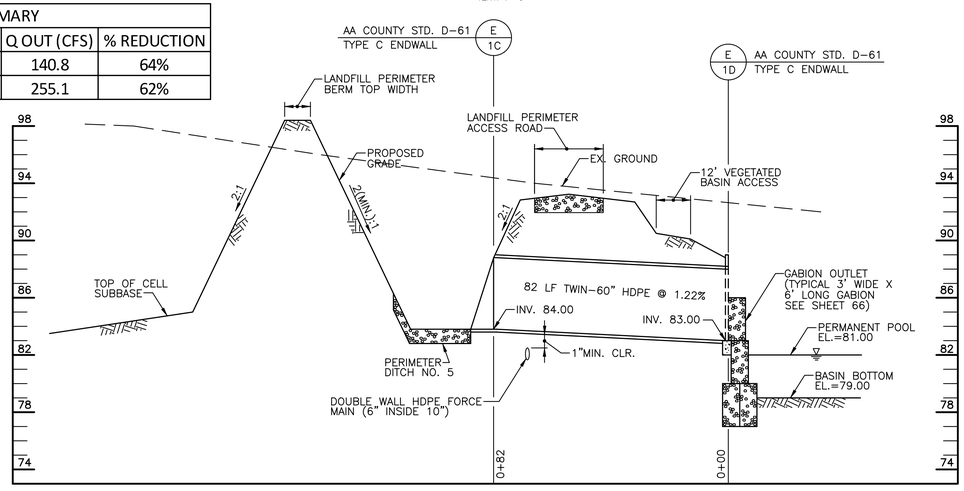
SCALE: HORZ. 1"=25'
VERT. 1"=5'



SECTION C–C

SCALE: HORZ. 1"=50'
VERT. 1"=5'

BASIN NO. 1 SUMMARY				
STORM	MAX WATER ELEV.	Q IN (CFS)	Q OUT (CFS)	% REDUCTION
25-YEAR	86.6	386.5	140.8	64%
100-YEAR	90.2	672.4	255.1	62%



SECTION B–B (CULVERT #1)

SCALE: HORZ. 1"=25'
VERT. 1"=5'

REVISION:
DATE: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1970 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

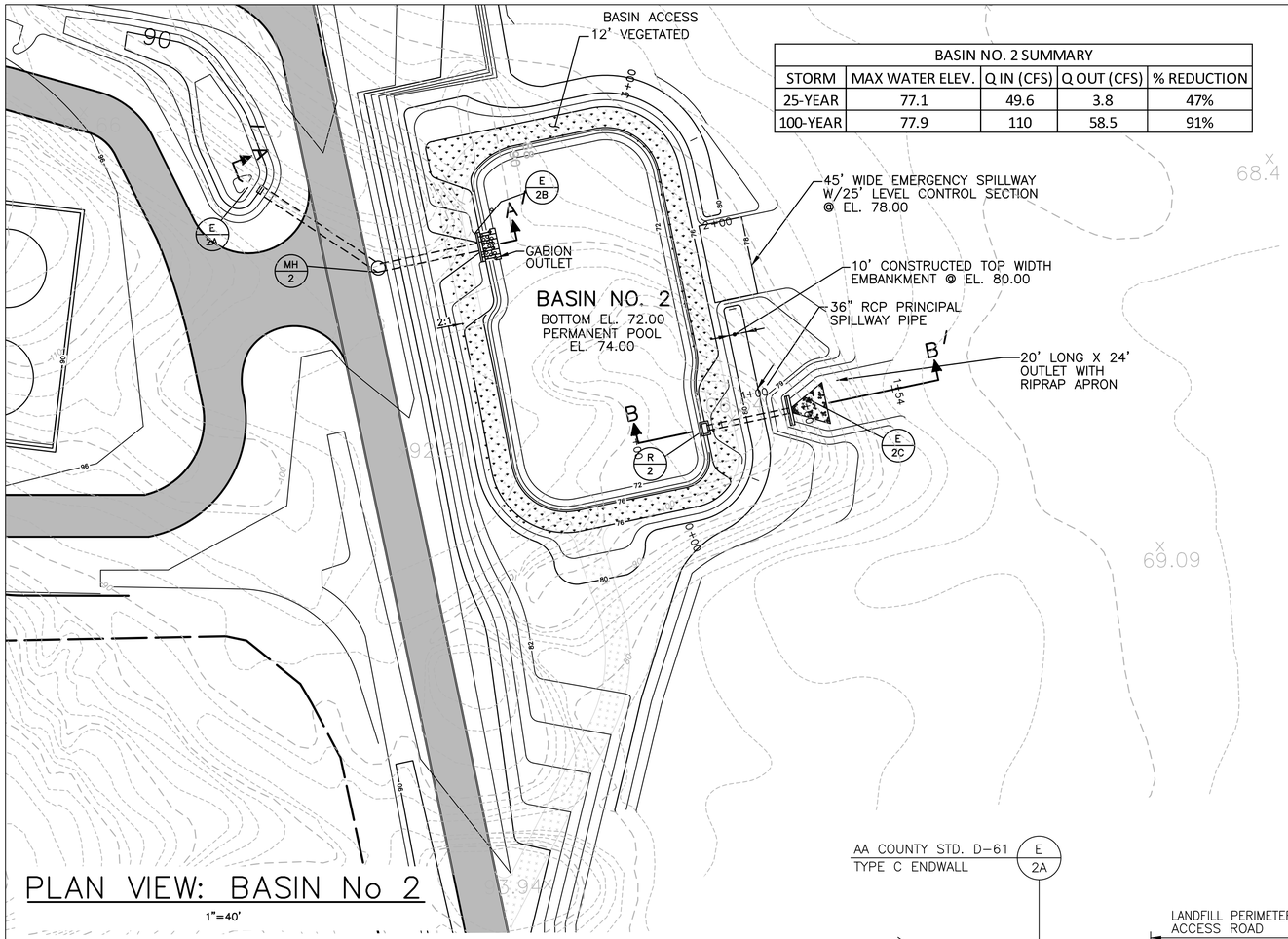
BASIN NO. 1
PLAN AND SECTION

PROJECT MANAGER: PGS
CHECKED BY: PGS
DRAWN BY: KHF
SCALE: AS NOTED
PROJECT NUMBER: 2018 - 3854
DATE: 09/03/2021

DRAWING 47

STATE OF MARYLAND
RICHARD STRICKMAN
PAUL
No. 21583
PROFESSIONAL ENGINEER

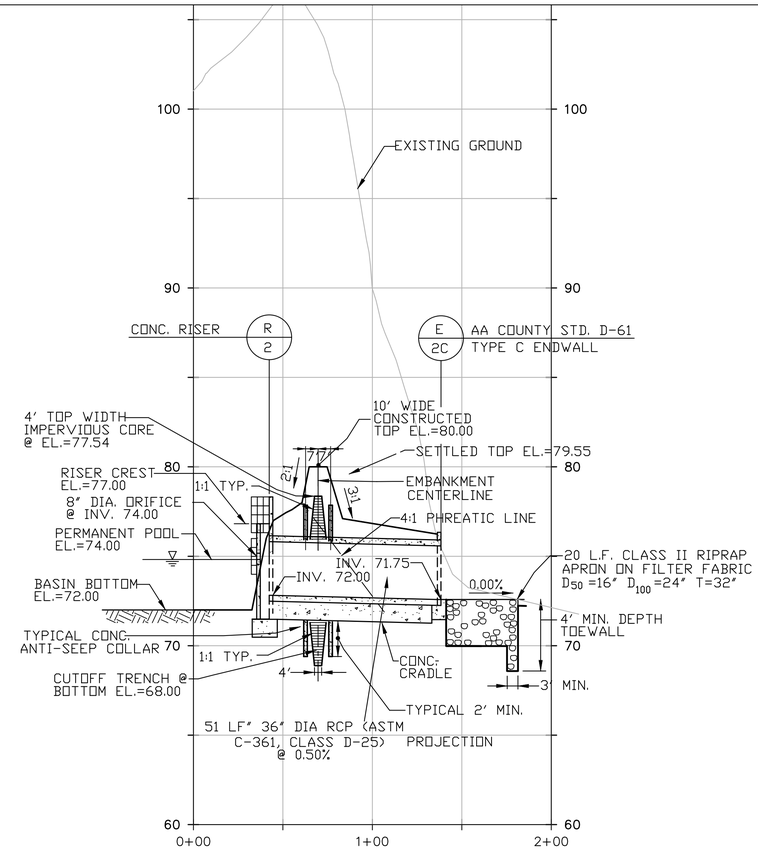
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PLAN VIEW: BASIN No 2

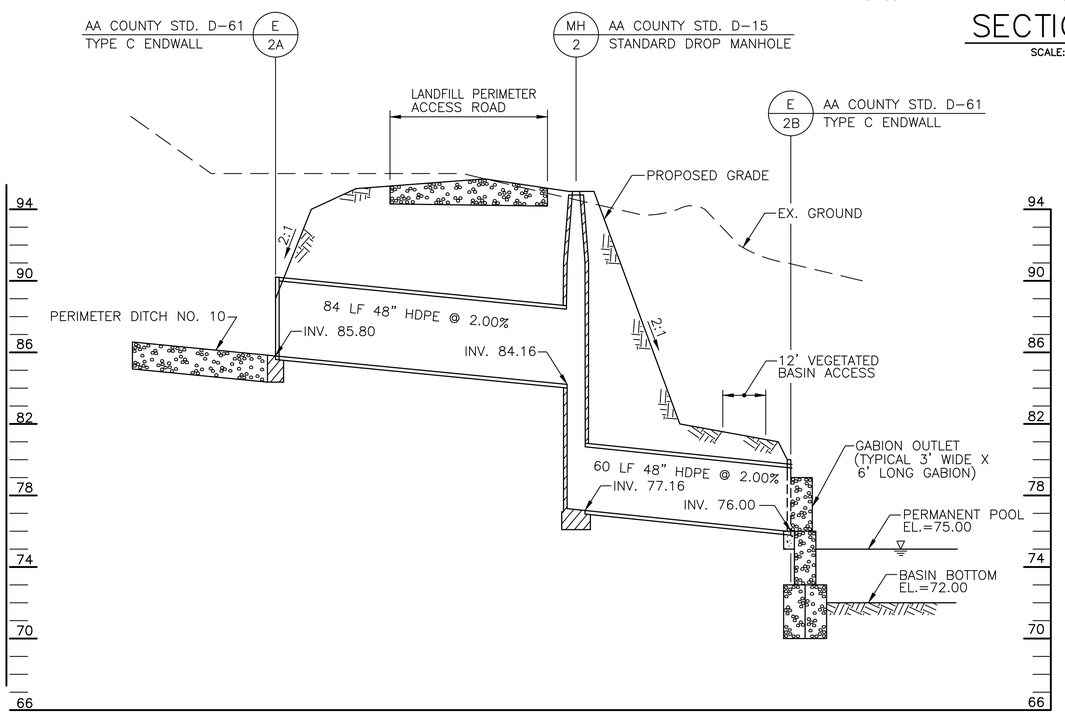
1"=40'

BASIN NO. 2 SUMMARY				
STORM	MAX WATER ELEV.	Q IN (CFS)	Q OUT (CFS)	% REDUCTION
25-YEAR	77.1	49.6	3.8	47%
100-YEAR	77.9	110	58.5	91%



SECTION B–B

SCALE: HORZ. 1"=40'
VERT. 1"=4'



SECTION A–A

SCALE: HORZ. 1"=20'
VERT. 1"=4'

SEQUENCE OF CONSTRUCTION

1. PROPOSED CONTOURS HEREON DEPICT BASIN NO. 2, LANDFILL PERIMETER ACCESS ROAD, PERIMETER DITCH AND OTHER INITIAL GRADING CONTOURS, AS SHOWN ON DRAWINGS 6 AND 7.
2. SEE DRAWINGS 6 AND 7 FOR LIMIT OF DISTURBANCE ATBASIN NO. 2 CONSTRUCTION AREA.
3. FOLLOWING INSTALLATION OF SUPER SILT FENCE, BASIN NO. 2 SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS ON THESE PERMIT DRAWINGS. SEE DRAWING 63 "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION" ITEM V(B)(I) FOR TYPICAL BASIN REQUIREMENTS.
4. PROVIDE 4" TOP SOIL ON BASIN NO 2 EMBANKMENT TOP WIDTH AND SIDE SLOPES. VEGETATIVELY STABILIZE ALL DISTURBED AREAS.
5. BASIN NO. 2 WILL SERVE AS A SEDIMENT CONTROL FACILITY UNTIL LANDFILL CELLS WITHIN THE CONTRIBUTING DRAINAGE AREA HAVE BEEN CLOSED AND VEGETATED IN ACCORDANCE WITH MARYLAND DEPARTMENT OF ENVIRONMENT REGULATIONS, SEE DRAWING 53 FOR CONCRETE RISER CONNECTIONS DURING THE SEDIMENT CONTROL PHASE.
6. TO CONVERT BASIN NO. 2 TO A PERMANENT STORMWATER MANAGEMENT POND, CONCRETE RISER CONNECTIONS DURING THE SEDIMENT CONTROL PHASE WILL BE REMOVED, THE BASIN WILL BE DEWATERED AND THE RISER ORIFICE WILL BE UTILIZED FOR SWM PURPOSE, AS SHOWN ON SECTION B–B HEREON. SEE DRAWING 53 FOR RISER ORIFICE DETAILS. SEE DRAWING 54 FOR BASIN CONVERSION TO SWM POND.

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

STATE OF MARYLAND
RICHARD STRICKMAN
LEGAL LAND SURVEYOR
PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

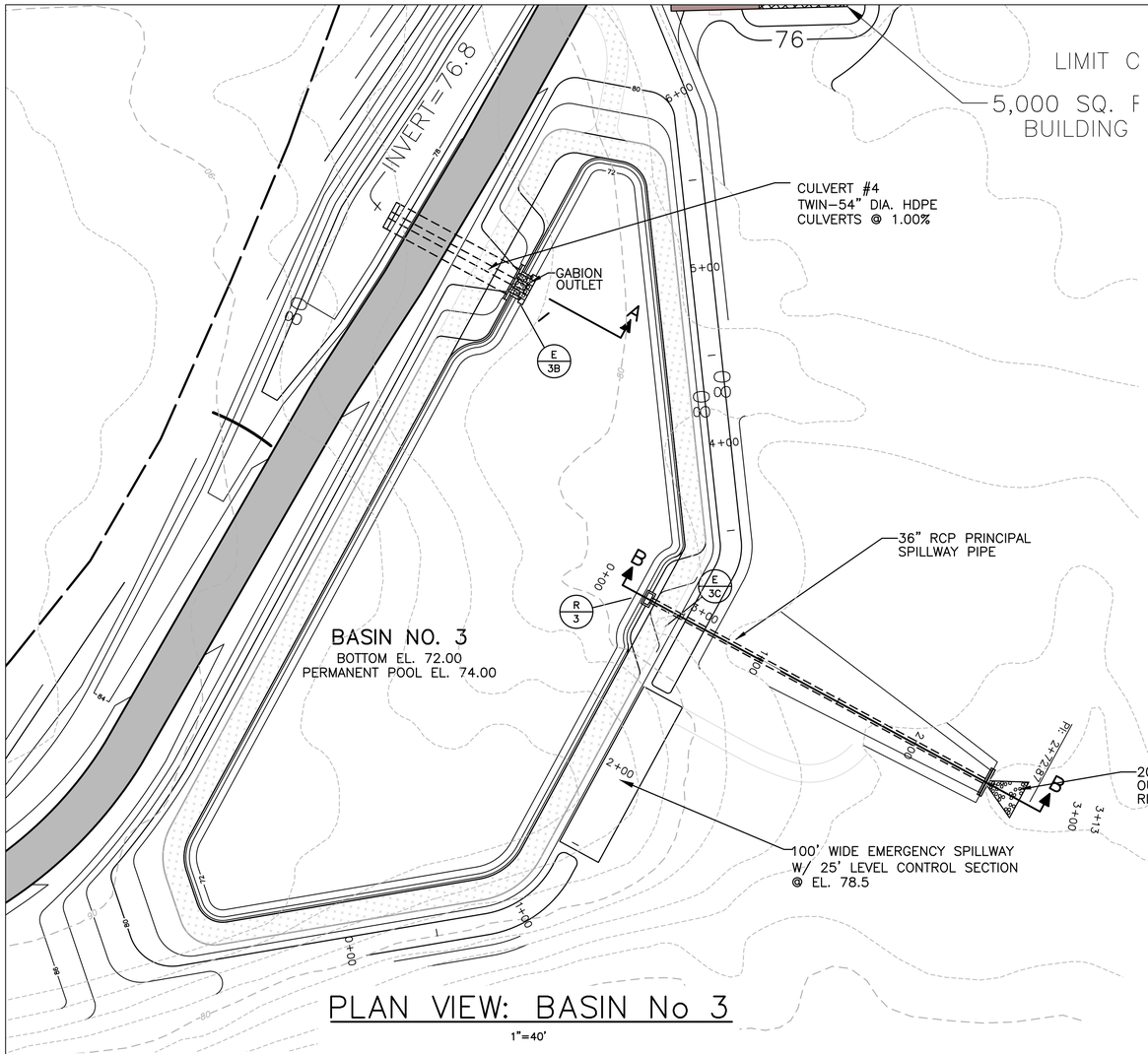
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a Montrose Environmental Group company
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BASIN NO. 2
PLAN AND SECTION

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

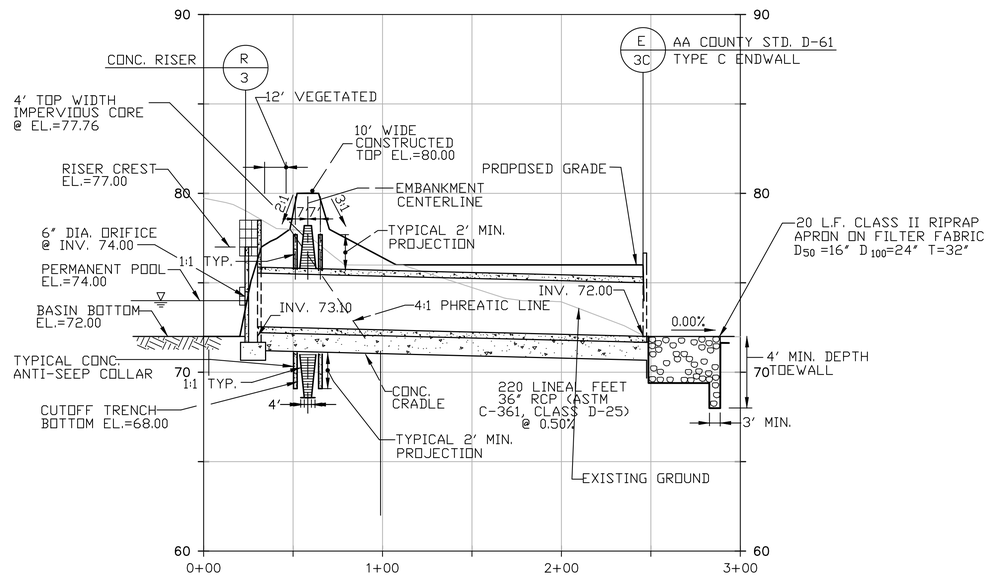
DRAWING 48

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PLAN VIEW: BASIN No 3

1"=40'



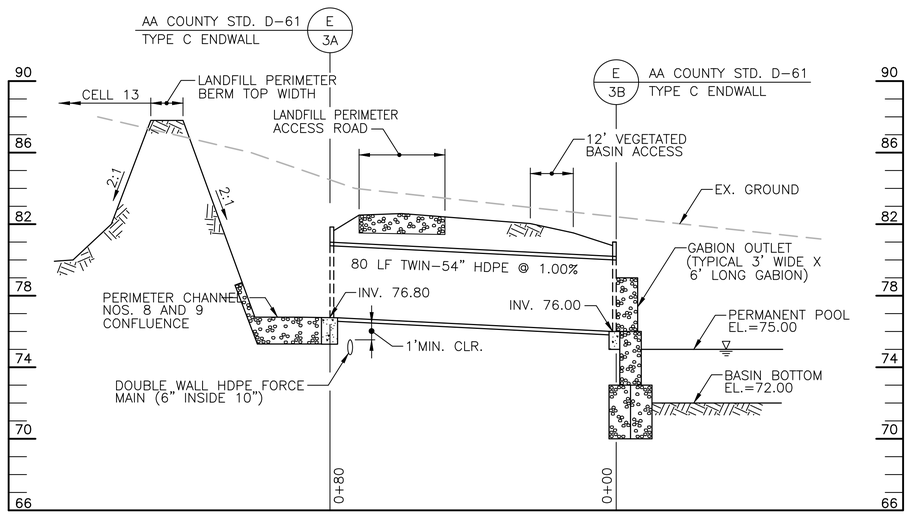
SECTION B–B

SCALE: HORZ. 1"=40'
VERT. 1"=4'

BASIN NO. 3 SUMMARY				
STORM	MAX WATER ELEV.	Q IN (CFS)	Q OUT (CFS)	% REDUCTION
25-YEAR	77.9	195.4	54.2	72%
100-YEAR	79.1	315.0	193.5	39%

SEQUENCE OF CONSTRUCTION

1. PROPOSED CONTOURS HEREON DEPICT BASIN NO. 3, LANDFILL PERIMETER ACCESS ROAD, PERIMETER DITCH AND OTHER INITIAL GRADING CONTOURS, AS SHOWN ON DRAWING 6.
2. SEE DRAWING 6 FOR "LIMIT OF DISTURBANCE REQUIRED FOR BASIN NO. 3 CONSTRUCTION".
3. FOLLOWING INSTALLATION OF SUPER SILT FENCE, BASIN NO. 3 SHALL BE CONSTRUCTED IN ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS ON THESE PERMIT DRAWINGS. SEE DRAWING 63 "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION" ITEM V(B)(I) FOR TYPICAL BASIN REQUIREMENTS.
4. PROVIDE 4" TOP SOIL ON BASIN NO 3 EMBANKMENT TOP WIDTH AND SIDE SLOPES. VEGETATIVELY STABILIZE ALL DISTURBED AREAS.
5. BASIN NO. 3 WILL SERVE AS A SEDIMENT CONTROL FACILITY UNTIL LANDFILL CELLS WITHIN THE CONTRIBUTING DRAINAGE AREA HAVE BEEN CLOSED AND VEGETATED IN ACCORDANCE WITH MARYLAND DEPARTMENT OF ENVIRONMENT REGULATIONS, SEE DRAWING 53 FOR CONCRETE RISER CONNECTIONS DURING THE SEDIMENT CONTROL PHASE.
6. TO CONVERT BASIN NO. 3 TO A PERMANENT STORMWATER MANAGEMENT POND, CONCRETE RISER CONNECTIONS DURING THE SEDIMENT CONTROL PHASE WILL BE REMOVED, THE BASIN WILL BE DEWATERED AND THE RISER ORIFICE WILL BE UTILIZED FOR SWM PURPOSE, AS SHOWN ON SECTION B–B HEREON. SEE DRAWING 53 FOR RISER ORIFICE DETAILS. SEE DRAWING 54 FOR BASIN CONVERSION TO SWM POND.



SECTION A–A (CULVERT #4)

SCALE: HORZ. 1"=20'
VERT. 1"=4'



REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
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PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

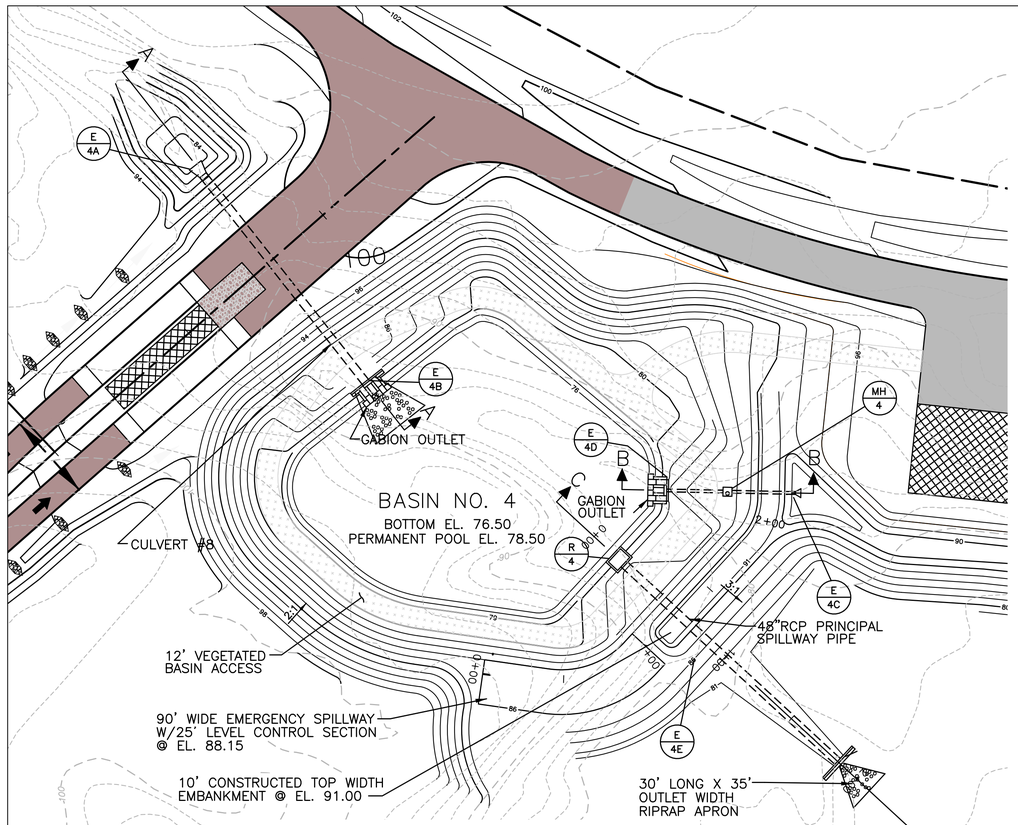
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BASIN NO. 3
PLAN AND SECTION

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 – 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

DRAWING 49

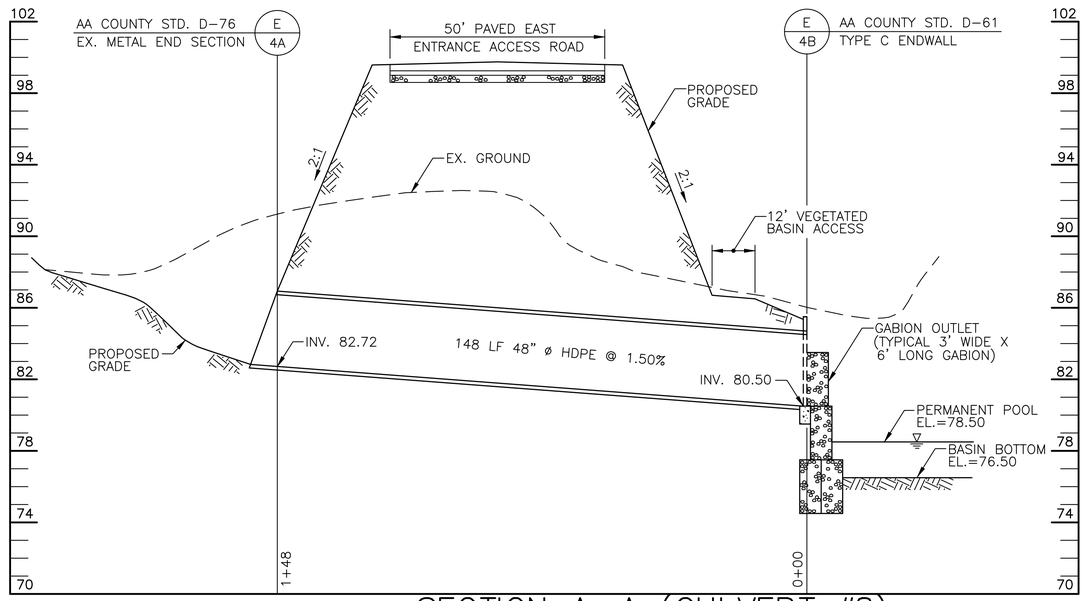
N:\Projects\2018\3854 - Chesapeake Terrace LF\CAD\PGS\MC & Phase III Application\Drawings\Final\JR\3854 BASIN NO.3 PLAN AND SECTION.dwg



PLAN VIEW: BASIN No 4

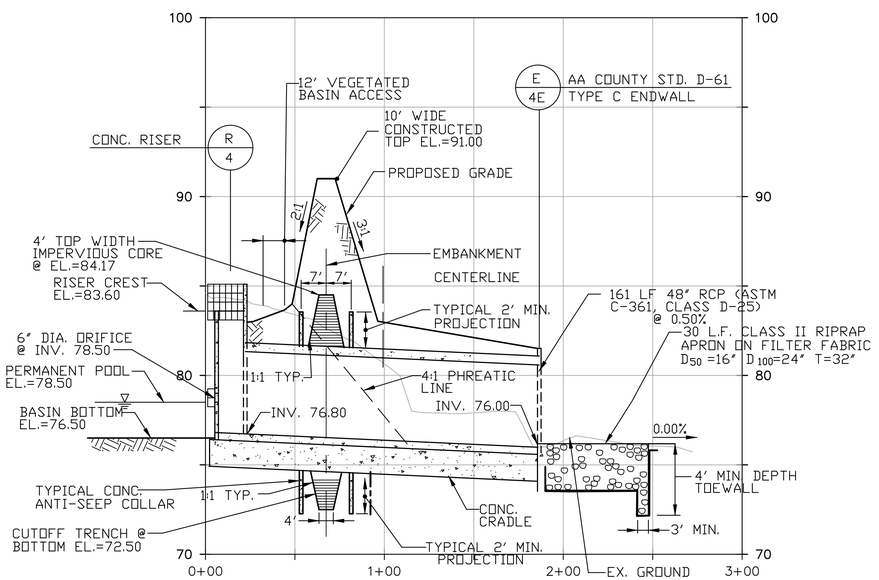
1"=40'

BASIN NO. 4 SUMMARY				
STORM	MAX WATER ELEV.	Q IN (CFS)	Q OUT (CFS)	% REDUCTION
25-YEAR	84.5	186.1	95.1	49%
100-YEAR	88.1	399.0	184.8	54%



SECTION A-A (CULVERT #8)

SCALE: HORZ. 1"=20'
VERT. 1"=4'



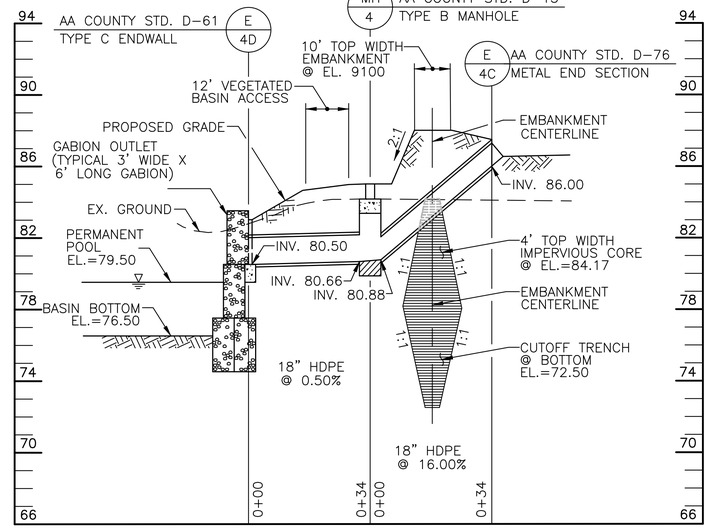
SECTION C-C

SCALE: HORZ. 1"=40'
VERT. 1"=4'

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.



SECTION B-B

SCALE: HORZ. 1"=20'
VERT. 1"=4'

SEQUENCE OF CONSTRUCTION

1. EXISTING CONTOURS SHOWN ABOVE FOR THE EAST ENTRANCE FACILITIES, PERIMETER ACCESS ROAD, AND PERIMETER CHANNEL NO. 8 ARE PROPOSED CONTOURS UNDER GRADING PLAN ON DRAWING 7.

   PROPOSED CONTOURS DEPICT BASIN NO. 4 AND THE GRASS SWALE AND BERM ADJACENT TO THE MAINTENANCE BUILDING AND CONCRETE CLEANOUT.

2. SEE SHEET 7 FOR LIMIT OF DISTURBANCE FOR BASIN NO. 4 CONSTRUCTION.

3. CONSTRUCT BASIN NO. 4 IN ACCORDANCE WITH ALL APPLICABLE REQUIREMENTS ON THESE PERMIT DRAWINGS. SEE " DRAWING 63 SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION" ITEM V(B)(I). TYPICAL FOR ALL BASINS.

   PROVIDE 4" TOPSOIL ON EMBANKMENT TOP WIDTH AND SIDE SLOPES, AND VEGETATIVELY STABILIZE DISTURBED AREAS.

4. INSTALL THE SCALE HOUSE AND TRUCK SCALES, MAINTENANCE BUILDING AND OFFICE, CONCRETE CLEANOUT AND WHEEL WASH. CONSTRUCT ACCESS ROAD FINISHED SURFACES.

STATE OF MARYLAND — RAYMOND STOCKMAN — 21655 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

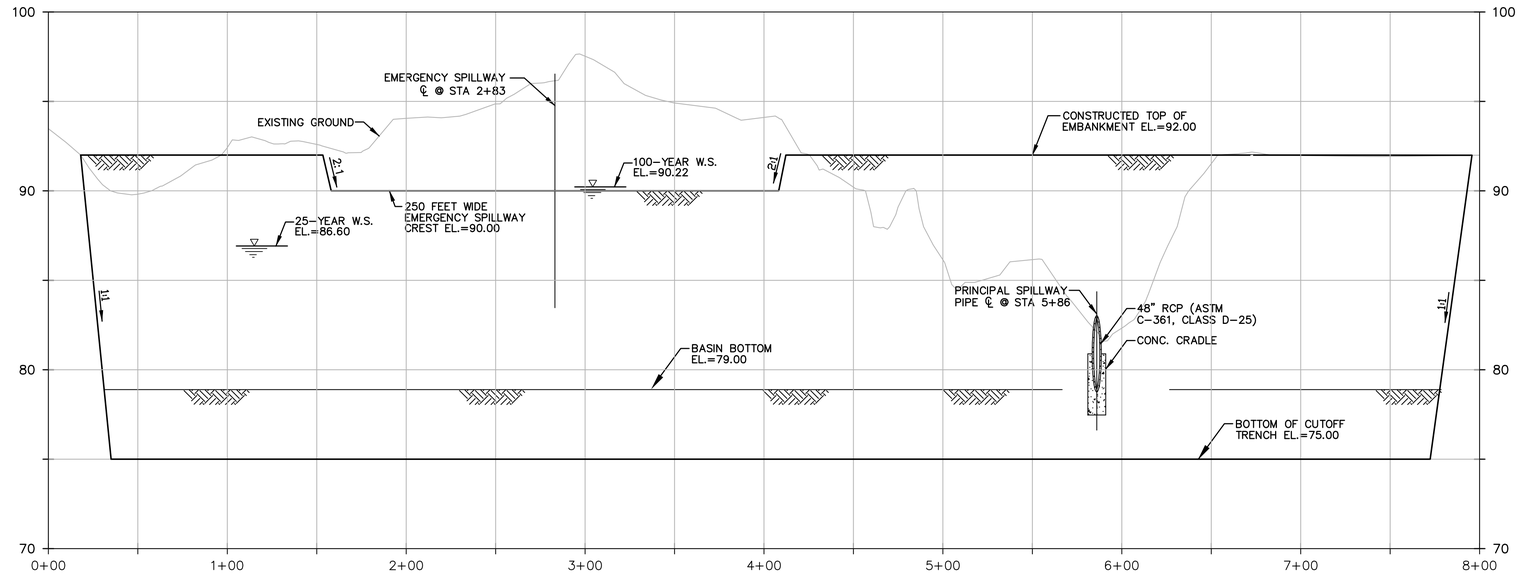
ADVANCED GeoServices
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T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

BASIN NO. 4
PLAN AND SECTION

PROJECT MANAGER:	POS	SCALE:	AS NOTED
CHECKED BY:	POS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

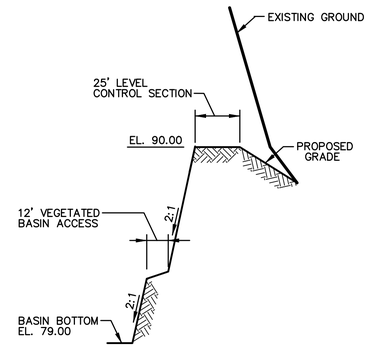
DRAWING 50

N:\Projects\2018\2018154 - Chesapeake Terrace\FIG\CAD\DWG\BC $ Phase III Application\Drawings\Final\2018154 BASIN NO. 4 PLAN AND SECTION.dwg



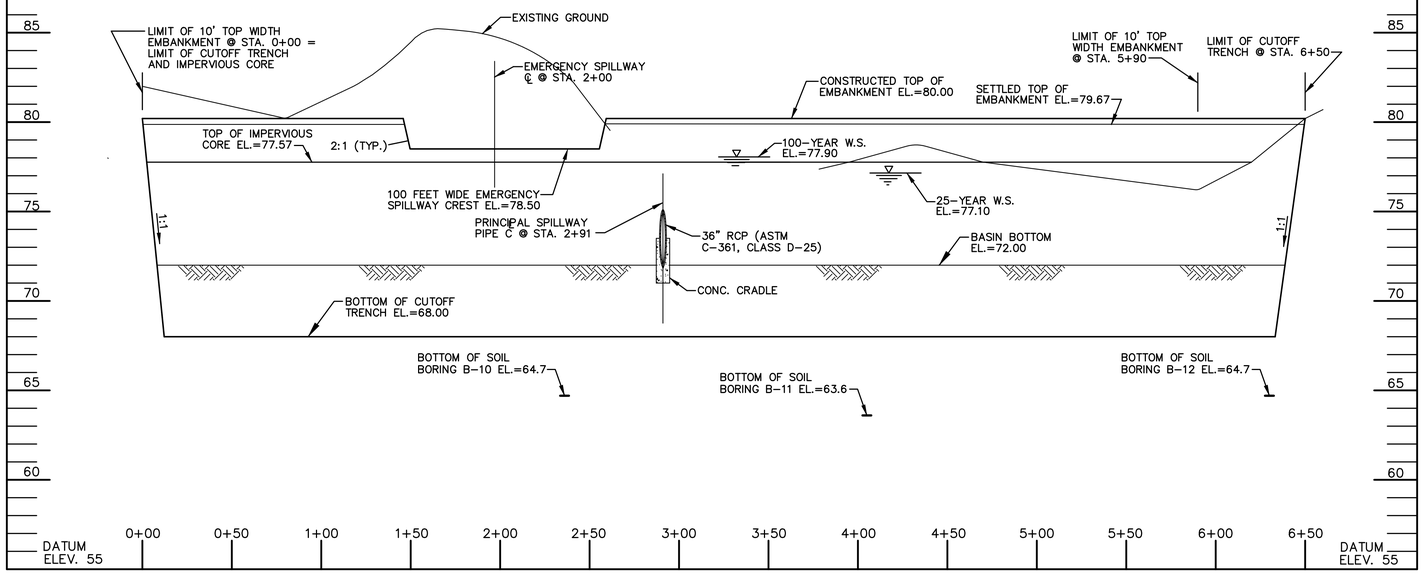
BASIN NO. 1 EMBANKMENT CENTERLINE PROFILE

SCALE: HOR. 1"=40'
VERT. 1"=4'



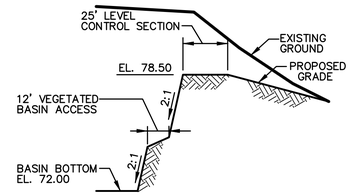
BASIN NO. 1 E.S. CENTERLINE SECTION

SCALE: HOR. 1"=40'
VERT. 1"=4'



BASIN NO. 3 EMBANKMENT CENTERLINE PROFILE

SCALE: HOR. 1"=40'
VERT. 1"=4'



BASIN NO. 3 E.S. CENTERLINE SECTION

SCALE: HOR. 1"=40'
VERT. 1"=4'

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

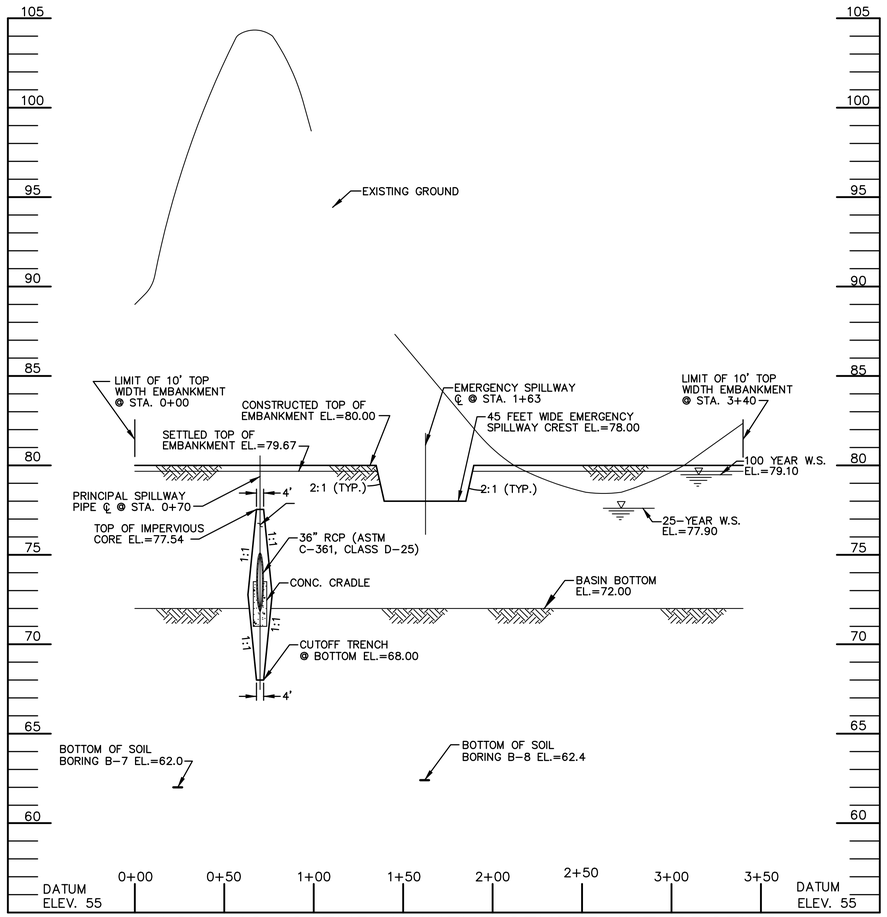
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STORMWATER BASIN
DETAILS (SHEET 1 OF 3)

PROJECT MANAGER:	POS	SCALE: AS NOTED
CHECKED BY:	POS	PROJECT NUMBER: 2018 - 3854
DRAWN BY:	KHF	DATE: 09/03/2021

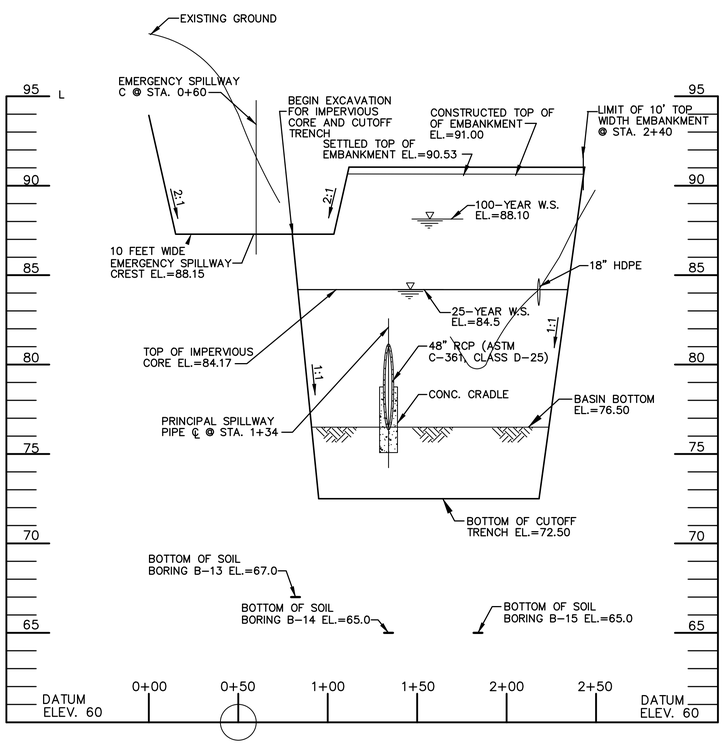
DRAWING 51

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\MXD\RC & Phase III Application\Drawings\Final\2018854 REV1 - STORMWATER BASIN DETAILS SHEET 1 OF 3.DWG



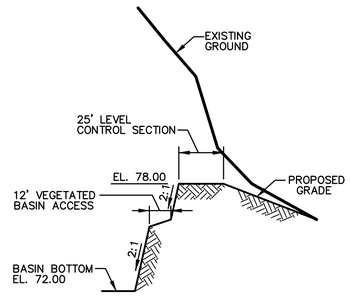
BASIN NO. 2 EMBANKMENT CENTERLINE PROFILE

SCALE: HOR. 1"=40'
VERT. 1"=4'



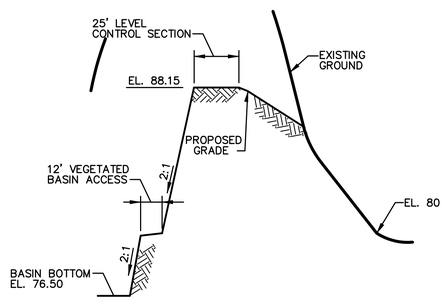
BASIN NO. 4 EMBANKMENT CENTERLINE PROFILE

SCALE: HOR. 1"=40'
VERT. 1"=4'



BASIN NO. 2 E.S. CENTERLINE SECTION

SCALE: HOR. 1"=40'
VERT. 1"=4'



BASIN NO. 4 E.S. CENTERLINE SECTION

SCALE: HOR. 1"=40'
VERT. 1"=4'

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

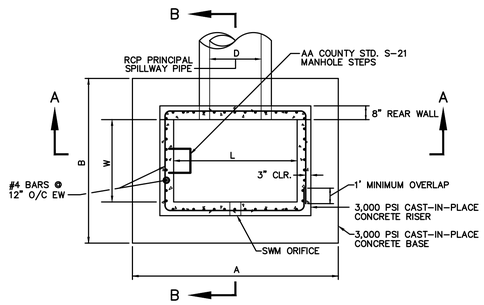
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STORMWATER BASIN
DETAILS (SHEET 2 OF 3)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 52

N:\Projects\2018\3018854 - Chesapeake Terrace\FIGURES\PSC & Phase III Application\Drawings\Final\3018854 BSN2 - STORMWATER BASIN DETAILS SHEET 2 OF 3.dwg



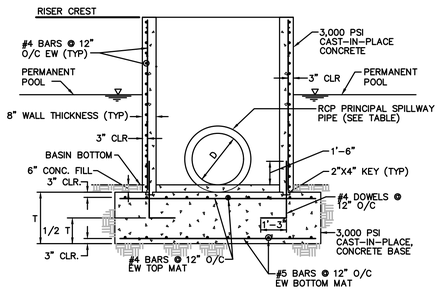
NOTE – SEE RISER TABLE FOR DIMENSIONS

TYPICAL CONCRETE RISER PLAN

NOT TO SCALE

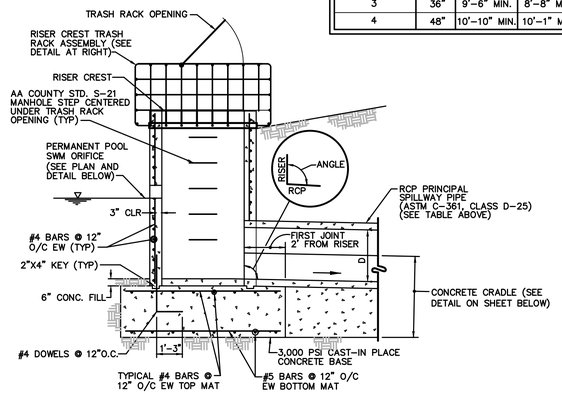
RISER TABLE OF DIMENSIONS					
DESCRIPTION	BASIN NO. 1	BASIN NO. 2	BASIN NO. 3	BASIN NO. 4	WQv FACILITY
FACILITY BOTTOM ELEV.	79.00	72.00	72.00	76.50	86.00
PERMANENT POOL ELEV.	81.00	74.00	74.00	78.50	88.00
RISER CREST ELEV.	84.50	77.00	77.00	83.60	89.50
RISER L	6'-6"	6'-6"	6'-6"	10'-0"	4'-0"
RISER W	3'-0"	3'-0"	3'-0"	7'-0"	4'-0"
TOP OF REAR WALL ELEV.	86.00	78.50	78.50	85.10	91.00
RCP PIPE "D"	48"	36"	36"	48"	18"
RCP PIPE INVERT ELEV.	79.00	72.00	73.10	76.80	86.00
RISER/RCP ANGLE	101°06'08"	23°20'15"	63°43'20"	77°57'18"	60°40'45"
TOP OF BASE ELEVATION	78.50	71.50	71.50	76.30	86.50
BASE DIM. A	9'-10"	9'-10"	9'-10"	13'-4"	7'-4"
BASE DIM B	6'-4"	6'-4"	6'-4"	10'-4"	7'-4"
BASE THICKNESS	1'-3"	1'-0"	1'-0"	1'-6"	1'-0"

ORIFICE TABLE OF DIMENSIONS			
FACILITY	L	ORIFICE DIA.	ORIFICE INV. ELEV.
BASIN NO. 1	6'-6"	9"	81.00
BASIN NO. 2	6'-6"	8"	74.00
BASIN NO. 3	6'-6"	6"	74.00
BASIN NO. 4	10'-0"	6"	78.50
WQv FACILITY	4'-0"	3"	88.00



RISER SECTION A–A

NOT TO SCALE



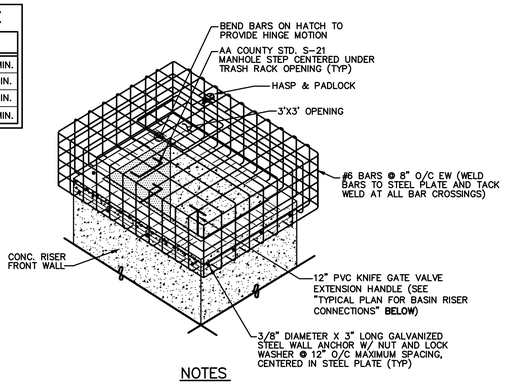
RISER SECTION B–B

NOT TO SCALE

NOTES

1. RISER CREST TRASH RACK AND RCP PRINCIPAL SPILLWAY PIPE CONCRETE CRADLE ARE NOT SHOWN ON SECTION A–A. SEE SECTION B–B AND TRASH RACK DETAIL AT RIGHT. SEE SHEET BELOW FOR CONCRETE CRADLE DETAIL.
2. RISERS MUST BE CAST–IN–PLACE.

RISER CREST TRASH RACK			
BASIN NO.	D	W	H
1	48"	10'-10" MIN.	10'-1" MIN.
2	36"	9'-6" MIN.	8'-8" MIN.
3	36"	9'-6" MIN.	8'-8" MIN.
4	48"	10'-10" MIN.	10'-1" MIN.



NOTES

1. ENTIRE TRASH RACK ASSEMBLY SHALL BE HOT–DIPPED GALVANIZED AFTER FABRICATION.
2. TRASH RACK SHALL EXTEND 8" HORIZONTALLY FROM FRONT WALL AND BOTH SIDE WALLS AND DOWNWARD TO 8" BELOW THE RISER CREST ELEVATION. TOP OF TRASH RACK SHALL BE FLAT, AND LEVEL W/ TOP OF REAR WALL.

TYPICAL RISER CREST TRASH RACK DETAIL

NOT TO SCALE

SWM ORIFICE PLAN

NOT TO SCALE

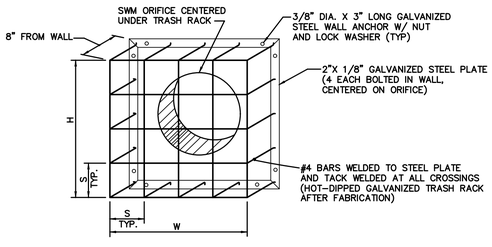
DEWATERING PIPE PERFORATION DETAIL

NOT TO SCALE

TABLE OF DIMENSIONS						
BASIN NO.	D	t	H_1	H_2	W_1	W_2
1	48"	5"	1'-3"	2'-5"	6'-10"	4"
2	36"	4"	1'-0"	1'-10"	5'-6"	3"
3	36"	4"	1'-0"	1'-10"	5'-6"	3"
4	48"	5"	1'-3"	2'-5"	6'-10"	4"

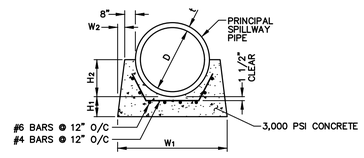
ORIFICE TRASH RACK TABLE OF DIMENSIONS				
BASIN NO.	ORIFICE DIA.	W	H	S(1)
1	9"	2'-0"	2'-0"	6"
2	8"	1'-0"	1'-3"	2 1/2"
3	6"	1'-0"	1'-3"	2 1/2"
4	6"	1'-6"	1'-6"	4 1/2"
WQv	3"	1'-0"	1'-3"	2 1/2"

(1) #4 BARS CENTER TO CENTER DIMENSION



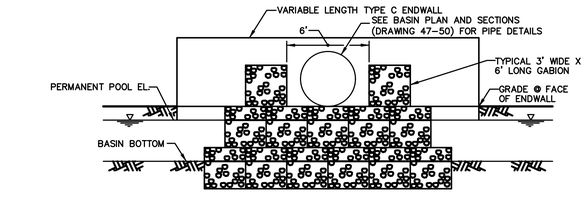
SWM ORIFICE TRASH RACK DETAIL

NOT TO SCALE



CONCRETE CRADLE DETAIL

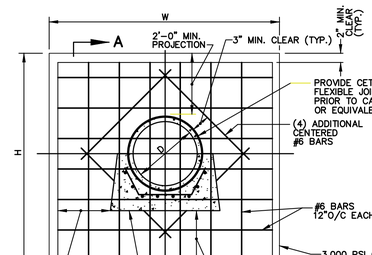
NOT TO SCALE



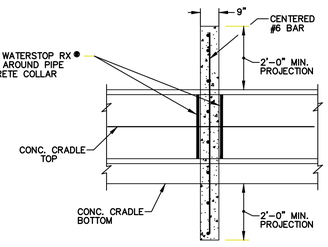
NOTE – STEEL PLATE SHOWN ABOVE SHALL BE AFFIXED OVER SWM ORIFICES IN RISERS FOR BASIN NOS. 1, 2 AND 3, UNTIL EACH BASIN IS CONVERTED INTO A STORMWATER MANAGEMENT POND. SEE "RISER CONNECTIONS PLAN" AND "RISER CONNECTION SECTION A–A" AT RIGHT.

SWM ORIFICE PLATE DETAIL

NOT TO SCALE



FRONT VIEW



SECTION A–A

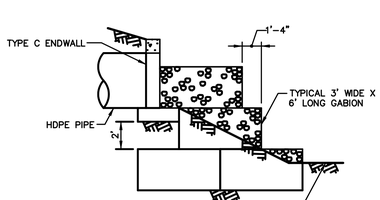
ANTI–SEEP COLLAR

NOT TO SCALE

SECTION THROUGH GABION OUTLET LOOKING AT ENDWALL

NOT TO SCALE

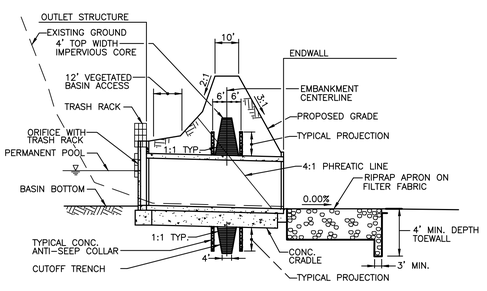
NOTE – SECTION ABOVE SHOWNS GABION OUTLETS FOR BASIN INFLOW PIPES, AS SHOWN ON SHEETS 47, 48, 49 AND 50. PERMANENT POOL EL.=75.00 AND GRADE AT FACE OF ENDWALL EL.=76.00 FOR BASIN NOS. 1, 2 AND 3. BASIN NO. 4 PERMANENT POOL EL.=79.50 AND GRADE AT FACE OF ENDWALL EL.=80.50



SECTION THROUGH HDPE PIPE AT GABION OUTLET

NOT TO SCALE

NOTE – SECTION ABOVE SHOWNS GABION OUTLETS FOR BASIN INFLOW PIPES, AS SHOWN ON SHEETS 47, 48, 49 AND 50.



TYPICAL BASIN EMBANKMENT DETAIL

NOT TO SCALE

NOTE – SEE ADDITIONAL DETAILS ON SHEETS 47 THROUGH 50 FOR OUTLET STRUCTURE, ANTI–SEEP COLLARS, CONCRETE CRADLE, RIPRAP APRON, TRASH RACK, AND ENDWALL DETAILS

STATE OF MARYLAND — RICHARD STRICKMAN — LICENSE NO. 21581 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
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STORMWATER BASIN
DETAILS (SHEET 3 OF 3)

PROJECT MANAGER:	PGS	SCALE:AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 53

N:\Projects\2018\2018854 - Chesapeake Terrace II\PLANS\WORK & Phase III Application\Drawings\Final\20181854 BMP3 - STORMWATER BASIN DETAILS SHEET 3 OF 3.dwg

SEDIMENT BASIN/SWM POND CONVERSION NOTES

1. BASIN NOS. 1, 2, AND 3 WILL FUNCTION AS SEDIMENT BASINS DURING THE LIFE OF LANDFILL CELL CONSTRUCTION AND CELL CLOSURE. SEE ITEM V, "ESTIMATED CELL CONSTRUCTION AND WASTE PLACEMENT SCHEDULE ON DRAWING 63).

   BASIN NO. 4 WILL FUNCTION SOLELY AS A STORM WATER MANAGEMENT POND.

   AS PART OF INITIAL BASIN CONSTRUCTION, INSTALL BASIN RISERS AS SHOWN ON "TYPICAL CONCRETE RISER PLAN". TO PROVIDE CAPABILITY TO DEWATER PERMANENT POOLS, INSTALL 8" PERFORATED AND SOLID WALL PVC PIPE WITH 8" PVC KNIFE GATE VALVE AND APPURTENANCES (AS SHOWN ON "RISER CONNECTIONS PLAN" AND "RISER CONNECTION SECTION A–A" AT RIGHT) IN ALL FOUR BASINS. TO DEWATER DRY STORAGE VOLUMES IN BASIN NOS. 1. 2 AND 3 DURING THEIR FUNCTION AS SEDIMENT BASINS, INSTALL 12" PERFORATED AND SOLID WALL CMP (AS SHOWN ON "RISER CONNECTIONS PLAN" AND "RISER CONNECTION SECTION B–B").

2. WHEN THE RUBBLE WASTE PLACEMENT OPERATION HAS CEASED, AND THE CONTRIBUTING DRAINAGE AREA TO A SEDIMENT BASIN (I.E., EITHER BASIN NO. 1, NO. 2 OR NO. 3) HAVE BEEN PROVIDED WITH PERMANENT VEGETATIVE STABILIZATION IN ACCORDANCE WITH MARYLAND DEPARTMENT OF THE ENVIRONMENT REGULATIONS, THE APPLICABLE BASIN SHALL BE CONVERTED INTO A STORMWATER MANAGEMENT POND.

   SEDIMENT BASIN/SWM POND CONVERSION FOR BASIN NO. 1, NO. 2 OR NO. 3 SHALL BE ACHIEVED BY DEWATERING THE BASIN WET POOL VOLUME VIA THE 8" PVC PIPE CONNECTED TO THE PVC KNIFE GATE VALVE HOUSED IN THE CONCRETE RISER. FOLLOWING WET POOL DRAW–DOWN, 12" PERFORATED AND SOLID WALL CMP PIPES (INCLUDING THE UNDERLYING EARTH BERM AND 1/8" STEEL PLATE ATTACHED TO THE CONCRETE RISER WALL) SHALL BE REMOVED. TRASH RACKS SHALL BE INSTALLED OVER RISER SWM ORIFICES AS SHOWN HEREON, AND DISTURBED AREAS SHALL BE STABILIZED WITH SOD.

   FOLLOWING COMPLETION OF ALL REQUIRED CONSTRUCTION, THE PVC KNIFE GATE VALVE SHALL BE CLOSED AND THE SWM POND WILL BE FILLED WITH WATER TO THE PERMANENT POOL ELEVATION.

CONSULTANT'S HAZARD CLASS CERTIFICATION

I CERTIFY THAT THIS POND MEETS ALL REQUIREMENTS FOR HAZARD CLASS A REQUIREMENTS, AS STATED IN THE USDA NATURAL RESOURCES CONSERVATION SERVICE – MARYLAND CONSERVATION PRACTICE STANDARD FOR POND, CODE 378, JANUARY 2000. ALL NECESSARY INVESTIGATIONS AND COMPUTATIONS HAVE BEEN PERFORMED TO VERIFY THIS FINDING. A COPY OF SAID INFORMATION HAS BEEN SUPPLIED TO AASCD.

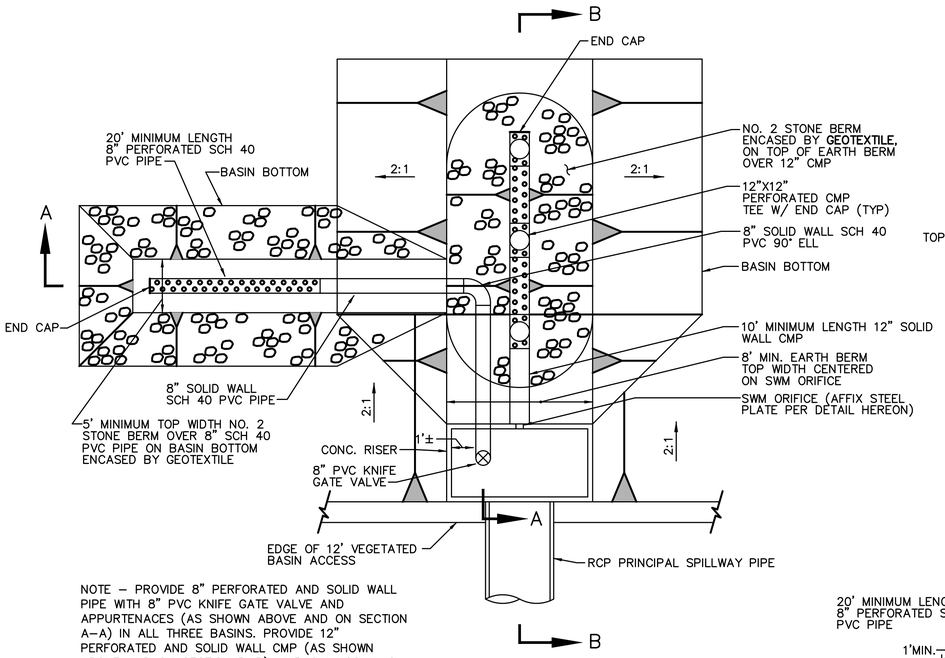
SIGNATURE _____

NAME (PRINTED) _____ DATE _____

BASIN NOS. 1, 2 AND 3 SEDIMENT CONTROL PHASE ELEVATIONS

BASIN NO.	WET STORAGE ELEVATION	DRY STORAGE ELEVATION	CLEANOUT ELEVATION	RISER CREST ELEVATION(1)
1	79.00	84.10	80.20	84.50
2	74.00	76.70	73.10	77.00
3	74.00	76.00	73.10	77.00

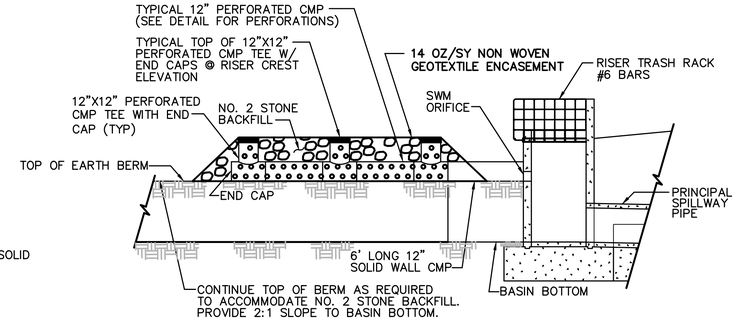
(1) RISER CREST ELEVATION IS EQUIVALENT TO TOP OF 12"X12" PERFORATED CMP TEES WITH END CAPS, AS SHOWN BELOW.



NOTE – PROVIDE 8" PERFORATED AND SOLID WALL PIPE WITH 8" PVC KNIFE GATE VALVE AND APPURTENACES (AS SHOWN ABOVE AND ON SECTION A–A) IN ALL THREE BASINS. PROVIDE 12" PERFORATED AND SOLID WALL CMP (AS SHOWN ABOVE AND ON SECTION B–B) IN BASIN NOS. 1, 2 AND 3.

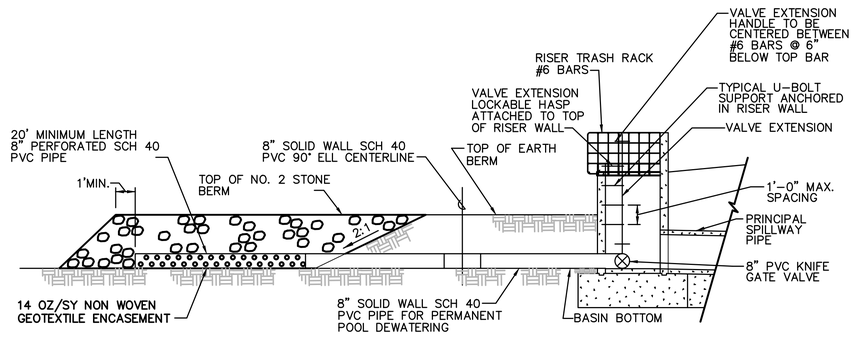
TYPICAL RISER CONNECTIONS PLAN

NOT TO SCALE



RISER CONNECTION SECTION B–B

NOT TO SCALE



RISER CONNECTION SECTION A–A

NOT TO SCALE

AS–BUILT CERTIFICATION FOR AASCD SMALL POND NUMBER 999

I CERTIFY THAT THIS AS–BUILT IS ACCURATE AND COMPLETE AND THE POND AS CONSTRUCTED MEETS THE REQUIREMENTS OF THE USDA, NATURAL RESOURCES CONSERVATION DISTRICT SERVICE MARYLAND STANDARDS AND SPECIFICATIONS FOR PONDS (MD–378). ANY POND DESIGN COMPONENTS NOT IDENTIFIED WITH AS–BUILT NOTATIONS WERE CONSTRUCTED AS PER THE APPROVED POND DESIGN.

SEAL

SIGNATURE _____

NAME (PRINTED) _____ DATE _____

ADDRESS _____

_____

MD LICENSE # _____

PHONE # _____

AS–BUILT CERTIFICATION FOR AASCD SMALL POND NUMBER 1000

I CERTIFY THAT THIS AS–BUILT IS ACCURATE AND COMPLETE AND THE POND AS CONSTRUCTED MEETS THE REQUIREMENTS OF THE USDA, NATURAL RESOURCES CONSERVATION SERVICE MARYLAND STANDARDS AND SPECIFICATIONS FOR PONDS (MD–378). ANY POND DESIGN COMPONENTS NOT IDENTIFIED WITH AS–BUILT NOTATIONS WERE CONSTRUCTED AS PER THE APPROVED POND DESIGN.

SEAL

SIGNATURE _____

NAME (PRINTED) _____ DATE _____

ADDRESS _____

_____

MD LICENSE # _____

PHONE # _____

AS–BUILT CERTIFICATION FOR AASCD SMALL POND NUMBER 1001

I CERTIFY THAT THIS AS–BUILT IS ACCURATE AND COMPLETE AND THE POND AS CONSTRUCTED MEETS THE REQUIREMENTS OF THE USDA, NATURAL RESOURCES CONSERVATION SERVICE MARYLAND STANDARDS AND SPECIFICATIONS FOR PONDS (MD–378). ANY POND DESIGN COMPONENTS NOT IDENTIFIED WITH AS–BUILT NOTATIONS WERE CONSTRUCTED AS PER THE APPROVED POND DESIGN.

SEAL

SIGNATURE _____

NAME (PRINTED) _____ DATE _____

ADDRESS _____

_____

MD LICENSE # _____

PHONE # _____

POND DESIGN CERTIFICATION FOR AASCD SMALL POND NUMBERS 999, 1000, 1001 AND 1002

I CERTIFY THAT THIS DESIGN PLAN FOR THE CONSTRUCTION OF THE EMBANKMENT AND/OR EXCAVATED POND(S) REPRESENTS A HAZARD CLASS "A" POND(S) AND WAS DESIGNED IN ACCORDANCE WITH THE REQUIREMENTS OF THE USDA, NATURAL RESOURCES CONSERVATION SERVICE – MARYLAND STANDARDS AND SPECIFICATIONS FOR PONDS, (MD–378). I HAVE REVIEWED THIS PLAN WITH THE OWNER/DEVELOPER.

SEAL

SIGNATURE _____

NAME (PRINTED) _____ DATE _____

MD LICENSE # _____

ADDRESS _____

_____

PHONE # _____

STATE OF MARYLAND · RICHARD STRICKMAN · LICENSE NO. 19981 · PROFESSIONAL ENGINEER

REVISION: REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
DATE: 9/03/2021

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

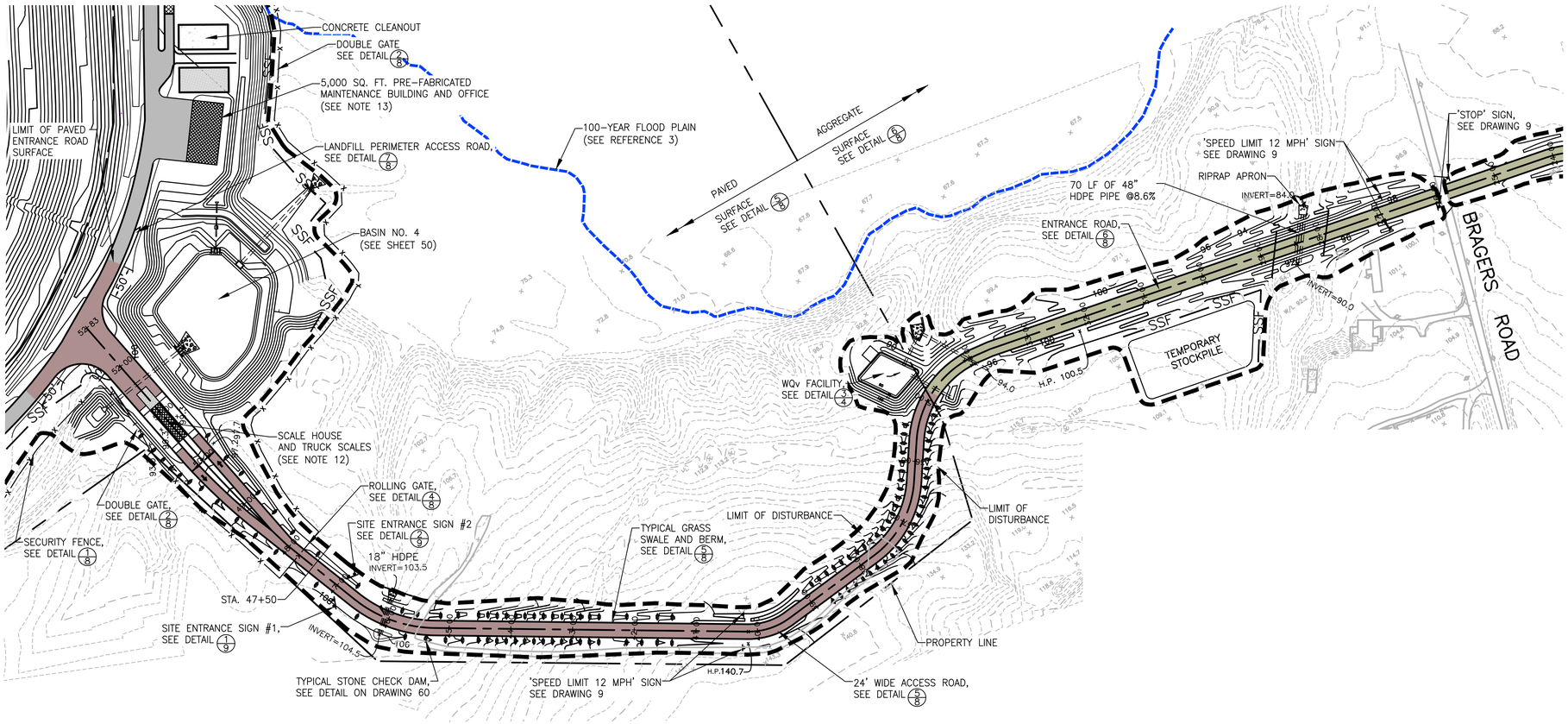
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a Montrose Environmental Group company
1979 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

BASIN / SWM CONVERSION DETAILS

PROJECT MANAGER: PGS
CHECKED BY: PGS
DRAWN BY: KHF
SCALE:AS NOTED
PROJECT NUMBER: 2018 – 3854
DATE:09/03/2021

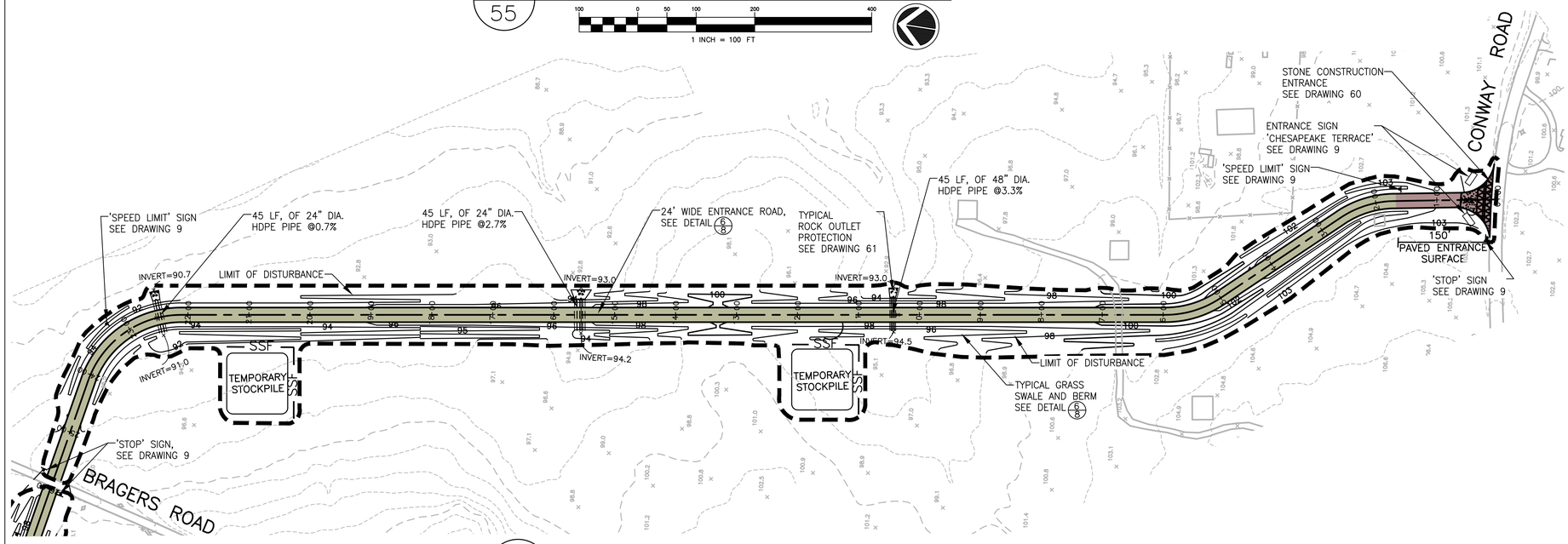
DRAWING 54

N:\Projects\2018\3854 - Chesapeake Terrace\05\CAD\ENGINEERING & Phase III Application\Drawings\Final\3854-BASIN SWM CONVERSION DETAILS.dwg



1/55 BRAGERS ROAD TO LANDFILL PERIMETER ACCESS ROAD

1 INCH = 100 FT



2/55 CONWAY ROAD TO BRAGERS ROAD

1 INCH = 100 FT

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 07/67
- PIPE
- ROCK OUTLET PROTECTION
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8 AND NOTE 14
- ENTRANCE ROAD, AGGREGATE SURFACE, SEE DRAWING 6/8
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- SF — SILTFENCE SEE DETAIL E1/60
- SSF — SUPER SILTFENCE SEE DETAIL E3/60

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) EAST ENTRANCE ROAD ALIGNMENT, PAVING, WQv FACILITY AND GRASS SWALE IS FROM DIGITAL FILE (3 OF 8) TITLED "EAST SECTION ACCESS RD GRADING PLAN" PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012.

NOTES

1.) DISTURBED AREA (MEASURED TO STATION 47+50) = 12.1 AC.

2.) SEE SITE PLAN ON DRAWING 3 FOR ASSUMED EAST ENTRANCE ACCESS ROAD LOCATION.

3.) SEE DRAWING 4 FOR ASSUMED EAST ENTRANCE ACCESS ROAD PLAN.

4.) WQv FACILITY ROADSIDE GRASS SWALES SHALL BE CONSTRUCTED PER PLANS AND SECTIONS ON DRAWINGS 4 AND 8.

5.) UNLESS INDICATED OTHERWISE, ALL STEEP SLOPES ARE 2:1.

SEQUENCE OF CONSTRUCTION

1.) ANNE ARUNDEL COUNTY PLANNING AND CODE ENFORCEMENT (PACE) INSPECTIONS AND PERMITS (410) 222-7780 SHALL BE NOTIFIED AT LEAST 72 HOURS PRIOR TO COMMENCING CONSTRUCTION.

WQv FACILITY AND ROADSIDE GRASS SWALES SHALL BE CONSTRUCTED PER PLANS AND SECTIONS ON DRAWINGS 4 AND 8.

2.) INSTALL STONE CONSTRUCTION ENTRANCE AT CONWAY ROAD AND CLEAR AREA WITHIN LIMIT OF LIMIT OF DISTURBANCE TO LANDFILL PERIMETER ACCESS ROAD. — 5 DAYS

3.) CONSTRUCT ROAD AND GRASS SWALES TO APPROXIMATE STATION 12+00, PER DESCRIPTION BELOW.

- A. GRUB DISTURBED AREA — 1 DAY
- B. GRADE ROAD — 2 DAYS
- C. INSTALL ROAD AGGREGATE AND INSTALL 48" HDPE CULVERT, INCLUDING ROCK OUTLET PROTECTION @ STA. 10+45 (3 ADDITIONAL DAYS IF SOIL CEMENT IS REQUIRED) — 3 DAYS
- D. FINE GRADE AND VEGETATIVELY STABILIZE DISTURBED AREA — 1 DAY

4.) CONSTRUCT ROAD AND GRASS SWALES TO BRAGERS ROAD (STA 26+00), PER SEQUENCE UNDER ITEMS 3(A), 3(B) AND 3(C) ABOVE. THREE ADDITIONAL DAYS WOULD BE REQUIRED FOR SOIL CEMENT INSTALLATION. INSTALL 24" HDPE CULVERT, INCLUDING ROCK OUTLET PROTECTION @ STA 15+60. — 7 DAYS

5.)CONSTRUCT ROAD TO APPROXIMATE STATION 30+00, PER DESCRIPTION BELOW.

- A. GRUB DISTURBED AREA — 1 DAY
- B. INSTALL REINFORCED SILT FENCE AS SHOWN, BEGIN ROAD GRADING AND INSTALL 48" HDPE, INCLUDING ROCK OUTLET PROTECTION @ STA 28+30 — 2 DAYS
- C. REMOVE REINFORCED SILT FENCE WHEN REQUIRED, COMPLETE ROAD GRADING (INCLUDING ROAD AGGREGATE PLACEMENT) AND VEGETATIVELY STABILIZE DISTURBED AREA. — 5 DAYS

6.) CONSTRUCT GRASS SWALES, WQv FACILITY AND ROAD TO END OF AGGREGATE SURFACE AND BEGINNING OF BITUMINOUS CONCRETE SURFACE AT APPROXIMATE PROPERTY LINE, PER DESCRIPTION BELOW.

- A. GRUB DISTURBED AREA — 1 DAY
- B. ROUGH GRADE THE AREA AND INSTALL THE WQv FACILITY AS SHOWN ON DRAWING 4 — 1 DAY
- C. COMPLETE ROAD CONSTRUCTION AND VEGETATIVE STABILIZE DISTURBED AREA. — 2 DAYS

7.) GRUB DISTURBED AREA AND INSTALL THE 48" HDPE @ BASIN NO. 4 AND 18" HDPE CULVERT, INCLUDING ROCK OUTLET PROTECTION @ STA 46+00 — 3 DAYS

8.) CONSTRUCT BASIN NO. 4 AND ASSUMED EAST ENTRANCE FACILITIES AS SHOWN ON SHEET 5. — 2 WEEKS

9.) CONSTRUCT ROAD TO LANDFILL PERIMETER ACCESS ROAD, PER DESCRIPTION BELOW.

- A. GRUB DISTURBED AREA — 1 DAY
- B. FINE GRADE ROAD AND ROADSIDE DITCHES — 5 DAYS
- C. CONSTRUCT ROAD BITUMINOUS SURFACE. VEGETATIVELY STABILIZE DISTURBED AREAS — 3 DAYS

STATE OF MARYLAND — RAYMOND STICKMAN — No. 21708 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

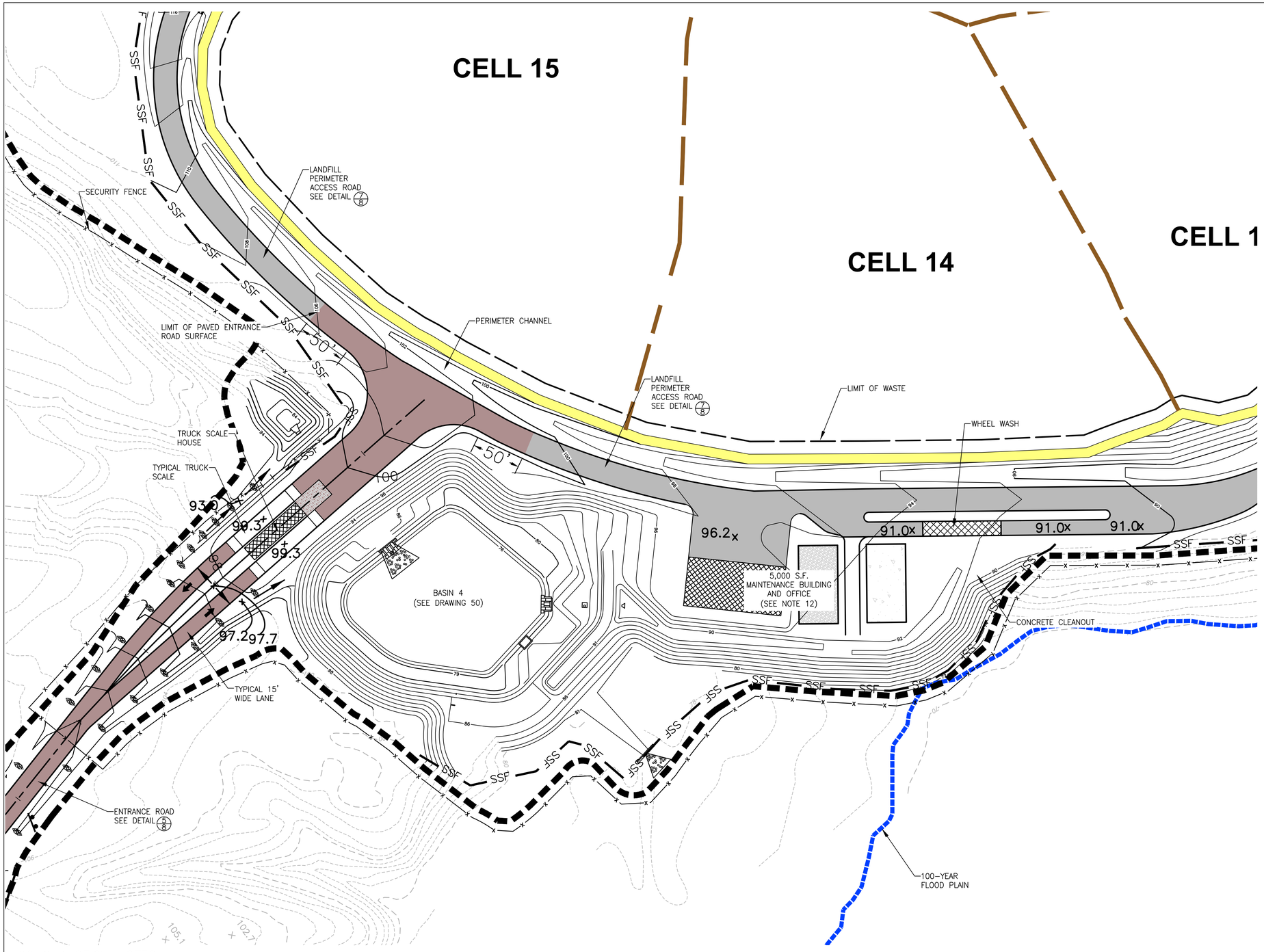
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EAST ENTRANCE ROAD
SEDIMENT CONTROL PLAN
(SHEET 1 OF 2)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 55

N:\Projects\2018\2018854 - Chesapeake Terrace\1 FC\ACAD\WORK_B_Phase III Application\Drawings\Final\2018854 BSS - 1 of 1 ENTRANCE ROAD SEDIMENT CONTROL PLAN (SHEET 1 OF 2).dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN (SEE NOTE 13)
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION LINE
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/60
- PIPE
- ROCK OUTLET PROTECTION
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 3/8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- SIGNS, SEE DRAWING 9
- SSF — SUPER SILTFENCE SEE DETAIL F3/60
- PERIMETER BERM, SEE DETAIL 2/16

GENERAL NOTES

1. THE PURPOSE OF THIS SHEET IS TO SHOW SEDIMENT CONTROL MEASURES FOR INITIAL GRADING TO OCCUR PRIOR TO CONSTRUCTION OF BASIN NO. 4, EAST ENTRANCE FACILITIES AND ACCESS ROADS.
2. SEE SITE PLAN ON DRAWING 2 FOR ASSUMED EAST ENTRANCE LOCATION.
3. SEE DRAWING 4 FOR ASSUMED EAST ENTRANCE ACCESS ROAD PLAN.
4. SEE DRAWING 4 FOR ASSUMED EAST ENTRANCE INITIAL GRADING PLAN.
5. SEE DRAWING 55 AND 63 FOR SEQUENCE OF CONSTRUCTION REQUIRED IN THE AREA HEREON.
6. SEE DRAWING 50 FOR BASIN NO. 4 AND EAST ENTRANCE FACILITIES CONSTRUCTION.
7. SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELLS 13 THROUGH 15 CONSTRUCTION REQUIREMENTS.

SEQUENCE OF CONSTRUCTION

1. NOTIFY ANNE ARUNDEL COUNTY PLANNING AND CODE ENFORCEMENT (PACE) INSPECTIONS AND PERMITS (410-222-7780) AT LEAST 72 HOURS BEFORE COMMENCING COSNTRUCTION.
2. INSTALL SUPER SILT FENCE AS SHOWN.
3. CLEAR THE MINIMUM AREA REQUIRED AND INSTALL THE 48" HDPE PIPE WITH SECTION AND RIPRAP APRON AS SHOWN. RIPRAP APRON SHALL BE IDENTICAL TO RIPRAP APRON FOR BASIN NO. 4 PRINCIPAL SPILLWAY PIPE. SEE SHEET 61 FOR PROFILES OF INSTALLED 48" HDPE PIPE AND BASIN NO. 4 PRINCIPAL SPILLWAY PIPE.
4. IMMEDIATELY STABILIZE THE DISTURBED AREA.
5. CLEAR THE MINIMUM AREA REQUIRED AND GRADE THE AREA FOR EAST ENTRANCE FACILITIES, FUTURE LANDFILL PERIMETER ACCESS ROAD AND PERIMETER CHANNEL NO. 8 AS SHOWN. SURFACE RUNOFF FROM PERIMETER CHANNEL NO. 8 WILL BE CONVEYED TO EXISTING BASIN NO. 3 (SEE DRAWING 38 & 39). SEE DRAWING 57 FOR CONTINUATION OF SUPER SILT FENCE REQUIRED FOR BASIN NO. 3 CONSTRUCTION.
6. IMMEDIATELY STABILIZE ALL DISTURBED AREAS.

CONSTRUCTION NOTES

1. NTRANCE ROAD SHALL BE PAVED FROM PROPERTY LINE (STA 35+00) TO LANDFILL PERIMETER ACCESS ROAD. SEE EAST ENTRANCE "TYPICAL SECTION FROM SITE PROPERTY LINE TO LANDFILL" ON SHEET 3 FOR ENTRANCE ROAD PAVEMENT CROSS SECTION. SEE PLAN BELOW FOR PAVEMENT WIDTH.
2. SCALE HOUSE IS CONFIGURED AT SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
3. MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.
4. UNLESS INDICATED OTHERWISE, ALL STEEP SLOPES ARE 2:1.

50 0 25 50 100 200
1 INCH = 50 FT

STATE OF MARYLAND — RAYMOND STOCKMAN — 21585 — REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

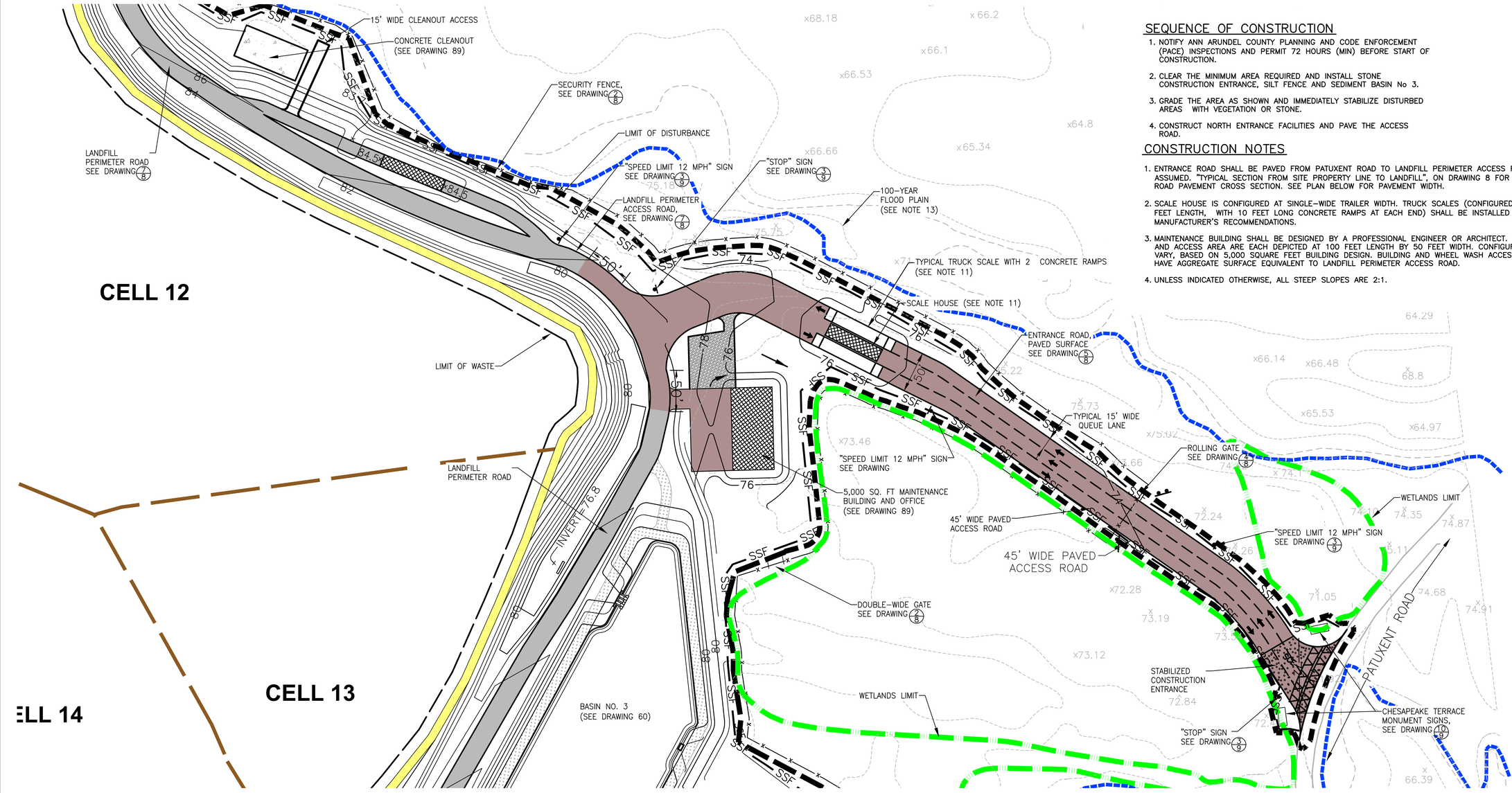
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EAST ENTRANCE ROAD
SEDIMENT CONTROL PLAN
SHEET 2 OF 2

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 56

N:\Projects\2018\2018854 - Chesapeake Terrace\07-CAD\DWGS\E & P\Phase III Application\Drawings\Final\20180854 BP56 - EAST ENTRANCE ROAD SEDIMENT CONTROL PLAN SHEET 2 OF 2.dwg



SEQUENCE OF CONSTRUCTION

1. NOTIFY ANN ARUNDEL COUNTY PLANNING AND CODE ENFORCEMENT (PACE) INSPECTIONS AND PERMIT 72 HOURS (MIN) BEFORE START OF CONSTRUCTION.
2. CLEAR THE MINIMUM AREA REQUIRED AND INSTALL STONE CONSTRUCTION ENTRANCE, SILT FENCE AND SEDIMENT BASIN No 3.
3. GRADE THE AREA AS SHOWN AND IMMEDIATELY STABILIZE DISTURBED AREAS WITH VEGETATION OR STONE.
4. CONSTRUCT NORTH ENTRANCE FACILITIES AND PAVE THE ACCESS ROAD.

CONSTRUCTION NOTES

1. ENTRANCE ROAD SHALL BE PAVED FROM PATUXENT ROAD TO LANDFILL PERIMETER ACCESS ROAD. SEE ASSUMED. "TYPICAL SECTION FROM SITE PROPERTY LINE TO LANDFILL", ON DRAWING 8 FOR ENTRANCE ROAD PAVEMENT CROSS SECTION. SEE PLAN BELOW FOR PAVEMENT WIDTH.
2. SCALE HOUSE IS CONFIGURED AT SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
3. MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.
4. UNLESS INDICATED OTHERWISE, ALL STEEP SLOPES ARE 2:1.

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN (SEE NOTE 13)
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION LINE
- LIMIT OF DISTURBANCE
- PIPE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- SIGNS, SEE DRAWING 3/9
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- TYPICAL WETLANDS
- SSF — SUPER SILT FENCE, SEE DRAWING 60
- ACCESS ROAD
- PERIMETER BERM, SEE DETAIL 2/16

60 0 30 60 120 240

1 INCH = 60 FT

GENERAL NOTES

1. THESE PERMIT DRAWINGS DO NOT CONTAIN A STORMWATER MANGEMENT PLAN FOR THE OPTIONAL NORTH ENTRANCE. THE OPTIONAL NORTH ENTRANCE MAY NOT BE CONSTRUCTED WITHOUT A STORMWATER MANAGEMENT PLAN APPROVED BY ANNE ARUNDEL SOIL CONSERVATION DISTRICT.
2. PROPOSED CONTOURS DEPICTED HEREON INDICATE GRADING REQUIRED FOR PART OF BASIN NO. 3, THE OPTIONAL NORTH ENTRANCE AND PART OF LANDFILL CELL NOS. 12, 13 AND 14 CONSTRUCTION.
3. BASIN NO. 3 WILL BE CONSTRUCTED PRIOR TO ANY OTHER CONSTRUCTION IN OR UPSLOPE OF THIS AREA (SEE DRAWING 63 "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION").
4. IF NEITHER THE ASSUMED EAST ENTRANCE NOR THE OPTIONAL SOUTH ENTRANCE IS CONSTRUCTED, THE OPTIONAL NORTH ENTRANCE WILL BE CONSTRUCTED IN LIEU OF THE EAST ENTRANCE, PER THE EAST ENTRANCE SEQUENCE OF CONSTRUCTION ON DRAWING 63 CELL NOS. 11, 12, 13, & 14 WILL PROCEED IN ACCORDANCE WITH REQUIREMENTS ON DRAWINGS 67, 68 AND 69, RESPECTIVELY.
5. SEE SITE PLAN ON DRAWING 3 FOR OPTIONAL NORTH ENTRANCE LOCATION.
6. SEE DRAWINGS 4 & 5 FOR ASSUMED SITE ACCESS (EAST ENTRANCE) INITIAL GRADING PLAN PLAN.
7. SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.
8. SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION" FOR CELLS 11 THROUGH 14 CONSTRUCTION REQUIREMENTS.

STATE OF MARYLAND — RAFAEL DE LA CRUZ — No. 21708 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

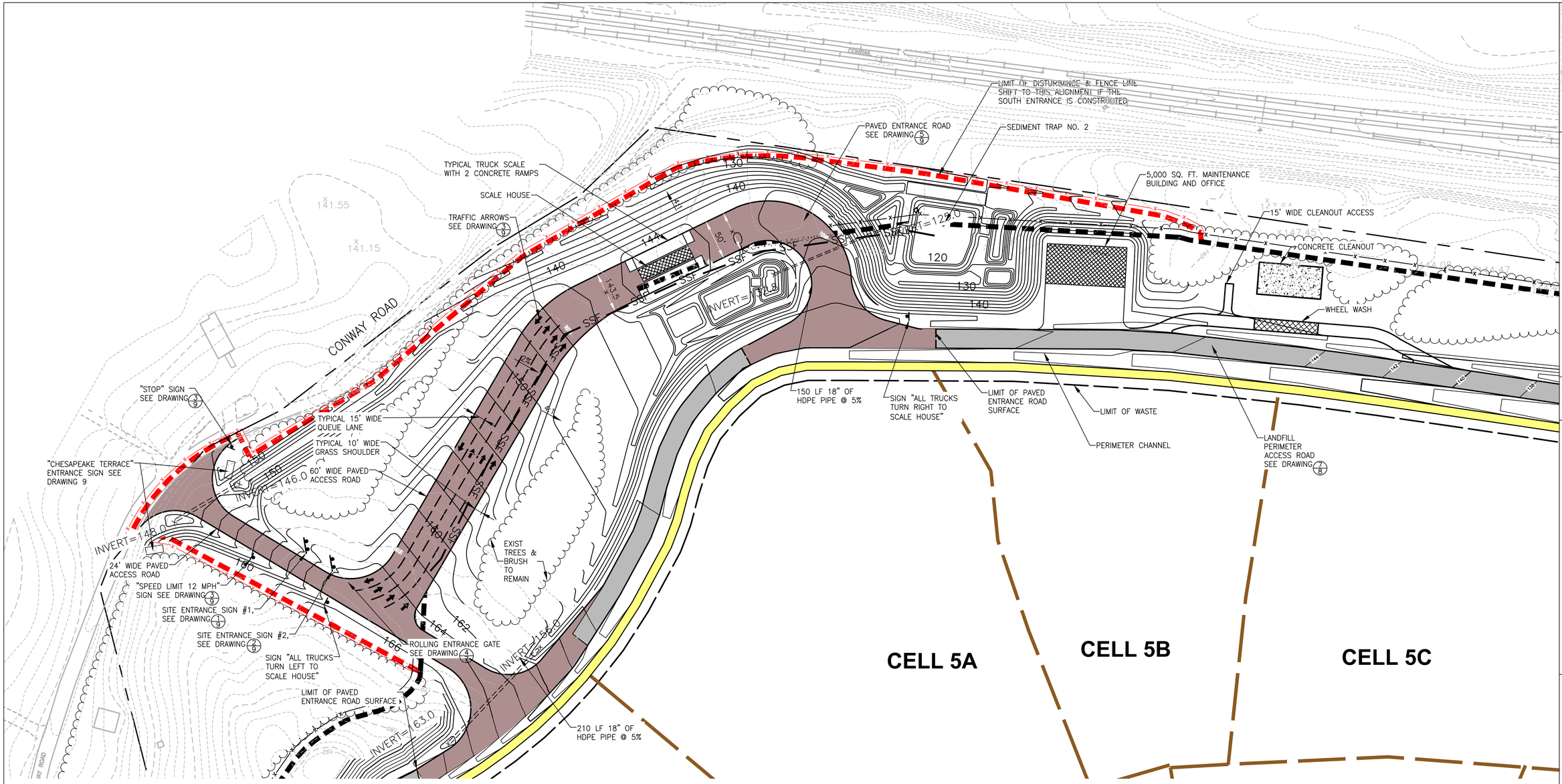
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OPTIONAL NORTH ENTRANCE ROAD
SEDIMENT CONTROL PLAN

PROJECT MANAGER:	PGS	SCALE: AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY:	KHF	DATE: 09/03/2021

DRAWING 57

N:\Projects\2018\2018854 - Chesapeake Terrace II\CAD\GWDR\E & Phase III Application\Drawings\Final\2018854 BK57 - NORTH ENTRANCE ROAD SDC CONTAN.dwg



LEGEND

- PROPERTY LINE
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- LIMIT OF DISTURBANCE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- SIGNS, SEE DRAWING 9
- CELL SEPARATION LINE
- PIPE
- ALTERNATE LIMIT OF DISTURBANCE
- ALTERNATE PROPOSED CHAIN LINK FENCE
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ROAD, SEE DRAWING 7/8
- TYPICAL WETLANDS
- SSF — SUPER SILT FENCE, SEE DRAWING 60
- RSF — REINFORCED SILT FENCE, SEE DRAWING 60
- NEW TREE LINE
- CONCRETE HATCH
- PERIMETER BERM, SEE DETAIL 2/16

GENERAL NOTES

1. THESE PERMIT DRAWINGS DO NOT CONTAIN A STORMWATER MANAGEMENT PLAN FOR THE OPTIONAL SOUTH ENTRANCE. THE OPTIONAL SOUTH ENTRANCE MAY NOT BE CONSTRUCTED WITHOUT A STORMWATER MANAGEMENT PLAN APPROVED BY ANNE ARUNDEL SOIL CONSERVATION DISTRICT.
2. CONTOURS DEPICTED HEREON INDICATE GRADING REQUIRED FOR THE SEDIMENT TRAP, SOUTH ENTRANCE AND PART OF PART OF LANDFILL CELL NOS. 5A, 5B & 5C (SEE DRAWING 63 "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION"). THE SEDIMENT TRAP AND SITE ENTRANCE WILL BE CONSTRUCTED PRIOR TO ANY OTHER CONSTRUCTION. IF NEITHER THE ASSUMED EAST ENTRANCE NOR THE OPTIONAL NORTH ENTRANCE IS CONSTRUCTED, THE OPTIONAL SOUTH ENTRANCE WILL BE CONSTRUCTED, PER THE EAST ENTRANCE SEQUENCE OF CONSTRUCTION ON SHEET 63. AN ACCESS ROAD WILL BE PROVIDED TO CELLS 11 THROUGH 16 AREA AS REQUIRED, AND LANDFILL CELL CONSTRUCTION WILL PROCEED IN ACCORDANCE WITH THE SEQUENCE OF CONSTRUCTION SPECIFIED ON THESE PERMIT DRAWINGS.
3. SEE SITE PLAN ON DRAWING 3 FOR OPTIONAL SOUTH ENTRANCE LOCATION.
4. SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.
5. SEE DRAWING 59 FOR CONTINUATION OF SEDIMENT CONTROL MEASURES AT WEST SECTION LIMIT OF DISTURBANCE.
6. SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELLS 8 AND 9 CONSTRUCTION REQUIREMENTS.

60 0 30 60 120 240
1 INCH = 60 FT

SEQUENCE OF CONSTRUCTION

1. NOTIFY ANN ARUNDEL COUNTY PLANNING AND CODE ENFORCEMENT (PACE) INSPECTIONS AND PERMIT.
2. CLEAR THE MINIMUM AREA REQUIRED AND INSTALL STONE CONSTRUCTION ENTRANCE, SILT FENCE AND SEDIMENT TRAP.
3. GRADE THE AREA AS SHOWN AND IMMEDIATELY VEGETATIVELY STABILIZE DISTURBED AREAS.
4. CONSTRUCT SOUTH ENTRANCE FACILITIES AND PAVE THE ACCESS ROAD.

CONSTRUCTION NOTES

1. ENTRANCE ROAD SHALL BE PAVED FROM CONWAY ROAD TO LANDFILL PERIMETER ACCESS ROAD. SEE ASSUMED EAST ENTRANCE ACCESS ROAD PLAN, "TYPICAL SECTION FROM SITE PROPERTY LINE TO LANDFILL", ON SHEET 3 FOR ENTRANCE ROAD PAVEMENT CROSS SECTION. SEE PLAN BELOW FOR PAVEMENT WIDTH.
2. SCALE HOUSE IS CONFIGURED AT SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
3. MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.
4. UNLESS INDICATED OTHERWISE, ALL STEEP SLOPES ARE 2:1.

STATE OF MARYLAND · RICHARD STRICKMAN · 19881 · PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

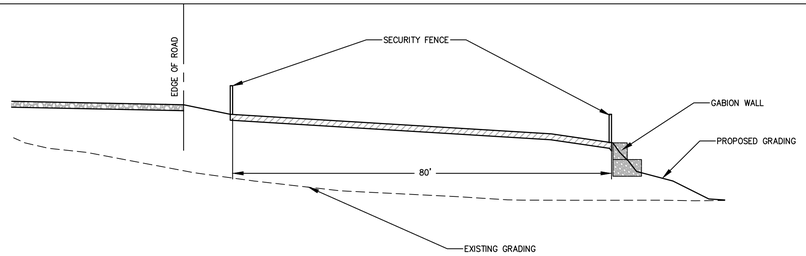
ADVANCED GeoServices
a Monroe Environmental Group company
1879 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
T: 856.354.2273, F: 856.354.8236 www.advancedgeoservices.com

OPTIONAL SOUTH ENTRANCE ROAD
SEDIMENT CONTROL PLAN

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

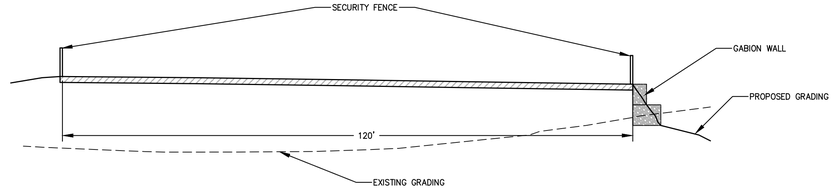
DRAWING 58

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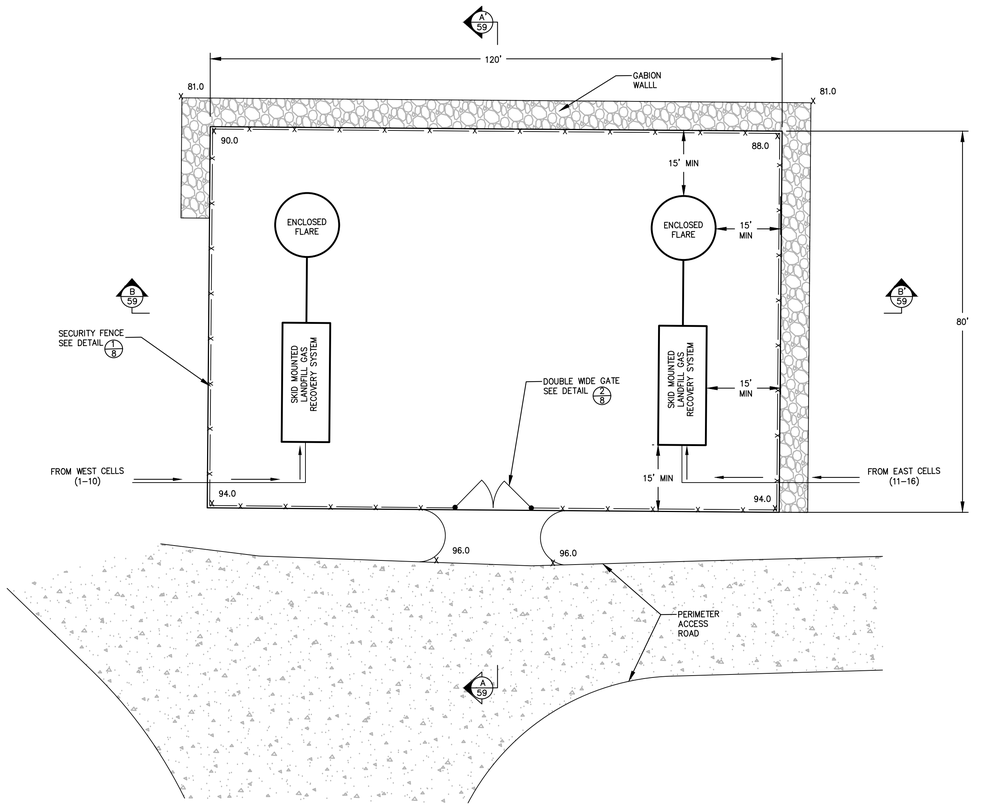
A/59 SECTION A-A'

NOT TO SCALE



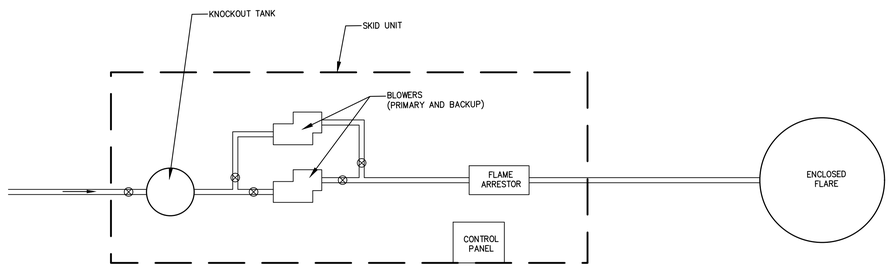
B/59 SECTION B-B'

NOT TO SCALE



PLAN VIEW
FLARE PADDOCK

NOT TO SCALE



2/59 SCHEMATIC: SKID MOUNTED RECOVERY SYSTEM

NOT TO SCALE

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
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FLARE PADDOCK

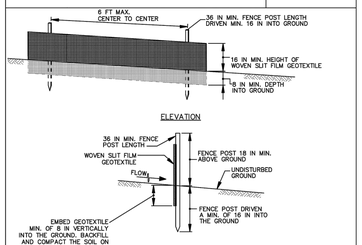
PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 – 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

DRAWING 59

I:\Projects\2018\2018854 - Chesapeake Terrace LFG\ACAD\WORC & Phase III Application\Drawings\Final\2018854 8059 - FLARE PADDOCK.DWG

DETAIL E-1 SILT FENCE

STANDARD SYMBOL: SF



1 OF 2

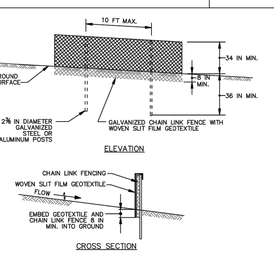
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

E.2

DETAIL E-3 SUPER SILT FENCE

STANDARD SYMBOL: SSF



CONSTRUCTION SPECIFICATIONS

1. INSTALL 2½ INCH DIAMETER GALVANIZED STEEL POSTS OF 0.095 INCH WALL THICKNESS AND SIX FOOT LENGTH SPACED NO FURTHER THAN 10 FEET APART. DRIVE THE POSTS A MINIMUM OF 36 INCHES INTO THE GROUND.
2. FASTEN 9 GAUGE OR HEAVIER GALVANIZED CHAIN LINK FENCE (2⅜ INCH MAXIMUM OPENING) 42 INCHES IN HEIGHT SECURELY TO THE FENCE POSTS WITH WIRE TIES OR HOG RINGS.
3. FASTEN WOVEN SLIT FILM GEOTEXTILE AS SPECIFIED IN SECTION H–1 MATERIALS, SECURELY TO THE UPSLOPE SIDE OF CHAIN LINK FENCE WITH TIES SPACED EVERY 24 INCHES AT THE TOP AND MID SECTION. EMBED GEOTEXTILE AND CHAIN LINK FENCE A MINIMUM OF 8 INCHES INTO THE GROUND.
4. WHERE ENDS OF THE GEOTEXTILE COME TOGETHER, THE ENDS SHALL BE OVERLAPPED BY 6 INCHES, FOLDED, AND STAPLED TO PREVENT SEDIMENT BY PASS.
5. EXTEND BOTH ENDS OF THE SUPER SILT FENCE A MINIMUM OF FIVE HORIZONTAL FEET UPSLOPE AT 45 DEGREES TO THE MAIN FENCE ALIGNMENT TO PREVENT RUNOFF FROM GOING AROUND THE ENDS OF THE SUPER SILT FENCE.
6. PROVIDE MANUFACTURER'S CERTIFICATION TO THE INSPECTION/ENFORCEMENT AUTHORITY SHOWING THAT GEOTEXTILE USED MEETS THE REQUIREMENTS IN SECTION H–1 MATERIALS.
7. REMOVE ACCUMULATED SEDIMENT AND DEBRIS WHEN BULGES DEVELOP IN FENCE OR WHEN SEDIMENT REACHES 25% OF FENCE HEIGHT. REPLACE GEOTEXTILE IF TORN. IF UNDERMINING OCCURS, REINSTALL CHAIN LINK FENCING AND GEOTEXTILE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

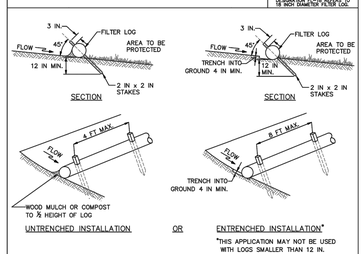
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

E.7

DETAIL E-6 FILTER LOG

STANDARD SYMBOL: FL–18

DESIGNATION FL–18 REFERS TO 18 INCH DIAMETER FILTER LOG



1 OF 2

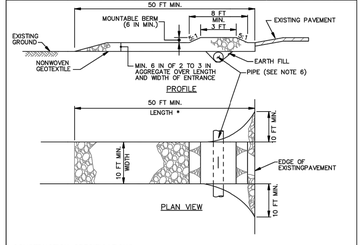
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

E.15

DETAIL B-1 STABILIZED CONSTRUCTION ENTRANCE

STANDARD SYMBOL: SCE



CONSTRUCTION SPECIFICATIONS

1. PLACE STABILIZED CONSTRUCTION ENTRANCE IN ACCORDANCE WITH THE APPROVED PLAN. VEHICLES MUST TRAVEL OVER THE ENTIRE LENGTH OF THE SCE. USE MINIMUM LENGTH OF 50 FEET (*30 FEET FOR SINGLE RESIDENCE LOT). USE MINIMUM WIDTH OF 10 FEET. FLARE SCE 10 FEET MINIMUM AT THE EXISTING ROAD TO PROVIDE A TURNING RADIUS.
2. PIPE ALL SURFACE WATER FLOWING TO OR DIVERTED TOWARD THE SCE UNDER THE ENTRANCE, MAINTAINING POSITIVE DRAINAGE. PROTECT PIPE INSTALLED THROUGH THE SCE WITH A MOUNTABLE BERM WITH 5:1 SLOPES AND A MINIMUM OF 12 INCHES OF STONE OVER THE PIPE. PROVIDE PIPE AS SPECIFIED ON APPROVED PLAN. WHEN THE SCE IS LOCATED AT A HIGH SPOT AND HAS NO DRAINAGE TO CONVEY, A PIPE IS NOT NECESSARY. A MOUNTABLE BERM IS REQUIRED WHEN SCE IS NOT LOCATED AT A HIGH SPOT.
3. PREPARE SUBGRADE AND PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS.
4. PLACE CRUSHED AGGREGATE (2 TO 3 INCHES IN SIZE) OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) AT LEAST 6 INCHES DEEP OVER THE LENGTH AND WIDTH OF THE SCE.
5. MAINTAIN ENTRANCE IN A CONDITION THAT MINIMIZES TRACKING OF SEDIMENT. ADD STONE OR MAKE OTHER REPAIRS AS CONDITIONS DEMAND TO MAINTAIN CLEAN SURFACE, MOUNTABLE BERM, AND SPECIFIED DIMENSIONS. IMMEDIATELY REMOVE STONE AND/OR SEDIMENT SPILLED, DROPPED, OR TRACKED ONTO ADJACENT ROADWAY BY VACUUMING, SCRAPING, AND/OR SWEEPING. WASHING ROADWAY TO REMOVE MUD TRACKED ONTO PAVEMENT IS NOT ACCEPTABLE UNLESS WASH WATER IS DIRECTED TO AN APPROVED SEDIMENT CONTROL PRACTICE.

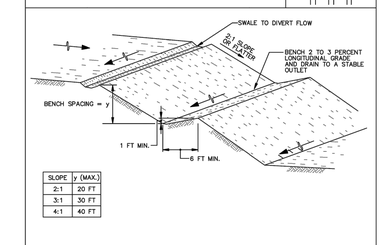
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B.2

DETAIL B-3-1 BENCHING

STANDARD SYMBOL: BENCHING



SLOPE	y (MAX.)
2:1	20 FT
3:1	30 FT
4:1	40 FT

CONSTRUCTION SPECIFICATIONS

1. USE FILL MATERIAL FREE OF BRUSH, RUBBISH, ROCKS, LOGS, STUMPS, BUILDING DEBRIS, AND OTHER OBJECTIONABLE MATERIALS THAT WOULD INTERFERE WITH OR PREVENT CONSTRUCTION OF SATISFACTORY FILLS.
2. DO NOT INCORPORATE FROZEN, SOFT, MUCKY, OR HIGHLY COMPRESSIBLE MATERIALS INTO FILL SLOPES OR STRUCTURAL FILLS. DO NOT PLACE FILL ON A FROZEN FOUNDATION.
3. PLACE ALL FILL IN LOOSE LIFTS NOT TO EXCEED 8 INCHES AND THEN COMPACT.
4. COMPACT ALL FILLS AS REQUIRED TO REDUCE EROSION, SLIPPAGE, SETTLEMENT, OR OTHER RELATED PROBLEMS. COMPACT FILL INTENDED TO SUPPORT BUILDINGS, STRUCTURES, CONDUITS, ETC., IN ACCORDANCE WITH LOCAL REQUIREMENTS OR CODES.
5. HANDLE SEEPS OR SPRINGS ENCOUNTERED DURING CONSTRUCTION IN ACCORDANCE WITH SECTION H–2 SUBSURFACE DRAINS OR OTHER APPROVED METHODS.
6. MAINTAIN LINE, GRADE, AND CROSS SECTION OF BENCHING. STABILIZE IN ACCORDANCE WITH THE 3/7 DAY STABILIZATION CRITERIA OR AS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN. INSTALLATION OF EROSION CONTROL MATTING MAY BE NECESSARY IN BENCH/SWALE INVERTS. CONTINUOUSLY MEET REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.
7. KEEP ALL BENCHES FREE OF SEDIMENT DURING ALL PHASES OF DEVELOPMENT.

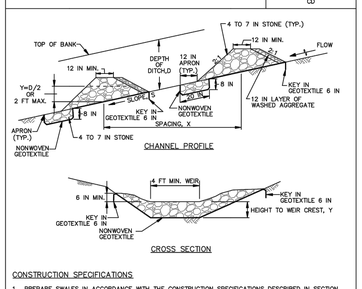
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B.7

DETAIL D-2 STONE CHECK DAM

STANDARD SYMBOL: CD



CONSTRUCTION SPECIFICATIONS

1. PREPARE SWALES IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS DESCRIBED IN SECTION C–2, STANDARDS AND SPECIFICATIONS FOR TEMPORARY SWALES, AS SPECIFIED ON PLAN.
2. PLACE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H–1 MATERIALS, UNDER THE BOTTOM AND SIDES OF THE DAM PRIOR TO PLACEMENT OF STONE. CONSTRUCT THE CHECK DAM WITH WASHED 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE (WITHOUT REBAR) WITH SIDE SLOPES OF 2:1 OR FLATTER AND A MINIMUM TOP WIDTH OF 12 INCHES. PLACE THE STONE SO THAT IT COMPLETELY COVERS THE WIDTH OF THE CHANNEL AND CHANNEL BANKS. FORM THE WEIR SO THAT TOP OF THE OUTLET CREST IS APPROXIMATELY 6 INCHES LOWER THAN THE OUTER EDGES. LINE THE UPSTREAM FACE OF THE DAM WITH A 1 FOOT THICK LAYER OF WASHED AGGREGATE (¾ TO 1½ INCH).
3. SET THE HEIGHT FOR THE WEIR CREST EQUAL TO ONE–HALF THE DEPTH OF THE CHANNEL OR DITCH. TO AVOID SCOUR THE MAXIMUM HEIGHT OF THE WEIR CREST MUST NOT EXCEED 2.0 FEET.
4. REMOVE ACCUMULATED SEDIMENT WHEN IT REACHES ONE–HALF OF THE HEIGHT OF THE WEIR CREST. MAINTAIN LINE, GRADE, AND CROSS SECTION.

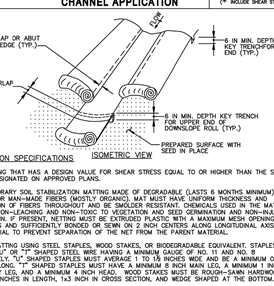
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

D.8

DETAIL B-4-6-A TEMPORARY SOIL STABILIZATION MATTING CHANNEL APPLICATION

STANDARD SYMBOL: TSSMC – * lb/ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN–MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE CHANNEL CENTERLINE. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MAT SMOOTHLY AND FIRMLY ON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. KEY–IN UPSTREAM END OF EACH MAT ROLL BY DIGGING A 6 INCH (MINIMUM) TRENCH AT THE UPSTREAM END OF THE MATTING, PLACING THE ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END.
7. OVERLAP OR ABUT ROLL EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

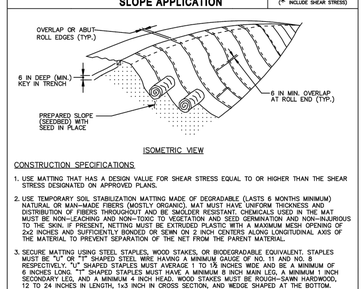
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B.38

DETAIL B-4-6-B TEMPORARY SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL: TSSMC – * lb/ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE TEMPORARY SOIL STABILIZATION MATTING MADE OF DEGRADABLE (LASTS 6 MONTHS MINIMUM) NATURAL OR MAN–MADE FIBERS (MOSTLY ORGANIC). MAT MUST HAVE UNIFORM THICKNESS AND DISTRIBUTION OF FIBERS THROUGHOUT AND BE SMOLDER RESISTANT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES, WOOD STAKES, OR BIODEGRADABLE EQUIVALENT. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPED AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING DOWNSLOPE. LAY MAT SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT ROLLS EDGES PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSLOPE MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
7. KEY IN THE UPSLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

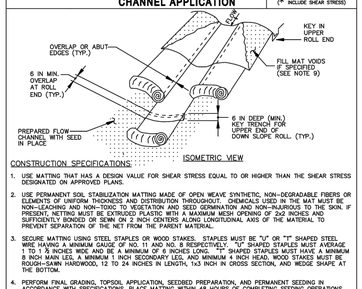
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B.39

DETAIL B-4-6-C PERMANENT SOIL STABILIZATION MATTING CHANNEL APPLICATION

STANDARD SYMBOL: PSSMC – * lb/ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE PERMANENT SOIL STABILIZATION MATTING MADE OF OPEN WEAVE SYNTHETIC, NON–DEGRADABLE FIBERS OR ELEMENTS OF UNIFORM THICKNESS AND DISTRIBUTION THROUGHOUT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES OR WOOD STAKES. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPE AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS, UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING IN DIRECTION OF WATER FLOW, CENTERING THE FIRST ROLL ON THE CHANNEL CENTER LINE. WORK FROM CENTER OF CHANNEL OUTWARD WHEN PLACING ROLLS. LAY MATTING SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT EDGES OF MATTING ROLLS PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE NEXT DOWNSTREAM MAT.
7. KEY IN THE TOP OF SLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. IF SPECIFIED BY THE DESIGNER OR MANUFACTURER AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, ONCE THE MATTING IS KEYED AND STAPLED IN PLACE, FILL THE MAT VOIDS WITH TOP SOIL OR GRANULAR MATERIAL AND LIGHTLY COMPACT OR ROLL TO MAXIMIZE SOIL/MAT CONTACT WITHOUT CRUSHING MAT.
10. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

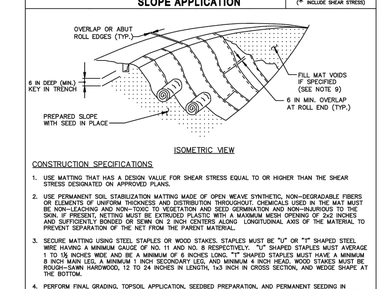
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B.40

DETAIL B-4-6-D PERMANENT SOIL STABILIZATION MATTING SLOPE APPLICATION

STANDARD SYMBOL: PSSMS – * lb/ft² (* INCLUDE SHEAR STRESS)



CONSTRUCTION SPECIFICATIONS

1. USE MATTING THAT HAS A DESIGN VALUE FOR SHEAR STRESS EQUAL TO OR HIGHER THAN THE SHEAR STRESS DESIGNATED ON APPROVED PLANS.
2. USE PERMANENT SOIL STABILIZATION MATTING MADE OF OPEN WEAVE SYNTHETIC, NON–DEGRADABLE FIBERS OR ELEMENTS OF UNIFORM THICKNESS AND DISTRIBUTION THROUGHOUT. CHEMICALS USED IN THE MAT MUST BE NON–LEACHING AND NON–TOXIC TO VEGETATION AND SEED GERMINATION AND NON–INJURIOUS TO THE SKIN. IF PRESENT, NETTING MUST BE EXTRUDED PLASTIC WITH A MAXIMUM MESH OPENING OF 2x2 INCHES AND SUFFICIENTLY BONDED OR SEWN ON 2 INCH CENTERS ALONG LONGITUDINAL AXIS OF THE MATERIAL TO PREVENT SEPARATION OF THE NET FROM THE PARENT MATERIAL.
3. SECURE MATTING USING STEEL STAPLES OR WOOD STAKES. STAPLES MUST BE "U" OR "T" SHAPED STEEL WIRE HAVING A MINIMUM GAUGE OF NO. 11 AND NO. 8 RESPECTIVELY. "U" SHAPED STAPLES MUST AVERAGE 1 TO 1½ INCHES WIDE AND BE A MINIMUM OF 6 INCHES LONG. "T" SHAPED STAPLES MUST HAVE A MINIMUM 8 INCH MAIN LEG, A MINIMUM 1 INCH SECONDARY LEG, AND A MINIMUM 4 INCH HEAD. WOOD STAKES MUST BE ROUGH–SAWN HARDWOOD, 12 TO 24 INCHES IN LENGTH, 1x3 INCH IN CROSS SECTION, AND WEDGE SHAPE AT THE BOTTOM.
4. PERFORM FINAL GRADING, TOPSOIL APPLICATION, SEEDBED PREPARATION, AND PERMANENT SEEDING IN ACCORDANCE WITH SPECIFICATIONS. PLACE MATTING WITHIN 48 HOURS OF COMPLETING SEEDING OPERATIONS, UNLESS END OF WORKDAY STABILIZATION IS SPECIFIED ON THE APPROVED EROSION AND SEDIMENT CONTROL PLAN.
5. UNROLL MATTING DOWN SLOPE. LAY MATTING SMOOTHLY AND FIRMLY UPON THE SEEDED SURFACE. AVOID STRETCHING THE MATTING.
6. OVERLAP OR ABUT EDGES OF MATTING ROLLS PER MANUFACTURER RECOMMENDATIONS. OVERLAP ROLL ENDS BY 6 INCHES (MINIMUM), WITH THE UPSTREAM MAT OVERLAPPING ON TOP OF THE DOWNSLOPE MAT.
7. KEY IN THE TOP OF SLOPE END OF MAT 6 INCHES (MINIMUM) BY DIGGING A TRENCH, PLACING THE MATTING ROLL END IN THE TRENCH, STAPLING THE MAT IN PLACE, REPLACING THE EXCAVATED MATERIAL, AND TAMPING TO SECURE THE MAT END IN THE KEY.
8. STAPLE/STAKE MAT IN A STAGGERED PATTERN ON 4 FOOT (MAXIMUM) CENTERS THROUGHOUT AND 2 FOOT (MAXIMUM) CENTERS ALONG SEAMS, JOINTS, AND ROLL ENDS.
9. IF SPECIFIED BY THE DESIGNER OR MANUFACTURER AND DEPENDING ON THE TYPE OF MAT BEING INSTALLED, ONCE THE MATTING IS KEYED AND STAPLED IN PLACE, FILL THE MAT VOIDS WITH TOP SOIL OR GRANULAR MATERIAL AND LIGHTLY COMPACT OR ROLL TO MAXIMIZE SOIL/MAT CONTACT WITHOUT CRUSHING MAT.
10. ESTABLISH AND MAINTAIN VEGETATION SO THAT REQUIREMENTS FOR ADEQUATE VEGETATIVE ESTABLISHMENT ARE CONTINUOUSLY MET IN ACCORDANCE WITH SECTION B–4 VEGETATIVE STABILIZATION.

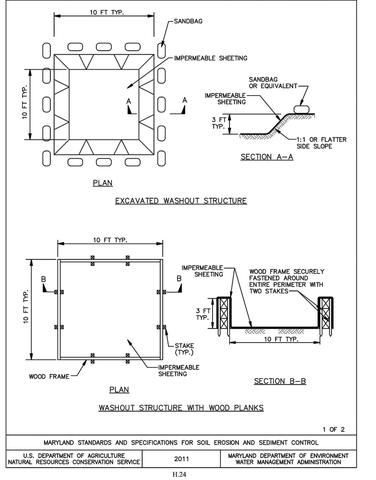
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

B.41

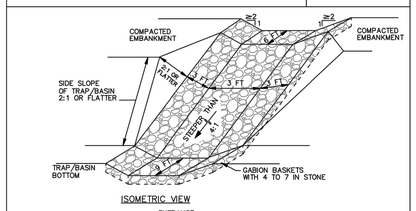
DETAIL H-6 ONSITE CONCRETE WASHOUT STRUCTURE

STANDARD SYMBOL: CWS


10 FT TYP.
SANDBAG
IMPERMEABLE SHEETING
10 FT TYP.
A
A
SANDBAG OR EQUIVALENT
IMPERMEABLE SHEETING
3 FT TYP.
1:1 OR FLATTER SIDE SLOPE
SECTION A–A
PLAN
EXCAVATED W

DETAIL D-3-2 GABION INFLOW PROTECTION

STANDARD SYMBOL: GP



CONSTRUCTION SPECIFICATIONS

1. PROVIDE NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, UNDER THE BOTTOM AND ALONG SIDES OF ALL GABION BASKETS.
2. USE BASKETS MADE OF MINIMUM 11 GAUGE WIRE.
3. CONSTRUCT GABION INFLOW PROTECTION BY ARRANGING 9 X 3 X 1 FOOT GABION BASKETS TO FORM A TRAPEZOIDAL SECTION WITH A 3 FOOT BOTTOM WIDTH, 1 FOOT MINIMUM DEPTH, 3 FOOT SIDE WALLS, AND 2:1 OR FLATTER SIDE SLOPES. FILL GABION BASKETS WITH 4 TO 7 INCH STONE OR EQUIVALENT RECYCLED CONCRETE WITHOUT REBAR OR WEIR MESH.
4. INSTALL ENTRANCE AND EXIT SECTIONS AS SHOWN ON THE PROFILE.
5. INSTALL GABIONS IN ACCORDANCE WITH MANUFACTURER RECOMMENDATIONS.
6. BLEND GABIONS INTO EXISTING GROUND.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. KEEP POINTS OF INFLOW AND OUTFLOW FREE OF EROSION

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

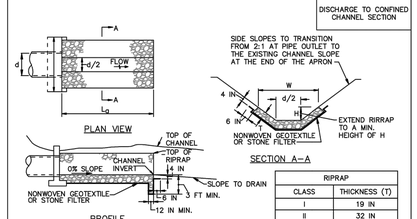
U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

D.12

DETAIL D-4-1-B ROCK OUTLET PROTECTION II

STANDARD SYMBOL: ROPII

DISCHARGE TO CONFINED CHANNEL SECTION



RIPRAP	
CLASS	THICKNESS (T)
I	19 IN
II	32 IN
III	46 IN

CONSTRUCTION SPECIFICATIONS

1. RIPRAP AND STONE MUST CONFORM TO THE SPECIFIED CLASS.
2. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, AND PROTECT FROM PUNCTURING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE TOGETHER.
3. PREPARE THE SUBGRADE FOR GEOTEXTILE OR STONE FILTER (⅜ TO 1½ INCH STONE FOR 6 INCH MINIMUM DEPTH) AND RIPRAP TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EXTEND GEOTEXTILE AT LEAST 6 INCHES BEYOND EDGES OF RIPRAP AND EMBED AT LEAST 4 INCHES AT SIDES OF RIPRAP.
5. CONSTRUCT RIPRAP OUTLET TO FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. PLACE STONE FOR RIPRAP OUTLET IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE RIPRAP IN A MANNER TO PREVENT DAMAGE TO THE STONE FILTER BLANKET OR GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. WHERE NO ENDWALL IS USED, CONSTRUCT THE UPSTREAM END OF THE APRON SO THAT THE WIDTH IS TWO TIMES THE DIAMETER OF THE OUTLET PIPE, AND EXTEND THE STONE UNDER THE OUTLET BY A MINIMUM OF 18 INCHES.
7. CONSTRUCT APRON WITH 0% SLOPE ALONG ITS LENGTH AND WITHOUT OBSTRUCTIONS. PLACE STONE SO THAT IT BLENDS IN WITH EXISTING GROUND.
8. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

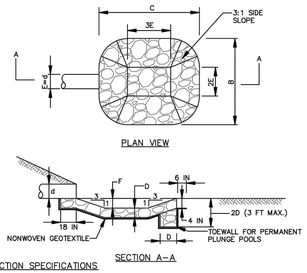
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

D.21

DETAIL D-4-2 PLUNGE POOL

STANDARD SYMBOL: PP



CONSTRUCTION SPECIFICATIONS

1. USE SPECIFIED CLASS OF RIPRAP.
2. USE NONWOVEN GEOTEXTILE AS SPECIFIED IN SECTION H-1 MATERIALS, AND PROTECT FROM PUNCHING, CUTTING, OR TEARING. REPAIR ANY DAMAGE OTHER THAN AN OCCASIONAL SMALL HOLE BY PLACING ANOTHER PIECE OF GEOTEXTILE OVER THE DAMAGED PART OR BY COMPLETELY REPLACING THE GEOTEXTILE. PROVIDE A MINIMUM OF ONE FOOT OVERLAP FOR ALL REPAIRS AND FOR JOINING TWO PIECES OF GEOTEXTILE.
3. PREPARE THE SUBGRADE FOR THE PLUNGE POOL TO THE REQUIRED LINES AND GRADES. COMPACT ANY FILL REQUIRED IN THE SUBGRADE TO A DENSITY OF APPROXIMATELY THAT OF THE SURROUNDING UNDISTURBED MATERIAL.
4. EMBED THE GEOTEXTILE A MINIMUM OF 4 INCHES AND EXTEND THE GEOTEXTILE A MINIMUM OF 6 INCHES BEYOND THE EDGE OF THE SCOUR HOLE.
5. STONE FOR THE PLUNGE POOL MAY BE PLACED BY EQUIPMENT. CONSTRUCT TO THE FULL COURSE THICKNESS IN ONE OPERATION AND IN SUCH A MANNER AS TO AVOID DISPLACEMENT OF UNDERLYING MATERIALS. DELIVER AND PLACE THE STONE FOR THE PLUNGE POOL IN A MANNER THAT WILL ENSURE THAT IT IS REASONABLY HOMOGENEOUS WITH THE SMALLER STONES AND SPALLS FILLING THE VOIDS BETWEEN THE LARGER STONES. PLACE STONE FOR THE PLUNGE POOL IN A MANNER TO PREVENT DAMAGE TO THE GEOTEXTILE. HAND PLACE TO THE EXTENT NECESSARY.
6. AT THE PLUNGE POOL OUTLET, PLACE THE STONE SO THAT IT MEETS THE EXISTING GRADE.
7. MAINTAIN LINE, GRADE, AND CROSS SECTION. KEEP OUTLET FREE OF EROSION. REMOVE ACCUMULATED SEDIMENT AND DEBRIS. AFTER HIGH FLOWS INSPECT FOR SCOUR AND DISLODGED RIPRAP. MAKE NECESSARY REPAIRS IMMEDIATELY.

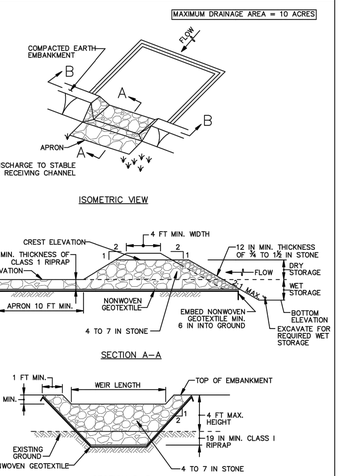
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

D.25

DETAIL G-1-2 STONE/RIPRAP OUTLET SEDIMENT TRAP ST-II

STANDARD SYMBOL: ST–II



1 OF 3

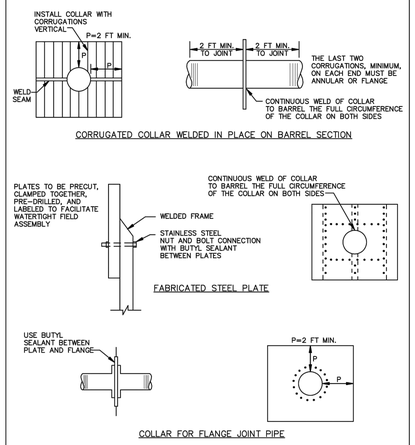
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

G.11

DETAIL G-2-1 TYPICAL ANTI-SEEP COLLARS

STANDARD SYMBOL:



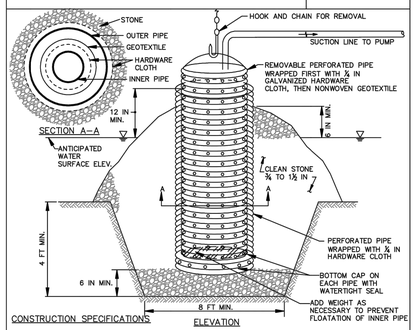
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

G.42

DETAIL F-1 REMOVABLE PUMPING STATION

STANDARD SYMBOL: RPS



CONSTRUCTION SPECIFICATIONS

1. USE CORRUGATED METAL OR PLASTIC PIPE WITH 1 INCH DIAMETER PERFORATIONS 6 INCHES ON CENTER.
2. USE A MINIMUM 12 INCH DIAMETER INNER PIPE WITH AN OUTER PIPE A MINIMUM 6 INCHES LARGER IN DIAMETER. BOTTOM OF EACH PIPE MUST BE CAPPED WITH WATERTIGHT SEAL.
3. WRAP EACH PIPE WITH ¾ INCH GALVANIZED HARDWARE CLOTH. ON INNER PIPE WRAP NONWOVEN GEOTEXTILE, AS SPECIFIED IN SECTION H-1 MATERIALS, OVER THE HARDWARE CLOTH.
4. EXCAVATE 8 FEET X 8 FEET X 4 FEET DEEP PIT FOR PIPE PLACEMENT. PLACE CLEAN ¾ TO 1½ INCH STONE OR EQUIVALENT RECYCLED CONCRETE, 6 INCHES IN DEPTH PRIOR TO PIPE PLACEMENT.
5. SET TOP OF INNER AND OUTER PIPES MINIMUM 12 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION (OR RISER CREST ELEVATION WHEN DEWATERING A BASIN).
6. BACKFILL PIT AROUND THE OUTER PIPE WITH ¾ TO 1½ INCH CLEAN STONE OR EQUIVALENT RECYCLED CONCRETE AND EXTEND STONE A MINIMUM OF 6 INCHES ABOVE ANTICIPATED WATER SURFACE ELEVATION.
7. DISCHARGE TO A STABLE AREA AT A NONEROSIVE RATE.
8. A REMOVABLE PUMPING STATION REQUIRES FREQUENT MAINTENANCE. IF SYSTEM CLOGS, PULL OUT INNER PIPE AND REPLACE GEOTEXTILE. KEEP POINT OF DISCHARGE FREE OF EROSION.

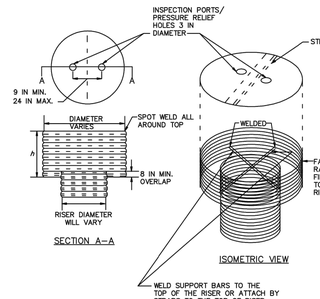
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F.3

DETAIL G-2-3 CONCENTRIC TRASH RACK AND ANTI-VORTEX DEVICE

STANDARD SYMBOL: TR



1 OF 2

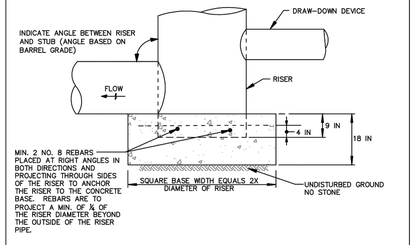
MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

G.44

DETAIL G-2-2 CORRUGATED RISER BASE

STANDARD SYMBOL:



CONSTRUCTION SPECIFICATIONS

1. BOTTOM OF CONCRETE BASE TO BE PLACED ON UNDISTURBED, NATURAL GROUND.
2. NO STONE IS ALLOWED UNDER BASE. IF NECESSARY, TO ACHIEVE STABILITY INCREASE DEPTH OF CONCRETE BASE.

MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL

U.S. DEPARTMENT OF AGRICULTURE NATURAL RESOURCES CONSERVATION SERVICE	2011	MARYLAND DEPARTMENT OF ENVIRONMENT WATER MANAGEMENT ADMINISTRATION

G.43

NOTES

DETAILS PROVIDED BY MDE MANUAL (2011).

STATE OF MARYLAND — LESLIE H. STRICKMAN — No. 21708 — REGISTERED PROFESSIONAL ENGINEER

REVISION: 9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1976 MARLTON PIKE EAST, SUITE 1D, CHERRY HILL, NJ 08003
T: 856.354.2273 F: 856.354.8236 www.advancedgeoservices.com

SEDIMENT CONTROL DETAILS (SHEET 2 OF 2)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER: 2018 – 3854	
DRAWN BY:	KHF	DATE: 09/03/2021	

DRAWING 61

N:\Projects\2018\2018854 - Chesapeake Terrace\LF\CAD\ENGR\CE & Phase III Application\Drawings\Final\PLAN1854.DWG - SEDIMENT CONTROL DETAILS SHEET 2 OF 2.dwg

DETAILS AND SPECIFICATIONS FOR VEGETATIVE ESTABLISHMENT

SITE PREPARATION

1. STABILIZE AS PER STANDARD RESPONSIBILITY NOTE NO. 3.

2. TEMPORARY PERIMETER DIKES AND SILT TRAPS, ETC., ARE TO BE PROVIDED AS PER THIS PLAN PRIOR TO GRADING OPERATIONS WITH LOCATION ADJUSTMENTS TO BE MADE IN THE FIELD AS NECESSARY AND TO BE MAINTAINED AT THE END OF THE WORKING DAY. THE MINIMUM AREA PRACTICAL SHALL BE DISTURBED FOR THE MINIMUM AMOUNT OF TIME POSSIBLE.

3. **Permanent Seeding:**

   A. SEEDBED PREPARATION: AREA TO BE SEEDED SHALL BE LOOSE AND FRIABLE TO A DEPTH OF AT LEAST 3 INCHES. THE TOP LAYER SHALL BE LOOSENED BY RAKING, DISKING OR OTHER ACCEPTABLE MEANS BEFORE SEEDING OCCURS. APPLY 2 TONS OF DOLOMITIC LIMESTONE AND 1,000 POUNDS OF 10–20–20 FERTILIZER PER ACRE. HARROW OR DISK LIME AND FERTILIZER INTO THE SOIL TO A DEPTH OF AT LEAST 3 INCHES ON SLOPES FLATTER THAN 3:1. NO ATTEMPT SHOULD BE MADE TO DRAG ANY DISKED AREA TO MAKE THE SOIL SURFACE SMOOTH AFTER DISKING.

   B. SEEDING: APPLY THE FOLLOWING SEED MIXTURE BETWEEN 1 FEBRUARY AND 31 OCTOBER:

Kentucky 31 Tall Fescue	100 pounds per acre
Red Top	15 pounds per acre
German Millet	20 pounds per acre
or	
Annual Ryegrass	25 pounds per acre
Sericea Lespedeza	30 pounds per acre
Total	165 to 170 pounds per acre

   USE GERMAN MILLET BETWEEN 1 JUNE AND 15 AUGUST.

   APPLY SEED UNIFORMLY ON A MOIST, FIRM SEEDBED WITH A CYCLONE SEED DRILL, CULTIPACKER SEEDER OR HYDROSEEDER (SLURRY INCLUDES SEEDS AND FERTILIZER, RECOMMENDED ON STEEP SLOPES ONLY). MAXIMUM SEED DEPTH SHOULD BE 1/4" IN CLAYEY SOILS AND 1/2" IN SANDY SOILS WHEN USING OTHER THAN THE HYDROSEEDER METHOD. IRRIGATE IF SOIL MOISTURE IS DEFICIENT TO SUPPORT ADEQUATE GROWTH, UNTIL VEGETATION IS FIRMLY ESTABLISHED.

   C. MULCHING: MULCH SHALL BE UNCHOPPED, UNROTTED, SMALL GRAIN STRAW APPLIED AT A RATE OF 2 TONS PER ACRE. MULCH MATERIALS SHALL BE RELATIVELY FREE OF ALL KINDS OF WEEDS AND SHALL BE FREE OF PROHIBITED NOXIOUS WEEDS.

   SPREAD MULCH MECHANICALLY. MULCH ANCHORING SHALL BE ACCOMPLISHED IMMEDIATELY AFTER MULCH PLACEMENT TO MINIMIZE LOSS BY WIND OR WATER USING SYNTHETIC LIQUID MULCH BINDERS.

   D. GUARANTEED PERMANENT VEGETATIVE STABILIZATION OF ALL AREAS AFFECTED BY THE EXECUTION OF THIS CONTRACT IS REQUIRED. AREAS NOT STABILIZED WITH A VIABLE STAND OF PERMANENT VEGETATIVE COVER MUST BE OVERSEEDED, LIMED, AND FERTILIZED AND, IF NECESSARY, STRAW MULCHED AND TACKED BY NO LATER THAN THE FOLLOWING GROWING SEASON FOLLOWING INITIAL STABILIZATION EFFORTS.

4. **Temporary Seeding:**

LIME:	100 POUNDS OF DOLOMITIC LIMESTONE PER 1,000 SQUARE FEET
FERTILIZER:	15 POUNDS OF 10–10–10 PER 1,000 SQUARE FEET
SEED:	PERENNIAL RYE, ITALIAN RYE – 0.92 POUNDS PER 1,000 SQUARE FEET (1 FEBRUARY THROUGH 30 APRIL OR 15 AUGUST THROUGH 1 NOVEMBER)
MULCH:	SAME AS 3C ABOVE (2 NOVEMBER THROUGH 31 JANUARY)

5. NO VEGETATIVE SUPPORT FILL MATERIAL MAY BE PLACED ON FROZEN GROUND. ALL FILL TO BE PLACED IN APPROXIMATELY HORIZONTAL LAYERS, EACH LAYER HAVING A LOOSE THICKNESS OF NOT MORE THAN 8 INCHES. STRUCTURAL FILL IN ROADWAYS AND PARKING AREAS IS TO BE CLASSIFIED TYPE 2 AS PER ANNE ARUNDEL COUNTY CODE, SECTION 2–308, AND COMPACTED TO 95 PERCENT MAXIMUM DRY DENSITY. AS DETERMINED BY ASTM D680 (STANDARD PROCTOR). FILL FOR POND EMBANKMENTS SHALL BE COMPACTED AS PER MD–378 CONSTRUCTION SPECIFICATIONS. ALL OTHER FILLS SHALL BE COMPACTED SUFFICIENTLY SO AS TO BE STABLE AND PREVENT EROSION AND SLIPPAGE, AND AS REQUIRED BY PROJECT SPECIFICATIONS.

6. **Permanent Sod:(I.E. SOIL EXCAVATION)**

   PERMANENT SOD IS TO BE KENTUCKY 31 TALL FESCUE, STATE APPROVED SOD; LIME AND FERTILIZE PER PERMANENT SEEDING SPECIFICATIONS AND LIGHTLY IRRIGATE SOIL PRIOR TO LAYING SOD. SOD IS TO BE LAID ON THE CONTOUR WITH ALL ENDS TIGHTLY ABUTTING, JOINTS ARE TO BE STAGGERED BETWEEN ROWS. WATER AND ROLL OR TAMP SOD TO INSURE POSITIVE ROOT CONTACT WITH THE SOIL. ALL SLOPES GREATER THAN 3:1 (OUTSIDE THE LIMIT OF WASTE) AS SHOWN, ARE TO BE PERMANENTLY SODDED OR PROTECTED WITH AN APPROVED EROSION CONTROL NETTING. ADDITIONAL WATERING FOR ESTABLISHMENT MAY BE REQUIRED. SOD IS NOT TO BE APPLIED ON FROZEN GROUND.

7. **Mining Operations:**

   SEDIMENT CONTROL PLANS FOR MINING OPERATIONS MUST INCLUDE THE FOLLOWING SEEDING DATES AND MIXTURES:

   FOR SEEDING DATES OF:

   FEBURARY 1 THROUGH APRIL 30 AND AUGUST 15 THROUGH OCTOBER 31 USE SEED MIXTURE OF KENTUCKY 31 TALL FESCUE AT THE RATE OF 2 POUNDS PER 1000 SQUARE FEET AND SERICEA LESPEDEZA AT THE MINIMUM RATE OF 0.5 POUND PER 1000 SQUARE FEET.

   FOR SEEDING DATES OF MAY 1 THROUGH AUGUST 14 USE SEED MIXTURE OF KENTUCKY 31 TALL FESCUE AT THE RATE OF 2 POUNDS PER 1000 SQUARE FEET AND WEEPING LOVEGRASS AT THE RATE OF 0.1 POUND PER 1000 SQUARE FEET.

   NOTE: USE OF THIS INFORMATION DOES NOT PRECLUDE MEETING ALL OF THE REQUIREMENTS OF THE CURRENT "MARYLAND STANDARDS AND SPECIFICATIONS FOR SOIL EROSION AND SEDIMENT CONTROL."

SEDIMENT CONTROL GENERAL NOTES

1. NO GRADING WILL TAKE PLACE UNTIL THE GRADING PERMIT HAS BEEN OBTAINED FROM THE ANNE ARUNDEL SOIL CONSERVATION DISTRICT.

2. ALL DISTURBED AREAS WHERE CONCENTRATED FLOW WILL OCCUR (SWALES, DITCHES, OUTFALLS) SHALL BE STABILIZED WITHIN 24 HOURS OF COMPLETION OF GRADING. ALL OTHER AREAS SHALL BE STABILIZED WITHIN 7 DAYS OF COMPLETION OF GRADING.

3. ALL SEDIMENT CONTROL MEASURES SHALL BE INSPECTED AND MAINTAINED BY THE CONTRACTOR ON A DAILY BASIS.

4. SEDIMENT REMOVED FROM SEDIMENT TRAPPING DEVICES SHALL BE PLACED IN AN AREA PROTECTED BY SEDIMENT CONTROL MEASURES, AND NOT SUBJECT TO CONCENTRATED FLOWS OF STORMWATER.

STANDARD STABILIZATION NOTE

FOLLOWING INITIAL DISTURBANCE OR RE–DISTURBANCE PERMANENT OR TEMPORARY STABILIZATION MUST BE COMPLETED WITHIN:
A.) THREE (3) CALENDAR DAYS TO THE SURFACE OF ALL PERIMETER DIKES, SWALES, DITCHES, PERIMETER SLOPES ,AND ALL SLOPES STEEPER THAN 3:1; AND
B.) SEVEN (7) CALENDAR DAYS AS TO ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE NOT UNDER ACTIVE GRADING.

STANDARD RESPONSIBILITY NOTES

I(WE) CERTIFY THAT:

1. A. ALL DEVELOPMENT AND CONSTRUCTION WILL BE DONE IN ACCORDANCE WITH THIS SEDIMENT AND EROSION CONTROL PLAN, AND FURTHER, AUTHORIZE THE RIGHT OF ENTRY FOR PERIODIC ON–SITE EVALUATION BY THE ANNE ARUNDEL SOIL CONSERVATION DISTRICT BOARD OF SUPERVISORS OR THEIR AUTHORIZED AGENTS.

   B. ANY RESPONSIBLE PERSONNEL INVOLVED IN THE CONSTRUCTION PROJECT WILL HAVE A CERTIFICATE OF ATTENDANCE FROM THE MARYLAND DEPARTMENT OF THE ENVIRONMENT'S APPROVED TRAINING PROGRAM FOR THE CONTROL OF SEDIMENT AND EROSION BEFORE BEGINNING THE PROJECT.

   RESPONSIBLE PERSONNEL ON SITE:

   _____

   _____

   C. IF APPLICABLE, THE APPROPRIATE ENCLOSURE WILL BE CONSTRUCTED AND MAINTAINED ON SEDIMENT BASIN(S) INCLUDED IN THIS PLAN. SUCH STRUCTURE(S) WILL BE IN COMPLIANCE WITH THE ANNE ARUNDEL COUNTY CODE.

2. THE DEVELOPER IS RESPONSIBLE FOR THE ACQUISITION OF ALL EASEMENTS, RIGHTS, AND/OR RIGHTS–OF–WAY THAT MAY BE REQUIRED FOR THE SEDIMENT AND EROSION CONTROL PRACTICES, STORMWATER MANAGEMENT PRACTICES AND THE DISCHARGE OF STORMWATER ONTO OR ACROSS ADJACENT OR DOWNSTREAM PROPERTIES INCLUDED IN THIS PLAN.

3. INITIAL SOIL DISTURBANCE OR REDISTURBANCE, PERMANENT OR TEMPORARY STABILIZATION SHALL BE COMPLETED WITHIN SEVEN CALENDAR DAYS FOR THE SURFACE OF ALL PERIMETER CONTROLS, DIKES, SWALES, PERIMETER SLOPES, AND ALL SLOPES GREATER THAN 3 HORIZONTAL TO 1 VERTICAL (3:1) AND FOURTEEN DAYS FOR ALL OTHER DISTURBED OR GRADED AREAS ON THE PROJECT SITE.

4. THE SEDIMENT CONTROL APPROVALS ON THE PLAN EXTEND ONLY TO AREAS AND PRACTICES IDENTIFIED AS PROPOSED WORK.

5. THE APPROVAL OF THIS PLAN FOR SEDIMENT AND EROSION CONTROL DOES NOT RELIEVE THE DEVELOPER/CONSULTANT FROM COMPLYING WITH ANY FEDERAL/STATE/COUNTY REQUIREMENTS APPERTAINING TO ENVIRONMENTAL ISSUES.

6. THE DEVELOPER MUST REQUEST THAT THE DEPARTMENT OF INSPECTIONS AND PERMITS APPROVE WORK COMPLETED IN ACCORDANCE WITH THE APPROVED EROSION AND SEDIMENT CONTROL PLAN, THE GRADING OR BUILDING PERMIT, AND THE ORDINANCE.

7. ALL MATERIAL SHALL BE TAKEN TO A SITE WITH AN APPROVED SEDIMENT CONTROL PLAN.

8. ON ALL SITES WITH DISTURBED AREAS IN EXCESS OF 2 ACRES, APPROVAL OF THE DEPARTMENT OF INSPECTIONS AND PERMITS SHALL BE REQUIRED ON COMPLETION OF INSTALLATION OF PERIMETER EROSION AND SEDIMENT CONTROLS, BUT BEFORE PROCEEDING WITH ANY OTHER EARTH DISTURBANCE OR GRADING. THIS WILL REQUIRE FIRST PHASE INSPECTIONS. OTHER BUILDING OR GRADING INSPECTION APPROVALS MAY NOT BE AUTHORIZED UNTIL THE INITIAL APPROVAL BY THE DEPARTMENT OF INSPECTIONS AND PERMITS IS GIVEN.

9. APPROVAL SHALL BE REQUESTED ON FINAL STABILIZATION OF ALL SITES WITH DISTURBED AREAS IN EXCESS OF 2 ACRES BEFORE REMOVAL OF CONTROLS.

10. EXISTING TOPOGRAPHY MUST BE FIELD VERIFIED BY RESPONSIBLE PERSONNEL TO THE SATISFACTION OF THE SEDIMENT CONTROL INSPECTOR PRIOR TO COMMENCING WORK.

CONSULTANT'S CERTIFICATION

"THE DEVELOPER'S PLAN TO CONTROL SILT AND EROSION IS ADEQUATE TO CONTAIN THE SILT AND EROSION ON THE PROPERTY COVERED BY THE PLAN. I CERTIFY THAT THIS PLAN OF EROSION AND SEDIMENT CONTROL REPRESENTS A PRACTICAL AND WORKABLE PLAN BASED ON MY PERSONAL KNOWLEDGE OF THIS SITE, AND WAS PREPARED IN ACCORDANCE WITH THE REQUIREMENTS OF THE ANNE ARUNDEL SOIL CONSERVATION DISTRICT PLAN SUBMITTAL GUIDELINES AND THE CURRENT MARYLAND STANDARDS AND SPECIFICATIONS FOR SEDIMENT AND EROSION CONTROL. I HAVE REVIEWED THIS EROSION AND SEDIMENT CONTROL PLAN WITH THE OWNER/DEVELOPER."

_____ DATE _____
SIGNATURE OF CONSULTANT

NAME PAUL G. STRATMAN MD P.E. LICENSE # 21681

FIRM ADVANCED GEO SERVICES CORP. TELEPHONE 601–840–9100

ADDRESS 1055 ANDREW DRIVE, SUITE A, WEST CHESTER PA 19380

_____ DATE _____
SIGNATURE OF DEVELOPER/OWNER

NAME STEPHEN N. FLEISCHMAN TITLE VICE PRESIDENT – NATIONAL WASTE MANAGERS, INC.

ADDRESS 2900 LINDEN LANE, SUITE 300, SILVER SPRING, MD 20910

TELEPHONE (301) 495–1520

POND MD–378 STORMWATER MANAGEMENT POND CONSTRUCTION SPECIFICATIONS

CONSTRUCTION SPECIFICATIONS

THESE SPECIFICATIONS ARE APPROPRIATE TO ALL PONDS WITHIN THE SCOPE OF THE STANDARD FOR PRACTICE MD–378. ALL REFERENCES TO ASTM AND AASHTO SPECIFICATIONS APPLY TO THE MOST RECENT VERSION.

SITE PREPARATION

AREAS DESIGNATED FOR BORROW AREAS, EMBANKMENT, AND STRUCTURAL WORKS SHALL BE CLEARED, GRUBBED AND STRIPPED OF TOPSOIL. ALL TREES, VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED. CHANNEL BANKS AND SHARP BREAKS SHALL BE SLOPED TO NO STEEPER THAN 1:1. ALL TREES SHALL BE CLEARED AND GRUBBED WITHIN 15 FEET OF THE TOE OF THE EMBANKMENT.

AREAS TO BE COVERED BY THE RESERVOIR WILL BE CLEARED OF ALL TREES, BRUSH, LOGS, FENCES, RUBBISH AND OTHER OBJECTIONABLE MATERIAL UNLESS OTHERWISE DESIGNATED ON THE PLANS. TREES, BRUSH, AND STUMPS SHALL BE CUT APPROXIMATELY LEVEL WITH THE GROUND SURFACE. FOR DRY STORMWATER MANAGEMENT PONDS, A MINIMUM OF A 25–FOOT RADIUS AROUND THE INLET STRUCTURE SHALL BE CLEARED.

ALL CLEARED AND GRUBBED MATERIAL SHALL BE DISPOSED OUTSIDE AND BELOW THE LIMITS OF THE DAM AND RESERVOIR AS DIRECTED BY THE OWNER OR HIS REPRESENTATIVE. WHEN SPECIFIED, A SUFFICIENT QUANTITY OF TOPSOIL SHALL BE STOCKPILED IN A SUITABLE LOCATION FOR USE ON THE EMBANKMENT AND OTHER DESIGNATED AREAS.

EARTH FILL

MATERIAL – THE FILL MATERIAL SHALL BE TAKEN FROM APPROVED DESIGNATED BORROW AREAS. IT SHALL BE FREE OF ROOTS, STUMPS, WOOD, RUBBISH, STONES GREATER THAN 6", FROZEN OR OTHER OBJECTIONABLE MATERIALS. FILL MATERIAL FOR THE CENTER OF THE EMBANKMENT, AND CUT OFF TRENCH SHALL CONFORM TO UNIFIED SOIL CLASSIFICATION GC, SC, CH, OR CL AND MUST HAVE AT LEAST 30% PASSING THE #200 SIEVE. CONSIDERATION MAY BE GIVEN TO THE USE OF OTHER MATERIALS IN THE EMBANKMENT IF DESIGNED BY A GEOTECHNICAL ENGINEER. SUCH SPECIAL DESIGNS MUST HAVE CONSTRUCTION SUPERVISED BY A GEOTECHNICAL ENGINEER.

MATERIALS USED IN THE OUTER SHELL OF THE EMBANKMENT MUST HAVE THE CAPABILITY TO SUPPORT VEGETATION OF THE QUALITY REQUIRED TO PREVENT EROSION OF THE EMBANKMENT.

PLACEMENT – AREAS ON WHICH FILL IS TO BE PLACED SHALL BE SCARIFIED PRIOR TO PLACEMENT OF FILL. FILL MATERIAL SHALL BE PLACED IN MAXIMUM 8 INCH THICK (BEFORE COMPACTION) LAYERS WHICH ARE TO BE CONTINUOUS OVER THE ENTIRE LENGTH OF THE FILL. THE MOST PERMEABLE BORROW MATERIAL SHALL BE PLACED IN THE DOWNSTREAM PORTIONS OF THE EMBANKMENT. THE PRINCIPAL SPILLWAY MUST BE INSTALLED CONCURRENTLY WITH FILL PLACEMENT AND NOT EXCAVATED INTO THE EMBANKMENT.

COMPACTION – THE MOVEMENT OF THE HAULING AND SPREADING EQUIPMENT OVER THE FILL SHALL BE CONTROLLED SO THAT THE ENTIRE SURFACE OF EACH LIFT SHALL BE TRAVERSED BY NOT LESS THAN ONE TREAD TRACK OF HEAVY EQUIPMENT OR COMPACTION SHALL BE ACHIEVED BY A MINIMUM OF FOUR COMPLETE PASSES OF A SHEEPSFOOT, WIDETRACKED BULLDOZER OR VIBRATORY SMOOTH–DRUM ROLLER. FILL MATERIAL SHALL CONTAIN SUFFICIENT MOISTURE SUCH THAT THE REQUIRED DEGREE OF COMPACTION WILL BE OBTAINED WITH THE EQUIPMENT USED. THE FILL MATERIAL SHALL CONTAIN SUFFICIENT MOISTURE SO THAT IF FORMED INTO A BALL IT WILL NOT CRUMBLE, YET NOT BE SO WET THAT WATER CAN BE SQUEEZED OUT.

WHEN REQUIRED BY THE REVIEWING AGENCY, THE MINIMUM REQUIRED DENSITY SHALL NOT BE LESS THAN 95% OF MAXIMUM DRY DENSITY WITH A MOISTURE CONTENT WITHIN ±2% OF THE OPTIMUM. EACH LAYER OF FILL SHALL BE COMPACTED AS NECESSARY TO OBTAIN THAT DENSITY, AND IS TO BE CERTIFIED BY THE ENGINEER AT THE TIME OF CONSTRUCTION. ALL COMPACTION IS TO BE DETERMINED BY AASHTO METHOD T–99 (ASTM D698 STANDARD PROCTOR).

CUT OFF TRENCH – THE CUTOFF TRENCH SHALL BE EXCAVATED INTO IMPERVIOUS MATERIAL ALONG OR PARALLEL TO THE CENTERLINE OF THE EMBANKMENT AS SHOWN ON THE PLANS. THE BOTTOM WIDTH OF THE TRENCH SHALL BE GOVERNED BY THE EQUIPMENT USED FOR EXCAVATION, WITH THE MINIMUM WIDTH BEING FOUR FEET. THE DEPTH SHALL BE AT LEAST FOUR FEET BELOW EXISTING GRADE OR AS SHOWN ON THE PLANS. THE SIDE SLOPES OF THE TRENCH SHALL BE 1H TO 1V OR FLATTER. THE BACKFILL SHALL BE COMPACTED WITH CONSTRUCTION EQUIPMENT, ROLLERS, OR HAND TAMPERS TO ASSURE MAXIMUM DENSITY AND MINIMUM PERMEABILITY REQUIREMENTS ARE MET.

EMBANKMENT CORE – THE CORE SHALL BE PARALLEL TO THE CENTERLINE OF THE EMBANKMENT AS SHOWN ON THE PLANS. THE TOP WIDTH OF THE CORE SHALL BE A MINIMUM OF FOUR FEET. THE HEIGHT SHALL EXTEND UP TO AT LEAST THE 10 YEAR WATER ELEVATION OR AS SHOWN ON THE PLANS. THE SIDE SLOPES SHALL BE 1H TO 1V OR FLATTER. THE CORE SHALL BE COMPACTED WITH CONSTRUCTION EQUIPMENT, ROLLERS, OR HAND TAMPERS TO ASSURE MAXIMUM DENSITY AND MINIMUM PERMEABILITY. IN ADDITION, THE CORE SHALL BE PLACED CONCURRENTLY WITH THE OUTER SHELL OF THE EMBANKMENT.

STRUCTURE BACKFILL

BACKFILL ADJACENT TO PIPES OR STRUCTURES SHALL BE OF THE TYPE AND QUALITY CONFORMING TO THAT SPECIFIED FOR THE ADJOINING FILL MATERIAL. THE FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT TO EXCEED FOUR INCHES IN THICKNESS AND COMPACTED BY HAND TAMPERS OR OTHER MANUALLY DIRECTED COMPACTION EQUIPMENT. THE MATERIAL NEEDS TO FILL COMPLETELY ALL SPACES UNDER AND ADJACENT TO THE PIPE. AT NO TIME DURING THE BACKFILLING OPERATION SHALL DRIVEN EQUIPMENT BE ALLOWED TO OPERATE CLOSER THAN FOUR FEET, MEASURED HORIZONTALLY, TO ANY PART OF A STRUCTURE. UNDER NO CIRCUMSTANCES SHALL EQUIPMENT BE DRIVEN OVER ANY PART OF A CONCRETE STRUCTURE OR PIPE, UNLESS THERE IS A COMPACTED FILL OF 24" OR GREATER OVER THE STRUCTURE OR PIPE.

STRUCTURAL BACKFILL MAY BE FLOWABLE FILL MEETING THE REQUIREMENTS OF MARYLAND DEPARTMENT OF TRANSPORTATION, STATE HIGHWAY ADMINISTRATION STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS, SECTION 313 AS MODIFIED. THE MIXTURE SHALL HAVE A 100–200 PSI; 28 DAY UNCONFINED COMPRESSIVE STRENGTH. THE FLOWABLE FILL SHALL HAVE A MINIMUM PH OF 4.0 AND A MINIMUM RESISTIVITY OF 2,000 OHM–CM. MATERIAL SHALL BE PLACED SUCH THAT A MINIMUM OF 6" (MEASURED PERPENDICULAR TO THE OUTSIDE OF THE PIPE) OF FLOWABLE FILL SHALL BE UNDER (BEDDING), OVER AND, ON THE SIDES OF THE PIPE. IT ONLY NEEDS TO EXTEND UP TO THE SPRING LINE FOR RIGID CONDUITS. AVERAGE SLUMP OF THE FILL SHALL BE 7" TO ASSURE FLOWABILITY OF THE MATERIAL. ADEQUATE MEASURES SHALL BE TAKEN (SAND BAGS, ETC.) TO PREVENT FLOATING THE PIPE. WHEN USING FLOWABLE FILL, ALL METAL PIPE SHALL BE BITUMINOUS COATED. ANY ADJOINING SOIL FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT TO EXCEED FOUR INCHES IN THICKNESS AND COMPACTED BY HAND TAMPERS OR OTHER MANUALLY DIRECTED COMPACTION EQUIPMENT. THE MATERIAL SHALL COMPLETELY FILL ALL VOIDS ADJACENT TO THE FLOWABLE FILL ZONE. AT NO TIME DURING THE BACKFILLING OPERATION SHALL DRIVEN EQUIPMENT BE ALLOWED TO OPERATE CLOSER THAN FOUR FEET, MEASURED HORIZONTALLY, TO ANY PART OF A STRUCTURE. UNDER NO CIRCUMSTANCES SHALL EQUIPMENT BE DRIVEN OVER ANY PART OF A STRUCTURE OR PIPE UNLESS THERE IS A COMPACTED FILL OF 24" OR GREATER OVER THE STRUCTURE OR PIPE. BACKFILL MATERIAL OUTSIDE THE STRUCTURAL BACKFILL (FLOWABLE FILL) ZONE SHALL BE OF THE TYPE AND QUALITY CONFORMING TO THAT SPECIFIED FOR THE EMBANKMENT OR OTHER EMBANKMENT MATERIALS.

PIPE CONDUITS

ALL PIPES SHALL BE CIRCULAR IN CROSS SECTION.

CORRUGATED METAL PIPE – ALL OF THE FOLLOWING CRITERIA SHALL APPLY FOR CORRUGATED METAL PIPE:

MATERIALS – (POLYMER COATED STEEL PIPE) –STEEL PIPES WITH POLYMERIC COATINGS SHALL HAVE A MINIMUM COATING THICKNESS OF 0.01 INCH (10 MIL) ON BOTH SIDES OF THE PIPE. THIS PIPE AND ITS APPURTENANCES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO SPECIFICATIONS M–245 & M–246 WITH WATERTIGHT COUPLING BANDS OR FLANGES.

1. MATERIALS – (ALUMINUM COATED STEEL PIPE) – THIS PIPE AND ITS APPURTENANCES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO SPECIFICATION M–274 WITH WATERTIGHT COUPLING BANDS OR FLANGES. ALUMINUM COATED STEEL PIPE, WHEN USED WITH FLOWABLE FILL OR WHEN SOIL AND/OR WATER CONDITIONS WARRANT THE NEED FOR INCREASED DURABILITY, SHALL BE FULLY BITUMINOUS COATED PER REQUIREMENTS OF AASHTO SPECIFICATION M–190 TYPE A. ANY ALUMINUM COATING DAMAGED OR OTHERWISE REMOVED SHALL BE REPLACED WITH COLD APPLIED BITUMINOUS COATING COMPOUND. ALUMINUM SURFACES THAT ARE TO BE IN CONTACT WITH CONCRETE SHALL BE PAINTED WITH ONE COAT OF ZINC CHROMATE PRIMER OR TWO COATS OF ASPHALT.

   MATERIALS – (ALUMINUM PIPE) – THIS PIPE AND ITS APPURTENANCES SHALL CONFORM TO THE REQUIREMENTS OF AASHTO SPECIFICATION M–196 OR M–211 WITH WATERTIGHT COUPLING BANDS OR FLANGES. ALUMINUM PIPE, WHEN USED WITH FLOWABLE FILL OR WHEN SOIL AND/OR WATER CONDITIONS WARRANT FOR INCREASED DURABILITY, SHALL BE FULLY BITUMINOUS COATED PER REQUIREMENTS OF AASHTO SPECIFICATION M–190 TYPE A. ALUMINUM SURFACES THAT ARE TO BE IN CONTACT WITH CONCRETE SHALL BE PAINTED WITH ONE COAT OF ZINC CHROMATE PRIMER OR TWO COATS OF ASPHALT. HOT DIP GALVANIZED BOLTS MAY BE USED FOR CONNECTIONS. THE PH OF THE SURROUNDING SOILS SHALL BE BETWEEN 4 AND 9.

COUPLING BANDS, ANTI–SEEP COLLARS, END SECTIONS, ETC., MUST BE COMPOSED OF THE SAME MATERIAL AND COATINGS AS THE PIPE. METALS MUST BE INSULATED FROM DISSIMILAR MATERIALS WITH USE OF RUBBER OR PLASTIC INSULATING MATERIALS AT LEAST 24 MILS IN THICKNESS.

CONNECTIONS – ALL CONNECTIONS WITH PIPES MUST BE COMPLETELY WATERTIGHT. THE DRAIN PIPE OR BARREL CONNECTION TO THE RISER SHALL BE WELDED ALL AROUND

2. WHEN THE PIPE AND RISER ARE METAL. ANTI–SEEP COLLARS SHALL BE CONNECTED TO THE PIPE IN SUCH A MANNER AS TO BE COMPLETELY WATERTIGHT. DIMPLE BANDS ARE NOT CONSIDERED TO BE WATERTIGHT.

   ALL CONNECTIONS SHALL USE A RUBBER OR NEOPRENE GASKET

3. WHEN JOINING PIPE SECTIONS. THE END OF EACH PIPE SHALL BE RE–ROLLED AN ADEQUATE NUMBER OF CORRUGATIONS TO ACCOMMODATE THE BANDWIDTH. THE FOLLOWING TYPE CONNECTIONS ARE ACCEPTABLE FOR PIPES LESS THAN 24 INCHES IN DIAMETER: FLANGES ON BOTH ENDS OF THE PIPE WITH A CIRCULAR 3/8 INCH CLOSED CELL NEOPRENE GASKET, PRE–PUNCHED TO THE FLANGE BOLT CIRCLE, SANDWICHED BETWEEN ADJACENT FLANGES; A 12–INCH WIDE STANDARD LAP TYPE BAND WITH 12–INCH WIDE BY 3/8–INCH THICK CLOSED CELL CIRCULAR NEOPRENE GASKET; AND A 12–INCH WIDE HUGGER TYPE BAND WITH O–RING GASKETS HAVING A MINIMUM DIAMETER OF 1/2 INCH GREATER THAN THE CORRUGATION DEPTH. PIPES 24 INCHES IN DIAMETER AND LARGER SHALL BE CONNECTED BY A NEOPRENE GASKET; AND A 12–INCH WIDE HUGGER TYPE BAND WITH O–RING GASKETS HAVING A MINIMUM DIAMETER OF 1/2 INCH GREATER THAN THE CORRUGATION DEPTH. PIPES 24 INCHES IN DIAMETER AND LARGER SHALL BE CONNECTED BY A 24 INCH LONG ANNULAR CORRUGATED BAND USING A MINIMUM OF 4 (FOUR) RODS AND LUGS, 2 ON EACH CONNECTING PIPE END. A 24–INCH WIDE BY 3/8–INCH THICK CLOSED CELL CIRCULAR NEOPRENE GASKET WILL BE INSTALLED WITH 12 INCHES ON THE END OF EACH PIPE. FLANGED JOINTS WITH 3/8 INCH CLOSED CELL GASKETS THE FULL WIDTH OF THE FLANGE ARE ALSO ACCEPTABLE. HELICALLY CORRUGATED PIPE SHALL HAVE EITHER CONTINUOUSLY WELDED SEAMS OR HAVE LOCK SEAMS WITH INTERNAL CAULKING OR A NEOPRENE BEAD.

4. BEDDING – THE PIPE SHALL BE FIRMLY AND UNIFORMLY BEDDED THROUGHOUT ITS ENTIRE LENGTH. WHERE ROCK OR SOFT, SPONGY OR OTHER UNSTABLE SOIL IS ENCOUNTERED, ALL SUCH MATERIAL SHALL BE REMOVED AND REPLACED WITH SUITABLE EARTH COMPACTED TO PROVIDE ADEQUATE SUPPORT.

5. BACKFILLING SHALL CONFORM TO "STRUCTURE BACKFILL".

6. OTHER DETAILS (ANTI–SEEP COLLARS, VALVES, ETC.) SHALL BE AS SHOWN ON THE DRAWINGS.

   REINFORCED CONCRETE PIPE – ALL OF THE FOLLOWING CRITERIA SHALL APPLY FOR REINFORCED CONCRETE PIPE:

1. MATERIALS – REINFORCED CONCRETE PIPE SHALL HAVE BELL AND SPIGOT JOINTS WITH RUBBER GASKETS AND SHALL EQUAL OR EXCEED ASTM C–361.

2. BEDDING – REINFORCED CONCRETE PIPE CONDUITS SHALL BE LAID IN A CONCRETE BEDDING / CRADLE FOR THEIR ENTIRE LENGTH. THIS BEDDING / CRADLE SHALL CONSIST OF HIGH SLUMP CONCRETE PLACED UNDER THE PIPE AND UP THE SIDES OF THE PIPE AT LEAST 50% OF ITS OUTSIDE DIAMETER WITH A MINIMUM THICKNESS OF 6 INCHES. WHERE A CONCRETE CRADLE IS NOT NEEDED FOR STRUCTURAL REASONS, FLOWABLE FILL MAY BE USED AS DESCIBED IN THE "STRUCTURE BACKFILL" SECTION OF THIS STANDARD. GRAVEL BEDDING IS NOT PERMITTED.

3. LAYING PIPE – BELL AND SPIGOT PIPE SHALL BE PLACED WITH THE BELL END UPSTREAM. JOINTS SHALL BE MADE IN ACCORDANCE WITH RECOMMENDATIONS OF THE MANUFACTURER OF THE MATERIAL. AFTER THE JOINTS ARE SEALED FOR THE ENTIRE LINE, THE BEDDING SHALL BE PLACED SO THAT ALL SPACES UNDER THE PIPE ARE FILLED. CARE SHALL BE EXERCISED TO PREVENT ANY DEVIATION FROM THE ORIGINAL LINE AND GRADE OF THE PIPE. THE FIRST JOINT MUST BE LOCATED WITHIN 4 FEET FROM THE RISER.

4. BACKFILLING SHALL CONFORM TO "STRUCTURE BACKFILL".

5. OTHER DETAILS (ANTI–SEEP COLLARS, VALVES, ETC.) SHALL BE AS SHOWN ON THE DRAWINGS.

   PLASTIC PIPE – THE FOLLOWING CRITERIA SHALL APPLY FOR PLASTIC PIPE:

1. MATERIALS – PVC PIPE SHALL BE PVC–1120 OR PVC–1220 CONFORMING TO ASTM D–1785 OR ASTM D–2241. CORRUGATED HIGH DENSITY POLYETHYLENE (HDPE) PIPE, COUPLINGS AND FITTINGS SHALL CONFORM TO THE FOLLOWING: 4" – 10" INCH PIPE SHALL MEET THE REQUIREMENTS OF AASHTO M252 TYPE S, AND 12" THROUGH 24" INCH SHALL MEET THE REQUIREMENTS OF AASHTO M294 TYPE S.

2. JOINTS AND CONNECTIONS TO ANTI–SEEP COLLARS SHALL BE COMPLETELY WATERTIGHT.

3. BEDDING –THE PIPE SHALL BE FIRMLY AND UNIFORMLY BEDDED THROUGHOUT ITS ENTIRE LENGTH. WHERE ROCK OR SOFT, SPONGY OR OTHER UNSTABLE SOIL IS ENCOUNTERED, ALL SUCH MATERIAL SHALL BE REMOVED AND REPLACED WITH SUITABLE EARTH COMPACTED TO PROVIDE ADEQUATE SUPPORT.

4. BACKFILLING SHALL CONFORM TO "STRUCTURE BACKFILL".

5. OTHER DETAILS (ANTI–SEEP COLLARS, VALVES, ETC.) SHALL BE AS SHOWN ON THE DRAWINGS.

   DRAINAGE DIAPHRAGMS – WHEN A DRAINAGE DIAPHRAGM IS USED, A REGISTERED PROFESSIONAL ENGINEER WILL SUPERVISE THE DESIGN AND CONSTRUCTION INSPECTION.

CONCRETE

CONCRETE SHALL MEET THE REQUIREMENTS OF MARYLAND DEPARTMENT OF TRANSPORTATION, STATE HIGHWAY ADMINISTRATION STANDARD SPECIFICATIONS FOR CONSTRUCTION AND MATERIALS, SECTION 902.10.03, MIX NO. 3.

ROCK RIPRAP

ROCK RIPRAP SHALL MEET THE REQUIREMENTS OF MARYLAND DEPARTMENT OF TRANSPORTATION, STATE HIGHWAY ADMINISTRATION STANDARD SPECIFICATIONS FOR CONSTRUCTION A

SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION

I. OVERVIEW

A. LANDFILL SITE ENTRANCES

THREE SITE ENTRANCES (I.E., EAST, NORTH, AND SOUTH ENTRANCES) ARE SHOWN IN THESE PERMIT DRAWINGS. CONSTRUCTION OF ONLY ONE SITE ENTRANCE (COMPRISED OF ACCESS ROAD, SCALE HOUSE, TRUCK SCALES, MAINTENANCE BUILDING, WHEEL WASH, AND CONCRETE CLEANOUT) IS REQUIRED FOR RUBBLE LANDFILL OPERATION. SITE ENTRANCE DESCRIPTION IS PROVIDED IN PHASE III REPORT SECTION 3.4. THE EAST ENTRANCE IS REQUIRED FOR USE BY ANNE ARUNDELE COUNTY.

REGARDLESS OF THE SITE ENTRANCE CONSTRUCTED, AN AUXILIARY ROAD (WITHOUT SCALES, SIGNS, AND WITH A REDUCED WIDTH) WILL BE CONSTRUCTED. THIS ROAD WILL PROVIDE INGRESS/EGRESS IN THE EVENT ENTRANCE IS BLOCKED OR COMPROMISED, REQUIRING SITE EVACUATION OR ACCESS BY EMERGENCY FIRST RESPONDERS. THE ACCESS POINTS DESIGNATED FOR THE AUXILIARY ROAD IS THE NORTH OR SOUTH ENTRANCE ACCESS.

B. LANDFILL CELL CONSTRUCTION

THE SITE FOR THE PROPOSED LANDFILL IS COMPRISED OF AREAS PREVIOUSLY MINED FOR SAND AND GRAVEL. PRIMARY LANDFILL AREAS ARE REFERENCED AS EAST SECTION (CELLS 11–16) AND WEST SECTION (CELLS 1–10) ON THE DRAWINGS. EACH SECTION IS SUBDIVIDED INTO CELL AREAS; EACH CELL AREA IS LINED AND SLOPED IN ACCORDANCE WITHCODE OF MARYLAND (COMAR) REGULATIONS, AS NECESSARY TO CREATE A SUMP FOR COLLECTION OF LEACHATE (I.E., STORM WATER PERCOLATION THROUGH RUBBLE WASTE PLACED IN THE CELL).

TWO LEACHATE STORAGE FACILITIES WILL BE CONSTRUCTED TO PROVIDE TEMPORARY STORAGE OF LEACHATE FROM THE LANDFILL CELLS. IN EACH LEACHATE STORAGE FACILITY, TWO 500,000 GALLON TANKS WILL BE INSTALLED WITHIN AN AREA SURROUNDED BY A CONCRETE SECONDARY CONTAINMENT WALLS. THERE ARE FIFTEEN CELLS (EACH WITH SUBMERSIBLE PUMPS IN A LEACHATE COLLECTION SUMP) IN THE WEST SECTION AND SIX CELLS (EACH WITH SUBMERSIBLE PUMPS IN A LEACHATE COLLECTION SUMP) IN THE EAST SECTION. LEACHATE FROM THREE CELLS IN THE WEST SECTION AND ALL CELLS IN THE EAST SECTION WILL BE PUMPED TO FORCE MAIN LINES CONNECTED TO LEACHATE STORAGE FACILITY NO. 1. FORCE MAIN TRUNK LINES FOR THE REMAINING CELLS IN THE WEST SECTION ARE CONNECTED TO LEACHATE STORAGE FACILITY NO. 2.

CELLS ARE NUMBERED, BEGINNING IN THE WEST SECTION. CELLS 2 THROUGH 4 AND 11 THROUGH 16 CONNECTED TO LEACHATE STORAGE FACILITY NO. 1. CELLS 1, 5A THROUGH 5F AND 6 THROUGH 10 ARE CONNECTED TO LEACHATE STORAGE FACILITY NO. 2.

FOUR STORMWATER MANAGMENT BASINS WILL SERVE AS SEDIMENT CONTROL AND STORMWATER MANAGEMENT STRUCTURES FOR THE RUBBLE LANDFILL CONSTRUCTION AND OPERATION THROUGHOUT
THE LIFE OF THE FACILITY. UNDER THE ULTIMATE DEVELOPED LANDFILL CONDITION,

- BASIN NO. 1 SHALL PROVIDE SEDIMENT CONTROL FOR THE ENTIRE WEST SECTION;
- BASIN NO. 2 SHALL PROVIDE SEDIMENT CONTROL FOR OFF–SITE DRAINAGE AREA AND LEACHATE STORAGE FACILITY NO. 1.
- BASIN NO. 3 SHALL PROVIDE SEDIMENT CONTROL FOR THE MAJORITY OF THE EAST SECTION CONSTRUCTION.
- BASIN NO. 4 ADDRESSES RUN –ON FROM UPGRADIANT OFF–SITE AND UNDISTURBED ON–SITE AREAS.
- A SEDIMENT TRAP AND SILT FENCE ENSURE THAT SEDIMENT FROM DISTURBED AREAS, OUTSIDE BASIN DRAINAGE AREAS IS CONTAINED ON–SITE.

PRIOR TO BEGINNING LANDFILL CONSTRUCTION IN ANY GIVEN AREA, ALL SEDIMENT BASINS AND PERIMETER CONTROLS SHALL BE INSTALLED AS SHOWN ON THE DRAWINGS AND INDICATED UNDER ITEM II, "SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS."

AS SPECIFIED IN THE SEQUENCE, EACH BASIN SHALL BE COMPLETELY CONSTRUCTED (I.E., TOPSOIL SHALL BE CLEARED AND STRIPPED, CUT–OFF TRENICH SHALL BE INSTALLED, SPILLWAY, EXCAVATION, AND EMBANKMENT CONSTRUCTION SHALL BE PERFORMED). PRIOR TO BEGINNING CONSTRUCTION, ALL CONSTRUCTION MATERIALS FOR THE BASIN MUST BE ON–SITE. BASINS WILL BE DEWATERED PER DETAILS ON THE DRAWINGS.

COMPOSITE VIEW OF ALL LANDFILL CELLS AT TOP OF SUBBASE GRADE IS PROVIDED ON DRAWINGS 10 AND 11 GRADES ON CELL SUBBASE PLANS INDICATE THAT EACH CELL WILL BE GRADED TO A SINGLE SUMP, IN WHICH SUBMERSIBLE PUMPS WILL BE INSTALLED IN A SUMP RISER PIPE, AS SHOWN ON DRAWINGS AND DETAILS. THE EMBANKMENT THAT RUNS PERPENDICULAR TO THE SUMP, COUPLED WITH COMPLETELY CONSTRUCTED GRADES IN THE CELL ASSURES POSITIVE DRAINAGE TO THE SUMP AND SEDIMENT CONTAINMENT WITHIN A CELL UNDER CONSTRUCTION. STORM WATER IMPOUNDED IN A CELL UNDER CONSTRUCTION SHALL BE PUMPED THE PERIMETER CHANNEL, WHICH IN TURN DISCHARGES DRAINAGE TO A SEDIMENT BASIN IS PROVIDED.

RUBBLE WASTE MAY NOT BE PLACED IN ANY CELL UNTIL THE CORRESPONDING LEACHATE STORAGE AREA AND FORCE MAIN PIPING SYSTEM TO THE CELL HAVE BEEN COMPLETELY CONSTRUCTED AND TESTED. A RECTANGULAR ACCESS TO THE STORAGE TANK FOR LOADING AND TRANSPORT OF LEACHATE MUST BE PROVIDED AND MAINTAINED. UPON COMPLETION OF CONSTRUCTION OF THE ACCESS ROAD, FINISHED GRADING FOR A GIVEN CELL, CELL CONSTRUCTION MATERIAL TESTING (INCLUDING PUMP AND FORCE MAIN), AND CONNECTION OF THE FORCE MAIN SYSTEM TO THE STORAGE TANK, WASTE PLACEMENT IN THE CELL MAY BEGIN. AT ALL TIMES DURING THE WASTE PLACEMENT OPERATION IN A CELL, WASTE SHALL BE PLACED IN A MANNER THAT ENSURES COLLECTION OF LEACHATE IN THE CELL SUMP AREA. DAILY AND INTERMEDIATE COVER SHALL BE PLACED IN ACCORDANCE WITH MDE REFUSE DISPOSAL PERMIT STIPULATIONS.

TO SUMMARIZE AND CLARIFY EVENTS THAT OCCUR CHRONOLOGICALLY (ON A CELL–BY–CELL CONSTRUCTION BASIS), ITEM II, "SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS", STIPULATES CONDITIONS UNDER WHICH THE LANDFILL WILL BE CONSTRUCTED. SEE DRAWINGS 64––––– THROUGH 81––––– FOR INTERMEDIATE CONSTRUCTION STAGE PLANS, WHICH ILLUSTRATE SEQUENCE OF FILLING AND OF THE LANDFILL CONSTRUCT FROM BEGINNING TO END OF CONSTRUCTION.

UNLESS OTHERWISE APPROVED BY MDE AND ANNE ARUNDEL SOIL CONSERVATION DISTRICT (AASCD), LANDFILL CELL SEQUENCE OF CONSTRUCTION WILL BE PER INTERMEDIATE STAGE CONSTRUCTION DRAWINGS, REFERENCED UNDER ITEM II(B). CELLS WILL BE CONSTRUCTED INDIVIDUALLY OR IN GROUPS, PER THE CHRONOLOGICAL REQUIREMENTS UNDER ITEM II(E), "LANDFILL CONSTRUCTION CHRONOLOGY". VARIANCE FROM CELL SEQUENCE OF CONSTRUCTION IS REFERENCED UNDER ITEM III. TIME FRAMES FOR CONSTRUCTION DURING THE LIFE OF THE LANDFILL OPERATION ARE GIVEN UNDER ITEM V, "ESTIMATED CELL CONSTRUCTION AND WASTE PLACEMENT SCHEDULE".

RUBBLE FILL OPERATION MAY PROCEED IN ANY GIVEN COMPLETED CELL AT ANY TIME THROUGHOUT THE LIFE OF THE FACILITY, PROVIDED THAT: SEDIMENT CONTROLS FOR THE DISTURBED AREA ARE IN–PLACE AND MAINTAINED; LEACHATE IS PROPERLY COLLECTED AND DISPOSED; AND ALL OTHER CONDITIONS OF THE MDE REFUSE DISPOSAL PERMIT ARE MET.

II. SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS

UNLESS "VARIANCE FROM SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS" IS OBTAINED, PER ITEM III, THE LANDFILL WILL BE CONSTRUCTED IN ACCORDANCE WITH CRITERIA PROVIDED HEREUNDER. "SURFACE RUNOFF/SEDIMENT CONTROL" SHALL BE PROVIDED PER ITEM II(A). ITEM II(B), "DESCRIPTION OF INTERMEDIATE CONSTRUCTION STAGE PLANS" AND ITEM II(C), "ASSUMPTIONS FOR DEVELOPMENT OF LANDFILL SEQUENCE OF CONSTRUCTION" DESCRIBE SITE CONDITIONS AND ASSUMPTIONS UNDER WHICH THE LANDFILL SEQUENCE OF CONSTRUCTION WAS DETERMINED. ITEM II(D), "INTERMEDIATE CONSTRUCTION STAGE PLAN DEPICTION" INDICATES CONSTRUCTION REQUIREMENTS CONSISTENT WITH DEPICTION ON EACH INTERMEDIATE CONSTRUCTION STAGE PLAN. ITEM II(E), "LANDFILL CONSTRUCTION CHRONOLOGY" LISTS THE SEQUENCE OF CONSTRUCTION SPECIFIED IN THESE PERMIT DRAWNGS.

A. SURFACE RUNOFF/SEDIMENT CONTROL

AS REFERENCED UNDER THE SEQUENCE OF CONSTRUCTION OVERVIEW ABOVE, ALL CELLS WILL BE CONSTRUCTED IN A MANNER THAT WILL CREATE A SUMP, AND SHALL BE LINED WITH MATERIAL SPECIFIED ON THESE PERMIT DRAWINGS. CLEAN SURFACE RUNOFF FROM ADJACENT UNDISTURBED AREAS WILL BE DIVERTED AROUND THE CELL CONSTRUCTION AREA, TO THE EXTENT PRACTICABLE. DURING CONSTRUCTION, CLEAN SURFACE RUNOFF IMPOUNDED IN CELL SUMPS WILL BE PUMPED TO A CONSTRUCTED PERMANENT PERIMETER CHANNEL OR TEMPORARY DITCH, AS REQUIRED, TO ENSURE THAT ALL WATER PUMPED FROM CELLS UNDER CONSTRUCTION WILL DRAIN TO A SEDIMENT BASIN.

CONSTRUCTION OF ACCESS ROADS AND PERIMETER CHANNEL ADJACENT TO CELL AREAS IS REFERENCED UNDER THE SEQUENCE OF CONSTRUCTION ON EACH INTERMEDIATE STAGE CONSTRUCTION DRAWING. IN CELL CONSTRUCTION AREAS WHERE THE PERIMETER CHANNEL IS TO BE CREATED BY FILL, THE MINIMUM WIDTH PERIMETER BERM AT THE TOP OF THE LANDFILL EMBANKMENT SIDE SLOPE SHALL BE PART OF THE CONSTRUCTION.

AS PRACTICABLE, TO REDUCE SEDIMENT LADEN SURFACE RUNOFF TO SEDIMENT BASINS THROUGHOUT THE LIFE OF THE CONSTRUCTION OPERATION, THE LANDFILL OPERATOR SHALL ATTEMPT TO MINIMIZE UN–VEGETATED DISTURBED AREAS THAT DRAIN DIRECTLY TO A SEDIMENT BASIN (VIA EXISTING DRAINAGE SWALES, CONSTRUCTED PERIMETER CHANNEL, OR TEMPORARY MEASURES). PERMANENT OR TEMPORARY VEGETATIVE STABILIZATION, AS APPLICABLE, SHALL BE APPLIED ON DISTURBED AREAS, PER MDE REFUSE DISPOSAL PERMIT STIPULATION, BEFORE OTHER CONSTRUCTION PROCEEDS.

B. DESCRIPTION OF INTERMEDIATE CONSTRUCTION STAGE PLANS

INTERMEDIATE CONSTRUCTION STAGE PLANS (DRAWINGS 64––– THROUGH 81––––) DEPICT CONSTRUCTION OF THE LANDFILL FROM BEGINNING OF CONSTRUCTION THROUGHOUT AND CLOSURE OF THE LANDFILL.

THE FOLLOWING SITE CONDITIONS WERE CONSIDERED IN DETERMINING SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS, ILLUSTRATED ON INTERMEDIATE CONSTRUCTION STAGE PLANS.

1. INTERMEDIATE CONSTRUCTION STAGE PLANS WERE PREPARED ASSUMING DAILY OR WEEKLY COVER SOILS WOULD BE OBTAINED FROM THE NEXT CELL TO BE CONSTRUCTED TO ALLOW BENEFICIAL USE OF ON–SITE EXCESS SOIL MATERIALS. WHERE ALLOWED BY MDE, ALTERNATE DAILY COVER MATERIALS WILL BE USED, WHEN AVAILABLE. SO THEN ON–SITE SOILS CAN BE USED FOR CLOSURE CONSTRUCTION, WHERE ON–SITES MEET THE CLOSURE MATERIALS SPECIFICATIONS.
2. THE PRIMARY MEANS OF SEDIMENT CONTROL FOR CONSTRUCTION OF THE SITE IS BY PERIMETER CHANNEL DRAINAGE TO SEDIMENT BASINS. NATURAL AND CONSTRUCTED DRAINAGE SWALES FROM THE FORMER SAND AND GRAVEL MINING AREAS CONVEY SURFACE RUNOFF THROUGH THE SITE IN A PREDOMINANTLY NORTHERN DIRECTION. ONCE SEDIMENT CONTROLS ARE IN–PLACE, AS CELL CONSTRUCTION PROCEEDS, CLEAN SURFACE RUNOFF DRAINAGE WILL BE DIVERTED AROUND CONSTRUCTION AREAS, TO THE EXISTING SWALES. UNTIL PRECLUDED BY CELL CONSTRUCTION. EXISTING SWALES WILL CONVEY CLEAN SURFACE RUNOFF TO PERIMETER DITCHES AND SEDIMENT BASINS, AS SHOWN ON INTERMEDIATE CONSTRUCTION STAGE PLANS.

C. ASSUMPTIONS FOR DEVELOPMENT OF LANDFILL SEQUENCE OF CONSTRUCTION

BASED ON THE ABOVE SITE CONDITIONS, AND ITEMS II(B)(1) AND II(B)(2), THE FOLLOWING ASSUMPTIONS WERE USED TO DEVELOP THE LANDFILL SEQUENCE OF CONSTRUCTION, DEPICTED ON INTERMEDIATE CONSTRUCTION STAGE PLANS IN THESE PERMIT DRAWINGS.

1. AS PART OF THE INITIAL CONSTRUCTION SEDIMENT BASINS 2, 3, AND 4 WILL BE CONSTRUCTED INITIALLY.
2. LANDFILL CELLS 2 THROUGH 4 AND 11 THROUGH 16, WHEREBY LEACHATE IS PUMPED TO LEACHATE STORAGE FACILITY NO. 1, WILL BE CONSTRUCTED PRIOR TO CELLS 1, 5A THROUGH 5F AND 6 THROUGH 10, WHERE BY LEACHATE IS PUMPED TO LEACHATE STORAGE FACILITY NO. 2.

   WITH RESPECT TO LANDFILL OPERATION, CONSTRUCTION OF LANDFILL CELLS 2 THROUGH 4 AND CELLS 11 THROUGH 16, PRIOR TO CONSTRUCTION OF CELLS 1, AND 5 THROUGH 10, IS ALSO THE MOST DESIRABLE SEQUENCE OF CONSTRUCTION FOR THE LANDFILL, DUE TO CLOSE PROXIMITY OF CELL CONSTRUCTION TO SEDIMENT BASINS AND THE EAST ENTRANCE.
3. STOCKPILES SHALL BE WITHIN DRAINAGE AREAS TO EXISTING SEDIMENT BASINS THROUGHOUT THE LIFE OF LANDFILL CONSTRUCTION AND OPERATION.
4. THREE SITE ENTRANCES TO THE LANDFILL ARE DEPICTED ON DRAWING 3. MDE REQUIRES ONLY ONE ENTRANCE. SOUTH ENTRANCE IS CONSIDERED TO BE THE LEAST DESIRABLE OF THE THREE SITE ENTRANCES, BECAUSE IT IS REMOTE FROM LANDFILL CELLS THAT SHOULD BE CONSTRUCTED AND FILLED WITH RUBBLE WASTE INITIALLY.
5. NORTH AND EAST ENTRANCES ARE, IN CLOSE PROXIMITY TO CELLS DESIGNATED FOR INITIAL CONSTRUCTION, ARE THE MOST DESIRABLE SITE ENTRANCE OPTIONS. ASSUMPTION USED TO DEVELOP THE SEQUENCE OF CONSTRUCTION INDICATED ON INTERMEDIATE CONSTRUCTION STAGE PLANS (DRAWINGS 64 THROUGH 81) IS THAT RUBBLE WASTE HAUL TO THE SITE WILL BE VIA THE COUNTY ROAD TO THE EAST ENTRANCE.

   VARIANCE FROM THE SEQUENCE OF CONSTRUCTION IN THESE PERMIT DRAWINGS MUST BE APPROVED BY AASCD AND MDE, PER ITEM III HEREON. CONTRACT DOCUMENTS FOR INTERMEDIATE STAGE CONSTRUCTION MUST BE PREPARED AND APPROVED BY MDE, PER ITEM VI(B).

D. INTERMEDIATE CONSTRUCTION STAGE PLAN DEPICTION

SEQUENCE OF CONSTRUCTION FOR EACH INTERMEDIATE CONSTRUCTION STAGE IS PROVIDED ON DRAWING 64 THROUGH 81. THE FOLLOWING LIST IDENTIFIES CONSTRUCTION REQUIREMENTS, METHODOLOGY ASSOCIATED WITH DEPICTION OF FEATURES ON INTERMEDIATE CONSTRUCTION STAGE PLANS, AS–BUILT SURVEY AND QUALITY ASSURANCE CRITERIA.

1. PERIMETER ROADS: TEMPORARY CONSTRUCTION ROADS INITIALLY USED FOR CONSTRUCTION EQUIPMENT ACCESS SHALL HAVE A SURFACE SUFFICIENT FOR SUCH USE. PERMANENT PERIMETER ROAD SURFACE FOR WASTE HAULERS SHALL BE AS SHOWN ON DRAWINGS 10 AND 11. TEMPORARY ACCESS ROADS USED FOR WASTE HAULERS IN CELL AREAS AND ON RUBBLE WASTE SHALL HAVE AN ALL WEATHER DURABLE SURFACE SUITABLE FOR SUCH USE.
2. PERIMETER CHANNELS: PERIMETER CHANNELS SHALL INCLUDE LINING PER THE TABULATION ON DRAWING 42. TEMPORARY BERMS, RIPRAP CHANNELS AND DITCHES ADJACENT TO TEMPORARY ROADS SHALL BE SUFFICIENT TO CONVEY SURFACE RUNOFF AROUND CELL CONSTRUCTION AND WASTE PLACEMENT AREAS AS SHOWN.
3. SEDIMENT BASINS: INITIAL CONSTRUCTION STAGE INCLUDES CONSTRUCTION OF SEDIMENT BASINS AND PERIMETER CHANNELS ASSOCIATED WITH EACH STAGE, AS NEEDED TO PROVIDE SURFACE RUNOFF TO BASINS, CONSISTENT WITH BASIN DESIGN CRITERIA. FOLLOWING THIS CONSTRUCTION, STOCKPILES SHALL BE PLACED WITHIN THE LIMIT OF DISTURBANCE AND DRAINAGE AREA TO A SEDIMENT BASIN, THROUGHOUT THE LIFE OF LANDFILL CONSTRUCTION AND OPERATION.
4. PROPOSED CONTOURS: FOR CLARITY, PROPOSED CONTOURS REQUIRED TO IMPLEMENT CONSTRUCTION OF EACH INTERMEDIATE CONSTRUCTION STAGE ARE REFERENCED AS "CONSTRUCTED CONTOURS FOR CELL CONSTRUCTION ACCESS AND CELL TOP OF SUBBASE" ON INTERMEDIATE CONSTRUCTION STAGE PLANS. TEMPORARY ACCESS ROADS AND DITCHES FOR CELL CONSTRUCTION WILL BE GRADED PER INTERMEDIATE CONSTRUCTION STAGE PLANS AND DETAILS, PER CONDITIONS SPECIFIED UNDER ITEM II, "SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS", ITEM III, "VARIANCE FROM SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS" AND ITEM VI, "GENERAL NOTES FOR LANDFILL CELLS AND APPURTENANT CONSTRUCTION" ON THIS DRAWING.
5. CONSTRUCTED CONTOURS ADJACENT TO TEMPORARY ROADS AND DITCHES REPRESENT GRADING REQUIREMENTS FOR CONSTRUCTING CELLS AND ACCESS ON EXISTING GROUND PRIOR TO LANDFILL CONSTRUCTION. PER ITEM 6 BELOW, STOCKPILES OR BORROW AREAS MAY EXIST IN SOME LOCATIONS SHOWN AS EXISTING GROUND ON INTERMEDIATE CONSTRUCTION STAGE PLANS.
6. STOCKPILE/BORROW AREAS: ALL AREAS WITHIN THE BOUNDARY OF THE LANDFILL MAY BE USED FOR STOCKPILE AND BORROW SOURCES FOR LANDFILL OPERATION THROUGHOUT THE LIFE OF THE FACILITY. STOCKPILES AND BORROW SOURCES MAY BE WITHIN AREAS ADJACENT TO TEMPORARY ACCESS ROADS AND CHANNELS FOR CELL CONSTRUCTION (SEE ITEM 4 ABOVE) AT TIME OF CONSTRUCTION. SUFFICIENT SPACE FOR CELL ACCESS AND SURFACE RUNOFF DIVERSION AROUND CELL CONSTRUCTION AND WASTE PLACEMENT SHALL BE PROVIDED THROUGHOUT THE LIFE OF THE FACILITY.
7. INTER–CELL ACCESS: INTER–CELL ACCESS FOR CELL CONSTRUCTION OR WASTE PLACEMENT SHALL BE VIA TEMPORARY ACCESS ROADS OR OVER COVERED RUBBLE WASTE IN ACTIVE CELLS.
8. AS–BUILT SURVEY: THROUGHOUT THE LIFE OF LANDFILL CONSTRUCTION AND OPERATION, FIELD RUN AND AERIAL TOPOGRAPHIC AS–BUILT SURVEY FOR ALL CONSTRUCTION SHALL BE PERFORMED IN ACCORDANCE WITH TECHNICAL SPECIFICATIONS, CONSTRUCTION QUALITY, ASSURANCE PLAN, AND LANDFILL OPERATIONS PLAN.
9. QUALITY ASSURANCE: ALL CELL CONSTRUCTION MATERIAL (INCLUDING LEACHATE COLLECTION SYSTEM) SHALL BE INSTALLED AND TESTED IN ACCORDANCE WITH CONTRACT DOCUMENTS. CONSTRUCTION CERTIFICATIONS BY A MARYLAND CERTIFIED PROFESSIONAL ENGINEER (AS REQUIRED BY THE CONSTRUCTION QUALITY ASSURANCE PLAN) MUST BE SUBMITTED TO AND APPROVED BY THE MDE PRIOR TO WASTE PLACEMENT.

E. LANDFILL CONSTRUCTION CHRONOLOGY

PRIOR TO ANY CONSTRUCTION, PERMANENT GROUNDWATER MONITORING WELLS SHALL BE INSTALLED, AS SHOWN ON "GROUNDWATER MONITORING PLAN" IN PHASE III REPORT SECTION 16.0.

PER CRITERIA AND ASSUMPTIONS UNDER ITEMS II(A), II(B), II(C) AND II(D) ABOVE, LANDFILL CONSTRUCTION CHRONOLOGY DEPICTED ON INTERMEDIATE STAGE CONSTRUCTION DRAWINGS 64 THROUGH 81 IS AS FOLLOWS:

1. INITIAL CONSTRUCTION (SEDIMENT BASIN NOS. 2 THROUGH 4 AND LEACHATE STORAGE FACILITY NO. 1) (STAGE A)
2. CELL 11 (STAGE A AND B)
3. CELL SEPARATION BERM FOR CELLS 12 THROUGH 16
4. CELL 16 (STAGE C)
5. CELLS 12 THROUGH 15, RESPECTIVELY (STAGES C, D, E, F, AND G)
6. CELLS 2, 3, 4, 1, 5F, 5E, AND BASIN NO. 1 AND LEACHATE STORAGE FACILITY NO. 2 (STAGES H, I, J, AND K)
7. CELL 10 AND 5D (AND SURFACE RUNOFF IMPOUNDMENT IN CELL 9 AREA)
8. CELLS 9 AND 5C; 8, 5A AND 5B; AND CELL 6 AND 7, IN THAT ORDER

III. VARIANCE FROM SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS

AS REFERENCED UNDER ITEM II(C)(5), SEQUENCE OF CONSTRUCTION IS BASED ON SITE ACCESS VIA THE EAST ENTRANCE. IF THE NORTH ENTRANCE IS CONSTRUCTED IN LIEU OF THE EAST ENTRANCE, THE SEQUENCE OF CONSTRUCTION WILL BE IDENTICAL, EXCEPT THAT THE PERIMETER ACCESS ROAD BETWEEN THE NORTH AND EAST ENTRANCES AND PERIMETER CHANNEL NO. 8 WILL NOT BE CONSTRUCTED, UNTIL NECESSARY FOR CONSTRUCTION OF CELLS 12 THROUGH 15. IF THE LANDFILL NORTH ENTRANCE IS CONSTRUCTED IN LIEU OF THE EAST ENTRANCE, THE SEQUENCE OF CONSTRUCTION FOR LANDFILL CELLS SHALL REMAIN AS DESCRIBED IN THESE PERMIT DRAWINGS, VARIANCE FROM THE SEQUENCE OF CONSTRUCTION HEREIN IS NOT REQUIRED. IF THE SOUTH ENTRANCE IS THE ONLY SITE ACCESS THAT IS ULTIMATELY CONSTRUCTED, THE SEQUENCE OF CONSTRUCTION WILL BE REVISED AND MUST BE APPROVED BY ANNE ARUNDEL SOIL CONSERVATION DISTRICT (AASCD) AND MARYLAND DEPARTMENT OF THE ENVIRONMENT (MDE).

IV. SEQUENCE OF RUBBLE WASTE PLACEMENT OPERATION

SEQUENCE OF RUBBLE WASTE PLACEMENT IS AS FOLLOWS.

1. FOR EACH INTERMEDIATE STAGE OF CONSTRUCTION PREPARE THE TOP OF CELL SUBGRADE (I.E. BOTTOM OF SUBBASE) IN ACCORDANCE WITH CONTRACT DOCUMENTS (SEE ITEM VI(B) HEREON) AND REQUIREMENTS OF THE REFUSE DISPOSAL PERMIT.
2. CONSTRUCT THE RUBBLE LANDFILL PER INTERMEDIATE CONSTRUCTION STAGE DRAWINGS 64 THROUGH 78. PLACE WASTE IN INDIVIDUAL CELLS IN EAST AND WEST SECTIONS AS SHOWN. AS RUBBLE WASTE PLACEMENT PROGRESSES, PROVIDE DAILY AND INTERMEDIATE COVER PER THE LANDFILL OPERATION AND MAINTENANCE PLAN (SEE SECTIONS 12 OF THE PHASE III PERMIT) AND THE REFUSE DISPOSAL PERMIT REQUIREMENTS.
3. WHEN RUBBLE WASTE FILLING IS AT A LEVEL ABOVE THE LANDFILL PERIMETER BERM, PROVIDE COVER AND VEGETATION IN A MANNER THAT PROMOTES SURFACE RUNOFF FROM SOIL COVER OVER THE RUBBLE, ACROSS THE PERIMETER BERM TO A PERIMETER CHANNEL (AS DESCRIBED IN THE LANDFILL OPERATIONS AND MAINTENANCE PLAN).
4. CONTINUE THE RUBBLE WASTE PLACEMENT OPERATION TO FINAL GRADE. ESTIMATED LIFE EXPECTANCY OF THE RUBBLE WASTE PLACEMENT OPERATION IS 12 YEARS. FINAL GRADES SHOWN ON THE PLANS REPRESENT THE TOP ELEVATION FOR THE LANDFILL CLOSURE CAP. FINAL COVER AND CLOSURE CAP SHALL BE INSTALLED PER MARYLAND REGULATIONS. FINAL SIDE SLOPES SHALL BE 3:1, WITH STORMWATER MANAGEMENT TERRACES AND DOWNCHUTES INSTALLED PER PLANS AND DETAILS.
5. WHEN FINAL GRADES ARE VEGETATED PER THE PLANS, SEDIMENT BASINS SHALL BE CONVERTED TO PERMANENT STORMWATER MANAGEMENT STRUCTURES.

V. ESTIMATED CELL CONSTRUCTION AND WASTE PLACEMENT SCHEDULE

PRIOR TO BEGINNING ANY WASTE PLCEMENT, PERMANENT GROUNDWATER MONITORING WELLS SHALL BE INSTALLED, AS SHOWN ON "GROUNDWATER MONITORING PLAN" IN PHASE III REPORT SECTION 16.0.

IN ACCORDANCE WITH ALL CONDITIONS SPECIFIED ON THIS DRAWING, THE LANDFILL SHALL BE CONSTRUCTED. INTERMEDIATE CONSTRUCTION STAGE PLANS (DRAWINGS 64 THROUGH 81) DEPICT CONSTRUCTION OF THE LANDFILL FROM BEGINNING OF CONSTRUCTION THROUGHOUT CONSTRUCTION OF ALL LANDFILL CELLS. SEQUENCE OF CONSTRUCTION IS PROVIDED ON EACH INTERMEDIATE CONSTRUCTION STAGE PLAN. ESTIMATED TIME FRAME FOR CELL CONSTRUCTION AND WASTE PLACEMENT IS PROVIDED HEREUNDER.

PRIOR TO BEGINNING ANY OTHER ON–SITE CONSTRUCTION, INTERMEDIATE CONSTRUCTION INITIAL STAGE, PER PLANS ON DRAWINGS 64 AND 65, SHALL PROCEED. UNDER INITIAL CONSTRUCTION, BASINS NO. 2, 3 AND 4, AND LEACHATE STORAGE FACILITY NO. 1 WILL BE CONSTRUCTED. AREAS OUTSIDE THE LIMIT OF DISTURBANCE FOR INITIAL CONSTRUCTION MAY BE USED TO STOCKPILE EXCAVATED MATERIAL FROM THE CONSTRUCTION OPERATION, AS APPROVED BY THE AASCD SEDIMENT CONTROL INSPECTOR. EXCLUDING ACCESS ROADS, DRAINAGE CHANNELS, AND ENTRANCE INFRASTRUCTURE, ALL DISTURBED AREAS SHALL BE VEGETATED FOR STABILIZATION.

BASED ON THE ANTICIPATED VOLUME AND DENSITY OF RUBBLE WASTE TO BE PLACED IN THE FACILITY ON A DAILY BASIS, DURING 5 DAYS PER WEEK OPERATION, THE ESTIMATED LIFE EXPECTANCY OF THE LANDFILL WASTE PLACEMENT OPERATION IS 12 YEARS.

A. CONSTRUCTION REQUIREMENTS

THE FOLLOWING CONSTRUCTION REQUIREMENTS AND ASSUMPTIONS WERE USED TO GENERATE THE "SEQUENCE OF CELL CONSTRUCTION AND WASTE PLACEMENT", UNDER ITEM B BELOW.

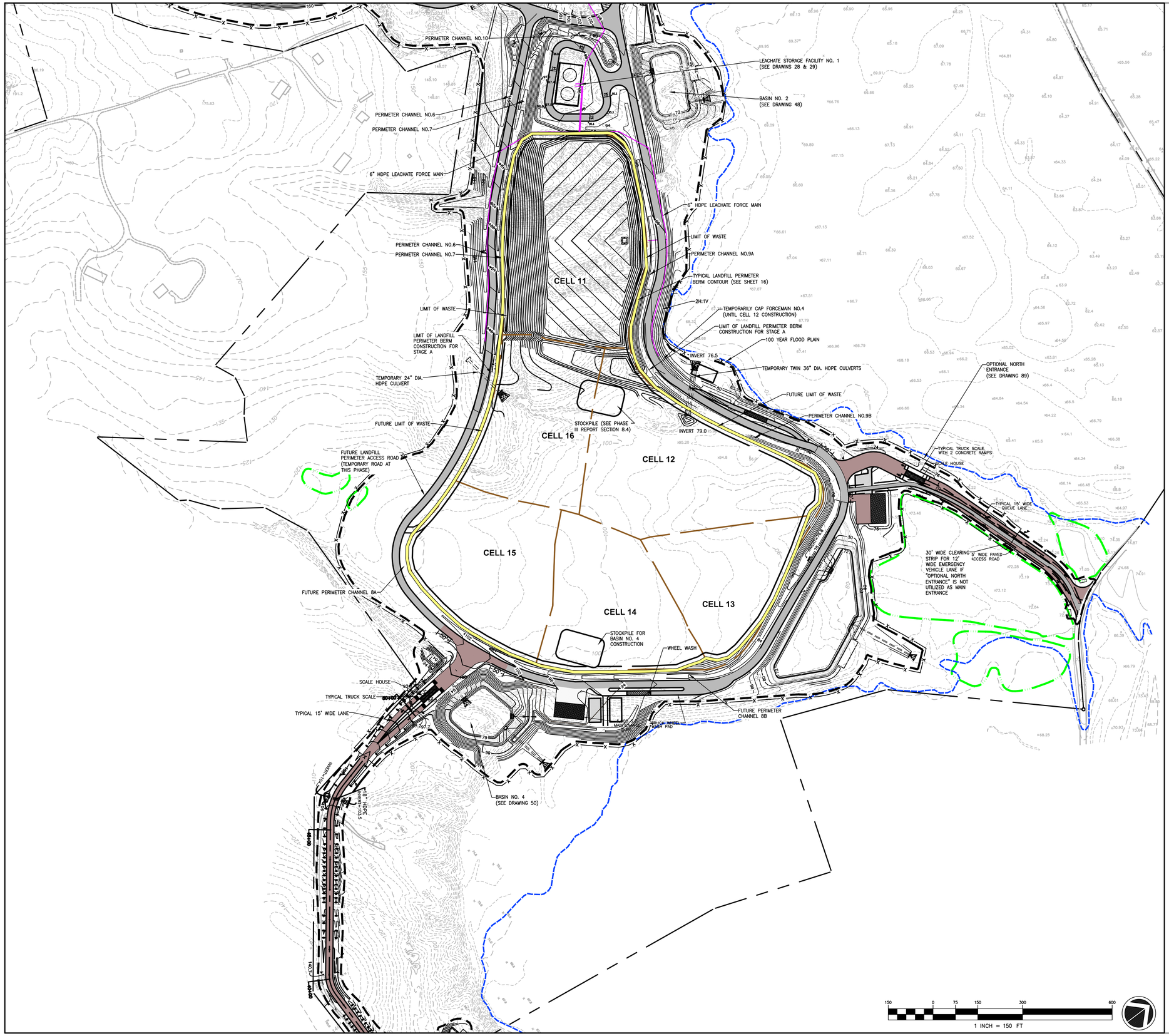
1. LANDFILL WASTE PLACEMENT OPERATION DURATION IS 12 YEARS UNLESS MODIFIED THROUGH REGULATORY OR LEGAL PROCESSES. INITIAL CONSTRUCTION PRIOR TO THE START OF WASTE PLACEMENT IS NOT SUBJECT TO THE 12 YEAR TIME FRAME.
2. COMPLETION OF ANY FINAL CLOSURE CAP CONSTRUCTION OF THE FACILITY (I.E., THE CONSTRUCTION OPERATION ASSOCIATED WITH INSTALLATION OF LANDFILL CLOSURE CAP MATERIAL, PER COMAR REGULATIONS) IS NOT INCLUDED IN THE "SEQUENCE OF CELL CONSTRUCTION AND WASTE PLACEMENT".
3. CONSTRUCTION OF CELL INFRASTRUCTURE (I.E., ACCESS ROADS, PERIMETER DITCHES, STORM DRAINS, AND FORCE MAINS) WILL OCCUR AS REQUIRED TO SUPPORT ONGOING LANDFILL CELL CONSTRUCTION. CELL INFRASTRUCTURE CONSTRUCTION SHOULD BE SCHEDULED AND COMPLETED AS NECESSARY TO ALLOW WASTE PLACEMENT IN ANY GIVEN CELL, IMMEDIATELY FOLLOWING CELL CONSTRUCTION COMPLETION.

B. SEQUENCE OF CELL CONSTRUCTION AND WASTE PLACEMENT

PRIOR TO BEGINNING WORK FOR ANY INTERMEDIATE STAGE OF CONSTRUCTION (AS SHOWN ON DRAWINGS 64 THROUGH 81 AND SPECIFIED UNDER ITEM VI(B) HEREON), ANNE ARUNDEL COUNTY PLANNING AND CODE ENFORCEMENT (PACE) INSPECTIONS AND PERMITS (410–222–7450) SHALL BE NOTIFIED. ALL PROPOSED STOCKPILE AREAS (INCLUDING TEMPORARY SEDIMENT CONTROL MEASURES) SHALL BE PER AASCD SEDIMENT CONTROL INSPECTOR'S APPROVAL.

BASED ON INDIVIDUAL CELL AIR SPACE (PRORATED PER TOTAL LANDFILL CELL ACREAGE) AND INTERMEDIATE CONSTRUCTION STAGE PLANS ON DRAWINGS 64 THROUGH 81, THE "SEQUENCE OF CELL CONSTRUCTION AND WASTE PLACEMENT" IS AS FOLLOWS.

1. COMPLETE CONSTRUCTION OF BASIN NOS. 2, 3, AND 4 AND LEACHATE STORAGE FACILITY NO. 1 INITIAL STAGE, AS SHOWN ON DRAWINGS 3, 11, AND 64, CONSTRUCT EAST ENTRANCE ACCESS ROAD AS SHOWN ON DRAWING 4, EAST ENTRANCE AND BASIN NO. 4 AS SHOWN ON DRAWINGS 5, 50, AND 64 AND THE PERIMETER ACCESS ROAD AS SHOWN ON DRAWINGS 64. CONSTRUCTION OF ALL BASINS SHALL COMPLY WITH THE FOLLOWING. — 2 YEARS (1)
   - ALL MATERIALS FOR BASIN CONSTRUCTION SHALL BE ON–SITE PRIOR TO COMMENCEMENT OF WORK.
   - PRIOR TO COMMENCEMENT OF WORK, AREAS FOR CLEARING, STRIPPING AND STOCKPILING TOPSOIL OR ANY IMPORTED BORROW, AND ANY ON–SITE BORROW AREAS (INCLUDING TEMPORARY SEDIMENT CONTROL MEASURES, SUCH AS SILT FENCE, ETC.) SHALL BE PER APPROVAL OF THE AASCD SEDIMENT CONTROL INSPECTOR.
   - BASINS WILL BE CONSTRUCTED PER APPROVAL BY MDE AND AASCD, UNDER THESE PERMIT DRAWINGS. CONSTRUCTION OF THE CUT–OFF TRENCH, PRINCIPAL AND EMERGENCY SPILLWAYS, AND ALL OTHER ASPECTS OF EMBANKMENT CONSTRUCTION, SHALL BE INSPECTED BY A PROFESSIONAL GEOTECHNICAL ENGINEER OR HIS AUTHORIZED REPRESENTATIVE.
2. CONSTRUCT EAST SECTION (30



LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL (D2/C1)
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL (2/16)
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING (5/8)
- LANDFILL PERIMETER ROAD, SEE DRAWING (6/8)
- SIGNS, SEE DRAWING 8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. HYDROGEOLOGIC AREAS AND MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.
3. ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

SEQUENCE OF CONSTRUCTION FOR EAST SECTION

1. BASIN NO. 2 AND 4 ARE CONSTRUCTED, AS WELL AS THE LEACHATE STORAGE TANK FACILITY NO. 1.
2. THE ENTRANCE AND THE EMERGENCY EXIT (FOLLOWING THE OPTIONAL NORTH ENTRANCE ALIGNMENT)..
3. PORTIONS OF LEACHATE FORCE MAINS #4 AND 5 BETWEEN LEACHATE STORAGE FACILITY NO. 1 AND CELL 11
4. PERIMETER BERM AND PERIMETER CHANNELS 6, 7, 9A AND 10 ARE CONSTRUCTED.
5. PERIMETER ROAD FROM ENTRANCE TO CELL 11 IS CONSTRUCTED ALONG THE PATH OF THE FINAL ROAD, BUT FILL PLACEMENT TO FINAL GRADES NEAR CELLS 12 THROUGH 16 WOULD INTERRUPT NATURAL DRAINAGE THROUGH THE AREA. THE PERIMETER ROAD IN THESE AREAS WILL SIMPLY RECEIVE NONWOVEN GEOTEXTILE OVERLAIN BY STONE SURFACING TO SUPPORT THE TRAFFIC LOAD. IN LOCATIONS OF NATURAL DRAINAGE, TEMPORARY CULVERTS MAY BE PLACED TO PASS THE FLOW PAST THE ROAD.
6. IF FILL MATERIAL IS NEEDED FOR CONSTRUCTION. FURTHER CLEANING AND EXCAVATION IN CELL 16 MAY OCCUR.
7. EXCAVATION AND FILL PLACEMENT TO ACHIEVE SUBGRADE ELEVATIONS IN CELL 11.
8. LINER SYSTEM CONSTRUCTION. SEE DETAIL (2/14)
9. UPON APPROVAL OF CELL 11 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 11.

NOTES:

1. THE PURPOSE OF THIS PLAN IS TO SHOW GRADING REQUIRED TO INSTALL BASIN 4, FUTURE EAST ENTRANCE FACILITIES, DISPOSAL CELLS, FUTURE ACCESS ROADS, AND PERIMETER CHANNELS AS SHOWN.
2. SEE SITE PLAN ON SHEET 3 FOR ASSUMED EAST ENTRANCE LOCATION.
3. SEE DRAWINGS 4 & 5 FOR ASSUMED EAST ENTRANCE GRADING PLAN.
4. SEE DRAWING 55 FOR EAST ENTRANCE GRADING SEDIMENT CONTROL PLAN.
5. SEE DRAWING 89 FOR OPTIONAL NORTH ENTRANCE PLAN.
6. SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.
7. SEE DRAWING 50 FOR CONSTRUCTION OF BASIN NO. 4, EAST ENTRANCE FACILITIES, ACCESS ROADS AND PERIMETER DITCH No 8, IN THE AREA SHOWN HEREON.
8. SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELLS 12 THROUGH 15 CONSTRUCTION REQUIREMENTS.
9. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

STATE OF MARYLAND — LEONARD STRAKOWSKI — 21681 — PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

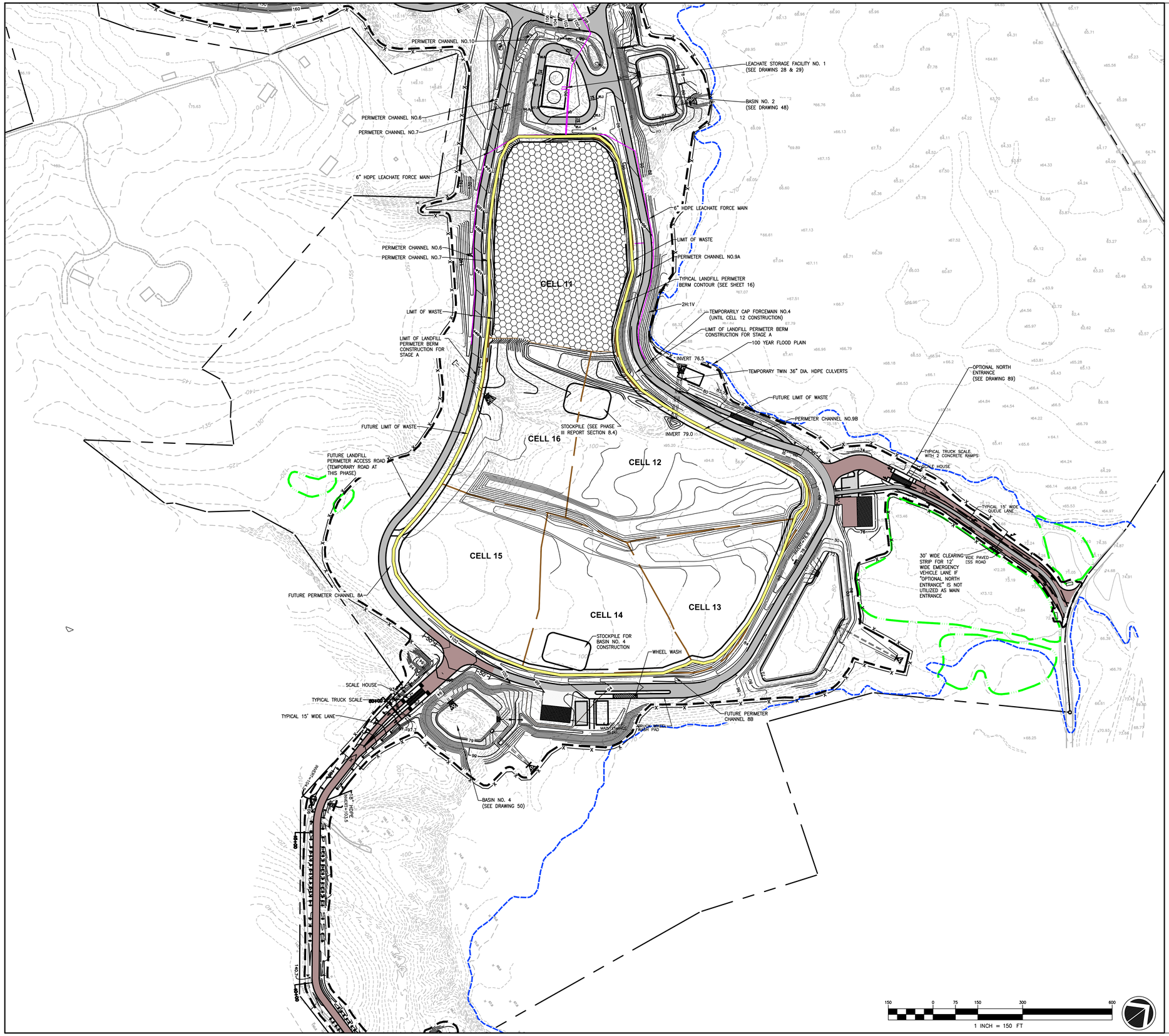
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INTERMEDIATE CONSTRUCTION STAGE A (EAST SECTION)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 64

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LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL (D7/61)
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL (2/16)
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING (5/8)
- LANDFILL PERIMETER ROAD, SEE DRAWING (6/8)
- SIGNS, SEE DRAWING 8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. HYDROGEOLOGIC AREAS AND MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.
3. ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

SEQUENCE OF CONSTRUCTION FOR CELL 11

1. LANDFILLING OPERATIONS COMMENCE IN CELL 11.
2. CONSTRUCT THE INTERCELL BERM BETWEEN CELLS 16/12 AND CELLS 13/14/15 IN ANTICIPATION OF THE CELL 16/12 CONSTRUCTION.
3. SOILS MAY BE EXCAVATED FROM CELLS 16/12 IN ORDER TO ADVANCE CONSTRUCTION OF THE PERIMETER ROAD, CHANNELS, AND BERM FOR CELL 16/12 CONSTRUCTION.
4. VEGETATE AND STABILIZE THE DISTURBED AREAS OF CELLS 13/14/15

NOTES:

1. THE PURPOSE OF THIS PLAN IS TO SHOW GRADING REQUIRED TO INSTALL DISPOSAL CELLS, TEMPORARY "CLEAN RUN-OFF" DIVERSIONS, AND CULVERTS, FUTURE ACCESS ROADS, AND PERIMETER CHANNELS AS SHOWN.
2. SEE SITE PLAN ON SHEET 3 FOR ASSUMED EAST ENTRANCE LOCATION.
3. SEE DRAWINGS 4 & 5 FOR ASSUMED EAST ENTRANCE GRADING PLAN.
4. SEE DRAWING 55 FOR EAST ENTRANCE GRADING SEDIMENT CONTROL PLAN.
5. SEE DRAWING 89 FOR OPTIONAL NORTH ENTRANCE PLAN.
6. SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.
7. SEE DRAWING 50 FOR CONSTRUCTION OF BASIN NO. 4, EAST ENTRANCE FACILITIES, ACCESS ROADS AND PERIMETER DITCH NO. 8, IN THE AREA SHOWN HEREON.
8. SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELLS 12 THROUGH 15 CONSTRUCTION REQUIREMENTS.
9. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

LEONARD STRICKMAN RAWLINGS
STATE OF MARYLAND
No. 21615
PROFESSIONAL ENGINEER

REVISION: REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
DATE: 9/03/2021

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

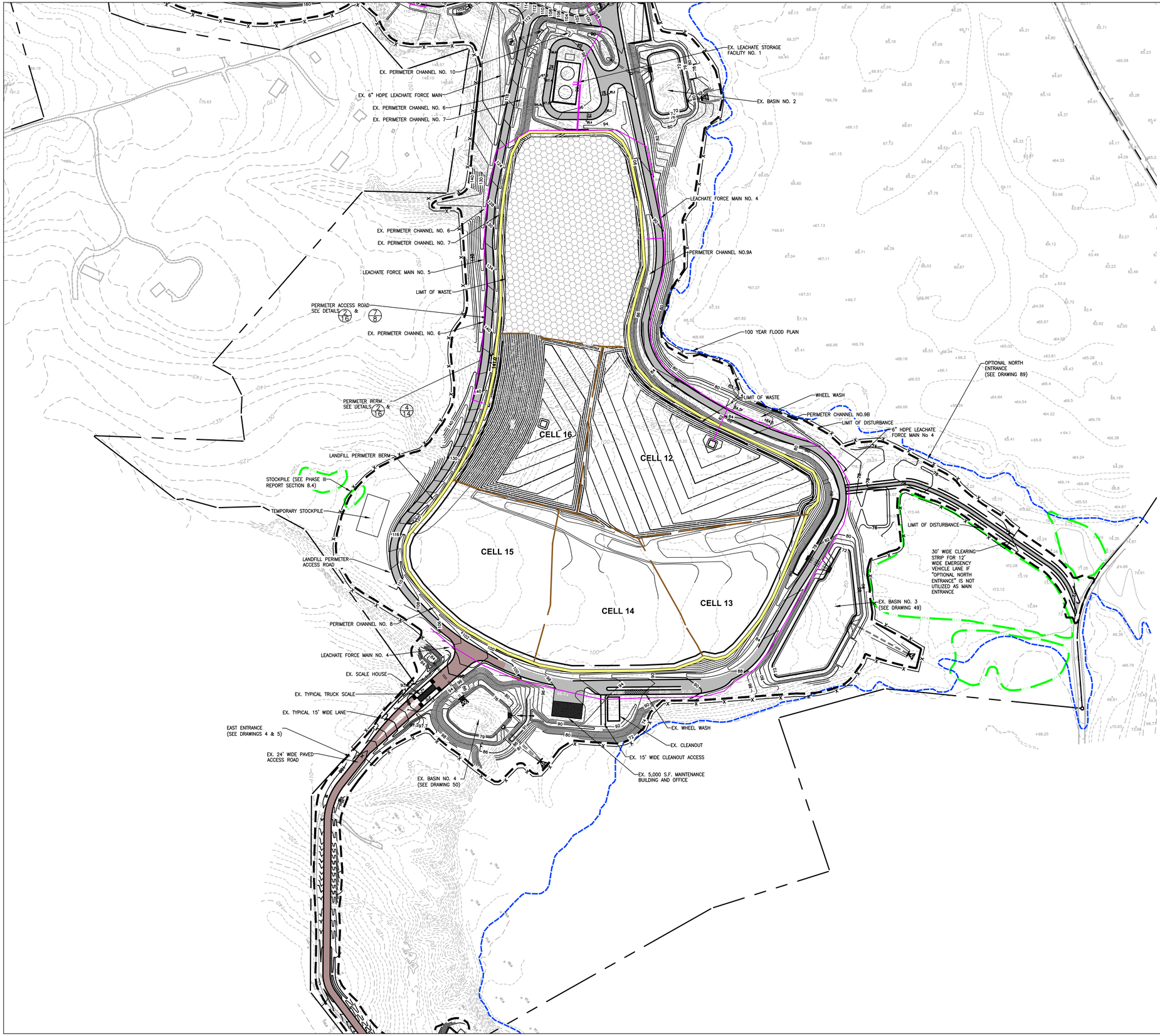
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INTERMEDIATE CONSTRUCTION STAGE B (CELL 11)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 65

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LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/61
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL 2/16
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ROAD, SEE DRAWING 6/8
- SIGNS, SEE DRAWING 8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

SEQUENCE OF CONSTRUCTION FOR CELL 16

1. EXTEND LEACHATE FORCE MAIN #5 TO CELL 16 COLLECTION SYSTEM PERIMETER BERM AND LEACHATE FORCE MAIN #4 TO THE CELL 12 VALVE VAULT.
2. REMOVE TEMPORARY CULVERTS PLACED IN PERIMETER ACCESS ROAD NEAR CELLS 16 & 12 DURING STABE A.
3. PLACE FILL FOR THE PERIMETER BERM AND ROAD AROUND REMAINDER OF EAST DISPOSAL AREA, PERIMETER CHANNELS 8A AND 9A AND 9B, AND THE PERIMETER BERM BETWEEN CELL 11 AND CELLS 13/14/15 INTERCELL BERMS CONSTRUCTED IN SEQUENCE B.
4. EXCAVATE CELLS 12 AND 16 TO ACHIEVE SUBGRADE ELEVATIONS.
5. INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 16.
6. IF FILL MATERIAL IS NEEDED FOR CONSTRUCTION, CLEARING AND EXCAVATION IN CELL 15 MAY OCCUR.
7. ADVANCE LINER SYSTEM CONSTRUCTION IN CELL 16.
8. UPON APPROVAL OF CELL 16 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 16.
9. PLACE INTERMEDIATE COVER ON PORTIONS OF CELL 11 WHICH HAVE ACHIEVED MAXIMUM FILLING GRADES AND STABILIZE WITH VEGETATION.

NOTES:

1. ITEMS LABELED AS "EXISTING" (EX.) ARE INTENDED TO HAVE BEEN CONSTRUCTED AT THE TIME OF THE SEQUENCE REFLECTED ON THIS DRAWING.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — KARL R. STEINMAN — No. 21583 — PROFESSIONAL ENGINEER

REVISION:

DATE:

9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

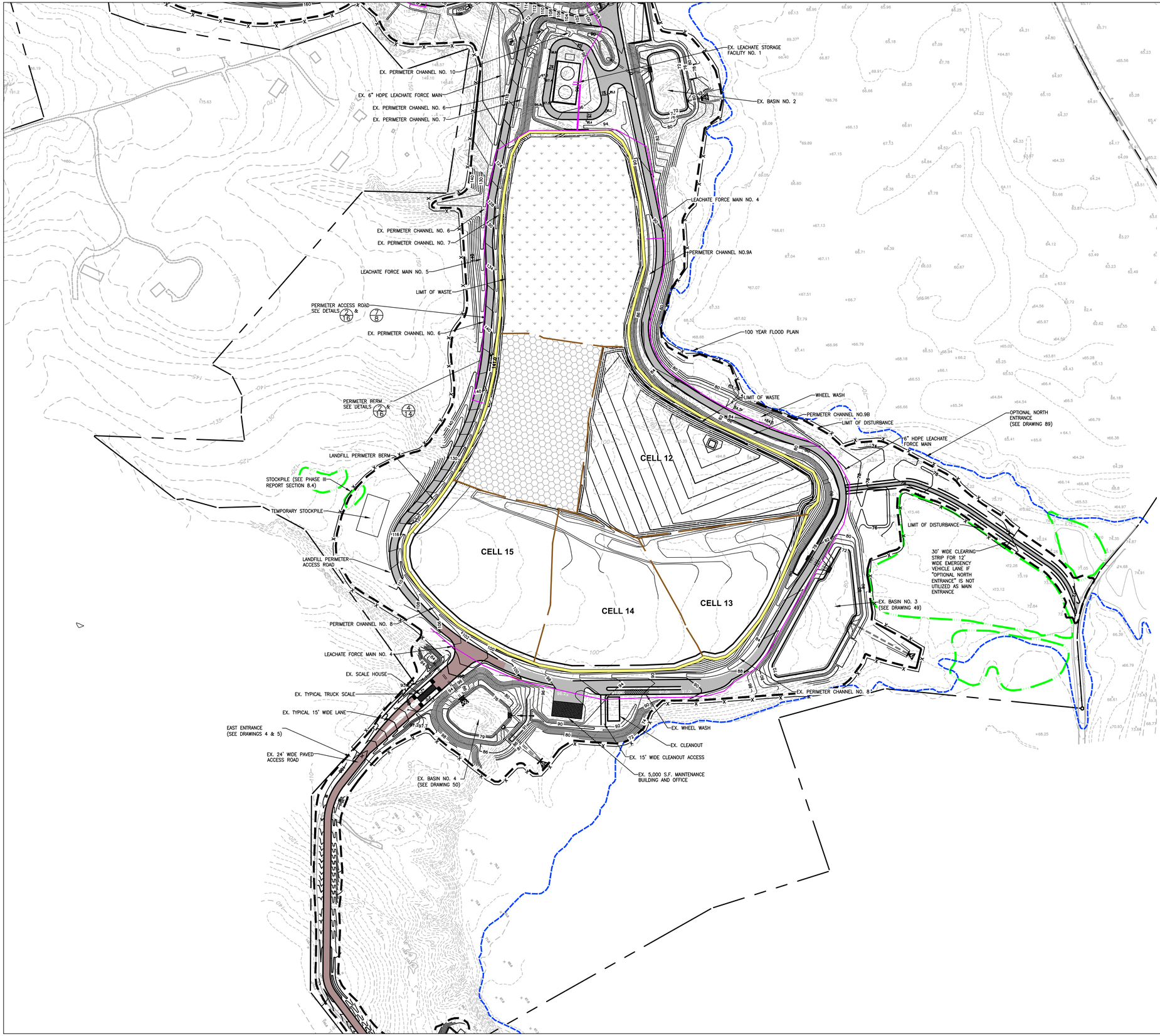
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INTERMEDIATE CONSTRUCTION STAGE C (CELL 16)

PROJECT MANAGER:	PGS	SCALE:AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY:	KHF	DATE:09/03/2021

DRAWING 66

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LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/61
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 15/16
- LANDFILL PERIMETER ROAD, SEE DRAWING 5/8
- SIGNS, SEE DRAWING 8 6/8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

SEQUENCE OF CONSTRUCTION FOR CELL 12

1. AS LANDFILLING IN CELL 16 ADVANCES, INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 12.
2. IF FILL MATERIAL IS NEEDED FOR CONSTRUCTION, CLEARING AND EXCAVATION IN CELLS 13, 14 AND 15 MAY OCCUR.
3. UPON APPROVAL OF CELL 12 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 12.
4. PLACE FINAL COVER ON PORTIONS OF CELL 16 WHICH HAVE ACHIEVED MAXIMUM FILLING GRADES INSTALL CLOSURE CAP OF COMPLETED FINAL COVER.

NOTES:

1. ITEMS LABELED AS "EXISTING" ARE INTENDED TO HAVE BEEN CONSTRUCTED AT THE TIME OF THE SEQUENCE REFLECTED ON THIS DRAWING.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — PAUL G. SKOKOS — LICENSED PROFESSIONAL ENGINEER — 21501

REVISION:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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INTERMEDIATE CONSTRUCTION STAGE D (CELL 12)

PROJECT MANAGER:	PGS	SCALE:AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:09/03/2021	

DRAWING 67

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EX. PERIMETER CHANNEL NO. 10
EX. 6" HDPE LEACHATE FORCE MAIN
EX. PERIMETER CHANNEL NO. 6
EX. PERIMETER CHANNEL NO. 7
EX. LEACHATE STORAGE FACILITY NO. 1
EX. BASIN NO. 2
LEACHATE FORCE MAIN NO. 4
EX. PERIMETER CHANNEL NO. 6
EX. PERIMETER CHANNEL NO. 7
PERIMETER CHANNEL NO.9A
LEACHATE FORCE MAIN NO. 5
LIMIT OF WASTE
PERIMETER ACCESS ROAD SEE DETAILS 2/16 & 7/8
EX. PERIMETER CHANNEL NO. 6
100 YEAR FLOOD PLAIN
PERIMETER BERM SEE DETAILS 2/16 & 4/14
LIMIT OF WASTE
WHEEL WASH
PERIMETER CHANNEL NO.9B
LIMIT OF DISTURBANCE
6" HDPE LEACHATE FORCE MAIN
OPTIONAL NORTH ENTRANCE (SEE DRAWING 89)
LANDFILL PERIMETER BERM
STOCKPILE (SEE PHASE III REPORT SECTION 8.4)
TEMPORARY STOCKPILE
LANDFILL PERIMETER ACCESS ROAD
LIMIT OF DISTURBANCE
30' WIDE CLEARING STRIP FOR 12' WIDE EMERGENCY VEHICLE LANE IF "OPTIONAL NORTH ENTRANCE" IS NOT UTILIZED AS MAIN ENTRANCE
EX. BASIN NO. 3 (SEE DRAWING 49)
PERIMETER CHANNEL NO. 8
LEACHATE FORCE MAIN NO. 4
EX. SCALE HOUSE
EX. TYPICAL TRUCK SCALE
EX. TYPICAL 15' WIDE LANE
EAST ENTRANCE (SEE DRAWINGS 4 & 5)
EX. 24' WIDE PAVED ACCESS ROAD
EX. WHEEL WASH
EX. CLEANOUT
EX. 15' WIDE CLEANOUT ACCESS
EX. 5,000 S.F. MAINTENANCE BUILDING AND OFFICE
EX. BASIN NO. 4 (SEE DRAWING 50)
CELL 11
CELL 12
CELL 13
CELL 14
CELL 15
CELL 16

LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/61
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 15/16
- LANDFILL PERIMETER ROAD, SEE DRAWING 5/8
- SIGNS, SEE DRAWING 8 6/8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

SEQUENCE OF CONSTRUCTION FOR CELL 13

1. EXTEND LEACHATE FORCE MAIN #4 TO THE CELLS 13, 14, AND 15.
2. EXCAVATE CELLS 13, 14, AND 15 TO ACHIEVE SUBGRADE ELEVATIONS.
3. INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 13.
4. UPON APPROVAL OF CELL 13 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 13.
5. PLACE FINAL COVER AND CLOSURE CAP ON PORTIONS OF CELLS 11 AND 16 WHICH HAVE ACHIEVED MAXIMUM FILLING GRADES.

NOTES:

1. ITEMS LABELED AS "EXISTING" ARE INTENDED TO HAVE BEEN CONSTRUCTED AT THE TIME OF THE SEQUENCE REFLECTED ON THIS DRAWING.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

STATE OF MARYLAND — RAYMOND STOCKMAN — No. 21708 — PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
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PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

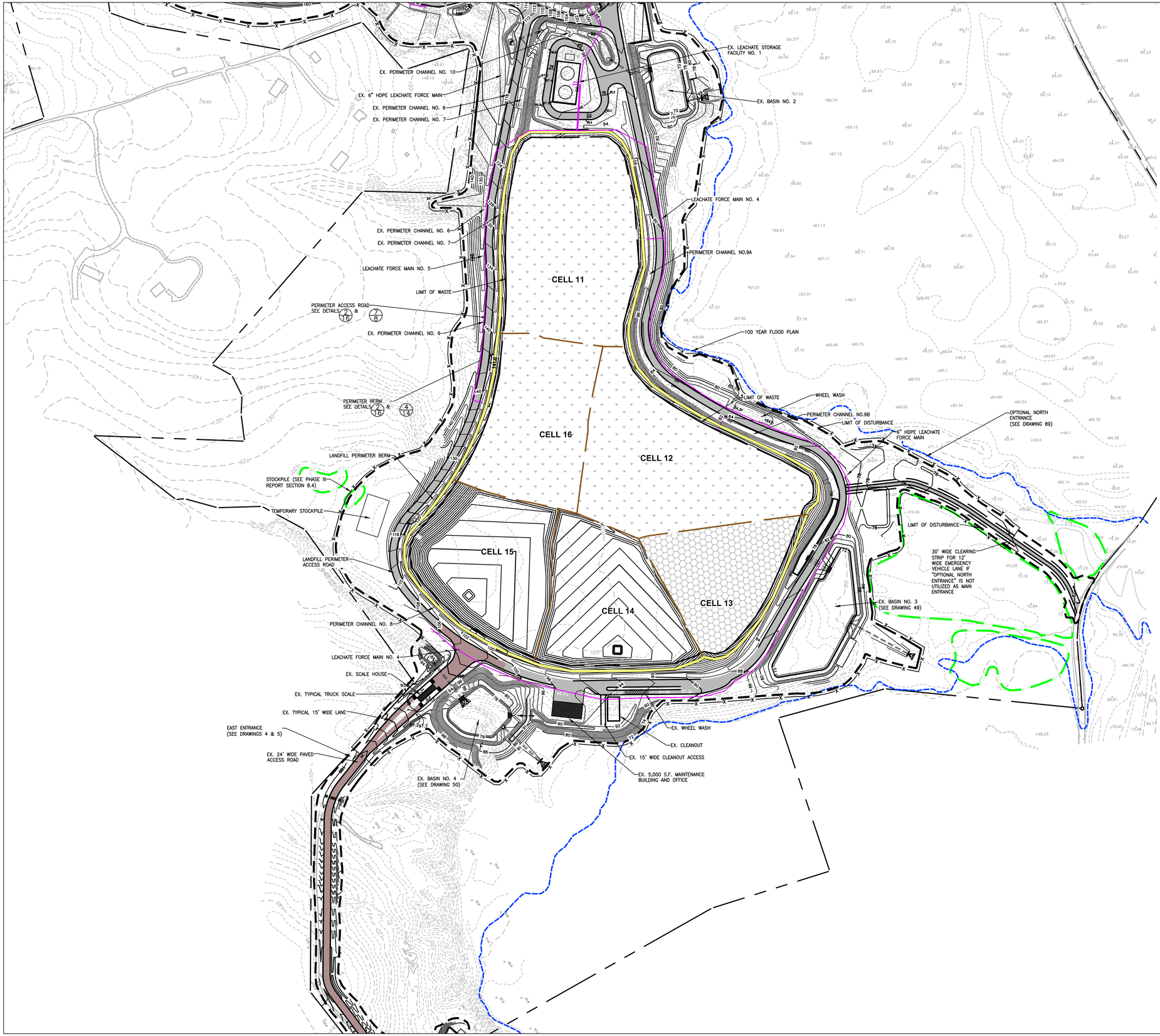
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INTERMEDIATE CONSTRUCTION STAGE E (CELL 13)

PROJECT MANAGER:	PGS	SCALE:AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:09/03/2021	

DRAWING 68

N:\Projects\2018\2018854 - Chesapeake Terrace\CAD\ACAD\WORC & Phase III Application\Drawings\Final\PLAN\1854-BASE - INTERMEDIATE CONSTRUCTION STAGE E - CELL 13.dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/61
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8 & 7/16
- LANDFILL PERIMETER ROAD, SEE DRAWING 6/8
- SIGNS, SEE DRAWING 8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

SEQUENCE OF CONSTRUCTION FOR CELL 14

1. AS LANDFILLING IN CELL 13 PROGRESSES, INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 14.
2. UPON APPROVAL OF CELL 14 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 14.
3. PLACE FINAL NTERMEDIATE COVER AND CLOSURE CAP ON PORTIONS OF CELL 12 WHICH HAVE ACHIEVED MAXIMUM FILLING GRADES AND STABILIZE WITH VEGETATION.

NOTES:

1. ITEMS LABELED AS "EXISTING" ARE INTENDED TO HAVE BEEN CONSTRUCTED AT THE TIME OF THE SEQUENCE REFLECTED ON THIS DRAWING.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — KEITH H. FAHRENKRUG — 21615 — PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

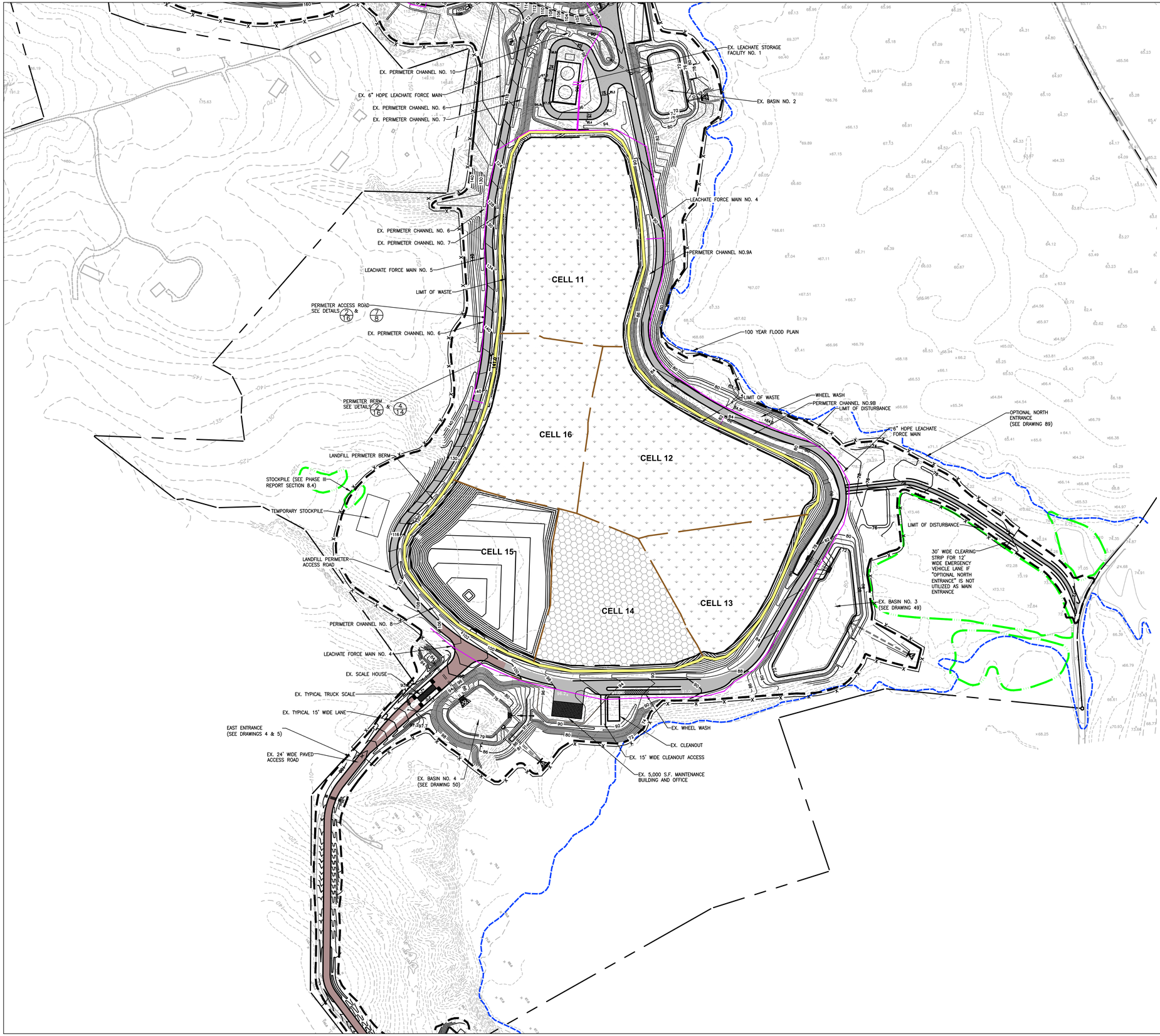
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INTERMEDIATE CONSTRUCTION STAGE F (CELL 14)

PROJECT MANAGER:	PGS	SCALE:AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:09/03/2021	

DRAWING 69

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LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- CHECK DAM, SEE DETAIL 12/61
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- PERIMETER BERM, SEE DETAIL
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 2/16
- LANDFILL PERIMETER ROAD, SEE DRAWING 5/8
- SIGNS, SEE DRAWING 8 6/8
- TYPICAL WETLANDS
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

REFERENCES:

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

SEQUENCE OF CONSTRUCTION FOR CELL 15

1. AS LANDFILLING IN CELL 15 ADVANCES, FINISH CLOSURE CAP CONSTRUCTION CELLS 11, 12, 13, 14 AND 16.
2. SOILS FROM ON-SITE MAY BE USABLE FOR FINAL COVER SOILS. EXCAVATION OF MATERIALS IN CELLS 2, 3 AND 4 MAY ADVANCE IN SUPPORT OF CLOSURE CAP CONSTRUCTION.
3. WHEN CELL REACHES FINAL GRADES CONSTRUCT FINAL COVER AND INSTALL REMAINING CLOSURE CAP.

NOTES:

1. ITEMS LABELED AS "EXISTING" ARE INTENDED TO HAVE BEEN CONSTRUCTED AT THE TIME OF THE SEQUENCE REFLECTED ON THIS DRAWING.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.

STATE OF MARYLAND — RAYMOND E. STRICKMAN — No. 21583 — PROFESSIONAL ENGINEER

REVISION:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
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INTERMEDIATE CONSTRUCTION STAGE G (CELL 15)

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 70

N:\Projects\2018\2018854 - Chesapeake Terrace\ACAD\ENGR\C & P\Issue #4 Application\Drawings\Final\PLAN1854.MXD - INTERMEDIATE CONSTRUCTION STAGE G - CELL 15.dwg

REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.

NOTES

1. WHILE FEMA HAS RE–ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

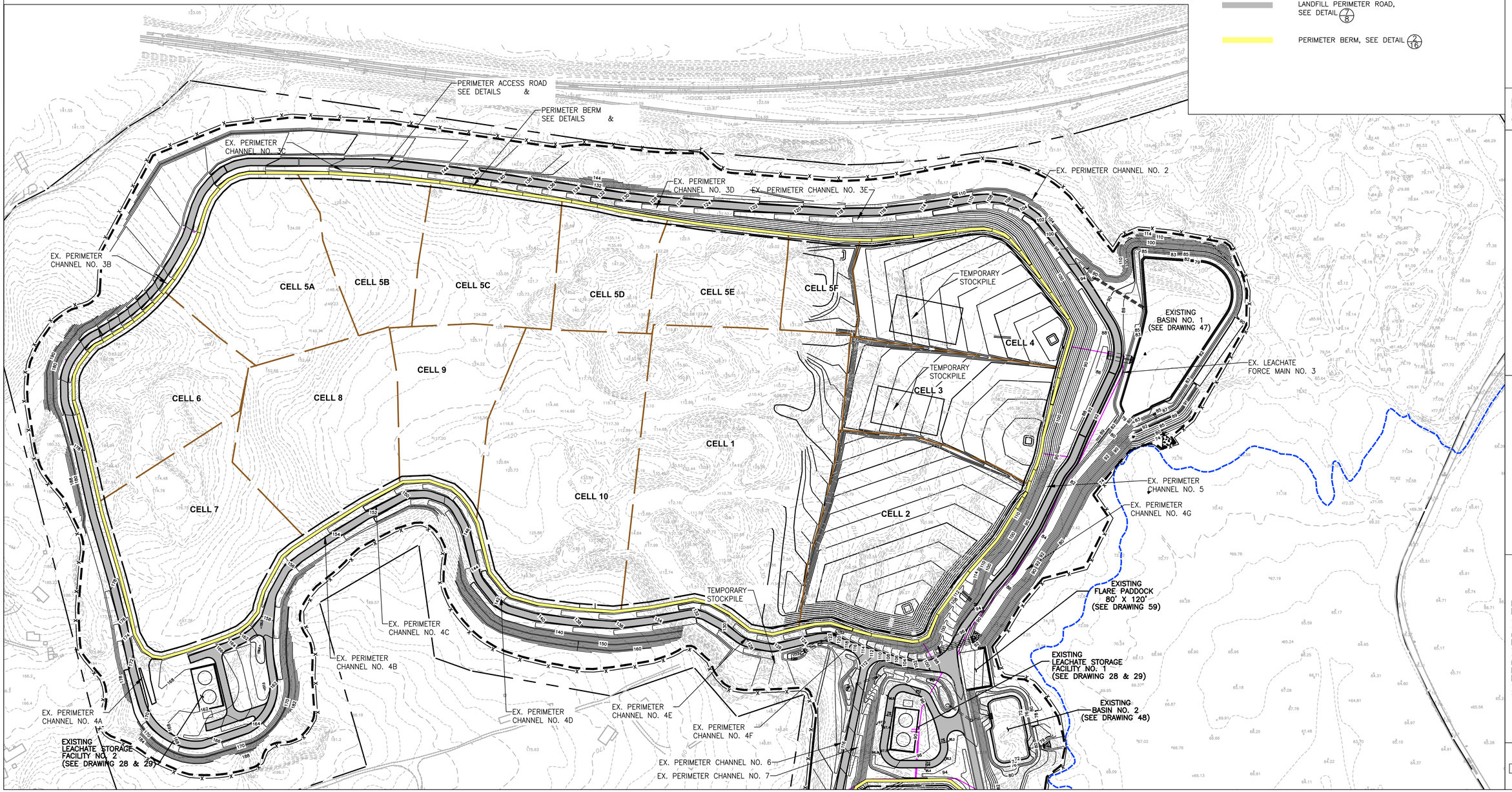
SEQUENCE OF CONSTRUCTION FOR WEST SIDE

1. AS LANDFILLING ADVANCES IN CELLS 14 & 15, BEGIN CONSTRUCTION OF THE WEST SIDE FEATURES, INCLUDING:
   a. BASIN NO. 1 IS CONSTRUCTED, AS WELL AS THE LEACHATE STORAGE TANK FACILITY NO. 2.
   b. PERIMETER ROAD AND PERIMETER BERMS ASSOCIATED WITH CELLS 1 THROUGH 10 ARE CONSTRUCTED.
   c. PERIMETER CHANNELS 1, 2, 3, 4, AND 5 ARE CONSTRUCTED.
   d. CULVERTS BETWEEN THE PERIMETER CHANNELS AND BASIN NO .1 ARE CONSTRUCTED.
2. LEACHATE FORCE MAIN #3 BETWEEN CELLS 2, 3, AND 4 AND LEACHATE STORAGE FACILITY NO. 1 IS CONSTRUCTED.
3. EXCAVATE AS NEEDED TO ACHIEVE SUBBASE ELEVATIONS IN CELLS 2, 3, AND 4.
4. RE–USE EXCAVATED SOILS FOR BERM AND ROAD CONSTRUCTION, AS NEEDED.
5. ADVANCE LINER SYSTEM CONSTRUCTION IN CELL 2, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM.
6. UPON APPROVAL OF CELL 2 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 2.

LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.



REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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INTERMEDIATE CONSTRUCTION STAGE H (WEST SECTION)

PROJECT MANAGER: PCS
CHECKED BY: PCS
DRAWN BY: KHF
SCALE: AS NOTED
PROJECT NUMBER: 2018 – 3854
DATE: 09/03/2021

DRAWING 71

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\SC & Phase III Application\Drawings\Final\2018854 ARTI - INTERMEDIATE CONSTRUCTION STAGE H.dwg

REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
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NOTES

1. WHILE FEMA HAS RE–ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

SEQUENCE OF CONSTRUCTION FOR CELL 2

1. AS LANDFILLING IN CELL 2 ADVANCES, INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELLS 3 & 4.
2. IF FILL MATERIAL IS NEEDED FOR CONSTRUCTION, CLEARING AND EXCAVATION IN CELLS 1, 5E OR 5F MAY OCCUR.
3. UPON APPROVAL OF CELLS 3 & 4 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELLS 3 & 4.
4. PLACE FINAL COVER AND CLOSURE CAP ON PORTIONS OF CELL 2 WHICH HAVE ACHIEVED MAXIMUM FILLING GRADES AND STABILIZE WITH VEGETATION.
5. IN PARALLEL, ADVANCE CLOSURE CAP CONSTRUCTION ON THE EAST SECTION.

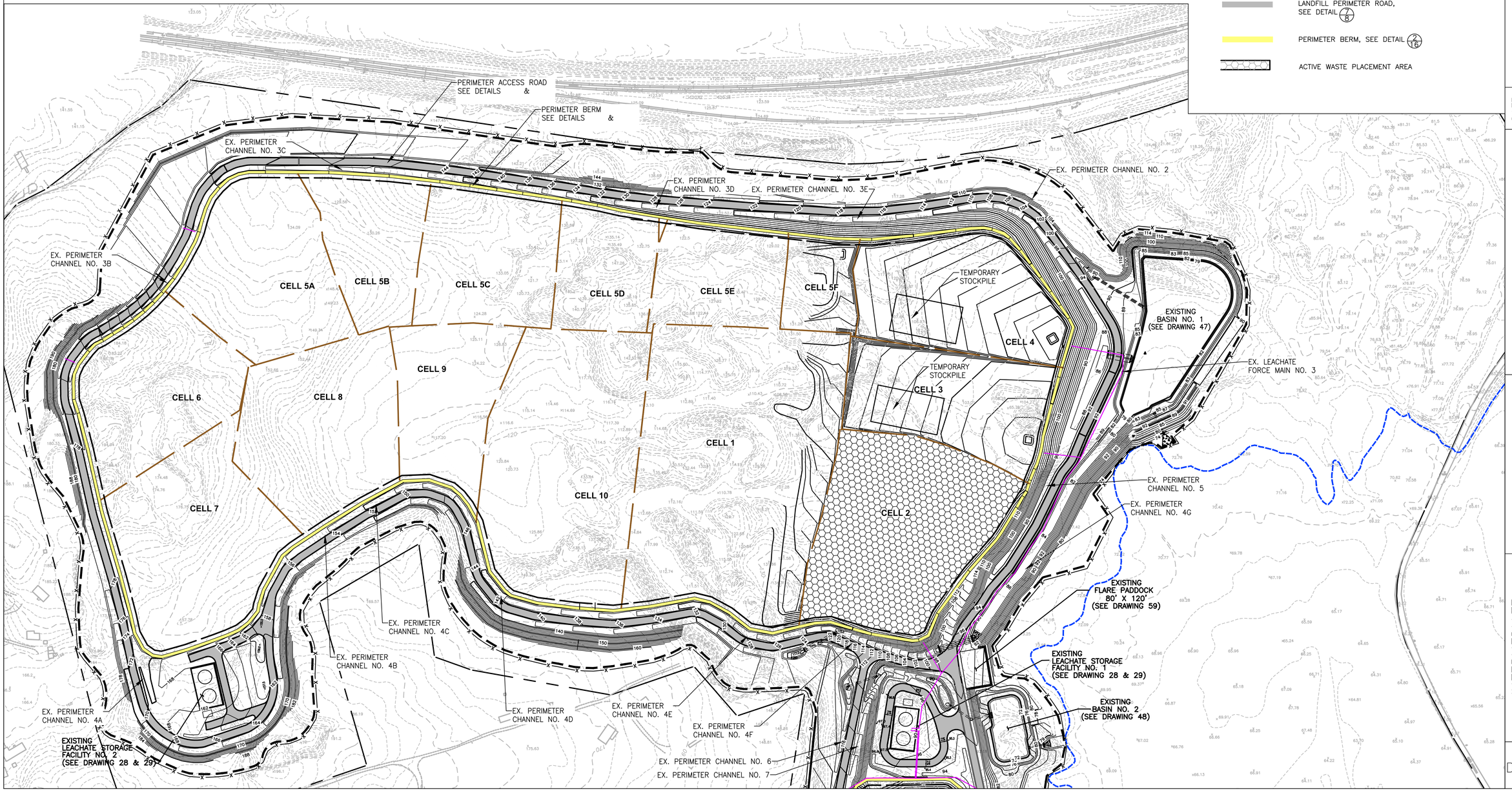
LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



STATE OF MARYLAND — RAYMOND STOCKMAN — 21615 — REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
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INTERMEDIATE CONSTRUCTION STAGE I (CELL 2)

PROJECT MANAGER: PCS | SCALE: AS NOTED
CHECKED BY: PCS | PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF | DATE: 09/03/2021

DRAWING 72

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\DWG\SC & Phase III Application\Drawings\Final\2018854 MP2 - INTERMEDIATE CONSTRUCTION STAGE I (CELL 2).dwg

REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.

NOTES

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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13 ,17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION

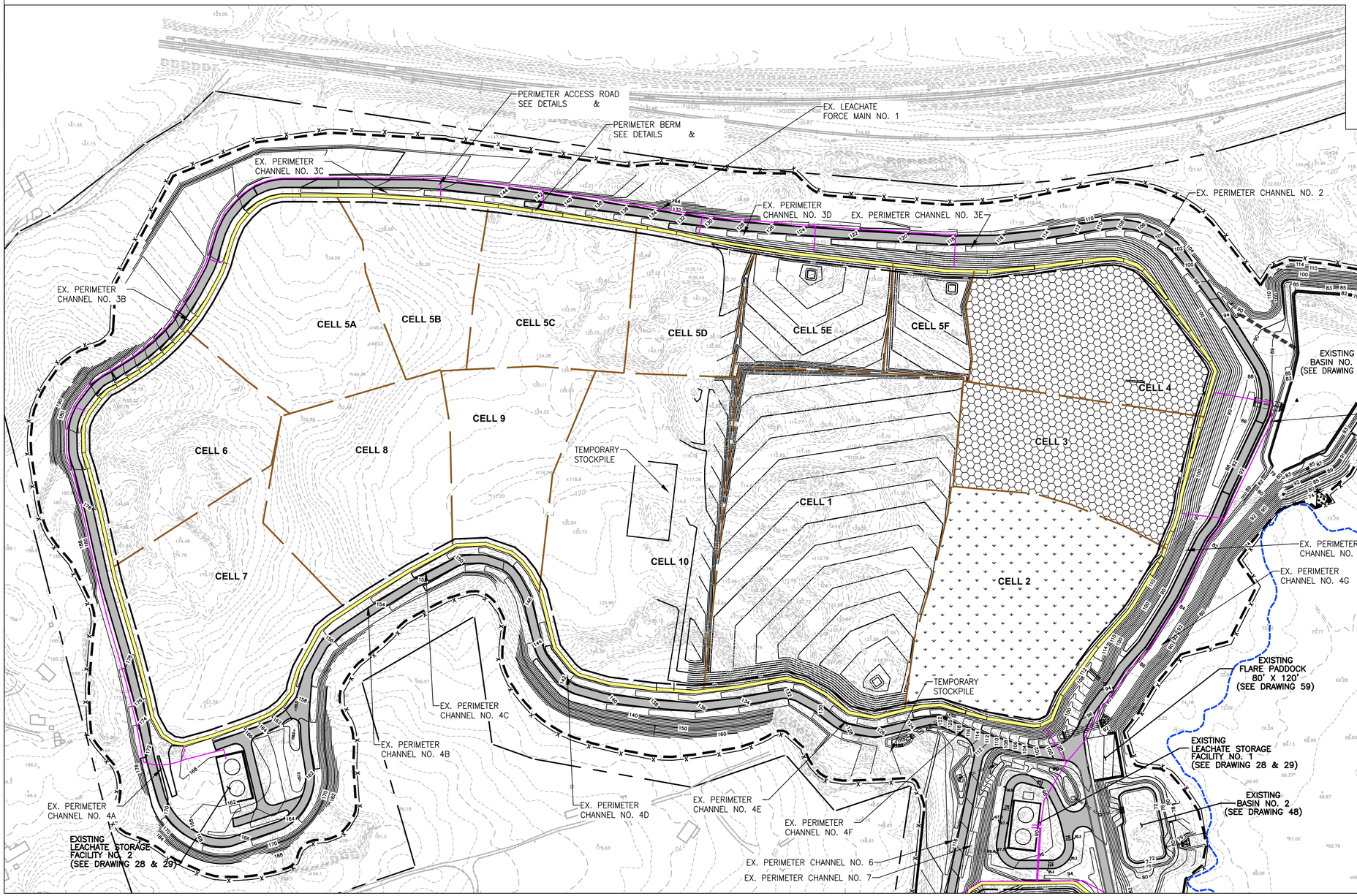
SEQUENCE OF CONSTRUCTION FOR CELLS 3 & 4

1. AS LANDFILLING IN CELLS 3&4 ADVANCES, BEGIN EXCAVATION OF CELLS 1, 5E AND 5F.
2. INSTALL FORCE MAIN #1.
3. RE–USE EXCAVATED SOILS FOR BERM AND ROAD CONSTRUCTION, AS NEEDED.
4. PLACE FINAL COVER AND FINAL CAP ON PORTIONS OF CELLS 2, 3 AND 4 AS THEY ACHIEVE MAXIMUM FILLING GRADES.
5. ADVANCE LINER SYSTEM CONSTRUCTION IN CELL 1, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM.
6. UPON APPROVAL OF CELL 1 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 1.

LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.



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REVISION:
DATE:
9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

INTERMEDIATE CONSTRUCTION STAGE J (CELLS 3 AND 4)

PROJECT MANAGER:	POS	SCALE:AS NOTED
CHECKED BY:	POS	PROJECT NUMBER: 2018 – 3854
DRAWN BY:	KHF	DATE:09/03/2021

DRAWING 73

STATE OF MARYLAND · RAYMOND STACKMAN · 21615 · PROFESSIONAL ENGINEER

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REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
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NOTES

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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

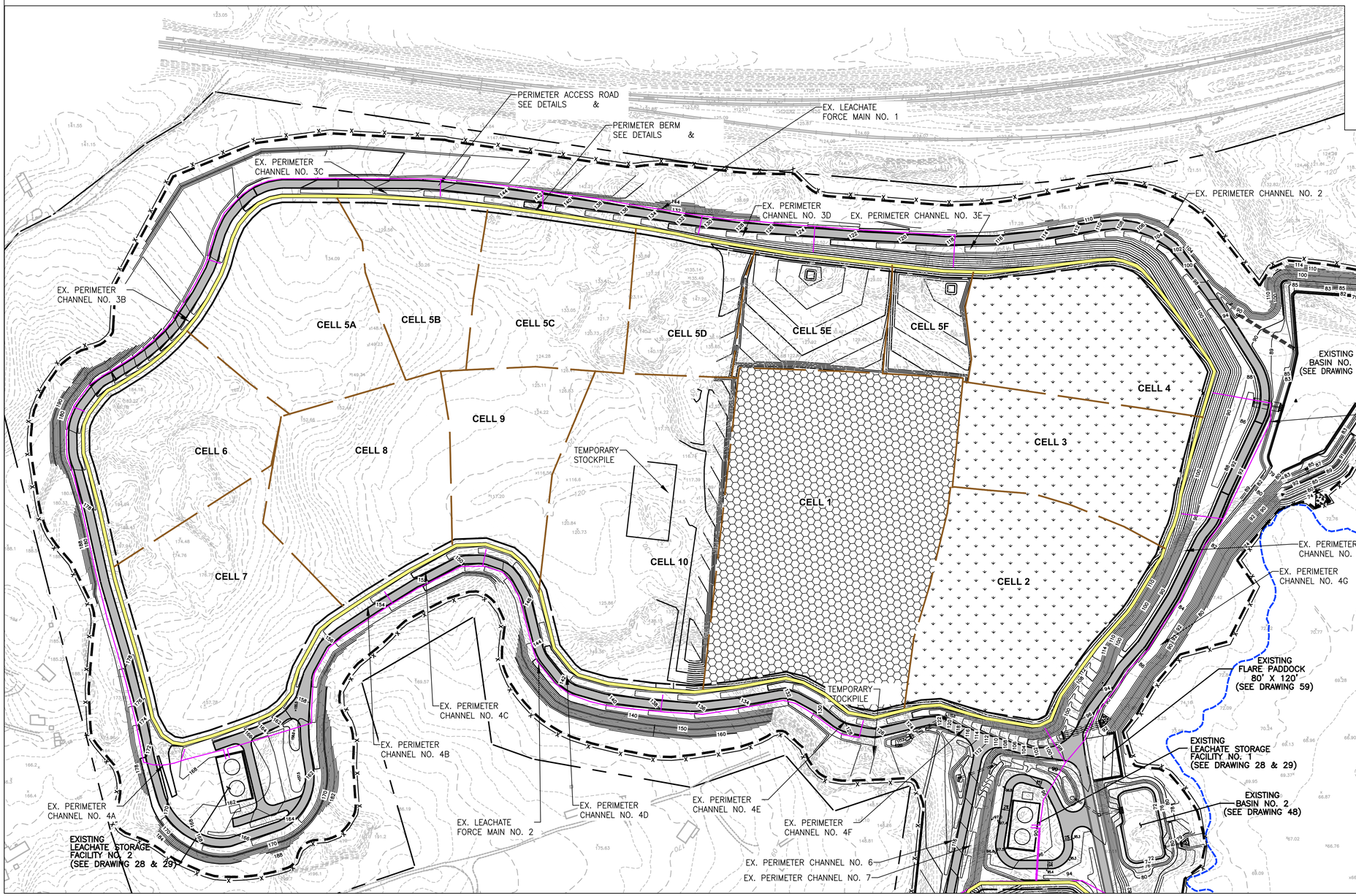
SEQUENCE OF CONSTRUCTION FOR CELL 1

1. AS LANDFILLING IN CELL 1 ADVANCES, INSTALL LINER SYSTEM CONSTRUCTION IN CELL 5E, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 5E.
2. UPON APPROVAL OF CELL 5E LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 5E.
3. PLACE INTERMEDIATE COVER AND VEGETATE PORTIONS OF CELLS 3 & 4 WHICH ACHIEVE MAXIMUM FILLING GRADES.

LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.



STATE OF MARYLAND — RAFAEL O. STEINMAN — 21615 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
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INTERMEDIATE CONSTRUCTION STAGE K (CELL 1)

PROJECT MANAGER: PGS | SCALE: AS NOTED
CHECKED BY: PGS | PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF | DATE: 09/03/2021

DRAWING 74

N:\Projects\2018\3854 - Chesapeake Terrace LF\CAD\DWG\R & Phase III Application\Drawings\Final\3854RA.RTX - INTERMEDIATE CONSTRUCTION STAGE K CELL 1.dwg

REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.

NOTES

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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

SEQUENCE OF CONSTRUCTION FOR CELL 5E

1. AS LANDFILLING IN CELL 5E AND 5F ADVANCES, EXCAVATE CELLS 5D AND 10 TO ACHIEVE SUBBASE ELEVATIONS.
2. INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELLS 5D & 10.
3. UPON APPROVAL OF CELLS 5D & 10 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELLS 5D & 10.
4. PLACE FINAL COVER AND CLOSURE CAP IN PORTIONS OF CELL 1 WHICH ACHIEVE MAXIMUM FILLING GRADES.

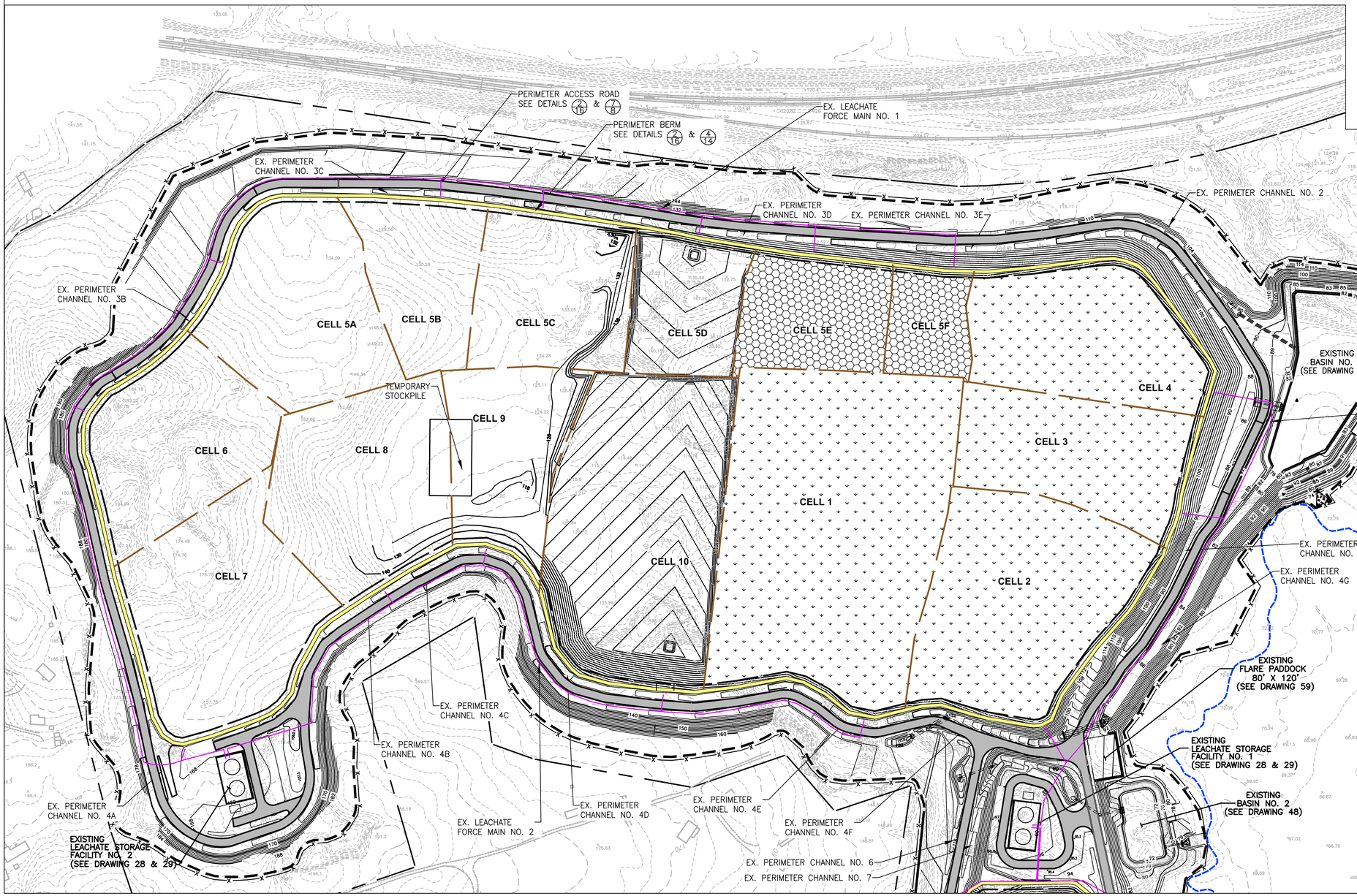
LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

INTERMEDIATE CONSTRUCTION STAGE I (CELLS 5E AND 5F)

PROJECT MANAGER: PGS
CHECKED BY: PGS
DRAWN BY: KHF
SCALE: AS NOTED
PROJECT NUMBER: 2018 – 3854
DATE: 09/03/2021

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DRAWING 75

STATE OF MARYLAND PATRICK G. SHERMAN 21585 REGISTERED PROFESSIONAL ENGINEER

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REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

SEQUENCE OF CONSTRUCTION FOR CELL 5D & 10

1. AS LANDFILLING IN CELLS 5D & 10 ADVANCES, EXCAVATE CELLS 5C AND 9 TO ACHIEVE SUBBASE ELEVATIONS.
2. INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELLS 5C & 9.
3. UPON APPROVAL OF CELLS 5C & 9 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELLS 5C & 9.
4. PLACE FINAL COVER AND CLOSURE CAP ON PORTIONS OF CELL 5E AND 5F WHICH ACHIEVE MAXIMUM FILLING GRADES.
5. PORTIONS OF CELLS 2, 3, & 4 WILL BE READY TO RECEIVE THE CLOSURE CAP.

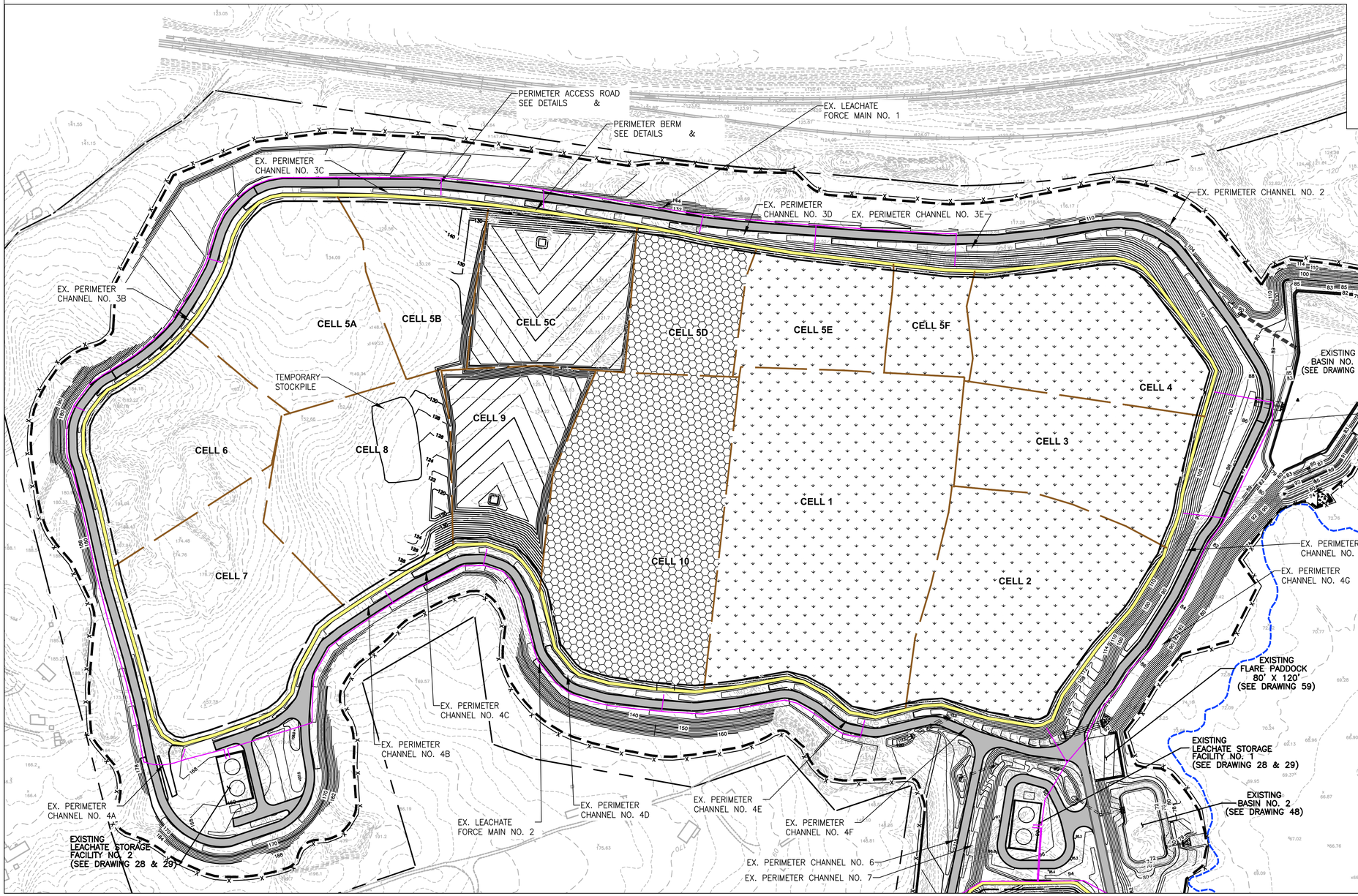
LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



STATE OF MARYLAND — RAYMOND STOCKMAN — 21585 — REGISTERED PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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INTERMEDIATE CONSTRUCTION STAGE M (CELL 5D AND 10)

PROJECT MANAGER: PGS	SCALE: AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF	DATE: 09/03/2021

DRAWING 76

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REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.

NOTES

1. WHILE FEMA HAS RE–ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

SEQUENCE OF CONSTRUCTION FOR CELL 5C AND 9

1. AS LANDFILLING IN CELL 5C & 9 ADVANCES, EXCAVATE CELLS 5A, 5B & 8 TO ACHIEVE SUBBASE ELEVATIONS.
2. INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 8.
3. UPON APPROVAL OF CELL 8 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 8.
4. PLACE FINAL COVER AND FINAL CAP ON PORTIONS OF CELLS 5D & 10 WHICH ACHIEVE MAXIMUM FILLING GRADES.

LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.

PERIMETER ACCESS ROAD SEE DETAILS 2/16 & 7/8
TEMPORARY STOCKPILE
PERIMETER BERM SEE DETAILS 2/16 & 4/14
EX. LEACHATE FORCE MAIN NO. 1
TEMPORARY STOCKPILE
EX. PERIMETER CHANNEL NO. 3C
EX. PERIMETER CHANNEL NO. 3D
EX. PERIMETER CHANNEL NO. 3E
EX. PERIMETER CHANNEL NO. 2
EX. PERIMETER CHANNEL NO. 3B
CELL 5A
CELL 5B
CELL 5C
CELL 5D
CELL 5E
CELL 5F
CELL 4
CELL 9
CELL 6
CELL 8
CELL 3
CELL 1
CELL 7
CELL 10
CELL 2
EXISTING BASIN NO. 1 (SEE DRAWING 47)
EX. LEACHATE FORCE MAIN NO. 3
EX. PERIMETER CHANNEL NO. 5
EX. PERIMETER CHANNEL NO. 4G
EXISTING FLARE PADDOCK 80' X 120' (SEE DRAWING 59)
EX. PERIMETER CHANNEL NO. 4C
EX. PERIMETER CHANNEL NO. 4B
EX. PERIMETER CHANNEL NO. 4A
EXISTING LEACHATE STORAGE FACILITY NO. 2 (SEE DRAWING 28 & 29)
EX. LEACHATE FORCE MAIN NO. 2
EX. PERIMETER CHANNEL NO. 4D
EX. PERIMETER CHANNEL NO. 4E
EX. PERIMETER CHANNEL NO. 4F
EX. PERIMETER CHANNEL NO. 6
EX. PERIMETER CHANNEL NO. 7
EXISTING LEACHATE STORAGE FACILITY NO. 1 (SEE DRAWING 28 & 29)
EXISTING BASIN NO. 2 (SEE DRAWING 48)

STATE OF MARYLAND — RAYMOND P. STOCKMAN — 21615 — PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices — a Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
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INTERMEDIATE CONSTRUCTION STAGE N (CELL 5C AND 9)

PROJECT MANAGER: PGS	SCALE: AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF	DATE: 09/03/2021

DRAWING 77

N:\Projects\2018\2018854 - Chesapeake Terrace LF\CAD\GWSR & Phase III Application\Drawings\Final\2018854 B077 - INTERMEDIATE CONSTRUCTION STAGE N, CELL 5C AND 9.dwg

REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.

NOTES

1. WHILE FEMA HAS RE–ASSESSED AND MODIFIED THE 100 YEAR FLOOD PLAIN IN THE VICINITY OF THE SITE, THE PROPOSED LANDFILL PERIMETER ROAD BERM GRADES ARE PROPOSED A MINIMUM OF 5 FEET ABOVE THE NEW FEMA BASE FLOOD ELEVATIONS.
2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

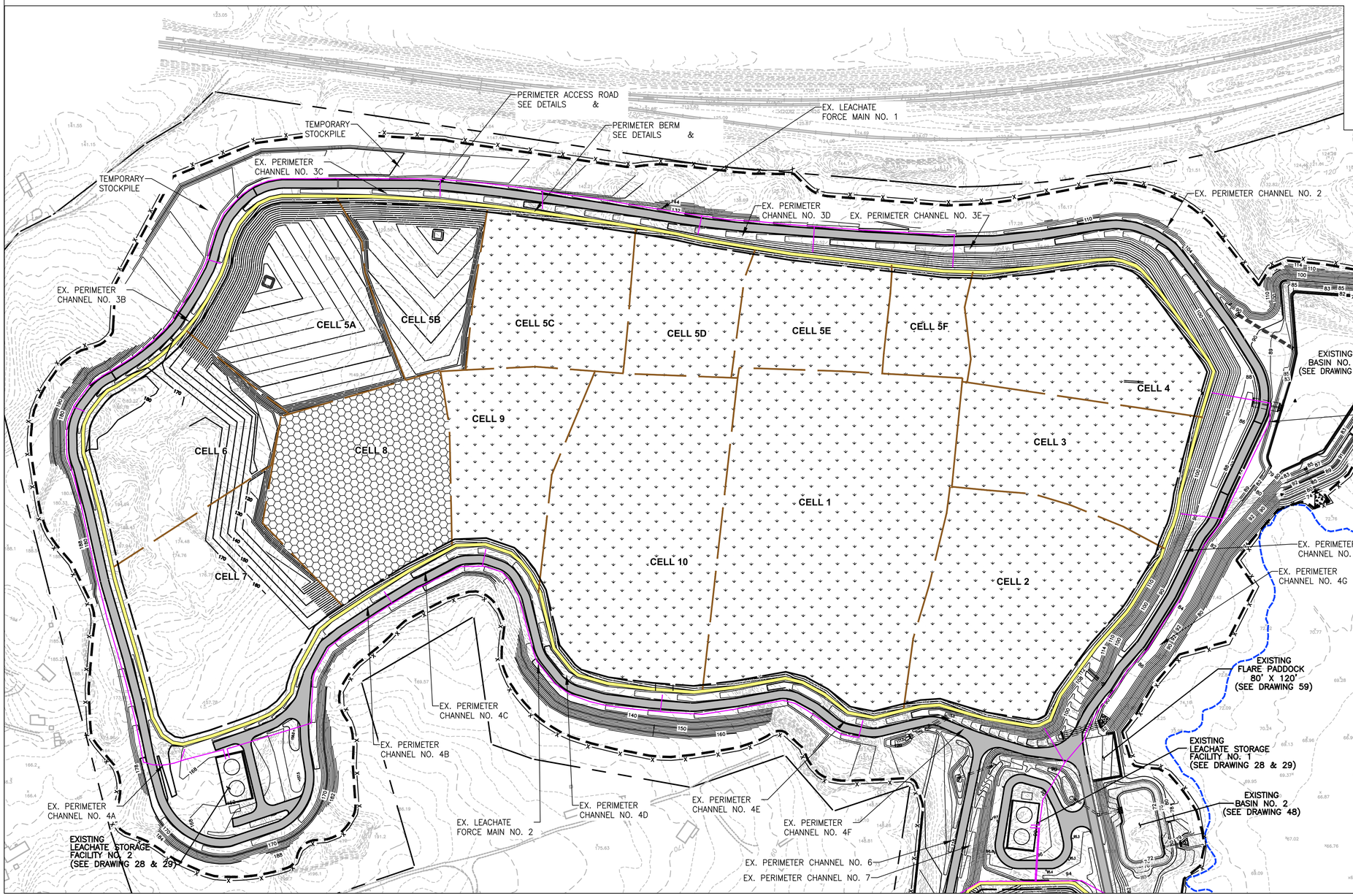
SEQUENCE OF CONSTRUCTION FOR CELL 8

1. AS LANDFILLING IN CELL 8 ADVANCES, INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELLS 5A & 5B.
2. UPON APPROVAL OF CELLS 5A & 5B LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELLS 5A & 5B.
3. PLACE FINAL COVER AND CLOSURE CAP ON PORTIONS OF CELL 5C & 9 WHICH ACHIEVE MAXIMUM FILLING GRADES.

LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE
150 0 75 150 300 600
1 inch = 150 ft.



REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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INTERMEDIATE CONSTRUCTION STAGE 0 (CELL 8)

PROJECT MANAGER: PGS | SCALE: AS NOTED
CHECKED BY: PGS | PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF | DATE: 09/03/2021

DRAWING 78

STATE OF MARYLAND
RICHARD STRICKMAN
No. 21708
PROFESSIONAL ENGINEER

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REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
2. THE POST–2012 100–YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3 OF THE PHASE II REPORT.

NOTES

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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

SEQUENCE OF CONSTRUCTION FOR 5A & 5B

1. AS LANDFILLING IN CELLS 5A & 5B ADVANCES, EXCAVATE CELLS 6 & 7 TO ACHIEVE SUBGRADE ELEVATIONS.
2. INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 6.
3. UPON APPROVAL OF CELL 6 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 6.
4. PLACE FINAL COVER AND CLOSURE CAP ON PORTIONS OF CELLS 5A, 5B, AND 8 WHICH ACHIEVE MAXIMUM FILLING GRADES.

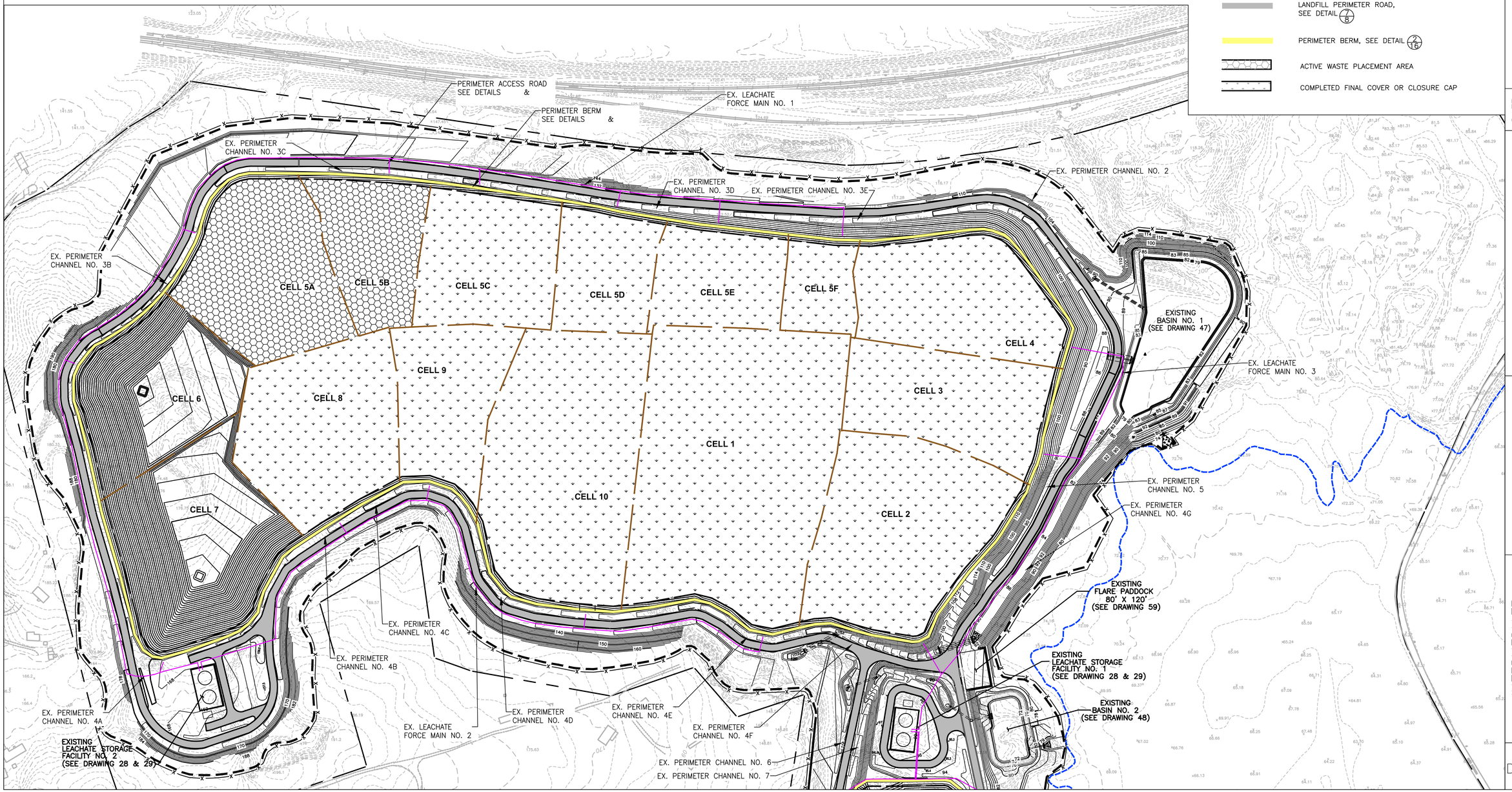
LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
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INTERMEDIATE CONSTRUCTION STAGE PLAN (CELLS 5A & 5B)

PROJECT MANAGER:	POS
CHECKED BY:	POS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

DRAWING 79

STATE OF MARYLAND
KAREN H. FAIRMAN
No. 21583
PROFESSIONAL ENGINEER

N:\Projects\3718\3718354 - Chesapeake Terrace\1\FACWORK\ 8 Phase III Application\Drawings\Final\3718354 INTR - INTERMEDIATE CONSTRUCTION STAGE 8 - 03.11.54.9.56.dwg

REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

SEQUENCE OF CONSTRUCTION FOR CELL 6

1. AS LANDFILLING IN CELL 6 ADVANCES, INSTALL LINER SYSTEM, INCLUDING LEACHATE COLLECTION AND REMOVAL SYSTEM, IN CELL 7.
2. UPON APPROVAL OF CELL 7 LINER SYSTEM CONSTRUCTION, BEGIN LANDFILLING OPERATIONS IN CELL 7.
3. PLACE FINAL COVER AND CLOSURE CAP ON PORTIONS OF CELLS 5A & 5B WHICH ACHIEVE MAXIMUM FILLING GRADES.

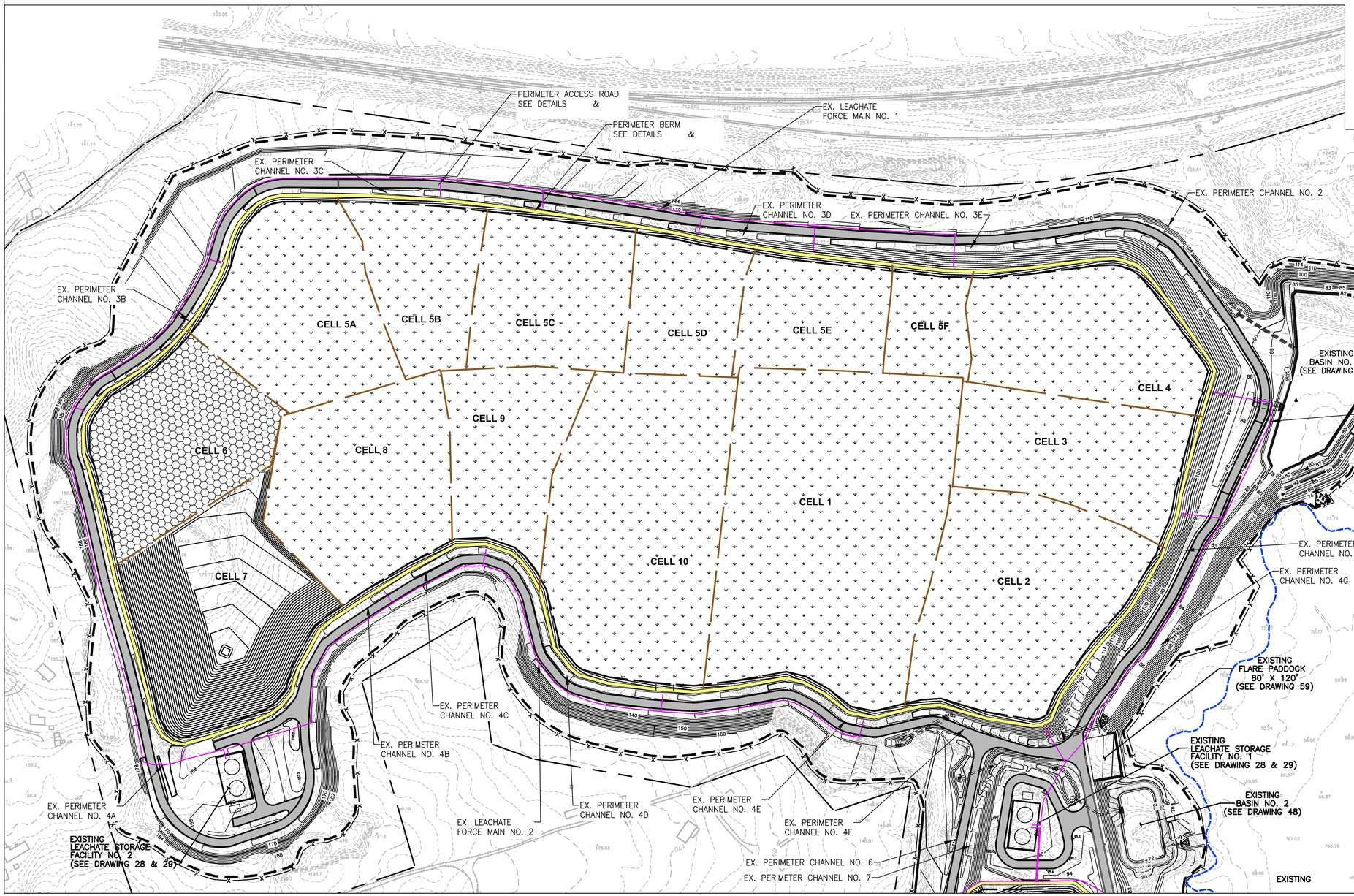
LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LIMIT OF DISTURBANCE
- LEACHATE FORCE MAIN
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



REVISION:

DATE:	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3
9/03/2021	

NATIONAL WASTE MANAGERS

PHASE III APPLICATION

CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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INTERMEDIATE CONSTRUCTION STAGE Q (CELL 6)

PROJECT MANAGER:	PGS	SCALE: AS NOTED	
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 80

STATE OF MARYLAND · KARL H. FISCHER · 21708 · REGISTERED PROFESSIONAL ENGINEER

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REFERENCES

1. BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.
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NOTES

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2. SEE DRAWINGS 6, 7, 10, 11, 12, 13, 17, AND 18 FOR BOTTOM OF CELL AND LINER SYSTEM GRADING INFORMATION.

SEQUENCE OF CONSTRUCTION FOR CELL 7

1. AS LANDFILLING IN CELL 7 ADVANCES, PLACE FINAL COVER AND CLOSURE CAP ON CELL 6 WHICH ACHIEVES MAXIMUM FILLING GRADES.

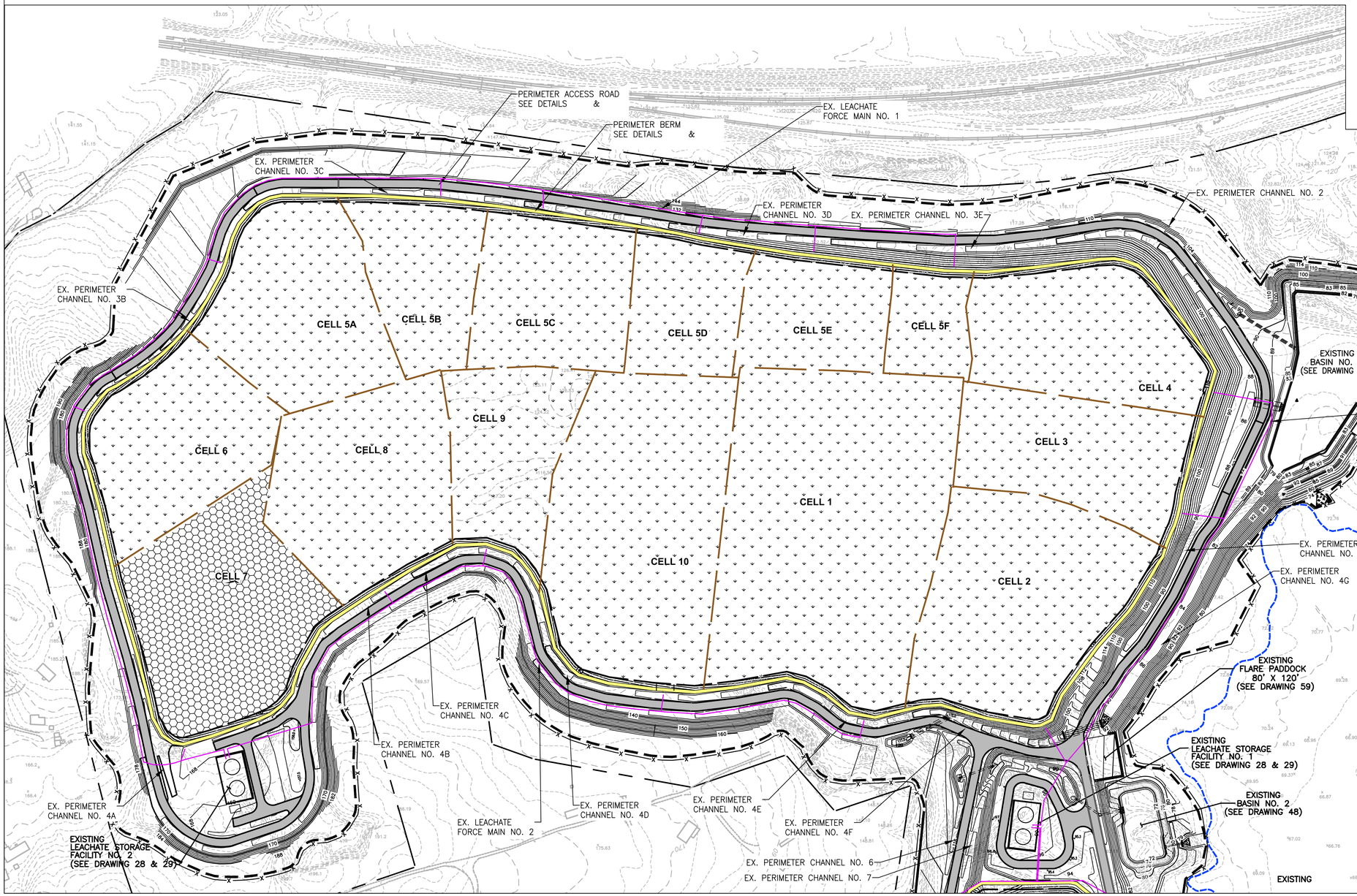
LEGEND

- PROPERTY LINE
- 100–YEAR FLOODPLAIN (SEE REF. 2)
- EXISTING 2 FT INCREMENT CONTOUR
- EXISTING 5 FT INCREMENT CONTOUR
- PROPOSED 2 FT INCREMENT CONTOUR
- PROPOSED 10 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION BOUNDARY
- LEACHATE FORCE MAIN
- LIMIT OF DISTURBANCE
- PIPE
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- LANDFILL PERIMETER ROAD, SEE DETAIL 7/8
- PERIMETER BERM, SEE DETAIL 2/16
- ACTIVE WASTE PLACEMENT AREA
- COMPLETED FINAL COVER OR CLOSURE CAP

GRAPHIC SCALE

150 0 75 150 300 600

1 inch = 150 ft.



REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
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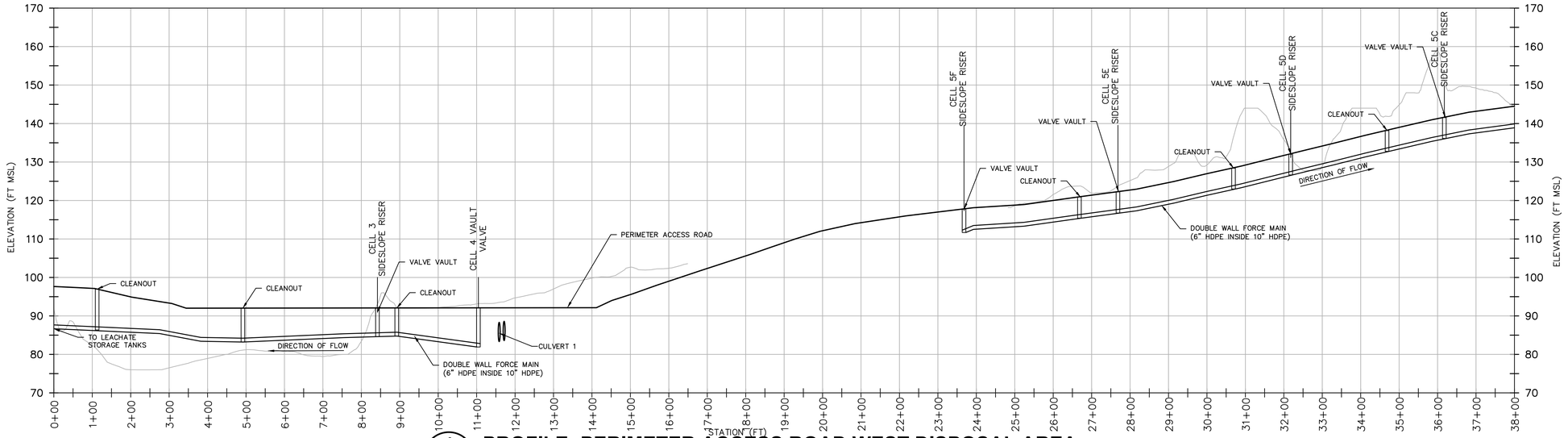
INTERMEDIATE CONSTRUCTION STAGE R (CELL 7)

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE: AS NOTED	
PROJECT NUMBER:	2018 – 3854
DATE:	09/03/2021

DRAWING 81

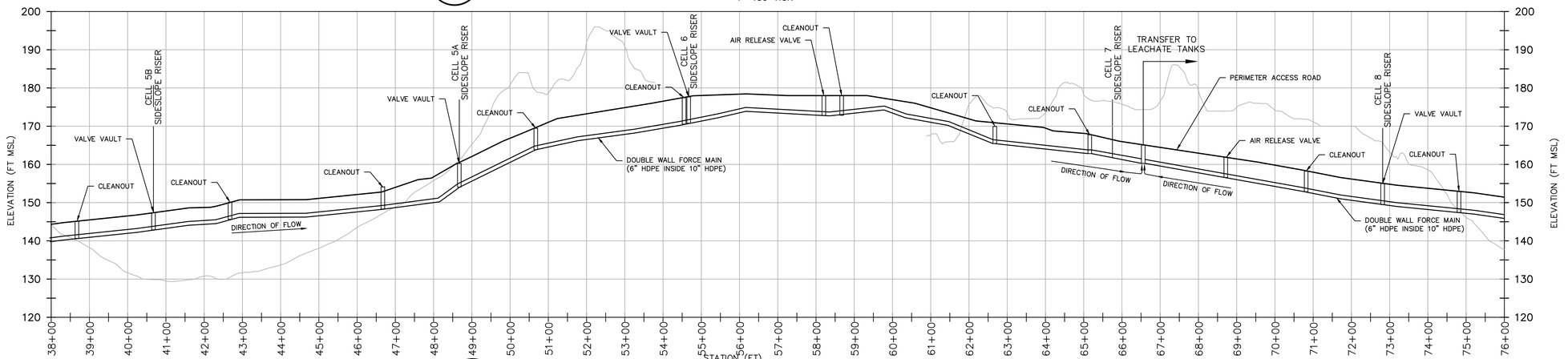
STATE OF MARYLAND · RICHARD STRICKMAN · 21615 · PROFESSIONAL ENGINEER

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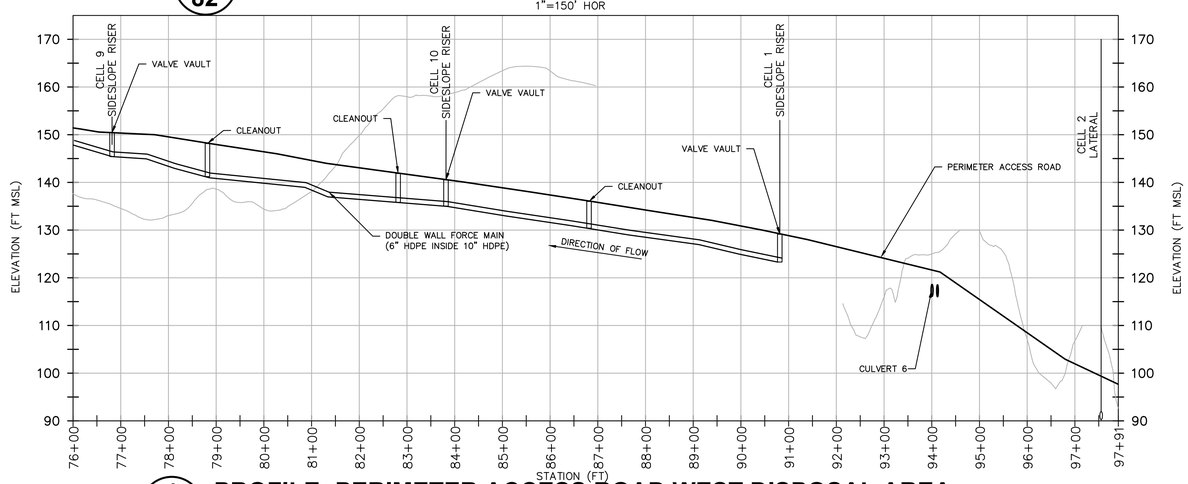
1/82 PROFILE- PERIMETER ACCESS ROAD WEST DISPOSAL AREA

SCALE: 1"=15' VERT
1"=150' HOR



1/82 PROFILE- PERIMETER ACCESS ROAD WEST DISPOSAL AREA

SCALE: 1"=15' VERT
1"=150' HOR



1/82 PROFILE- PERIMETER ACCESS ROAD WEST DISPOSAL AREA

SCALE: 1"=15' VERT
1"=150' HOR

NOTE

1.) SEE DRAWINGS 17 AND 18 FOR STATIONS OF PERIMETER ACCESS ROAD.

SCALE: VERTICAL— 0 7.5 15 30 1 INCH = 15 FT
HORIZONTAL— 0 75 150 300 1 INCH = 150 FT

STATE OF MARYLAND · RAYMOND STACKMAN · LICENSE NO. 19851 · PROFESSIONAL ENGINEER

REVISION:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

DATE:

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

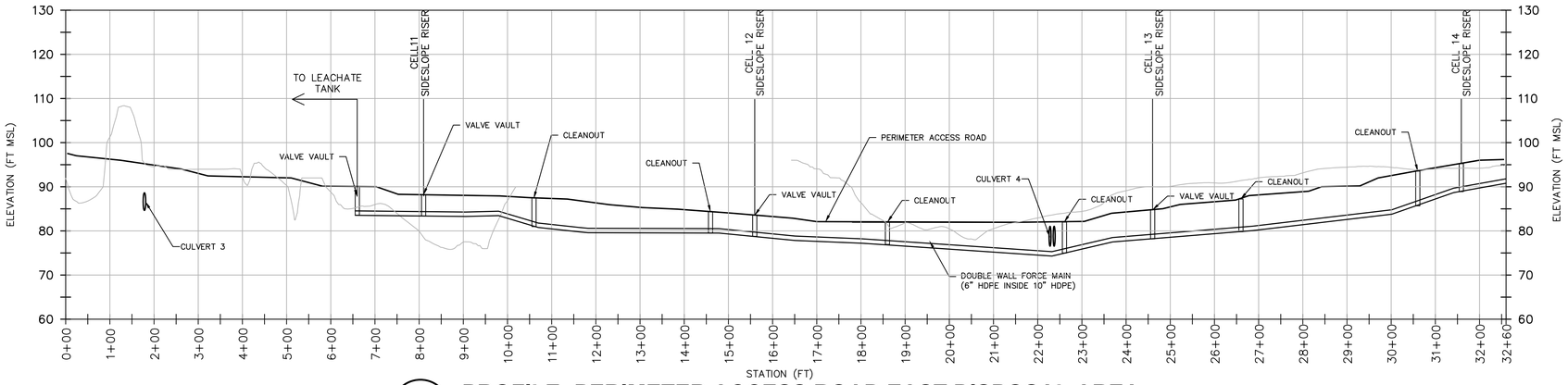
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PERIMETER ACCESS ROAD PROFILES (SHEET 1 OF 2)

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 - 3854
DRAWN BY: KHF	DATE:09/03/2021

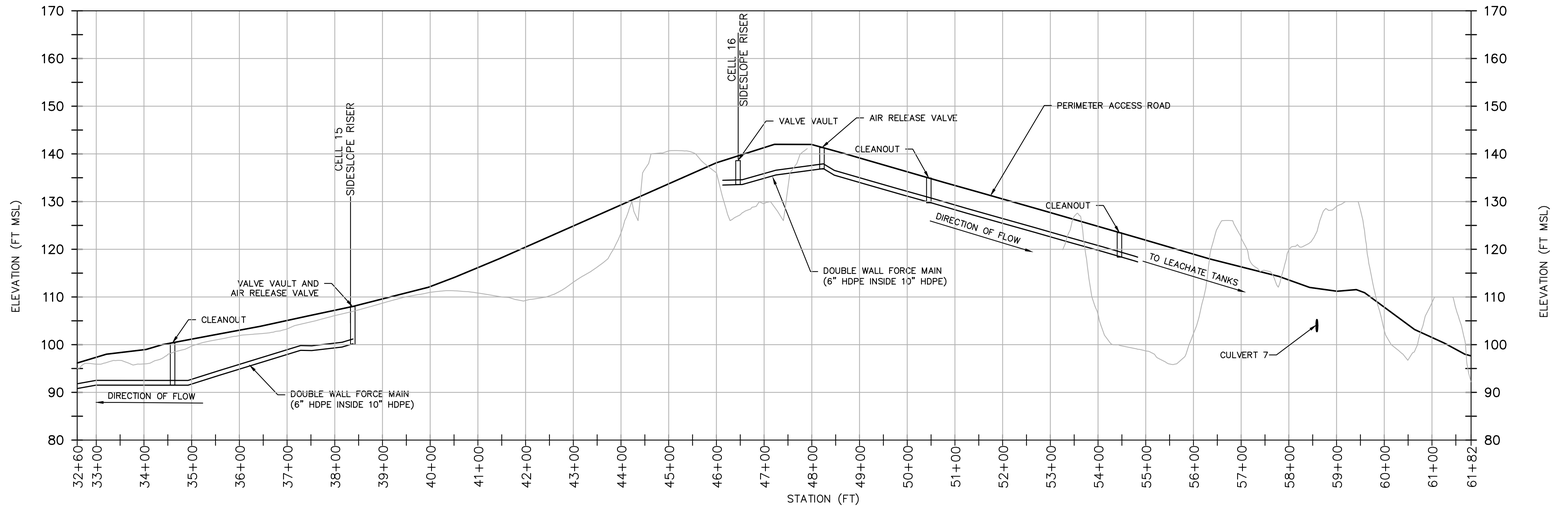
DRAWING 82

N:\Projects\2018\20183854 - Chesapeake Terrace LF\CAD\DWG\RC B_Phase III Application\Drawings\Final\20183854 B082 - PERIMETER ACCESS ROAD PROFILES (SHEET 1 OF 2).dwg



1/83 PROFILE- PERIMETER ACCESS ROAD EAST DISPOSAL AREA

SCALE: 1"=15' VERT
1"=150' HOR



2/83 PROFILE- PERIMETER ACCESS ROAD EAST DISPOSAL AREA

SCALE: 1"=15' VERT
1"=150' HOR

NOTE

1.) SEE DRAWINGS 17 AND 18 FOR STATIONS OF PERIMETER ACCESS ROAD.

SCALE: VERTICAL— 0 7.5 15 30 (1 INCH = 15 FT)
HORIZONTAL— 0 75 150 300 (1 INCH = 150 FT)

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

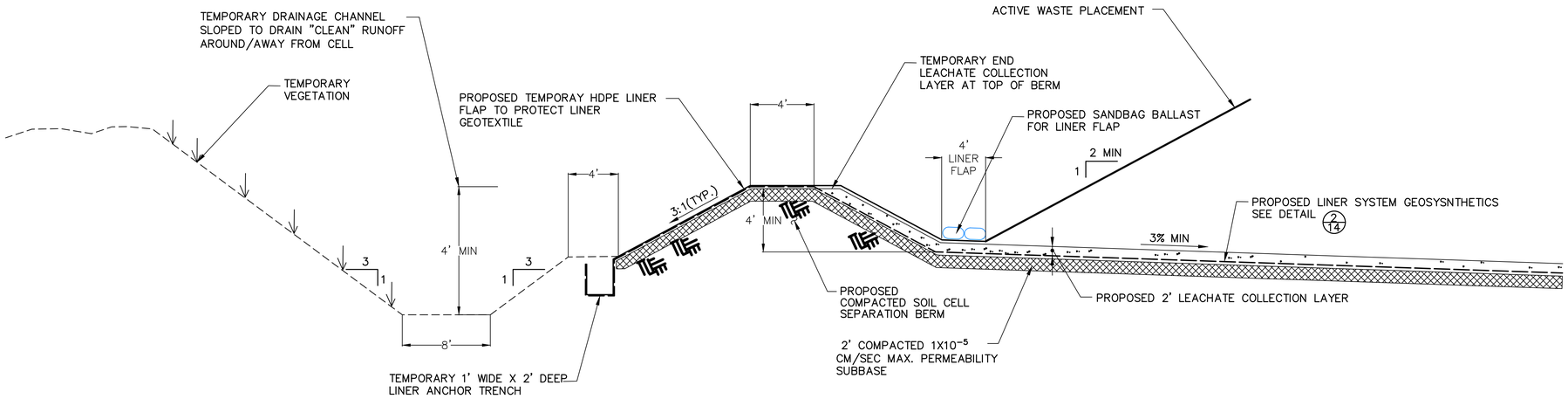
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PERIMETER ACCESS ROAD
PROFILES (SHEET 2 OF 2)

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 83

N:\Projects\2018\20183854 - Chesapeake Terrace LFI\CAD\DWG\RC B_Phase III Application\Drawings\Final\20183854 B083 - PERIMETER ACCESS ROAD PROFILES (SHEET 2 OF 2).dwg



NOTES

1. CELL SEPARATION BERM SHALL BE CONSTRUCTED PER DETAIL 5/14
2. THIS TYPICAL CONFIGURATION IS FOR LOCATION WHERE EXTERIOR GRADE IS EQUAL TO OR HIGHER THAN CELL BOTTOM.

TYPICAL STORMWATER SEPARATION (AT INTERCELL BERM ALONG UNLINED/UNFILLED AREA)

1/84

NOT TO SCALE

N:\Projects\2018\20183854 - Chesapeake Terrace LFI\CAD\DWG\IRC B_Phase III Application\Drawings\Final\20183854 B084 - INTERMEDIATE STORMWATER SEPARATION.dwg

STATE OF MARYLAND
RICHARD STRICKMAN
RAW-OSTM
No. 19981
PROFESSIONAL ENGINEER

REVISION:
DATE:
9/03/2021 REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

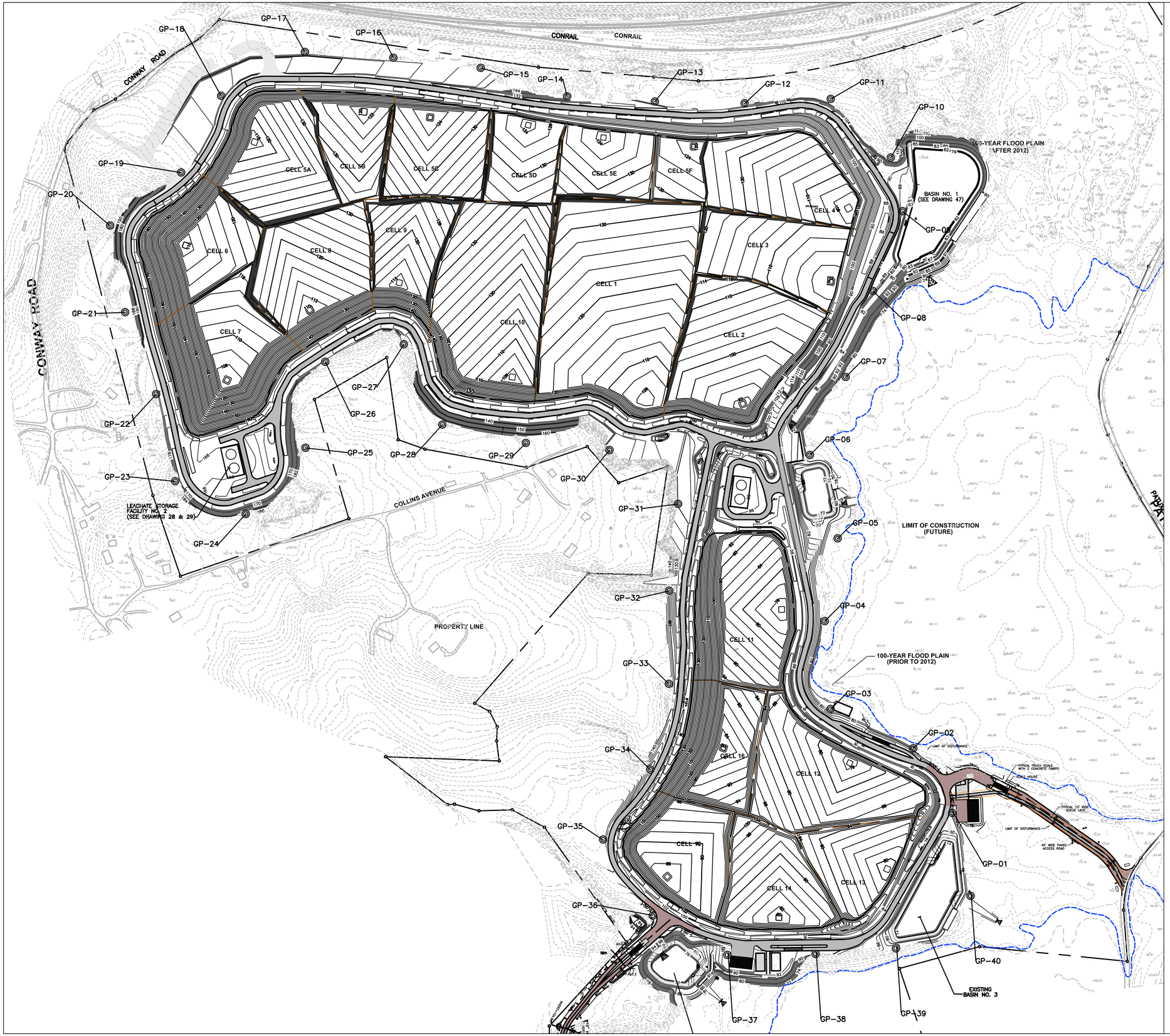
NATIONAL WASTE MANAGERS
PHASE III APPLICATION
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PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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INTERMEDIATE
STORWATER SEPARATION

PROJECT MANAGER: PGS	SCALE:AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF	DATE:09/03/2021

DRAWING 84



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN
- GP-24 GAS MONITORING PROBE (3/88)
- PROPOSED ACCESS ROAD

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) HYDROGEOLOGIC AREAS AND MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

NOTES

1. THE PURPOSE OF THIS DRAWING IS TO SHOW THE PROPOSED LOCATIONS OF THE GAS MONITORING PROBES. PROPOSED LOCATIONS ARE APPROXIMATELY 400 FEET ON-CENTER AND LOCATED OUTSIDE THE PERIMETER ACCESS ROAD AND INSIDE THE SITE SECURITY FENCE.
2. THE PROPOSED SCALE HOUSE AND MAINTENANCE BUILDINGS SHALL BE MONITORED AS PART OF THE LANDFILL GAS MONITORING PLAN. (GP-01 AND GP-37)

240 0 120 240 480 960

1 INCH = 240 FT

STATE OF MARYLAND · RICHARD STRAKHMAN · LICENSE NO. 21586 · PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

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LANDFILL GAS PERIMETER PROBE MONITORING PLAN

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 - 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 85

N:\Projects\2018\2018854 - Chesapeake Terrace\CAD\ENGINEERING & Phase III Application\Drawings\Final\2018854 BMS - LANDFILL GAS PERIMETER MONITORING PLAN.dwg



LEGEND

- GP-24 — GAS MONITORING PROBE (3/88)
- PROPERTY LINE
- CELL DRAINAGE DIVIDE
- ACCESS ROAD
- LEACHATE FORCE MAIN
- PROPOSED FINAL GRADE
- HEADER/LATERAL (1/88)
- EW-85 — LANDFILL GAS EXTRACTION WELL (2/88)
- ISOLATION VALVE (4/88)
- LEACHATE SIDE SLOPE RISERS (4/88)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) HYDROGEOLOGIC AREAS AND MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

1 INCH = 150 FT

STATE OF MARYLAND — RICHARD STRICKMAN — LICENSED PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

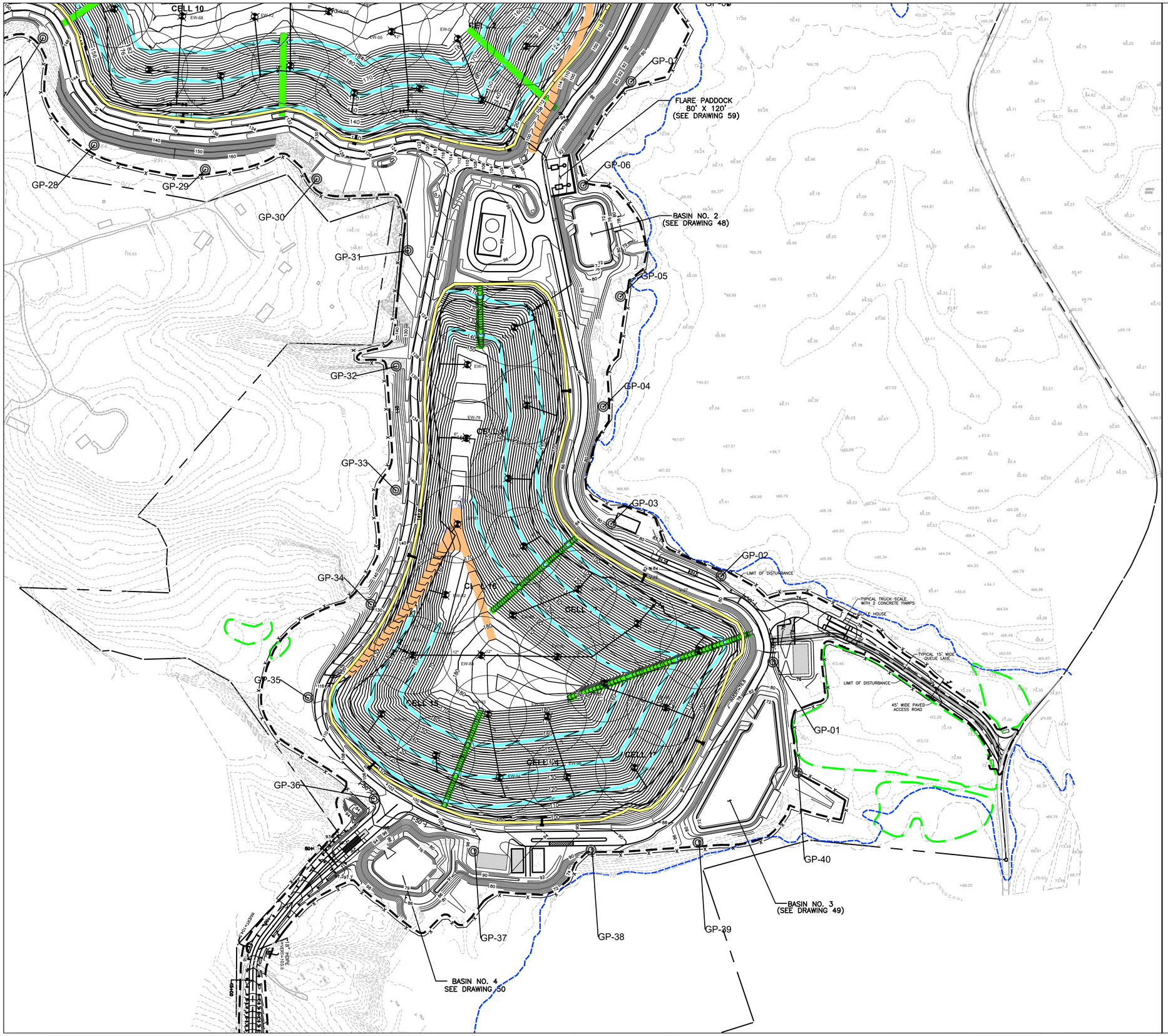
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WEST SECTION
LANDFILL GAS COLLECTION
CONTROL SYSTEM PLAN

PROJECT MANAGER: PGS	SCALE: AS NOTED
CHECKED BY: PGS	PROJECT NUMBER: 2018 – 3854
DRAWN BY: KHF	DATE: 09/03/2021

DRAWING 86

N:\Projects\2018\20183854 - Chesapeake Terrace LF\CAD\DWG\KC 8_Phase III Application\Drawings\Final\20183854 8086 - WEST SECTION LANDFILL GAS COLLECTION CONTROL SYSTEM PLAN.dwg



LEGEND

- GP-24 — GAS MONITORING PROBE (3/88)
- PROPERTY LINE
- CELL DRAINAGE DIVIDE
- ACCESS ROAD
- PM — LEACHATE FORCE MAIN
- 220 — PROPOSED FINAL GRADE
- HEADER/LATERAL (1/88)
- EW-85 — LANDFILL GAS EXTRACTION WELL (2/88)
- ISOLATION VALVE (4/88)
- LEACHATE SIDE SLOPE RISERS (4/88)

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) HYDROGEOLOGIC AREAS AND MONITORING WELL LOCATIONS DIGITIZED FROM HARD COPY OF DRAWING ENTITLED "PERMANENT GROUNDWATER MONITORING WELL PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED MAY 2008.

3.) ADDITIONAL HISTORICAL BORING LOCATIONS FROM HARD COPY OF DRAWING ENTITLED "PLATE 2, CHESAPEAKE RUBBLE LANDFILL HYDROGEOLOGIC BASE MAP," DATED NOVEMBER 2003, CREATED BY MARK SCHULTZ ASSOCIATES, ANNAPOLIS, MARYLAND.

150 0 75 150 300 600
1 INCH = 150 FT

STATE OF MARYLAND — KENNETH H. FAIRMAN — No. 21708 — PROFESSIONAL ENGINEER

REVISION:

DATE:	REVISION:
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

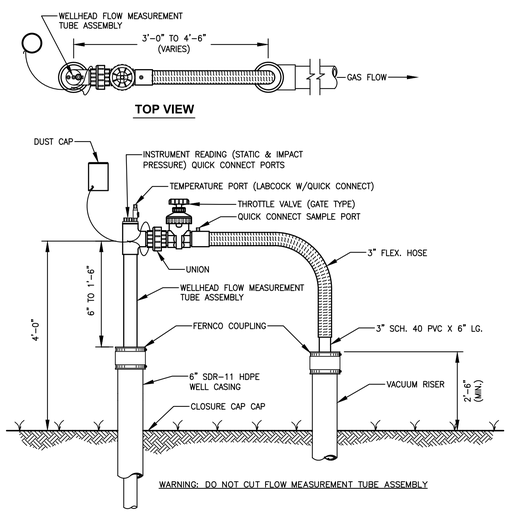
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EAST SECTION
LANDFILL GAS COLLECTION
CONTROL SYSTEM PLAN

PROJECT MANAGER:	PGS	SCALE:	AS NOTED
CHECKED BY:	PGS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

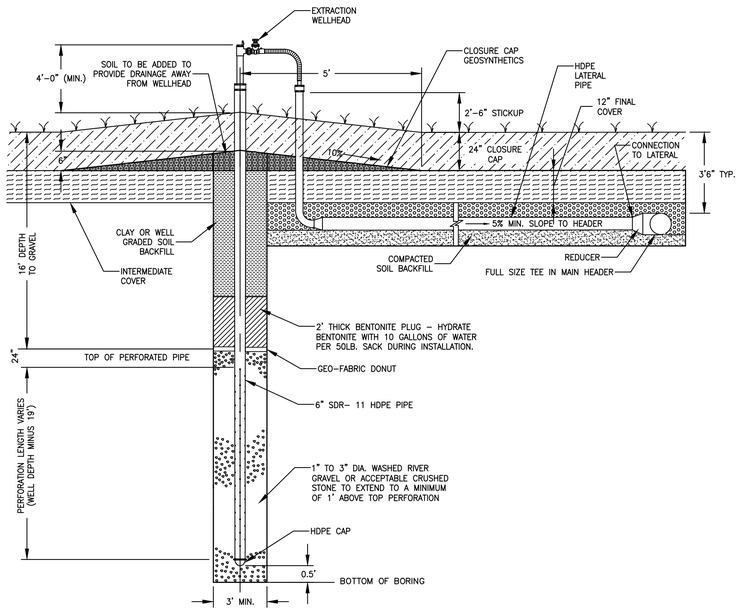
DRAWING 87

N:\Projects\2018\20183854 - Chesapeake Terrace LFG\CAD\DWG\RC B_Phase III Application\Drawings\Final\20183854 B087 - EAST SECTION LANDFILL GAS COLLECTION CONTROL SYSTEM PLAN.dwg



1/88 TYPICAL WELLHEAD FOR ACTIVE GAS EXTRACTION

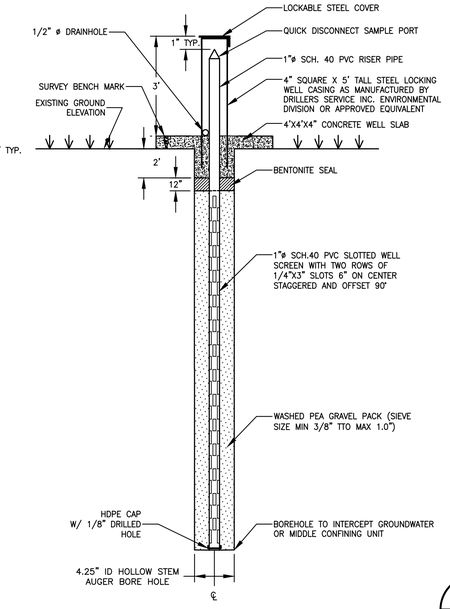
NOT TO SCALE



2/88 TYPICAL LANDFILL GAS WELL (CONNECTED TO EXTRACTION SYSTEM)

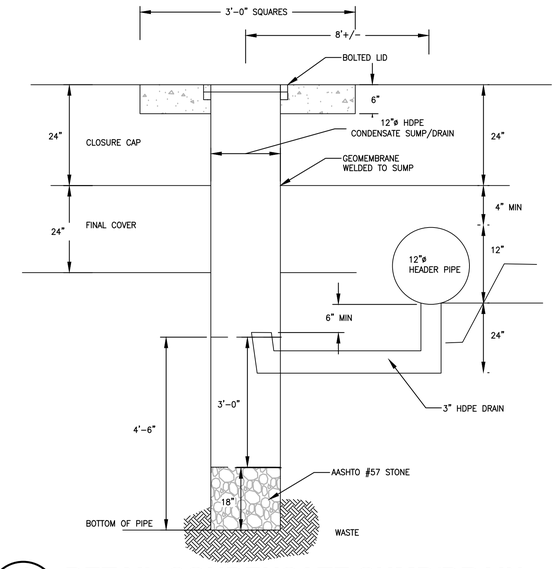
NOT TO SCALE

NOTE: SEE DETAIL 9/88 FOR LANDFILL GAS WELL IN PASSIVE VENTING CONFIGURATION



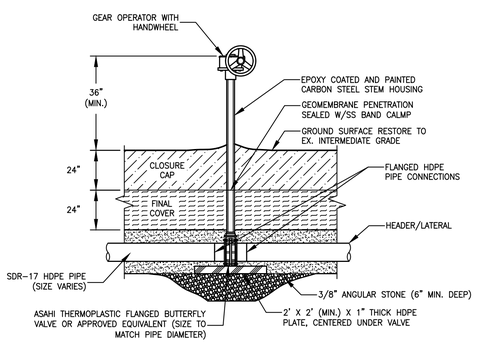
3/88 PERIMETER GAS MONITORING PROBE

NOT TO SCALE



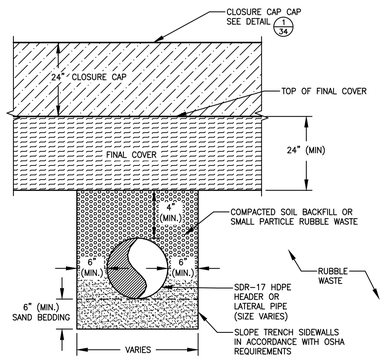
4/88 DETAIL CONDENSATE SUMP/DRAIN

NOT TO SCALE



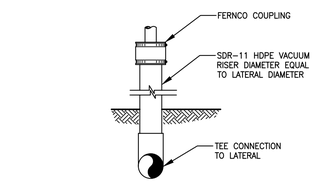
5/88 TYPICAL ISOLATION VALVE

NOT TO SCALE

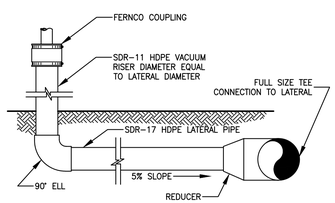


6/88 TYPICAL GAS HEADER AND LATERAL TRENCH

NOT TO SCALE



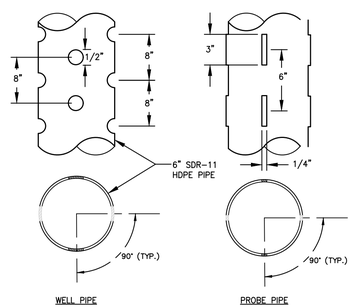
DIRECT CONNECTION TO LATERAL



CONNECTION OFFSET FROM LATERAL

7/88 CONNECTION TO LATERAL

NOT TO SCALE



8/88 PIPE PERFORATION

NOT TO SCALE

NOTES:

1. THE TYPICAL MINIMUM PIPE SLOPE FOR GAS HEADERS AND LATERALS IS FIVE PERCENT (5%) IN RUBBLE WASTE, AND ONE PERCENT (1%) OUTSIDE OF RUBBLE WASTE.
2. ALL HDPE PIPES FOR THE GAS EXTRACTION SYSTEM SHALL BE CONNECTED BY BUTT FUSION, ELECTROFUSION COUPLINGS, OR FLANGED JOINTS. THE INTEGRITY OF THE PIPE AND ALL CONNECTIONS SHALL BE VERIFIED BY THE CONTRACTOR USING AIR PRESSURE TESTING DURING CONSTRUCTION. PASSING TEST: 20 PSI AIR, 20 MINUTES, MAX FIVE PERCENT (5%) PRESSURE DROP.
3. FLANGE CONNECTIONS SHALL BE MADE USING HDPE STUB END FLANGE ADAPTERS, EPOXY COATED CARBON STEEL BACKUP RINGS, STAINLESS STEEL BOLTING HARDWARE COATED WITH ANTI-SIEZE COMPOUND, AND NEOPRENE GASKETS.
4. NO FIELD CONSTRUCTED SADDLE TEES OR BRANCHES ARE PERMITTED.
5. BLIND FLANGES ARE TO BE DRILLED TO ANSI 150# BOLT PATTERN AND CAN BE FABRICATED FROM ONE INCH (1") THICK HDPE FLAT STOCK.
6. ALL TEES USED DURING CONSTRUCTION SHALL BE SIZED ACCORDING TO THE CONNECTING PIPE DIAMETERS. CONCENTRIC REDUCERS SHALL BE USED AS NECESSARY.
7. RUBBLE WASTE REMOVED DURING THE CONSTRUCTION OF THE LANDFILL GAS COLLECTION & CONTROL SYSTEM SHALL BE DISPOSED WITHIN THE ACTIVE LANDFILL WORKFACE BY THE CONTRACTOR, UNLESS USED AS BACKFILL MATERIAL. RUBBLE WASTE USED AS BACKFILL SHALL BE APPROVED BY THE OWNER.
8. SOIL BACKFILL SHALL BE CLEAN MATERIAL FREE OF ORGANIC MATTER, ROOTS, DEBRIS, OR FROZEN MATERIAL, AND SHALL HAVE A MAXIMUM TWO INCH (2") PARTICLE SIZE.
9. CONTRACTOR SHALL ENSURE THAT ALL CONSTRUCTION SLOPES AND EXCAVATIONS ARE COMPLIANT WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS FOR JOB SITE SAFETY.
10. ALL EXISTING CONDITIONS SHALL BE FIELD LOCATED AND VERIFIED BY CONTRACTOR PRIOR TO CONSTRUCTION.
11. REFER TO DRAWING 86 & 87 FOR LAND FILL GAS EXTRACTION WELL AND LATERAL LAYOUT AND SIZES.
12. REFER TO DRAWING 85 FOR LANDFILL GAS MONITORING PROBE LOCATIONS.

STATE OF MARYLAND · KRISTEN H. FAWN · 21585 · REGISTERED PROFESSIONAL ENGINEER

REVISION:
DATE: 9/03/2021 | REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

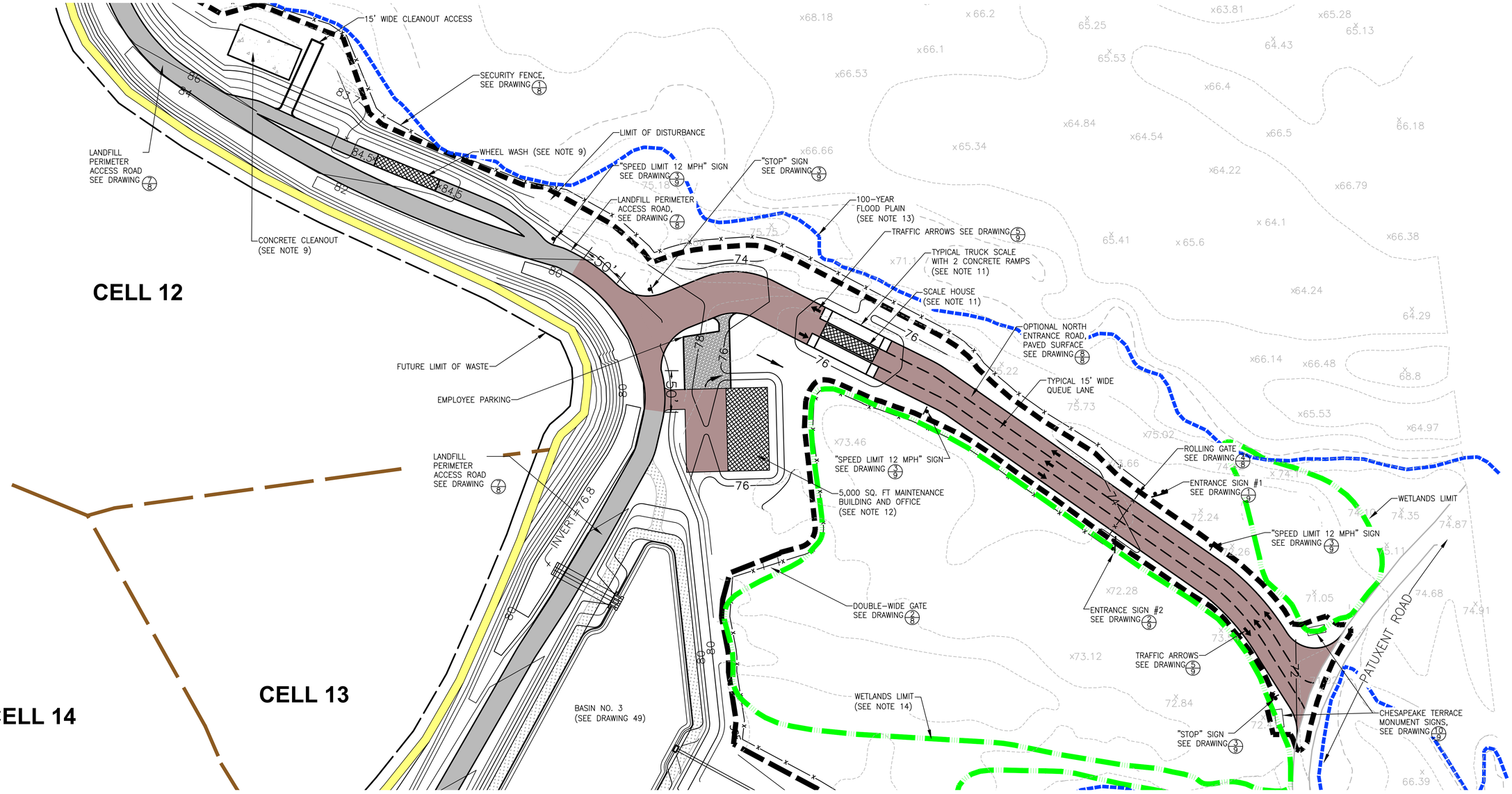
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LANDFILL GAS EXTRACTION DETAILS

PROJECT MANAGER:	POS	SCALE:	AS NOTED
CHECKED BY:	POS	PROJECT NUMBER:	2018 – 3854
DRAWN BY:	KHF	DATE:	09/03/2021

DRAWING 88

N:\Projects\2018\3854\834 - Chesapeake Terrace LF\ACAD\MXDs\E & Phase III Application\Drawings\Final\20180834 #088 - LANDFILL GAS EXTRACTION DETAILS.dwg



LEGEND

- PROPERTY LINE
- 100-YEAR FLOODPLAIN (SEE REFERENCE 2 & NOTE 13)
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION LINE
- LIMIT OF DISTURBANCE
- PIPE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- SIGNS, SEE DRAWING 3/9
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 5/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- TYPICAL WETLANDS
- ACCESS ROAD AROUND BASIN NO. 3
- PERIMETER BERM, SEE DETAIL 2/16

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) EAST ENTRANCE ROAD ALIGNMENT, PAVING, WQ_v FACILITY BASIN NO.4, AND ASSOCIATED GRADING IS FROM DIGITAL FILE (4 OF 68) TITLED "ASSUMED SITE ACCESS EAST ENTRANCE MASS GRADING," PREPARED BY CENTURY ENGINEERING INC., DATED MAY 2008.

3.) THE POST-2012 100-YEAR FLOOD PLAIN LIMITS SHOWN ARE BASED ON FEMA NATIONAL FLOOD INSURANCE PROGRAM MAP NUMBER 24003C0136E, DATED 10/16/2012, AND PROVIDED AS PLATE 3.

NOTES

1.) THE PURPOSE OF THIS PLAN IS TO SHOW GRADING REQUIRED TO INSTALL THE OPTIONAL NORTH ENTRANCE FACILITIES. THIS OPTION WILL ONLY BE CONSTRUCTED IF EAST ENTRANCE CANNOT BE CONSTRUCTED.

2.) SEE PROPOSED CONDITIONS ON DRAWING 3 FOR ENTRANCE LOCATION.

3.) SEE DRAWINGS 4 AND 5 FOR ASSUMED EAST ENTRANCE LAYOUT.

4.) SEE DRAWING 55 FOR EAST ENTRANCE INITIAL GRADING SEDIMENT CONTROL PLAN.

5.) SEE DRAWING 57 FOR OPTIONAL NORTH ENTRANCE GRADING SEDIMENT CONTROL PLAN.

6.) SEE DRAWING 90 FOR OPTIONAL SOUTH ENTRANCE PLAN.

7.) SEE DRAWING 49 FOR CONSTRUCTION OF BASIN NO. 3, EAST ENTRANCE FACILITIES, ACCESS ROADS AND PERIMETER CHANNEL NO. 8, IN THE AREA SHOWN HEREON.

8.) SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION", FOR CELLS 1 THROUGH 16 CONSTRUCTION REQUIREMENTS.

9.) WHEEL WASH SHALL HAVE WATER STORAGE COMPARTMENT WITH PIPE DRAIN CONNECTED TO CONCRETE CLEANOUT (SEE CONCRETE CLEANOUT DETAIL ON DRAWING 60). LANDFILL OPERATOR SHALL PUMP WATER FROM CLEANOUT TO TANKER TRUCK. WATER FROM CLEANOUT MAY BE USED FOR DUST SUPPRESSION IN ACTIVE WASTE FILL AREAS OR SHALL BE TRANSFERRED TO LEACHATE TANKS.

10.) OPTIONAL NORTH ENTRANCE ROAD (IF CONSTRUCTED) SHALL BE PAVED FROM PATUXENT ROAD TO LANDFILL PERIMETER ACCESS ROAD. SEE DETAIL 8 ON DRAWING 8 FOR ENTRANCE ROAD PAVEMENT CROSS SECTION. OPTIONAL NORTH ENTRANCE ROAD PAVEMENT WIDTH IS 45 FEET.

11.) SCALE HOUSE IS CONFIGURED AT SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.

12.) MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.

13.) THE 100-YEAR FLOODPLAIN ELEVATION IS BETWEEN 72 AND 73 FEET MSL IN THIS AREA OF THE SITE, BASED UPON MODELING BY FEMA, SHOWN ON FIRM MAP NO. 24003C0136E DATED OCTOBER 16, 2012, MODIFIED TO ALIGN WITH SITE TOPOGRAPHY BASED UPON DETERMINED BASE FLOOD ELEVATIONS.

14.) A WETLANDS PERMIT HAS BEEN OBTAINED FOR THE EXTENT OF WETLANDS IMPACTED BY THE PROPOSED CONSTRUCTION.

15.) THE EAST ENTRANCE IS PLANNED AS THE MAIN SITE ENTRANCE. THE OPTIONAL NORTH OR SOUTH ENTRANCE ARE PRESENTED FOR CONSTRUCTION IN THE EVENT THE EAST ENTRANCE IS NOT CONSTRUCTED AND ONE OF THE OTHER ENTRANCES IS PURSUED.

16.) EMPLOYEE PARKING SHALL BE "BACK-IN" ONLY.

17.) SEE DRAWINGS 10 AND 11 FOR TOP OF SUBGRADE ELEVATIONS IN THE CELLS.

OPTIONAL NORTH ENTRANCE PLAN

60 0 30 60 120 240

1 INCH = 60 FT

STATE OF MARYLAND — RAYMOND STOCKMAN — No. 21658 — PROFESSIONAL ENGINEER

REVISION:

DATE:	
9/03/2021	REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

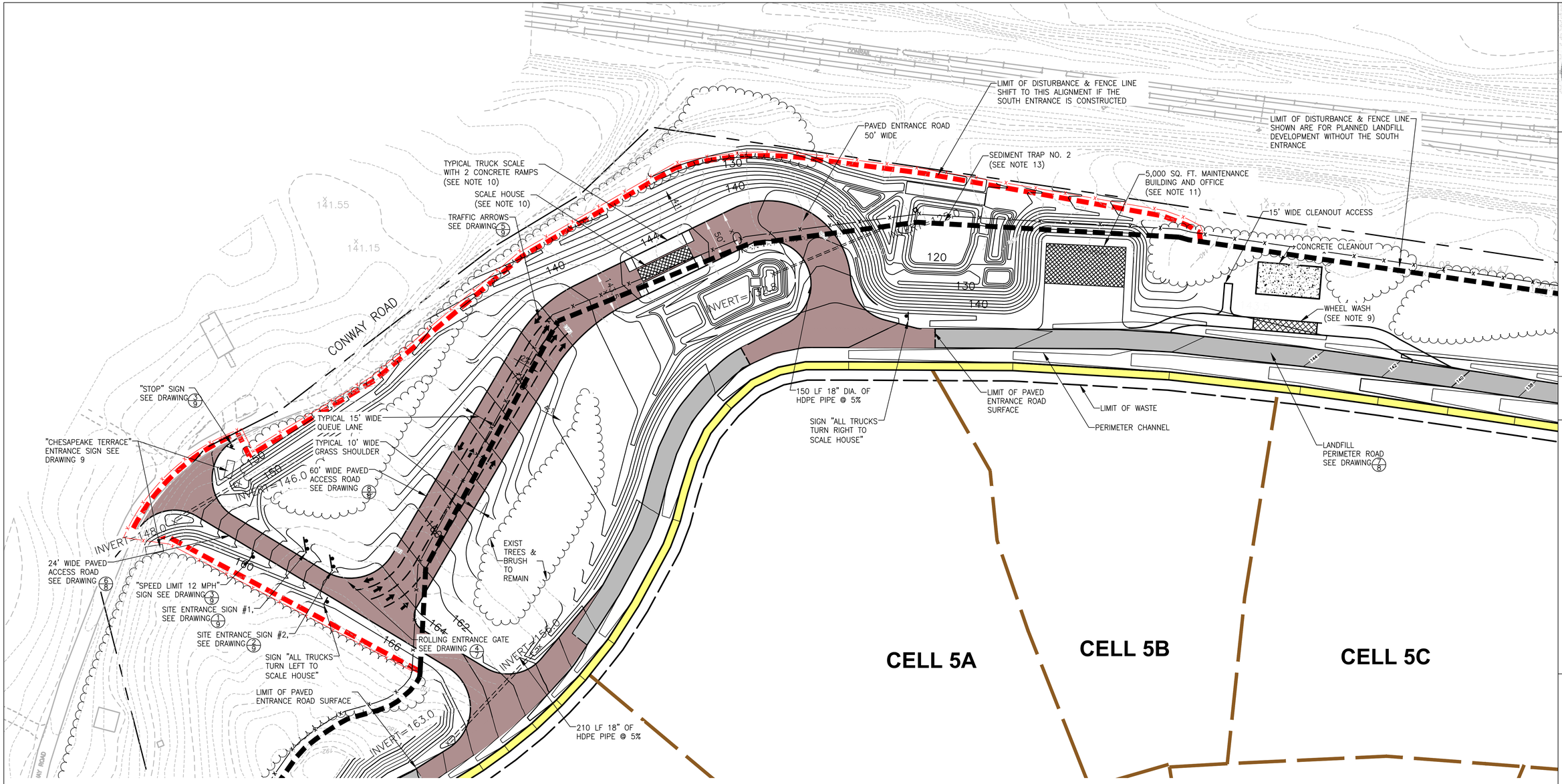
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OPTIONAL NORTH ENTRANCE LAYOUT

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 89

N:\Projects\2018\3018854 - Chesapeake Terrace II\CAD\MXD\SE 8 (Phase III Application)\Drawings\Final\3018854 B89 - OPTIONAL North ENTRANCE LAYOUT.dwg



LEGEND

- PROPERTY LINE
- 2 FT INCREMENT CONTOUR
- 5 FT INCREMENT CONTOUR
- LIMIT OF WASTE
- CELL SEPARATION LINE
- LIMIT OF DISTURBANCE
- RIPRAP APRON
- PROPOSED CHAIN LINK FENCE, SEE DRAWING 8
- SIGNS, SEE DRAWING 9
- ALTERNATE LIMIT OF DISTURBANCE
- ALTERNATE PROPOSED CHAIN LINK FENCE
- ENTRANCE ROAD, PAVED SURFACE, SEE DRAWING 8/8
- LANDFILL PERIMETER ACCESS ROAD, SEE DRAWING 7/8
- NEW TREE LINE
- CONCRETE HATCH
- PERIMETER BERM, SEE DETAIL 2/16

REFERENCES

1.) BASEMAP SHOWN, INCLUDING TOPOGRAPHICAL INFORMATION, IS FROM DIGITAL FILE (2 OF 68) SITE PLAN.DWG, ENTITLED "SITE PLAN," PREPARED BY CENTURY ENGINEERING, INC., DATED APRIL 12, 2010.

2.) SOUTH ENTRANCE ROAD ALIGNMENT, PAVING, SEDIMENT TRAP, AND ASSOCIATED GRADING IS FROM DIGITAL FILE (6 OF 68) TITLED "OPTIONAL SOUTH ENTRANCE PLAN," PREPARED BY CENTURY ENGINEERING INC., DATED MAY 2008

NOTES

1.) DRAWING 58 PRESENTS THE SEDIMENT CONTROL PLAN FOR THE OPTIONAL SOUTH ENTRANCE.

2.) CONTOURS DEPICTED HEREON INDICATE GRADING REQUIRED FOR THE OPTIONAL SOUTH ENTRANCE AND PART OF LANDFILL CELL NOS. 6, 5A,5B, AND 5C (SEE DRAWING 63 "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION").

3.) IF NEITHER THE ASSUMED EAST ENTRANCE NOR THE OPTIONAL NORTH ENTRANCE IS CONSTRUCTED, THE OPTIONAL SOUTH ENTRANCE WILL BE CONSTRUCTED. PER THE EAST ENTRANCE SEQUENCE OF CONSTRUCTION ON DRAWING 63. AN ACCESS ROAD WILL BE PROVIDED TO CELLS 11 THROUGH 16 AREA AS REQUIRED, AND LANDFILL CELL CONSTRUCTION WILL PROCEED IN ACCORDANCE WITH SEQUENCES OF CONSTRUCTION SPECIFIED ON THESE PERMIT DRAWINGS.

4.) SEE SITE PLAN ON DRAWING 3 FOR OPTIONAL SOUTH ENTRANCE LOCATION.

5.) SEE DRAWING 58 FOR OPTIONAL SOUTH ENTRANCE SEDIMENT CONTROL PLAN.

6.) SEE DRAWING 4 & 5 FOR ASSUMED SITE ACCESS (EAST ENTRANCE) PLAN.

7.) SEE DRAWING 89 FOR OPTIONAL NORTH ENTRANCE PLAN.

8.) SEE DRAWING 63, "SEQUENCE AND GENERAL NOTES FOR CONSTRUCTION" FOR CELLS 1 THROUGH 16 CONSTRUCTION REQUIREMENTS.

9.) WHEEL WASH SHALL HAVE WATER STORAGE COMPARTMENT WITH PIPE DRAIN CONNECTED TO CONCRETE CLEANOUT (SEE CONCRETE CLEANOUT DETAIL ON DRAWING 60). LANDFILL OPERATOR SHALL PUMP WATER FROM CLEANOUT TO TANKER TRUCK. WATER FROM CLEANOUT MAY BE USED FOR DUST SUPPRESSION IN ACTIVE WASTE FILL AREAS OR SHALL BE TRANSFERRED TO LEACHATE TANKS.

10.) SCALE HOUSE IS CONFIGURED AT SINGLE-WIDE TRAILER WIDTH. TRUCK SCALES (CONFIGURED AT 70 FEET LENGTH, WITH 10 FEET LONG CONCRETE RAMPS AT EACH END) SHALL BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.

11.) MAINTENANCE BUILDING SHALL BE DESIGNED BY A PROFESSIONAL ENGINEER OR ARCHITECT. BUILDING AND ACCESS AREA ARE EACH DEPICTED AT 100 FEET LENGTH BY 50 FEET WIDTH. CONFIGURATION MAY VARY, BASED ON 5,000 SQUARE FEET BUILDING DESIGN. BUILDING AND WHEEL WASH ACCESS SHALL HAVE AGGREGATE SURFACE EQUIVALENT TO LANDFILL PERIMETER ACCESS ROAD.

12.) THE EAST ENTRANCE IS PLANNED AS THE MAIN SITE ENTRANCE. THE OPTIONAL NORTH OR SOUTH ENTRANCE ARE PRESENTED FOR CONSTRUCTION IN THE EVENT THE EAST ENTRANCE IS NOT CONSTRUCTED AND ONE OF THE OTHER ENTRANCES IS PURSUED.

13.) SEDIMENT TRAP NO. 2 AND ASSOCIATED CULVERTS AND CHANNELS WILL ONLY BE CONSTRUCTED IF THE SOUTH ENTRANCE IS CONSTRUCTED.

SOUTH ENTRANCE PLAN

60 0 30 60 120 240

1 INCH = 60 FT

STATE OF MARYLAND — LESLIE HOWARD STICKMAN — No. 21583 — PROFESSIONAL ENGINEER

REVISION: 3
DATE: 9/03/2021
REVISED TO ADDRESS MDE COMMENTS ON PHASE 3

NATIONAL WASTE MANAGERS
PHASE III APPLICATION
CHESAPEAKE TERRACE RUBBLE LANDFILL
PATUXENT ROAD, ODENTON
ANNE ARUNDEL COUNTY, MARYLAND

ADVANCED GeoServices
a Montrose Environmental Group company
1878 MARLTON PIKE EAST, SUITE 10, CHERRY HILL, NJ 08003
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OPTIONAL SOUTH ENTRANCE LAYOUT

PROJECT MANAGER:	PGS
CHECKED BY:	PGS
DRAWN BY:	KHF
SCALE:	AS NOTED
PROJECT NUMBER:	2018 - 3854
DATE:	09/03/2021

DRAWING 90

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