Loudon County Solid Waste Disposal Commission
May 15th, 2025
6:00PM
Loudon County Annex

Roll Call

Public Comment

LCSWDC:
- 04.17.2025 Minutes
- Cell A Leachate Disconnect Update – Joint Submission
- New Borrow Pit Update
- Storm Water Ponds Update
- Minor Modification
- Protocol for Communication with Republic, including operations, onsite developments, and communications with TDEC

Republic:
- Operations
- Host & Security Fees Letter
- Airspace Utilization Report
- Quarterly Origin Report
- TDEC Inspection
- Loudon Financial Information

Action Items

Adjourn

LOUDON COUNTY SOLID WASTE DISPOSAL COMMISSION
LOUDON COUNTY, TENNESSEE
Thursday, April 17, 2025
Courthouse Annex Building
MINUTES

Opening of Meeting:

BE IT REMEMBERED That the Loudon County Solid Waste Disposal Commission convened in regular session in Loudon, Tennessee on the 17th day of April 2025.

Commission Chairman Mr. Waller called the meeting to order at 6:01 p.m. eastern time.

Roll Call:

Upon Roll Call, the following Commission Members were present: Ms. Monty Ross, Ms. Dianah Mullis, Mr. Larry Jameson, Mr. Gary Hendrix, Mr. Andy Lawson, Chairman Mr. Adam Waller, and Mr. Gary Busch

Legal Representation Ms. Elizabeth Murphy participated via phone

Also present from Republic Services were representatives – Mr. David Hollinshead and Ms. Turtle.

Election of Officers:

Commission Chairman Mr. Waller made call for vote for officers:

Ms. Ross nominated Mr. Waller for Chairman, no other nominations made, voice vote taken 4-0 in favor, Mr. Waller abstained and accepted.

Mr. Waller nominated Ms. Ross for Vice Chairman, no other nominations made, voice vote taken 4-0 in favor, Ms. Ross abstained and accepted.

Mr. Waller nominated Mr. Busch for Secretary, no other nominations made, voice vote taken 4-0 in favor, Mr. Busch abstained and accepted.

General Public Comments:

Public Comments were made by: Ms. Pat Hunter raised question, why is the agenda different than one posted on website regarding election of officers? She would like to see definitive plans to address mud. Commented; we should be seeing AER report this month and per contract we should have the landfill manager from Republic at the meetings.

Mr. Brian Viars curious about the long-term plan and solution with the mud leachate issue and pick up of trash along highway.

Bonnie Coffey commented about long-term solution and buzzard situation.

Approval of March 20th, 2025 Minutes:

Minutes for March 20, 2025, a motion was made by Mr. Jameson to approve minutes as written, seconded by Ms. Ross, voice vote taken, motion was unanimously approved 5-0. Absent Mr. Hendrix and Mr. Lawson.

Cell A Leachate Disconnect:

Commission Chairman Mr. Waller raised the issue regarding to the leachate problem and requested an update from Commission attorney Ms. Murphy regarding the status for the additional test requests made by the Commission.

Ms. Murphy commented that there was meeting with TDEC on Monday April 14th, it was a Zoom call, engineers from Republic along with Michael Cline engineer for the commission. There was an insertion made in an earlier meeting that TDEC approved physical planning made with the knowledge that there was a disconnection or blockage of the leachate line somewhere around the transition from the white PVC to black corrugated. The purpose of the meeting was to test that assertion if that was the understanding of TDEC when they had approved the proposed hook lining which is the current plan. Rob Burnett and Brian Wolff from TDEC were on the line.

Everyone understood there was a disconnect between the two and that there was still some flow coming down which is good, but recent bucket test intended on April 9th that the flow was so consistent and slow that there was nothing blocking it. All was shared with TDEC & Mr. Burnett that was not something he understood as the condition and they took the position that they wanted to see everything on paper and would get back to the parties.

Legal Counsel Ms. Murphy then spoke to counsel for Republic and tentatively agreed to a joint submission to TDEC which is being put together which should transpire early next week. Essentially there is some type of disconnect, question is; how do we ensure that leachate provide proper aide so there is not potential head liner pressure in module A that would create a compliance issue for the commission.

Ms. Ross raised a question when TDEC is looking at this do they consider extreme rain and can it be able to handle those conditions. Ms. Murphy responded that TDEC looks at it from the current regulatory requirements.

Chairman Mr. Waller raised a question to Republic; what are other options to get the leachate out if we don't want to dig down the 35ft to get to the area of potential blockage? Republic Ms. Turtle responded that Republic is not doing nothing, definitely want to do what is appropriate. The leachate designs are designed with weather and all current conditions applied and bucket tests showed slip lining is within range what would be producing within that cell, Republic believes this would be an appropriate fix. If TDEC, however, believes that another is required, there are other options to consider.

Chairman Mr. Waller asked if Ms. Turtle could provide the commission with the other types of fix options Republic may consider.

Legal Counsel Ms. Murphy commented that Republic needs to work with commission to put engineered solutions that address the leachate problem sooner rather than later that can be put in front of TDEC if they come back that current solution is not acceptable. The commission want to have something in its back pocket ready to go to avoid any further delays. If Republic can't or doesn't provide such engineered solutions to ensure there isn't any leachate buildup problems on the head liner in that area, then the commission can come up with their own engineered solutions to recommend to TDEC.

Chairman Mr. Waller in closing out the topic asked Republic Ms. Turtle if she can come up with those types of engineered solutions to be provided to the commission, Ms. Turtle responded they can and will provide.

Legal Counsel Ms. Murphy made final comment, TDEC was comforted that everything having to do with this issue, that the landfill was designed and containing the leachate on site. It is not necessarily a great situation, but not an emergency of the leachate getting off the site type of problem.

New Borrow Pit Update:

Commission Chairman Mr. Waller update, questions regarding the amount of soil within the new borrow pit. Ms. Turtle stated that they will be working with a different company and that they will provide that information back to commission. Legal Counsel Ms. Murphy asked if this work had started, Republic Ms. Turtle responded she was not sure and would need to get back with commission.

Mr. Waller also asked if the Bond was taken out to cover the additional soil they will have to bring in from offsite and not adequate on site. Ms. Turtle was not sure of this and will investigate this.

Storm Water Ponds:

Commission Chairman Mr. Waller with Mr. Cline visited the site back in March, while at the site witnessed some water being pumped from the new expansion into the stormwater pond on the south end and some leachate was found in the pond closer to Monterey Mushroom, both were sealed off, pumped and all the dirt was being removed and disposed of. What is the update on status?

Republic Ms. Turtle replied that both ponds were being remediated and met with TDEC and resampled. Updated timeline to be provided to commission.

Cameras:

Commission Chairman Mr. Waller reached out to two camera vendors that are working on quotes. Targeted to have quotes by mid-May.

Invoices & Reimbursements:

None submitted at this meeting.

Republic Report:

Commission Chairman Mr. Waller asked Mr. Hollinshead if he could give an introduction of Ms. Turtle. Republic Mr. Hollinshead gave a brief introduction of Ms. Turtle as requested.

Operations:

Ms. Ross raised a question regarding fencing and erosion controls related to the new construction taking place at the site.

Chairman Mr. Waller raised question to Legal Counsel Ms. Murphy regarding the types of reports including engineering type reports that Republic Counsel should be providing to the commission. Ms. Murphy responded with specific reports that have been requested that should be submitted to the Commission chairman.

Mr. Jameson, questioned a prior issue related to onsite debris, if a grinder had been brought on site. Mr. Hollinshead responded they are working on this with the individual that offered his services.

Ms. Turtle responded that Republic is looking into a number of options for use of the wood chips since it will be a large volume once all existing brush is ground.

Chairman Mr. Waller questioned when the commission could expect the annual engineering report. Republic Mr. Hollinshead to follow up on this topic.

Host & Security Fees Letter:

Nothing noted

Airspace Utilization Report:

Nothing noted

Quarterly Origin Report:

Nothing noted

TDEC Inspection:

Nothing noted

Loudon Financial Information:

Nothing noted

Action Items:

Commissioner Mr. Waller announced that this will be Ms. Mullis last meeting due to her family will be moving out of state.

Adjournment:

Motion to adjourn the meeting made by Mr. Jameson and Seconded by Mr. Busch. Vote taken 5 – 0 in favor, 2 absent.

The April 17th, 2025 Loudon County Solid Waste Disposal Commission was adjourned 6:36p.m.

The next Loudon County Solid Waste Disposal Commission meeting will be held May 15th 2025, at 6:00p.m. at the Loudon County Annex Building.

Respectfully Submitted by Gary M Busch LCSWDC Secretary,

Adam Waller - Chairman

Loudon County Solid Waste Disposal Committee

NOTE: Full Video of LCSWDC meeting can be found using below link

Loudon County Solid Waste Disposal Commission Meeting, April 17, 2025 (youtube.com)

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
Division of Solid Waste Management
Davy Crockett Tower, 7th Floor
500 James Robertson Parkway
Nashville, Tennessee 37243

May 15, 2025

Ms. Wells Trompeter **CERTIFIED MAIL** Holland & Knight **# 9589 0710 5270 2888 9340 47** 511 Union St, Suite 2700 **RETURN RECEIPT REQUESTED** Nashville, TN 37219

Ms. Elizabeth Murphy
Via email: elizmurphy966@msn.com

RE: Response to May 7, 2025 Letter Re: Follow Up to April 24, 2025 Meeting Regarding Leachate Pipe

Dear Ms. Trompeter and Ms. Murphy:

The Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management (DSWM), both appreciates and is in receipt of your May 7, 2025 correspondence on behalf of the Loudon County Solid Waste Commission (Permittee) and Republic Services, Inc. (Contractor), including information regarding the leachate pipe in Module A that had previously not been provided to DSWM. DSWM has reviewed the information included in the correspondence and compared it to the plan approved in the major modification to the permit, dated January 17, 2025, and other permit documents available to DSWM. During the major modification permitting process, DSWM confirmed that the information contained in your May 7, 2025 submission was available to the Permittee and their Contractor in consideration while developing a plan to the address the issues identified. This plan submitted to DSWM was assumedly deemed by the Permittee, an appropriate solution. Based upon available information DSWM acknowledges the position of this Fernco© disconnection is located at the low point of Module A, within the lined area of Module A. DSWM understands that the plan approved in the January 17, 2025 permit to slip line the PVC pipe will extend to this connection, within the lined area of Module A, maintaining the continuation of leachate flow that presently exists. DSWM's position is that the disconnect is within a lined area and not a threat to adversely impact the groundwater.

Per the items provided above, and in response to your request, DSWM's position is that if the approved plan is executed as written in the permit documents, it is an acceptable solution to maintain leachate flow from Module A into the new Module 1. If it is determined that the plan cannot be executed as written in the permit documents or the Permittee wishes to propose an alternative solution, then a permit modification would be necessary.

If you have any questions concerning this letter or decision, please contact Brian Wolf at Brian.Wolf@tn.gov or 615-946-7772.

Sincerely,

Lisa A. Hughey, CHMM
Director

cc: Rob Ashe, Deputy Director of Field Office Operations, DSWM
Craig Almanza, Deputy Director of Central Office Operations, DSWM
Revendra Awasthi, Knoxville Environmental Field Office Manager, DSWM
Lew Haynes, Knoxville Environmental Field Office, DSWM
Rob Burnette, Chief Engineer, Nashville Central Office, DSWM
Lindsey Turtle, General Manager, Republic Services
Adam Waller, Chairman, Loudon County Solid Waste Disposal Commission
Records.SWM@tn.gov

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May 7, 2025

Via E-mail

Mr. Brian Wolf
Mr. Rob Burnette
Tennessee Department of Environment and Conservation
Division of Solid Waste Management
brian.wolf@tn.gov
rob.burnette@tn.gov

Re: Follow Up to April 14, 2025 Meeting Regarding Leachate Pipe

Dear Mr. Wolf and Mr. Burnette:

Thank you for the video conference meeting on April 14, 2025, regarding a leachate pipe issue at Matlock Bend Landfill. In order to determine next steps, Mr. Rob Burnette requested additional information that would both document some of the items discussed respectively by Santek Environmental, LLC ("Santek"), as the Operator, and by the Loudon County Solid Waste Disposal Commission ("Commission") as the Owner and Permit Holder, and provide an update on some recent findings. As evidenced by the signatures of counsel below, this is a joint submission by Santek and Commission.

The issue at hand is whether TDEC's approval of the leachate pipe slip lining project was done with the understanding that upgradient of the PVC pipe in Module A to be lined is a disconnect between the PVC pipe and the Fernco coupler between the solid and perforated PVC leachate drain pipes. The PVC pipe in Module A to be slip lined extends at the upper end to a location at or near the "low point" of the cell. The location of the disconnect is not exactly identified but is near the "low point." The disconnect is shown in CCTV camera scoping and is understood to be upgradient of the pipe segment to be slip lined.

The Commission and an independent engineer are concerned that the disconnection between the black perforated pipe and the white PVC at the coupler is not a condition addressed

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by the slip lining because the slip lining addresses reinforcing the load management of the PVC line, not whether leachate is obstructed from draining into it from Module A. These are related but separate issues. A recent bucket test to evaluate the current leachate flow from this area showed mixed results. It was discussed on the April 14th call but TDEC did not have a copy of the report. The Commission retained Cannon & Cannon, Inc. ("CCI") last year as an independent engineer. CCI reviewed the camera footage and identified that the PVC pipe may not only be "pinched" as CEC had reported to TDEC in March of 2024 (*see* Tab 1) but appears to be disconnected and/or partially blocked upgradient. By comparison, a screenshot of the location provided by CEC in their March 2024 report is dark and unclear. A screenshot of the location taken by CCI from the same footage appears to show the disconnect with a metal connector band hanging loose and apparently inside of the white PVC pipe. As there is no leachate riser pipe in that area providing access to measure the head on the liner in Module A, the Commission is concerned about leachate building up in Module A, maintaining adequate flow down to the white PVC drain line, and whether these conditions will create a leachate outbreak and or compliance issues if the apparent disconnection does not allow for adequate capture and drainage of the leachate. (See Tab 3, CCI report of a leachate outbreak in the same area during construction in March, 2025.)

Santek's position is that the slip lining, previously approved by TDEC as part of the recent Matlock Bend Class I Landfill 2024 Horizontal Expansion, will appropriately address the issue and allow for continued leachate flow.

The expansion construction process is underway. While the area at issue is currently below approximately 35 feet of waste, it will be under approximately 85 feet of waste when the cell currently under construction is at final grade.

Per our April 14 video conference, attached for TDEC's review are the following:

1. CEC's March 22, 2024 Memorandum titled "Modules A, B, E, and H Pipe Penetration Scoping Summary"
    a. Section 2(c) under Pipe Scoping Operations, Existing Module A Pipe Penetration, Initial Scoping of the report references the "'pinched'" condition and that CEC was "unable to determine if flow was restricted."
    b. Photograph No. 2 in Attachment 2 is the referenced screen shot.
2. CCI Report after review of the CCTV footage, with screenshot of the disconnected location between white PVC pipe and black perforated
3. CCI Report from March of 2025 identifying a leachate outbreak area in Module A below the general area of the pipe disconnect location
4. CCI Report on the April 9, 2025 bucket test requested by the Commission to measure and assess flow downgradient from the pipe location.

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5. CEC's April 22, 2025 Memorandum detailing a more recent bucket flow test from April 9, 2025

The Commission and Santek respectfully request that TDEC respond to this letter as quickly as possible after it has the opportunity to review the attachments. Should TDEC believe that a follow-up discussion is necessary to resolve the issue, we likewise would welcome to the opportunity to have one.

Sincerely yours,

Wells Trompeter
Counsel for Santek Environmental, LLC

Elizabeth Murphy
Counsel for the Commission, LCSWDC

cc: Adam Waller (LCSWDC)
Chris Cline (Cannon & Cannon)
Lindsey Turtle (Republic)
Will McWhorter (Republic)
Stoddard Pickrell (Republic)
Dave Hollinshead (Republic)
Tim Mitchell (CEC)
Michael Yacyshyn (CEC)

TAB 1

MEMORANDUM

To: Mike Classen, P.E. – Republic Services (Republic)

From: Timothy D. Mitchell, P.E. – Civil & Environmental Consultants, Inc. (CEC)
B. Michael Yacyshyn, P.E. – CEC

Date: March 22, 2024

Subject: Modules A, B, E, and H Pipe Penetration Scoping Summary
Matlock Bend Landfill
CEC Project 317-474

A camera scoping investigation was performed for the existing Modules A, B, E, and H pipe penetrations at the Matlock Bend Landfill (MBLF). This memorandum (Memo) is intended to summarize our objective, methodology, observations, conclusions, and recommendations, as described below.

OBJECTIVE

During a site visit by TDEC on November 7, 2023, it was informally requested that the condition of the existing pipe penetrations for existing Modules A, B, E, and H be camera inspected. Tennessee Department of Environment and Conservation (TDEC) noted that as part of the permit expansion, the condition of the pipe penetrations would need to be evaluated ahead of permit approval and as part of routine maintenance at the site, regardless.

Further, TDEC was concerned with a previously installed single-walled 6-inch diameter Poly Vinyl Chloride (PVC) pipe from the Module A low point, extending to the west under the Module E liner system, and ending at two (2) existing 10,000-gallon leachate storage tanks. The 6-inch pipe is a single-walled solid PVC pipe starting at the Module A low point, then transitioning to a dual-contained High Density Polyethylene (HDPE) (10-inch by 6-inch) pipe at some point below the Module E liner system. As such, the camera inspection was performed to also evaluate the current conditions of the PVC pipe and PVC to HDPE transition.

Also, TDEC expressed concern that the planned additional waste resulting from the 2024 Horizontal Expansion would increase overburden loads on the PVC pipe and could cause pipe crushing. As such, CEC was to evaluate the potential for pipe crushing with the increased overburden loads resulting from the proposed permit expansion.

METHODOLOGY

To respond to TDEC's requests and concerns, CEC and Republic performed a camera scoping inspection for the existing pipe penetrations with the intent to evaluate the condition of the existing components noted above.

Additionally, CEC performed pipe crushing calculations to evaluate if the existing pipes are expected to be stable with respect to pipe crushing, buckling, and deflection.

PIPE SCOPING OBSERVATIONS

Camera scoping operations were performed by Hunt Environmental on February 15 and 27, 2024 at MBLF. CEC was onsite to observe the pipe scoping operations, with Jacob Mabrey being CEC's representative in the field. Generally, the pipe was cleaned with a pipe jetter first, then as the jetter was removed, the camera was used to verify the condition of the pipe. Field notes are included in Attachment 1. Also see below for a summary of observations from each pipe scoping event.

Existing Module A Pipe Penetration

Initial Scoping

1. The existing Module A pipe penetration was initially scoped by camera on February 15, 2024.

2. Observations from the initial camera scoping are:

    a. The initial section of the pipe is solid black 6-inch diameter HDPE Standard Dimension Ratio (SDR) 11 pipe.

        i. This pipe appeared to be in good condition, with no observed obstructions, deformations, or blockage (that were not removed as part of camera scoping/pipe jetting operations).

    b. The black HDPE pipe transitions to a white PVC pipe.

        i. This white PVC pipe also appeared to be in good condition, with no observed obstructions, deformations, or blockage (that were not removed as part of camera scoping/pipe jetting operations).

    c. The PVC pipe extends to what is believed to be the Module A "Low Point". The PVC pipe ends at what appears to be a black pipe connection, that we believe is a Fernco pipe coupling that connects the slotted PVC pipe within Module A to the solid PVC pipe that gravity drains leachate to the tanks, with aggregate/soil material observable around the black pipe connection. The black pipe connection appeared to be "pinched," but we were unable to undetermined if flow was restricted.

i. The camera survey was unable to extend beyond the end of the solid white PVC pipe in the low spot of Module A. Thus, the condition of the PVC pipe past that location is unclear. Leachate flow was observed discharging from the end of the pipe with Module A, so we know flow has not been stopped. The evidence gathered supports the conclusion that integrity of the existing PVC pipe below Module E and through the Module A liner penetration remains intact and sufficient to perform its design intent. See photograph in Attachment 2.

Follow-up Scoping

1. To confirm locations of features along the pipe, a second camera scoping was performed in the Module A pipe on February 27, 2024.

2. During this follow-up scoping, a survey tape was attached to the camera probe, to ensure a greater degree of confidence in the lengths reported. Measurements reported are from the "pipe entry point" near the secondary containment for the two (2) 10,000-gallon tanks along the pipes. The "pipe entry point" location was surveyed in the field.

3. The recorded lengths are as follows:

Location	**Length Along Pipe**
Length to HDPE/PVC Transition	116.1 feet
Length to end of PVC Pipe	133.8 feet

4. Additionally, to quantify the flow coming from the Module A Low Point, CEC and Hunt Environmental performed a "Bucket Test." A "Bucket Test" is described as measuring the flow from the pipe by timing the amount of time it takes to fill a 5-gallon bucket. The test was performed immediately after opening the pipe for camera scoping. The results of the bucket test are presented in Attachment 3. The average flow recorded was 0.8 gallons per minute (gpm), which verified flow was still coming from the Module A low area.

Existing Module B Pipe Penetration

1. The existing Module B pipe penetration was initially scoped by camera on February 15, 2024.

2. Observations from the camera scoping are as follows:

    a. The camera probe was pushed to ≈150 feet, short of the expected sump location.

        i. At this location, where an assumed bend in the pipe was encountered, the camera probe could not be advanced beyond that the bend.

        ii. Up to the bend at approximately 150 feet, the pipe appeared to be in good condition, with no observed deformations or blockage (that were not removed as part of camera scoping/pipe jetting operations).

    b. No video or photographs of this pipe scoping were possible because of blurry/obscured images caused by the high liquid level in the pipe.

Existing Module E Pipe Penetration

1. The existing Module E pipe penetration was initially scoped by camera on February 15, 2024.

2. Observations from the camera scoping are as follows:

    a. The camera probe pushed to approximately ≈250 ft (sump estimated to be at ≈180 feet).

        i. From what was observed, the pipe appeared to be in good condition, with no observed deformations or blockage (that were not removed as part of camera scoping/pipe jetting operations).

    b. No video or photographs of this pipe scoping were possible because of high liquid levels in the pipe.

Existing Module H Pipe Penetration

1. The Existing Module H pipe penetration was not able to be accessed. The existing location was under 15-20 feet of soil and a significant excavation effort with sloped sidewalls would need to be performed to provide access for camera scoping efforts.

PIPE CRUSHING CALCULATIONS

CEC performed structural pipe calculations for all "subliner" piping, those being pipes extending from the Modules A, B, E, and H sumps/low points. These calculations will be included with the expansion application and a copy of these calculations (as of March 2024) are included as Attachment 4 of this Memo. A summary of the structural pipe calculations is as follows:

1. Module A

    a. The PVC Pipe extending from the Module A Sump/Low Point will crush under the proposed overburden from the proposed Phase 1 expansion.

    b. The dual contained SDR 11 HDPE pipe have acceptable Factors of Safety (FS) with respect to deflection, buckling, and compression when subjected to the loads from the proposed Phase 1 expansion.

2. Modules B, E, and H

3. All of the dual contained SDR 11 HDPE pipes have acceptable FS with respect to deflection, buckling, and compression when subjected to the loads from the proposed Phase 1 expansion.

CONCLUSIONS

Conclusions from the pipe penetration camera scoping and pipe crushing evaluation are as follows:

1. Module A

    a. The HDPE and PVC pipes extending from the Module A Sump appear to be in good condition.

    b. There appears to be a pinched pipe connection, probably a distorted Fernco pipe coupling, with some exposed aggregate observed around the pipe connection at the end of the PVC pipe in the Module A low spot. However, leachate continues to flow from the Module A low spot.

    c. The PVC pipe will crush under the proposed loading associated with the proposed Phase 1 expansion for the site.

   d. The SDR 11 HDPE pipe appears to be suitable for use without crushing, buckling, or deflection under the proposed Phase 1 expansion configuration.

2. Module B

   a. The entirety of the pipe to the Module B pipe penetration was not able to be accessed due to a bend in the pipe. Up to the bend, where the camera probe could not pass, the pipe appeared to be in good condition, with no signs of deformation or distress.

   b. The SDR 11 HDPE pipe appears to be suitable for use without crushing, buckling, or deflection under the proposed Phase 1 expansion configuration.

3. Module E

   a. The pipe appeared to be in good condition, with no signs of deformation/stress.

   b. The SDR 11 HDPE pipe appears to be suitable for use without crushing, buckling, or deflection under the proposed Phase 1 expansion configuration.

4. Module H

   a. The Module H pipe could not be accessed.

   b. The SDR 11 HDPE pipe appears to be suitable for use without crushing, buckling, or deflection under the proposed expansion configuration.

RECOMMENDATIONS

Based on the observations from the camera scoping effort described above, CEC offers the following recommendations.

1. Module A

   a. The exiting solid PVC section of the pipe should be slip lined to provide additional structural capacity for the pipe. The slip lining should also provide adequate flow based on the anticipated maximum flows to be generated from Module A.

   b. Due to the observed exposed aggregate, and the potential for pipe clogging, CEC recommends this pipe be camera inspected and cleaned (e.g., jetted) on a more frequent basis. CEC recommends the Module A pipe penetration be camera inspected and cleaned every six months (other pipe penetrations are proposed to be camera inspected and cleaned annually).

2. Module B

   a. Because the entirety of this pipe could not be accessed during the February camera inspections, prior to Modules 1 and 2 construction, the entirety of the Module B pipe (at a minimum to the existing pipe penetration) should be camera inspected to verify integrity. This will need to be done by creating a different access point along the pipe, likely past the existing bend noted during the February camera inspection.

   b. This pipe should be camera inspected and cleaned on a routine basis (currently proposed for annual inspections and cleanings).

3. Module E

   a. The pipe appeared to be in good condition and can be used in the proposed expansion.

   b. This pipe should be camera inspected and cleaned on a routine basis (currently proposed for annual inspections and cleanings).

4. Module H

   a. Because the pipe could not be accessed during the February camera inspections, prior to Module 3 construction, the entirety of the Module H pipe (at a minimum to the existing pipe penetration) should be camera inspected to verify integrity.

   b. This pipe should be camera inspected and cleaned on a routine basis (currently proposed for annual inspections and cleanings).

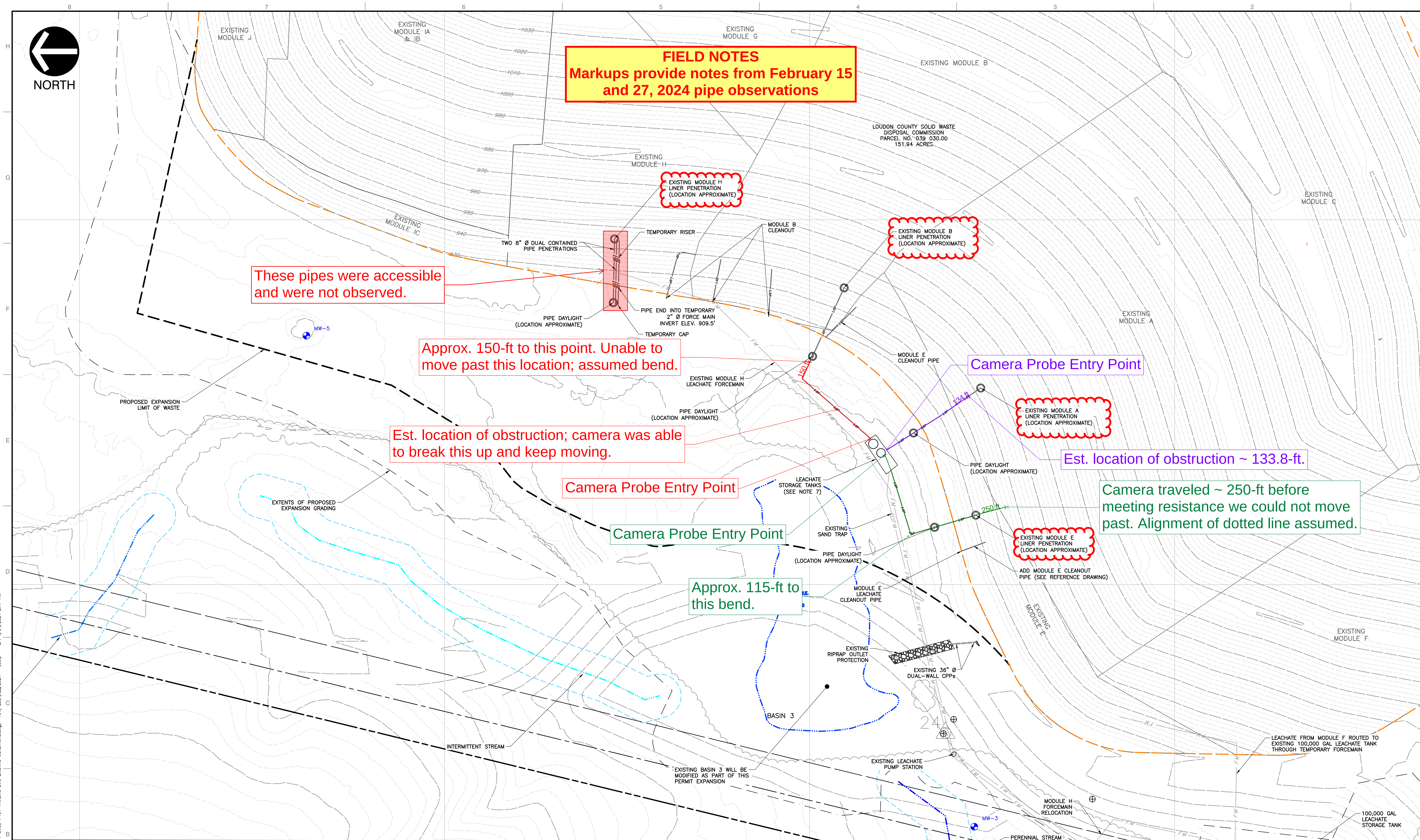
CEC trusts that this memo is sufficient for your needs at this time. However, if not, please contact us at 724-327-5200.

TDM:BMY/jg
Attachments

M-317474.Apr17/P

ATTACHMENT 1

FIGURE – FIELD NOTES



GENERAL NOTES

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED SEPTEMBER 21, 2023 AND DECEMBER 13, 2022 FOR OUTSIDE THE BOUNDARIES OF THE MORE RECENT.
2. THE COORDINATE GRID AND SURVEY MONUMENT LOCATIONS SHOWN ON THESE PLANS ARE BASED ON INFORMATION PROVIDED BY SITE OPERATOR.
3. PROPERTY BOUNDARY, LIMIT OF WASTE, AND CELL LIMITS WERE OBTAINED FROM PERMIT DRAWINGS PREPARED BY SANTEK ENVIRONMENTAL, INC., LAST REVISED 2018.
4. SEE APPENDIX "B" OF THE MATLOCK BEND LANDFILL OPERATIONS PLAN PART 2B PERMIT APPLICATION NOTEBOOK FOR TVA EMAIL APPROVAL OF POND LOCATION IN POWERLINE EASEMENT.
5. REFER TO THE SUPPLEMENTAL HYDROGEOLOGICAL INVESTIGATION REPORT PROVIDED IN SECTION II OF THIS PERMIT APPLICATION FOR THE LOCATION OF ALL SUBSURFACE INVESTIGATION SOIL BORINGS.
6. LIMITS OF DISTURBANCE FOR THE OVERALL PROPOSED GRADING (I.E., WASTE AND NON-WASTE GRADING) SHALL AVOID IMPACTS TO STREAMS. SPECIFICALLY NON-WASTE GRADING WILL BE OFFSET FROM STREAMS BY AT LEAST 30 FEET IN ACCORDANCE WITH THE LOUDON COUNTY STORMWATER MANAGEMENT RESOLUTION [SECTION 01-002-(6)-(a)] AND 50 FEET FROM THE PROPERTY LINE IN ACCORDANCE WITH THE TENNESSEE SOLID WASTE MANAGEMENT REGULATIONS [RULE 0400-11-01-.04-(3)-(a)-4]. ADDITIONALLY, ALL LIMITS OF WASTE GRADING (i.e., PROPOSED DISPOSAL LIMITS OF WASTE MATERIALS) SHALL BE AT LEAST 200 FEET FROM DELINEATED STREAMS IN ACCORDANCE WITH THE TENNESSEE SOLID WASTE MANAGEMENT REGULATIONS [RULE 0400-11-01-.04-(3)-(a)-4].
7. LEACHATE TANKS WILL REQUIRE RELOCATION PRIOR TO MODULES 1 AND 2 CONSTRUCTION.
8. LOCATIONS OF PIPING AND PUMP STATIONS ARE APPROXIMATE AND BASED OFF OF DESIGN DRAWINGS, AVAILABLE AS-BUILTS, AND FIELD OBSERVATIONS.
9. FOR CLARITY, ON THIS DRAWING ONLY PORTIONS OF THE LEACHATE COLLECTION PIPE SYSTEM THAT ARE APPLICABLE TO FUTURE TIE-INS ARE SHOWN. LOCATIONS ARE APPROXIMATE.

LEGEND

PROPERTY LINE
50' APPURTENANCE BUFFER
100' WASTE BUFFER
ADJOINING PROPERTY LINE
EXISTING SOLID WASTE BOUNDARY
EXISTING MODULE BOUNDARY
PROPOSED PHASE 1 SOLID WASTE EXPANSION
900 EXISTING INDEX CONTOUR
EXISTING INTERMEDIATE CONTOUR
30' BUFFER FROM STREAM, LOUDON CO. SWM RESOLUTION
EXISTING ROAD
EXISTING UNIMPROVED ROADWAY
EXISTING TREE LINE
EXISTING EPHEMERAL STREAM
EXISTING INTERMITTENT STREAM
EXISTING PERENNIAL STREAM
TVA POWERLINE EASEMENT
24 SITE BENCH MARK
MW-1 GROUNDWATER MONITORING WELL
LINER PENETRATIONS/PIPE DAYLIGHTS

PRELIMINARY DRAFT

SCALE IN FEET
0 60 120

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION
1	11/2023	REVISIONS TO ADDRESS TDEC COMPLETENESS COMMENTS.

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

PHASE 1 EXPANSION
EXISTING CONDITIONS

DATE:	DECEMBER 2023	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474		
APPROVED BY:			EDC*

DRAWING NO.: P-101
SHEET OF

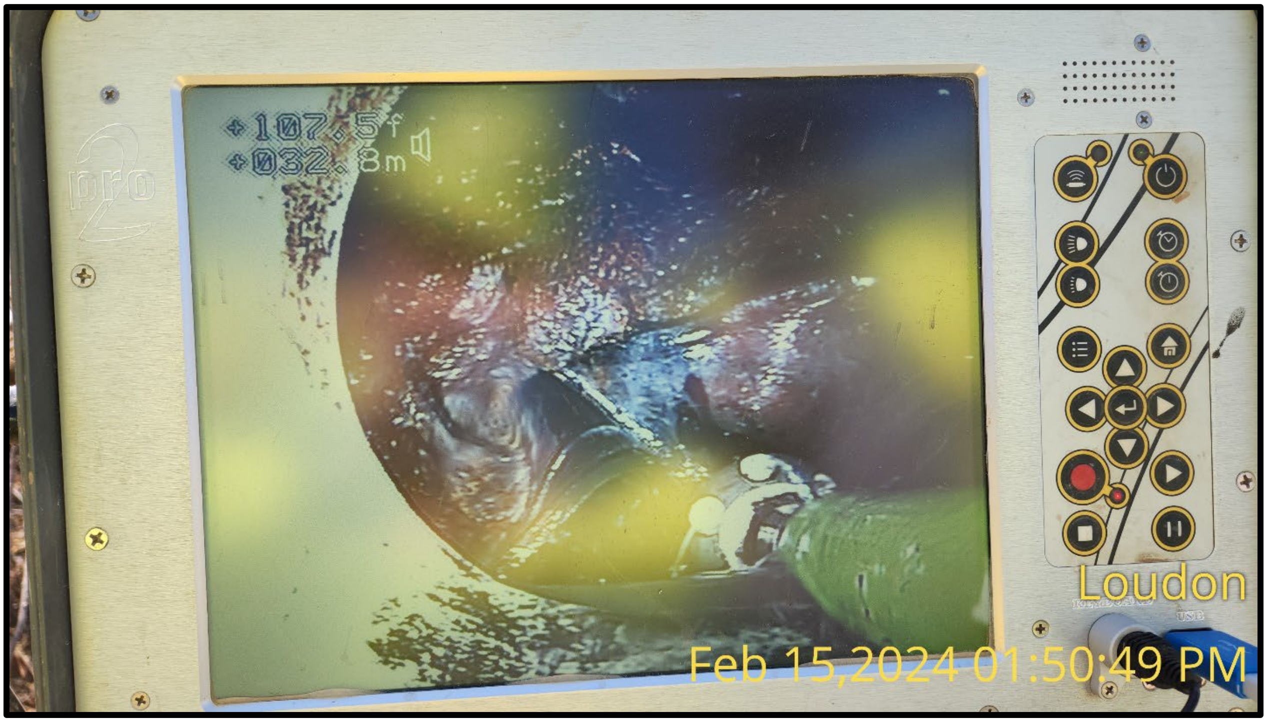
P:\310-000\317-474\-CADD\Dwg\SW03-REDUCED EXPANSION PLANS\317474-SW03-P101-PHASING EXISTING CONDITIONS.dwg[P-101] LS:(1/22/2024 - ecoe) - LP: 1/31/2024 2:17 PM

ATTACHMENT 2

PHOTOGRAPHS

PHOTOGRAPHS

PHOTOGRAPH NO. 1
View of camera scoping/inspection setup.



PHOTOGRAPH NO. 2
View of pipe conditions at end of PVC pipe near the Module A sump.

ATTACHMENT 3

BUCKET TEST RESULTS

BUCKET TEST RESULTS

PROCEDURES:

A "Bucket Test" is described as measuring the time for flow from a pipe to fill up a 5-gallon bucket. The volume of flow (i.e., 5 gallons) is then divided by the time. The result is a flow in gallons per minute (gpm).

RESULTS:

Time	**Gallons discharged**	**Flow Rate (gpm)**
0:02:56	5	1.70
0:04:10	5	1.20
0:06:31	5	0.77
0:06:07	5	0.82
0:06:20	5	0.79
Assumed Flow Rate		**0.8**

Notes:

1. The test was performed on February 27th by Hunt Environmental and CEC. The bucket test was performed for flow coming from Module A.

2. The test was performed immediately after opening the pipe for camera scoping.

3. The Assumed Flow Rate is an average of last three (3) readings, disregarding any liquid that had "built up" in the pipe.

ATTACHMENT 4

PIPE CRUSHING CALCULATIONS

CALCULATION BRIEF

MATLOCK BEND LANDFILL
EXPANSION PERMIT APPLICATION
LEACHATE COLLECTION SYSTEM PIPE STRENGTH

OBJECTIVE: Determine the structural strength of the 8-inch/12-inch diameter dual-contained SDR 11 high-density polyethylene (HDPE) pipe that is installed for leachate collection system tie-in to future modules. Confirm that the installed pipes can withstand the additional loading from the proposed vertical expansion included in this application. The HDPE SDR 11 pipe must be able to withstand the loading from the waste column for the proposed vertical limit of Cell E under proposed final conditions.

METHODOLOGY: Using the noted references, determine pipe structural strength for the outer 12-inch diameter solid-wall SDR 11 leachate collection pipes.

REFERENCES:

1. Plastic Pipe Institute (PPI), 2008. *Handbook of Polyethylene Pipe, Chapter 6 – Design of PE Piping Systems*, Irving, Texas. 2nd Edition, 2008

2. Matlock Bend Landfill Expansion Permit Application Drawings, prepared by Civil & Environmental Consultants, February 2024. (This Application).

3. ISCO HDPE Pipe Manual, ISCO Industries, Inc., Louisville, KY, Quarter 4, 2020, page B67.

4. United States Environmental Protection Agency (EPA), *When Does a Municipal Solid Waste Landfill become an Elevated Temperature Landfill (ETLF)*, February 2022.

ANALYSIS:

The proposed leachate collection piping will be analyzed for three possible modes of failure.

1. Ring Deflection
2. Ring Compression
3. Ring Buckling

Deflection, compressing and buckling all act upon the leachate collection pipes. This calculation will focus on the outermost pipe of the dual-contained collection system tie-in, which is comprised of a 12-inch diameter, SDR 11, solid-wall section located in the leachate collection system at the proposed liner penetration for tie-in to the new modules.

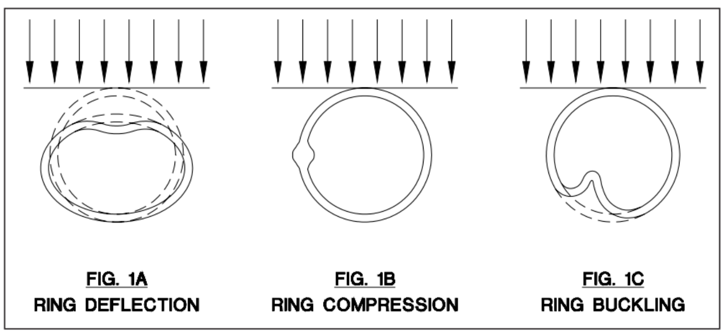


Figure 1: Failures of HDPE Pipe

The following pipe parameters will be used as well for this evaluation.

- Pipe Nominal Diameter: 12 in.
- Pipe Outside Diameter (OD): 12.75 in.
- Pipe Wall Thickness (t): 1.159 in.
- Pipe Inner Diameter (ID): 10.432 in.
- SDR: 11
- Number of Perforation Holes (/ft): Not Applicable
- Perforated Hole Diameter (in.): Not Applicable.

Table 1. HDPE Pipe Properties

PolyPipe®

PE3408/PE4710/PE100 Pipe
Pipe Data and Pressure Ratings - IPS

ISO 9001 REGISTERED

Pressure Rating		DR7 335 psi		DR9 255 psi		DR11 200 psi		DR13.5 160 psi		DR17 125 psi		DR21 100 psi		DR26 80 psi		DR32.5 65 psi	
Nominal Pipe Size	OD (inches)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)	Min. Wall (inches)	Weight (lbs/ft)
½"	0.840	0.120	0.119	0.093	0.096	0.076	0.080	–	–	–	–	–	–	–	–	–	–
¾"	1.050	0.150	0.185	0.117	0.150	0.095	0.126	–	–	–	–	–	–	–	–	–	–
1"	1.315	0.188	0.291	0.146	0.235	0.120	0.197	–	–	–	–	–	–	–	–	–	–
1 ¼"	1.660	0.237	0.463	0.184	0.374	0.151	0.314	0.123	0.261	–	–	–	–	–	–	–	–
1 ½"	1.900	0.271	0.607	0.211	0.490	0.173	0.411	0.141	0.342	–	–	–	–	–	–	–	–
2"	2.375	0.339	0.948	0.264	0.766	0.216	0.642	0.176	0.534	0.140	0.431	–	–	–	–	–	–
3"	3.500	0.500	2.058	0.389	1.664	0.318	1.395	0.259	1.159	0.206	0.936	0.167	0.768	0.135	0.626	–	–
4"	4.500	0.643	3.402	0.500	2.751	0.409	2.306	0.333	1.916	0.265	1.548	0.214	1.269	0.173	1.035	0.138	0.835
5"	5.375	0.768	4.854	0.597	3.925	0.489	3.289	0.398	2.733	0.316	2.208	0.256	1.810	0.207	1.477	0.165	1.192
5"	5.563	0.795	5.199	0.618	4.204	0.506	3.523	0.412	2.928	0.327	2.366	0.265	1.939	0.214	1.582	0.171	1.277
6"	6.625	0.946	7.374	0.736	5.963	0.602	4.997	0.491	4.152	0.390	3.355	0.315	2.750	0.255	2.244	0.204	1.811
7"	7.125	1.018	8.529	0.792	6.897	0.648	5.780	0.528	4.802	0.419	3.881	0.339	3.181	0.274	2.596	0.219	2.094
8"	8.625	1.232	12.498	0.958	10.106	0.784	8.470	0.639	7.037	0.507	5.687	0.411	4.662	0.332	3.804	0.265	3.069
10"	10.75	1.536	19.416	1.194	15.700	0.977	13.157	0.796	10.932	0.632	8.834	0.512	7.242	0.413	5.909	0.331	4.767
12"	12.75	1.821	27.312	1.417	22.085	1.159	18.508	0.944	15.379	0.750	12.427	0.607	10.187	0.490	8.312	0.392	6.703
14"	14.00	2.000	32.930	1.556	26.628	1.273	22.315	1.037	18.542	0.824	14.983	0.667	12.282	0.538	10.022	0.431	8.086
16"	16.00	2.286	43.010	1.778	34.779	1.455	29.146	1.185	24.218	0.941	19.569	0.762	16.042	0.615	13.090	0.492	10.561
18"	18.00	2.571	54.435	2.000	44.017	1.636	36.888	1.333	30.651	1.059	24.767	0.857	20.304	0.692	16.567	0.554	13.366
20"	20.00	2.857	67.203	2.222	54.342	1.818	45.541	1.481	37.840	1.176	30.577	0.952	25.066	0.769	20.453	0.615	16.501
22"	22.00	–	–	2.444	65.754	2.000	55.105	1.630	45.787	1.294	36.998	1.048	30.330	0.846	24.748	0.677	19.967
24"	24.00	–	–	2.667	78.253	2.182	65.579	1.778	54.490	1.412	44.031	1.143	36.095	0.923	29.452	0.738	23.762
28"	28.00	–	–	3.111	106.51	2.545	89.260	2.074	74.167	1.647	59.931	1.333	49.130	1.077	40.087	0.862	32.342
30"	30.00	–	–	3.333	121.63	2.727	102.467	2.222	85.141	1.765	68.798	1.429	56.399	1.154	46.019	0.923	37.128
32"	32.00	–	–	3.556	139.12	2.909	116.59	2.370	96.871	1.882	78.277	1.524	64.169	1.231	52.359	0.985	42.243
36"	36.00	–	–	4.000	176.07	3.273	146.78	2.667	121.96	2.118	99.069	1.714	81.214	1.385	66.267	1.108	53.464
42"	42.00	–	–	–	–	–	–	3.111	166.88	2.471	134.844	2.000	110.542	1.615	89.73	1.292	72.771
48"	48.00	–	–	–	–	–	–	–	–	2.824	176.122	2.286	144.381	1.846	117.808	1.477	95.047
54"	54.00	–	–	–	–	–	–	–	–	3.176	222.91	2.571	182.732	2.077	149.100	1.662	120.294
63"	63.00	–	–	–	–	–	–	–	–	3.706	303.398	3.000	248.72	2.423	202.94	1.938	163.73
65"	65.00	–	–	–	–	–	–	–	–	3.824	322.967	3.095	264.76	2.500	216.03	2.000	174.29

dura-line

*See notes on Page 4 for product and pressure rating information

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There are four (4) locations that will have liner penetrations associated with leachate collection system tie-ins to future modules. Working from north to south, the approximate thicknesses of waste with proposed waste filling associated with the vertical expansion is 121.8 feet, 118.5 feet, 84.7 feet, and 46.8 feet, respectively.

Before analyzing the pipe's strength, the total vertical load on the outer 12-inch diameter SDR 11 HDPE leachate collection pipes was calculated and summed. The overlying layers consist of 4 units:

- 2 ft of final cover soil;
- 1 ft of intermediate cover soil;
- Maximum thickness of 121.8 ft of MSW as described above; and
- 1 ft of protective soil.

Based on the approximate known thickness of each layer and assigned unit weight from the global slope stability analysis included in this application, the pressure that will be exerted by each layer calculated. The results for the soil loading are presented in the following table.

Table 2. SDR 11 HDPE Leachate Collection Pipe Loading Parameters

Layer	Approximate Thickness (ft)	Design Unit Weight (pcf)	Design Load (psf)
Final Cover Soil	2.0	125	250
Intermediate Cover Soil	1.0	125	125
MSW	121.8	80	9,744
Protective Cover Soil	1.0	125	125
Soil Loading wH			10,244 psf 71.14 psi

This gives us the following wH values:

$$P_T = 10{,}244\,psf = 71.14\ psi \qquad \text{(RES. 1)}$$

The number of perforations and the diameter of the perforations must be considered to determine the structural properties of the HDPE Pipe.

$$W_C = \frac{(P_T)\ x\ (D_O)}{\left(1-n\left(\frac{d}{12}\right)\right)} \qquad \text{(EQ. 1)}$$

Where: W_C= Vertical Load per Unit Length of Pipe, lb/in
P_T = Design Load (RES. 1), 71.14 psi
D_O = Outside Diameter of the Pipe, 12.75 in
d = Diameter of the Perforated Hole, 0 in
n = Number of Perforated holes per foot, 0

$$W_c = \frac{\left(71.14\ {}^{lb}/_{in^2}\right)\ x\ (12.75\ in)}{\left(1-0\left(\frac{0.0\ in}{12}\right)\right)}$$

$$W_C = 907\,\frac{lb}{in} \qquad \text{(RES. 2)}$$

The design value in psi is found by dividing the design load in lbs/in by 12 inches as that is the nominal diameter of the pipe:

$P_D = \frac{907}{12}$ = 75.58 psi or 10,884 psf (RES. 3)

<u>Ring Deflection:</u>

To determine the deflection anticipated in the leachate collection pipes, it is necessary to first determine the relative stiffness between pipe and soil, given as the Rigidity Factor, R_F, as determined by the following equation:

$$R_F = \frac{12E_s(DR-1)^3}{E} \qquad \text{(EQ. 2)}$$

Where:

DR = Dimension Ratio (SDR)
E = Apparent modulus of elasticity of pipe material, psi
E_S= Secant Modulus of Soil, psi

Reference No. 1 provides the tables to determine the factors for pipe deflection. The apparent elastic modulus is from the following table:

Table 3. Apparent Elastic Modulus

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.

For HDPE pipes subjected to earth and vehicle loading Ref. No. 1 recommends using the 100-year modulus. Assuming that a PE4XXX category pipe will be used, E is approximately 28,000 psi.

The maximum anticipated operating temperatures of landfill will be greater than the standard 73^{o}F thus an adjustment factor is needed for the elastic modulus. The operating temperature is estimated to be 110^{o}F based off EPA estimated normal landfill temperatures in Ref No. 4. Using the table below a factor will be to adjust the elastic modulus:

Table 4. Temperature Compensating Multiplier

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

As such, the apparent Elastic Modulus, E, is adjusted as follows:

$E = 28{,}000\ psi\ (0.64) = 17{,}920\ psi$ (RES. 4)

The secant modulus of soil, E_s, can be determined by the following the equation:

$E_s = M_S \frac{(1+\mu)(1-2\mu)}{(1-\mu)}$ (EQ. 3)

Where:

M_s = One-dimensional soil modulus
μ = Void Ratio (Ref No. 1 recommends a typical value of 0.1)

To determine the one-dimensional soil modulus, M_s, it was assumed that the vertical soil stress acting on the pipe is approximately 100 psi compacted to 90% of the standard proctor. Ref. No. 1 provides a table for the value which is below:

Table 5. One-Dimensional Modulus of Soil

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
$\boxed{100}$	6500	$\boxed{3200}$	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

Using EQ. 3, E_s, can be calculated as:

$$E_s = 3{,}200\text{ psi}\,\frac{(1+0.1)(1-2(0.1))}{(1-0.1)}$$

$$E_S = 3{,}129\text{ psi} \qquad \text{(RES. 5)}$$

Using EQ. 2, RES. 4 and RES. 5, the rigidity factor, R_F, can be calculated as:

$$R_F = \frac{12(3{,}129\text{ psi})(11-1)^3}{17{,}920\text{ psi}}$$

$R_F = 2{,}095$ (RES. 6)

This will be used to find the D_F using the Watkins-Gaube graph from Ref No.1, shown in Figure 3.

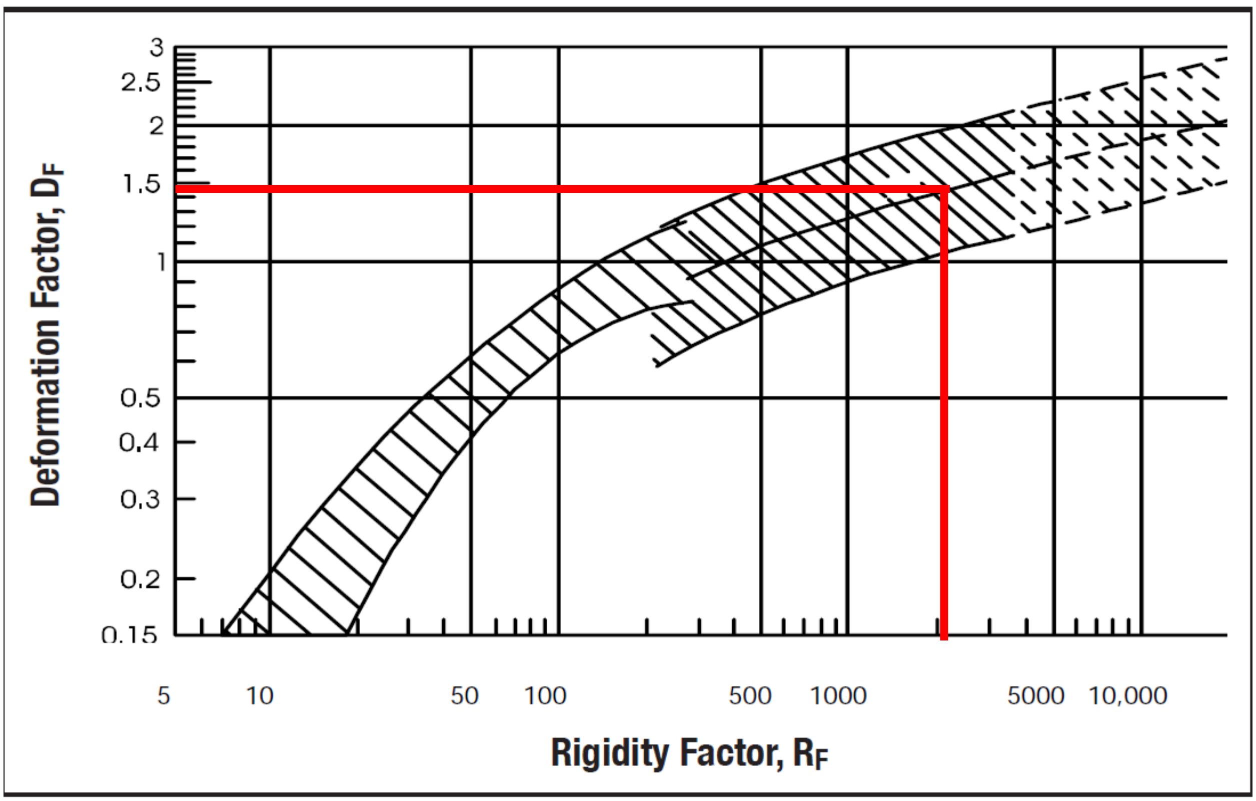


Figure 3: Watkins-Gaube Graph

Using an R_F of 2,095 a deformation factor of 1.45 will be used.

The anticipated pipe deflection is determined using the following equation.

$$\frac{\Delta X}{D_M} = D_F \varepsilon_S \qquad \text{(EQ. 4)}$$

Where:

$\frac{\Delta X}{D_M}$ = horizontal deflection (%)

D_F = Deformation factor, 1.45 from Figure 3

ε_S = soil strain, calculated as:

$$\varepsilon_S = \frac{W_C}{144Es} \qquad \text{(EQ. 5)}$$

Where:

W_C = soil loading, 10,884 psf (RES. 3)

E_S = 3,129 psi (RES. 5)

$$\varepsilon_S = \frac{10{,}884\ psf}{144(3{,}129\ psi)} X100\%$$

$$\varepsilon_S = 2.42\% \qquad \text{(RES. 7)}$$

Using EQ. 3, the anticipated deflection can be calculated,

$$\frac{\Delta \mathrm{X}}{\mathrm{D_M}} = \mathrm{D_F}\varepsilon_S = 2.42\%(1.45) = 3.5\% \qquad \text{(RES. 8)}$$

The maximum allowable pipe deflection provided in Ref. No. 1 is 7.5%. As such, the factor of safety against excessive pipe deflection is as follows:

$$FS_{deflection} = \frac{Allowable\ deflection}{Actual\ deflection} = \frac{7.5\%}{3.5\%} = 2.14$$

The $\mathrm{FS}_{\mathrm{deflection}}$ is greater than 1.0 therefore the pipe is acceptable.

Ring Compression (Crushing)

To determine the compressive stress that occurs on the pipe in deep fill conditions, it is necessary to first determine the vertical arching factor (VAF) given by the following equation:

$$VAF = 0.88 - 0.71\frac{S_A - 1}{S_A + 2.5} \qquad \text{(EQ. 6)}$$

Where:

VAF = Vertical arching factor

S_A = Hoop thrust stiffness ratio, calculated as:

$$S_A = \frac{1.43 \mathrm{M_s} \mathrm{r_{cent}}}{\mathrm{EA}} \qquad \text{(EQ. 7)}$$

Where:

M_s = One-dimensional soil modulus, 3,200 psi from Table 5

r_{cent}= Radius to centroidal axis of pipe, inches

E = Apparent modulus of elasticity of pipe material, psi

A = Wall thickness of pipe, inches

For the outer 12-inch diameter HDPE pipe with a SDR of 17, the radius to the centroidal axis (r_{cent})of the pipe is estimated to be as follows:

$$r_{cent} = \frac{OD - A}{2} \qquad \text{(EQ. 8)}$$

Where:

OD = Outside diameter of pipe, 12.75 inches

A = Wall thickness of pipe, 1.159 inches

Using EQ. 8, the centroidal axis can be calculated as follows:

$$r_{cent} = \frac{12.75\ inches - 1.159\ inches}{2} = 5.7955$$

$$r_{cent} = 5.7955\ inches \qquad \text{(RES. 9)}$$

Using EQ. 7, M_s from Table 6, RES. 4, and RES. 9, the hoop thrust stiffness ratio can be calculated to be:

$$S_A = \frac{1.43(3{,}200\ psi)(5.7955\ in)}{(17{,}920\ psi)(1.159\ in)} 26520.208/20769.28$$

$$S_A = 1.277 \qquad \text{(RES. 10)}$$

Using EQ. 6 and RES. 10, the vertical arching factor becomes:

$$VAF = 0.88 - 0.71\left(\frac{1.277 - 1}{1.277 + 2.5}\right)$$

$$VAF = 0.828 \qquad \text{(RES. 11)}$$

The radial directed earth pressure, P_{RD}, acting on the leachate collection pipe is given by the following equation. Use Res. 3 for the weight of the waste.

$$P_{RD} = (VAF)P_d == 0.828(10{,}884\ psf) \qquad \text{(EQ. 9)}$$

$$P_{RD} = 9{,}012\ \ psf \qquad \text{(RES. 12)}$$

Ref. No. 1 provides the following equation to determine the compressive stress, S, acting on the leachate collection pipes:

$$S = \frac{P_{RD}(OD)}{288(A)} \qquad \text{(EQ. 10)}$$

Where:

OD = Pipe outer diameter, 12.75 inches, for 12-in diameter SDR 11 HDPE pipe
A = Wall thickness, 1.159 inches, for 12-in diameter SDR 11 HDPE pipe
P_{RD} = 9,012 psf (RES. 12)

Using EQ, 10 and RES. 12, the compressive stress, S, acting on the leachate collection pipe is shown as:

$$S = \frac{9{,}012\ psf\,(12.75\ in)}{288(1.159\ in)}$$

$$S = 344.235\ psi \qquad \text{(RES. 13)}$$

Table 6. Isco Pipe Material Properties

Physical Property	ASTM Test Method	Units	PE2708		PE3608		PE4710	
			Cell Number	Typical Value	Cell Number	Typical Value	Cell Number	Typical Value
Density	D 1505	gr/cc	2	>0.925 - 0.940	3	>0.940 - 0.947	4	>0.947 - 0.955
Melt Index	D 1238	gr/10 min	3	<0.4 - 0.15	4	<0.15	4	<0.15
Flexural Modulus	D 790	psi	3	40,000 - <80,000	5	110,000 - <180,000	5	110,000 - <180,000
Tensile Strength	D 638	psi	3	2,600 - <3,000	4	3,000 - <3,500	4	3,000 - <3,500
							5	3,500 - <4,000
Resistance to Slow Crack Growth	F 1473	hours	7	500 minimum	6	100 minimum	7	500 minimum
Hydrostatic Design Basis, HDB	D 2837	psi	3	1250	4	1600	4	1600
UV Stabilizer	D 1603	%	E	Colored with UV Stabilizer	C	2% Min Carbon Black	C	2% Min Carbon Black

The table above from Ref. No. 4 shows the allowable hydrostatic design basis (i.e., compressive stress). Assuming the pipe will be PE4710 series the allowable compression is 1,600 psi. From Ref. No. 1 the safety factor is the following:

$$FS_{compressive} = \frac{Allowable\ Compressive\ Stress}{S}$$

$$FS_{compressive} = \frac{1{,}600}{344} = 4.65$$

Since the $FS_{compressive}$ is more than 1.3, the pipe is acceptable in Crushing.

Ring Buckling

From Ref. No. 1 the critical constrained pipe buckling pressure, PCR, is determined using the following equation:

$$P_{CR} = \frac{2.4\varphi R_H}{D_M}(EI)^{\frac{1}{3}}(E_S^*)^{\frac{2}{3}} \qquad \text{(EQ. 11)}$$

Where:

P_{CR} = critical constrained buckling pressure (psi)
Φ = Calibration Factor (Ref. No. 1 recommends 0.55 for granular soils)
R_H = Geometry Factor (Ref. No. 1 recommends 1.0 for burials in deep fill)
D_M = Mean diameter, 11.59 inches for 12-inch diameter SDR 11 pipe
E = Elastic Modulus, 17,920 psi (RES. 4)
I = Pipe wall moment of inertia (wall thickness^3/12), (1.159 in)^3/12 = 0.13-in^3 for 12-inch SDR 11 pipe
E_S^* = E_S / (1-μ)
E_S = 3,129 psi (RES. 5)
μ = void ratio, assumed 0.1 E_S^* = 3,129 psi/(1 – 0.1) = 3,477 psi

$$P_{CR} = \frac{2.4(0.55)(1)}{11.59\ in}\left(17{,}920\ psi\ (0.13\ in^3)\right)^{\frac{1}{3}}(3{,}477\ psi)^{\frac{2}{3}}$$

P_{CR} = 346 psi or 49,856 psf (RES. 14)

Safety factor against buckling failure is, using RES. 3 and RES.14:

$$FS = \frac{P_{CR}}{P_D} = \frac{49{,}856\ psf}{10{,}884\ psf} = 4.58 \qquad \text{(RES. 15)}$$

FS = 4.58 is greater than 1.3 so acceptable for buckling.

CONCLUSIONS: The deflection, buckling and compression are all acceptable values for the 12-inch SDR 11 pipes that are existing in the leachate collection system tie-in to future modules at Matlock Bend Landfill.

Project: Matlock Bend Landfill - Expansion Permit Application

Project No.: 317-474

Subject: Leachate Collection Zone - Pipe Strength Calculations

Prepared By: ZLM

Date: 2/26/2024

Checked By:

Date:

PIPE STRENGTH CALCULATIONS

Deep Fill Installation

	FACTORS:	Symbol	Unit	Value
COMPRESSION	Vertical Arching Factor	VAF	dimensionless	0.828
	Hoop Thrust Stiffness Ratio	S_A	dimensionless	1.277
	1-D Modulus of Soil	Ms	psi	3,200
	radius to centroidal axis of pipe	R_{cent}	inches	5.796
	Pipe Apparent Modulus of Elasticity	E	psi	17,920
	Wall thickness of pipe	A	inches	1.159
	Radial Directed Earth Pressure	P_{RD}	psf	9,011
	Earth Pressure Loading	wH	psf	10,244
	Compressive Stress	S	psi	344
	Pipe Outer Diameter	D_o	inches	12.750
	Allowable Compressive Stress		psi	1,600

	FACTORS:	Symbol	Unit	Value
DEFLECTION	Rigidity Factor	R_F	dimensionless	2,095
	Pipe Apparent Modulus of Elasticity	E	psi	17,920
	Secant Modulus of Soil	E_S	psi	3,129
	1-D Modulus of Soil	Ms	psi	3,200
	Dimension Ratio	DR	dimensionless	11
	Void ratio of soil	μ	dimensionless	0.10
	Earth Pressure Loading	wH	psf	10,244
	Soil Strain	ε_S	dimensionless	2.4%
	Deformation Factor	DF	dimensionless	1.45
	Deflection	$\Delta X/Dm$	dimensionless	3.5%
	Allowable Deflection		dimensionless	7.5%

	FACTORS:	Symbol	Unit	Value
BUCKLING	Buckling Pressure	P_{CR}	psi	346
	Buckling Pressure	P_{CR}	psf	49,856
	Pipe Apparent Modulus of Elasticity	E	psi	17,920
	Calibration Factor	ϕ	dimensionless	0.55
	Geometry Factor	R_H	dimensionless	1.0
	Mean Pipe Diameter	D_M	inches	11.59
	Pipe Wall Moment of Inertia	I	in^4/in	0.130
	Secant Modulus of Soil	E_S	psi	3,129
	Poisson’s Ratio of soil	μ	dimensionless	0.10
		Es*	psi	3477

FACTORS OF SAFETY:	Calculated FS	Minimum Allowable FS	Acceptable?
FS Against RING COMPRESSION	4.65	1.00	YES
FS against RING DEFLECTION	2.14	1.00	YES
FS Against RING BUCKLING	4.58	2.00	YES

2.168301

5.03505

7

1.071429

TAB 2

February 20, 2025

Mr. Adam Waller
Chairman
Loudon County Solid Waste Disposal Committee
100 River Road #106
Loudon, TN 37774

RE: Response to: Memo - Module A, B, E, and H Pipe Penetration Scoping Summary
Matlock Bend Landfill – Proposed 2024 Horizontal Expansion
Loudon County, Tennessee
SNL530000203

Dear Mr. Waller:

Cannon & Cannon, Inc. (CCI) has reviewed the referenced documents dated March 22, 2024. The review included evaluating the Memorandum for the Module A, B, E, and H Pipe Penetration Scoping Summary along with other proposed horizontal expansion documents for reference.

EXECUTIVE SUMMARY

This technical review focuses on the leachate collection system, specifically the transition from HDPE to PVC piping and the associated issues. The review is based on CCTV data, field investigation memos, and design documents. Excavating the end of the pipe, making proper repairs to the area of concern (AOC), and slip lining as planned while the end of the pipe is exposed will ensure a permanent repair and prevent trapping leachate in "Module A".

This review has been inclusive of all documents included with the March 22, 2024 Memorandum, CCTV video, and design plan sheets. Attached is a summary of the review with conclusive recommendation along with backup documents, separately. If you feel there is any further discussion necessary, please feel free to reach out.

Sincerely,

Chris Cline, P.E.
Project Manager

REVIEW DOCUMENTS AND KEY AREA IDENTIFIED

The leachate collection system under review includes the attached sheets:

- **P-101:** Information map indicating the area of interest (purple line into Modular A).
- **Images:** From the March 22, 2024 Memorandum.
- **Video Image:** From "Mod A Slow Pull1".
- **P-202:** Historic leachate collection grid requiring a "TEE" for connections.
- **P-617:** Marked-up sheet based on memo information, highlighting an area of "unknown".
- **P-118:** Detail indicating stopping grouting 2 feet short of the end of the pipe.

SUMMARY OF UNDERSTANDING AND FINDINGS

Based on the review of CCTV data, the following conclusions were made:

- The system transitions from 116 feet of HDPE to approximately 18 feet of PVC pipe.
- CCTV inspection was abandoned due to an impassable obstruction.
- The PVC pipe ends at a deformed or buckled fitting, possibly a TEE for corrugated leachate pipe.
- Soil/aggregate conditions are viable.
- The PVC pipe is not capable of withstanding the crushing load of the future cell.
- The deformed fitting may restrict the flow of leachate.

The proposed modifications of the 2024 Horizontal Expansion include the following to ensure the system can handle the overburden of expansion activities, including heavy equipment and future cell refuse and systems:

- Slip lining the 6-inch pipe with a smaller 4-inch pipe.
- Grouting the annular space from the exposed end.

CONCLUSION

Based on the review of information, the area of concern (AOC) is identified as a collapsed pipe or fitting and disconnected. Proposed slip lining and grouting will ensure the conduit can handle the overburden of expansion activities. However, slip lining and grouting into an area of unknown conditions can lead to other issues. If the slip liner pipe is not properly seated, the grout filling process may expand into the exposed soils and close off the pipe conduit further.

Currently, the AOC is in an active/open cell approximately 10-15 feet deep. It is recommended to excavate the end of the pipe, make proper repairs to the AOC, and slip line as planned while the end of the pipe is exposed. This will provide a permanent repair to the pipe or pipe connection and eliminate the possibility of trapping leachate in the existing "Module A".

TAB 3

CANNON & CANNON INC

March 17, 2025

Mr. Adam Waller
Chairman
Loudon County Solid Waste Disposal Committee
100 River Road #106
Loudon, TN 37774

RE: Response to: February 19, 2025 Leachate Outbreak Notice at
Matlock Bend Landfill SNL530000203
Loudon County, Tennessee

Dear Mr. Waller:

Following the notice from the TDEC of a leachate outbreak occurrence on February 19, 2025, Cannon & Cannon, Inc. (CCI) performed field observations and collected samplings. After reviewing all collected field and analytical data, we are pleased to provide the following report along with an attached site map, depicting areas discussed in the report.

This investigation has been inclusive of two site visits and lab testing. Attached is a summary of the investigation with conclusive recommendations along with backup documents, separately. If you feel there is any further discussion necessary, please feel free to reach out.

Sincerely,

Chris Cline, P.E.
Project Manager

EXECUTIVE SUMMARY

A leachate outbreak reportedly occurred on Feb 17, 0225. On February 19, 2025, the Commission was initially notified by Mr. Lewis Haynes of the Tennessee Department of Environment and Conservation (TDEC), via email, of the February 17th leachate outbreak occurrence, as reported by Santek Environmental / Republic Services (Republic). TDEC requested a plan of action to resolve the cause of the outbreak and remediate areas affected by the outbreak. Republic identified pump failure as the cause of the outbreak and leachate was contained in the sump of Module 2 and was being pumped from the sump to the pump station to be normally discharged to the Loudoun Utilities collection system and a vac truck would accompany these efforts to properly remove leachate form the site.

At the request of the Loudon County Solid Waste and Disposal Commission, CCI accompanied by representatives from the commission, performed a site investigation on February 24, 2025 to confirm the plan of action set forth by Republic on February 19 was under way. The site visit on Feb 24, 2025 identified:

1. Multiple leachate outbreaks,
2. Pumping as described in Republic's plan of action to TDEC, along with
3. Additional pumps that discharged leachate to the stormwater system.

To confirm, a follow-up site visit on February 27, 2025 for further observations and collect aqueous samples.

In conclusion, leachate outbreaks at perimeter berms are attributable to trapped or standing leachate, commonly referred to as "Head on Liner." TDEC regulates "head on Liner" to not exceed one foot in depth. The primary leachate outbreak occurring at the south slope of Cell E and A, or AOC 1, is to a high degree of confidence, due to leachate backing up in the waste pile or backed on the liner and not draining through the collapsed leachate collection pipe or pipe fitting within the existing "Module A," as identified in the detailed in the Technical Memorandum dated February 20, 2025. It is recommended that the collapsed pipe identified in the memorandum be excavated and repaired.

Based on observations and sampling results, there were multiple points of leachate from the active landfill Modules A, E, B, and H (AOC 1, 2, 3, & 4) that drained into the sump of Modules 1 / 2. Leachate was then pumped not only to the sewer system but also off site through the stormwater system and ultimately released offsite. It is recommended that the full extent of contamination be traced and remediation measures be implemented for all affected areas both within and beyond landfill property boundaries. Additionally, it is recommended that the connection between AOC 5 and AOC 6 be assessed, and any necessary repairs be made.

INTRODUCTION

A leachate outbreak reportedly occurred on Feb 17, 0225. On February 19, 2025, the Commission was initially notified by Mr. Lewis Haynes of the Tennessee Department of Environment and Conservation (TDEC), via email, of the February 17th leachate outbreak occurrence, as reported by Santek Environmental / Republic Services (Republic). TDEC requested a plan of action to resolve the cause of the outbreak and remediate areas affected by the outbreak.

Later on, February 19, 2025, Ms. Van Kirk of Republic, identified a pump failure as the cause of the outbreak. The pumps had been replaced and the leachate from the outbreak was collected in the sump of Module 2. It was reported that the collected leachate was being pumped from the sump to the pump station to be normally discharged to the Loudoun Utilities collection system and a vac truck would accompany these efforts to remove leachate form the site.

On behalf of the Loudon County Solid Waste and Disposal Commission, Commissioner Dianah Mullis, P.E., and CCI representatives (Chris Cline, P.E. and Jimmy Albert, P.E.) visited the site on February 24, 2025, took pictures and made observations. The team was escorted around the site by Republic representative Teresa Fox. In response to these observation , on February 27, 2025, Chairman Adam Waller and a CCI field team (Chris Cline, P.E. and Drew Williamson) revisited the site and collected water samples. The following details the findings from both the February 24 and the February 27 observations.

SITE VISIT OBSERVATIONS

FEBRUARY 24, 2025

The primary area of concern identified by Republic was a singular leachate outbreak. Based on emails between TDEC and Republic, initial reports identified the cause of the leachate outbreak as undersized pumps (pump failure) and leachate was collected in the sump of Module 2. Reports did not specify the precise location of the outbreak. Upon arriving in the construction area of the proposed new modules, the site representative identified the affected area as the north-facing slope of existing Module A and E, where the plywood is, as the location of the "Self-Reported" Leachate Outbreak. For reporting purposes, this area of concern is AOC 1. According to the findings in Technical Memo February 20, 2025, this area was defined as problematic for “trapping leachate” due to a collapsed pipe or pipe fitting. The collapsed pipe or fitting was identified by Republic in March 15, 2024. In addition to AOC 1, at least 3 other instances of leachate outbreaks were observed along the west-facing slope of Modules B and H (AOC 2, AOC 3, and AOC 4). See the attached site plan for general locations of these AOCs. Figures 1, 2, and 3, below, provide a visual of these AOCs as observed on February 24th.

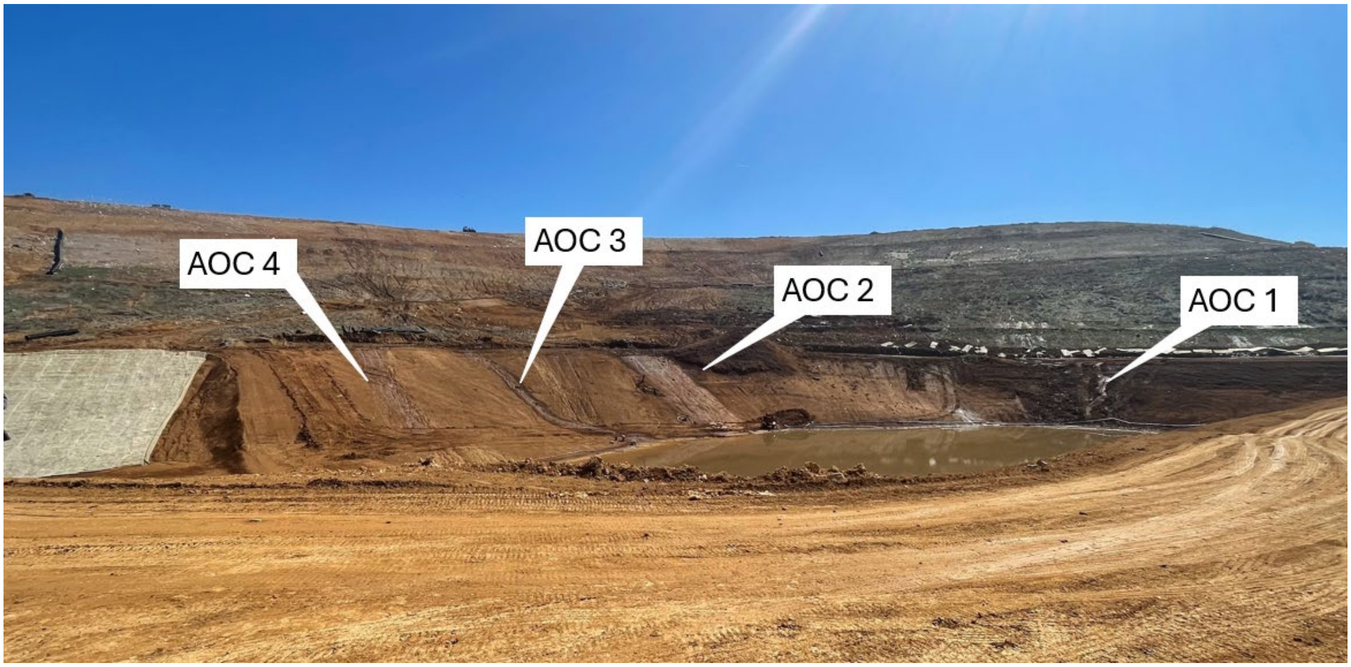


Figure 1: Leachate Outbreak Location (AOC 1, 2, 3, & 4)

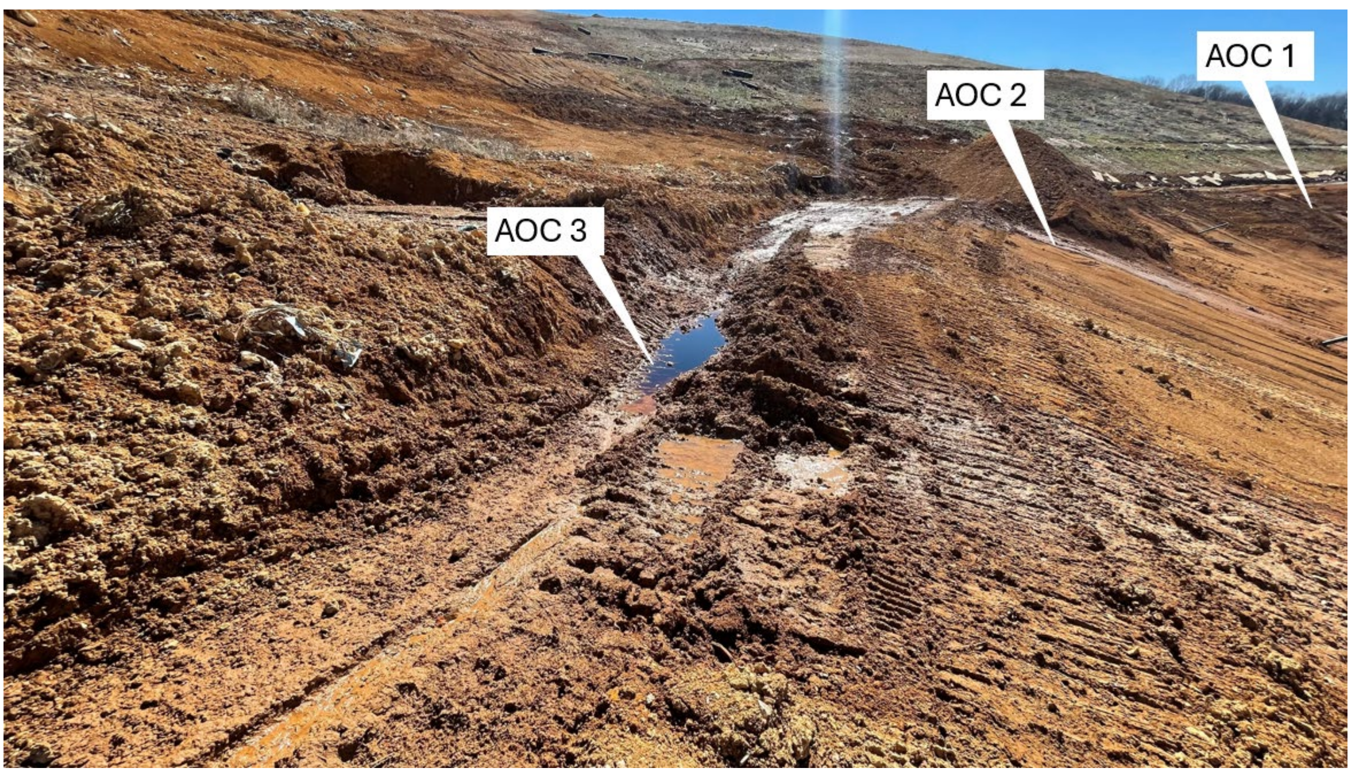


Figure 2: Leachate Outbreak Identification (AOC 1, 2, & 3)

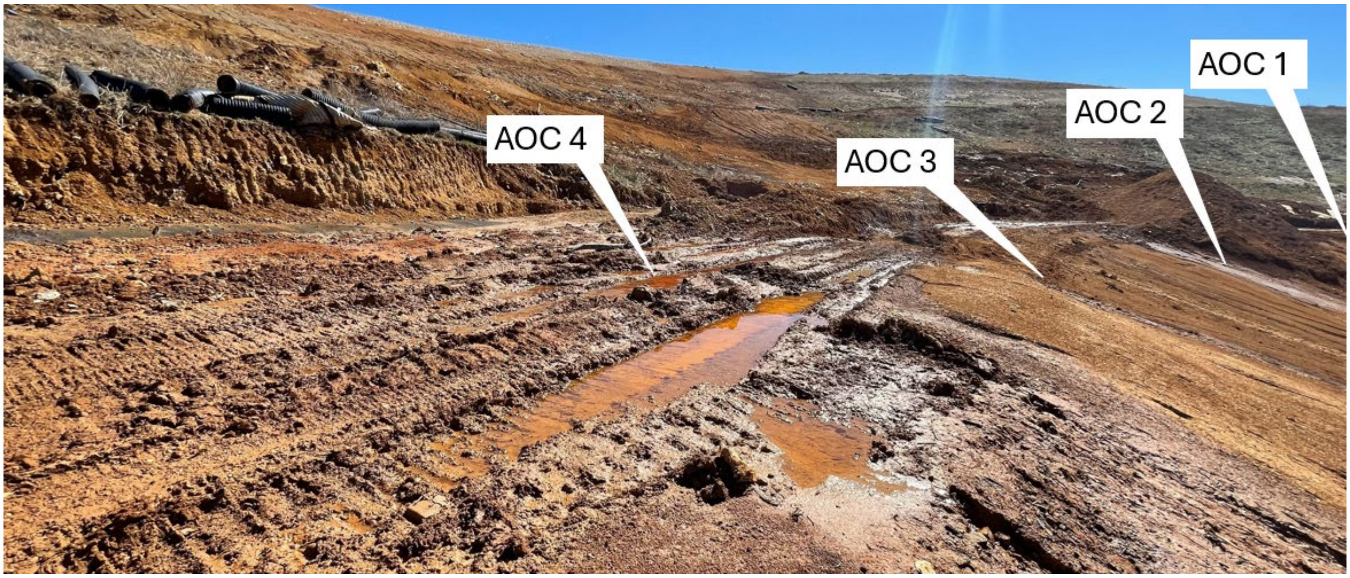


Figure 3: Leachate Outbreak Identification (AOC 1, 2, 3, & 4)

As originally reported, and observed, all leachate outbreak areas ultimately drained into a single collection point, namely, the proposed sub cell for newly constructed Modules 1 and 2. Prior to the site visit, communications had been issued indicating that remediation efforts would include pumping leachate-laden water from the Module 1/2 sump southward and into the existing leachate disposal system. During the site visit on February 24th, this primary disposal system, a fuel powered pump and suction and discharge lines, was observed to be in place and operational, discharging into the pump station. See Figure 4.

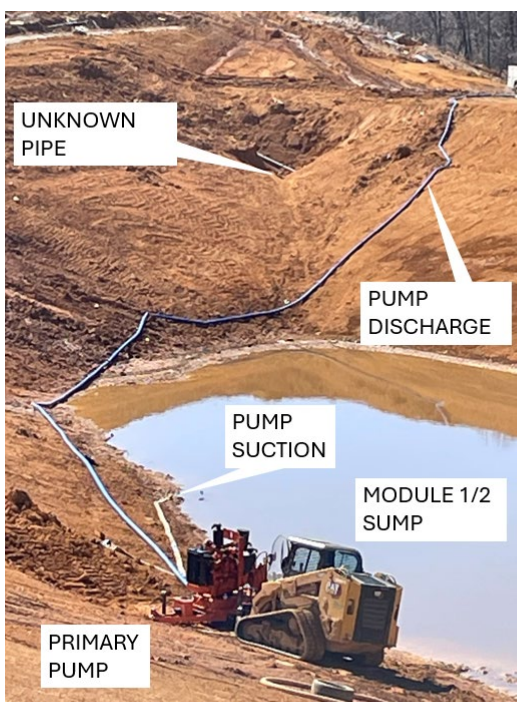


Figure 4: Leachate Disposal System (Primary Pumping System)

In addition to confirming the presence of the reported pumping system, it was also observed that a secondary pumping system was actively extracting water from the same pool of leachate-laden water and discharging to the north, into proposed module 3 sump. The discharge piping for this secondary pumping system was routed to a pipe that penetrated the bottom of the western berm of newly constructed Module 3 (Figures 5 and 6). Presumably, the drain for the sump of proposed Module 3. At a visibly similar elevation on the opposite side of the berm, an aqueous conveyance was observed along the northwestern side of the access road, in the ditch at the entry to Sediment Pond #3, see Figure 7. With a high degree of certainty, this strongly indicating the presence of a direct pathway of leachate-laden water to sediment pond #3.

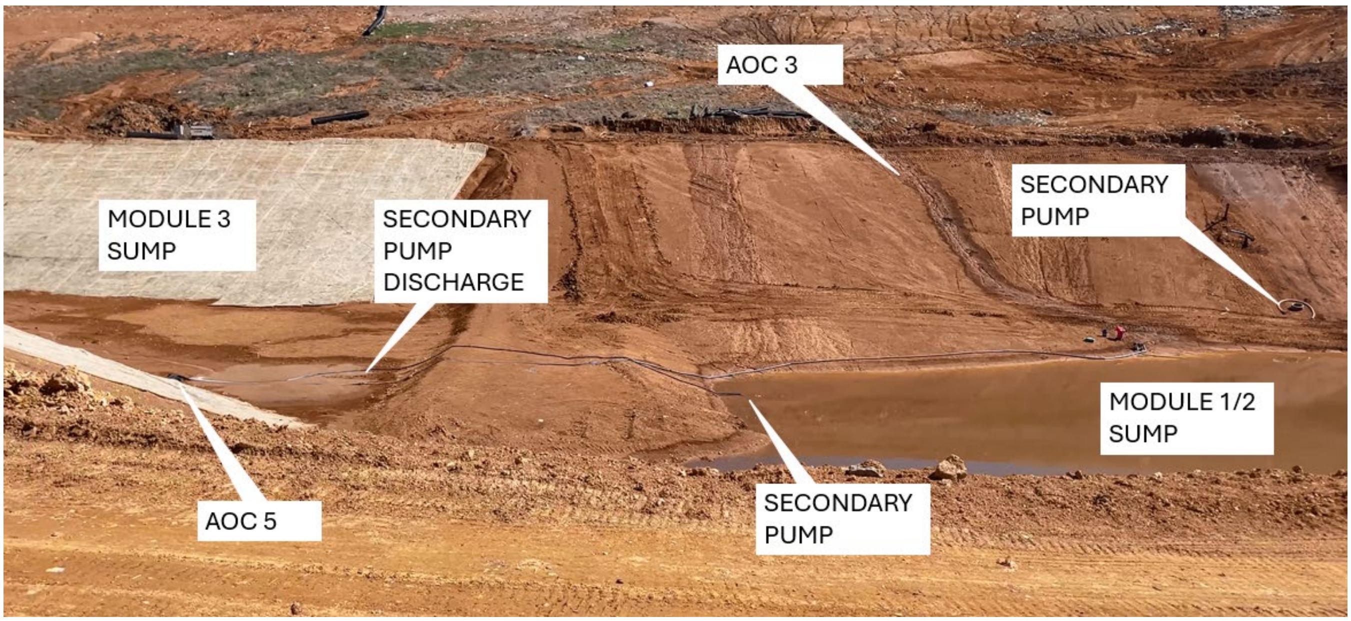


Figure 5: Leachate Disposal System (Secondary Pumping system)

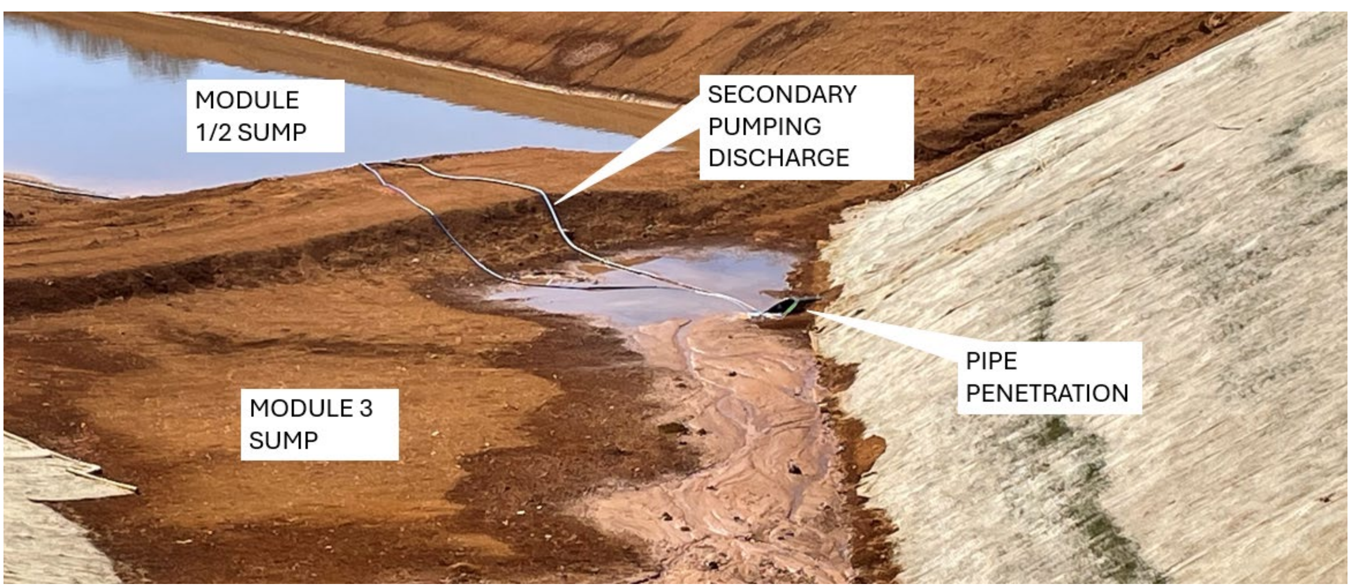


Figure 6: Pumping Discharge (AOC 5)

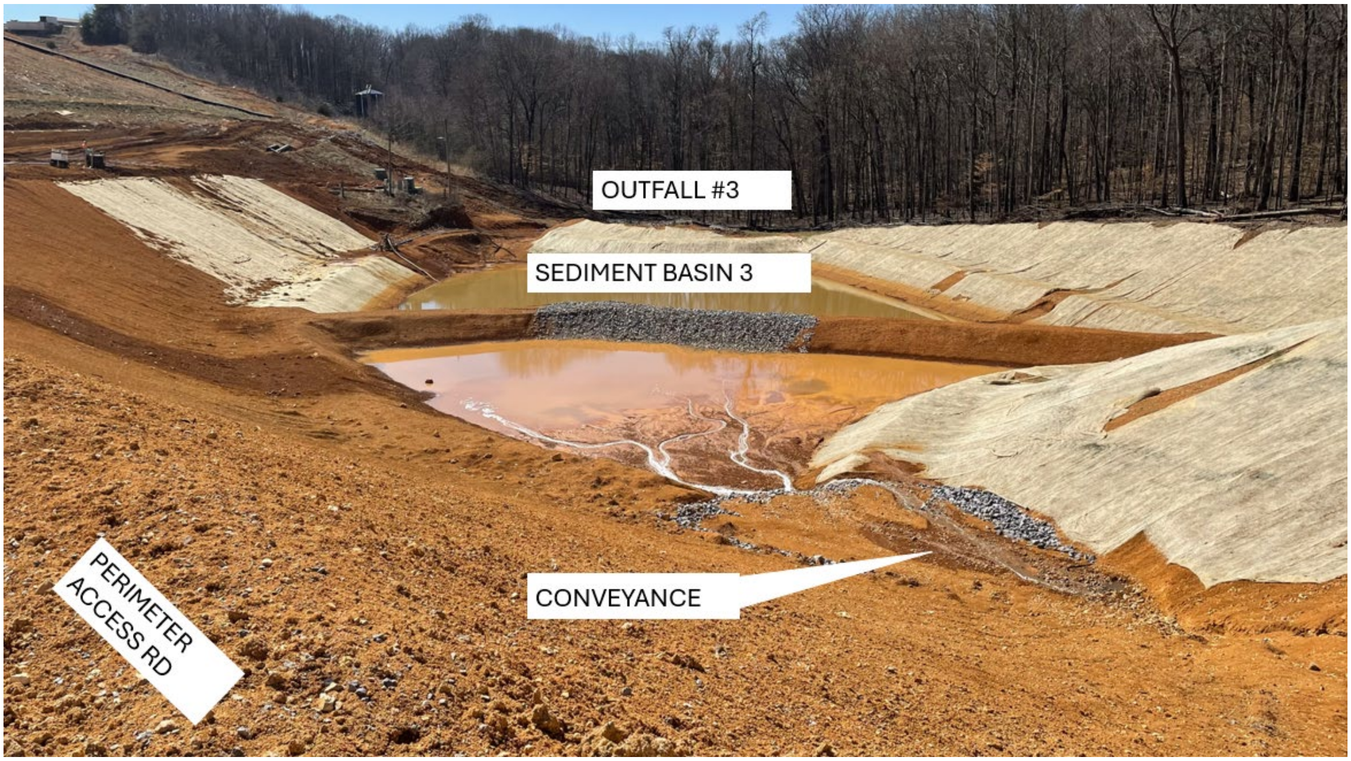


Figure 7: Conveyance into Sediment Basin (AOC 6)

FEBRUARY 27, 2025

INITIAL OBSERVATIONS (8:43AM – 8:47AM)

To provide a higher degree of confidence in the connection of the leachate source and the storm water in Sediment Basin #3, a second site visit was conducted to collect field data and samples at the source, in the sump of Module 1 / 2, Module 3 and in the conveyance into Sediment basin #3.

Upon arriving in the construction area of the proposed new modules, areas closest to the source, AOC 1, 2, 3, and 4, had evaporated, the ponding in sumps of Modules 1 / 2 was considerably reduced, and the sump of Module 3 had a noticeable increase in the volume of water, see Figure 8 as compared to Figure 5. All pumps were running similarly to February 24, 2025, and the aqueous conveyance at AOC 6 continued to flow, see Figure 9. A pump was actively drawing out of Sediment Basin #3 near the designed discharge and pumping westward to a sediment bag at the outfall and discharging off site (see Figure 10).

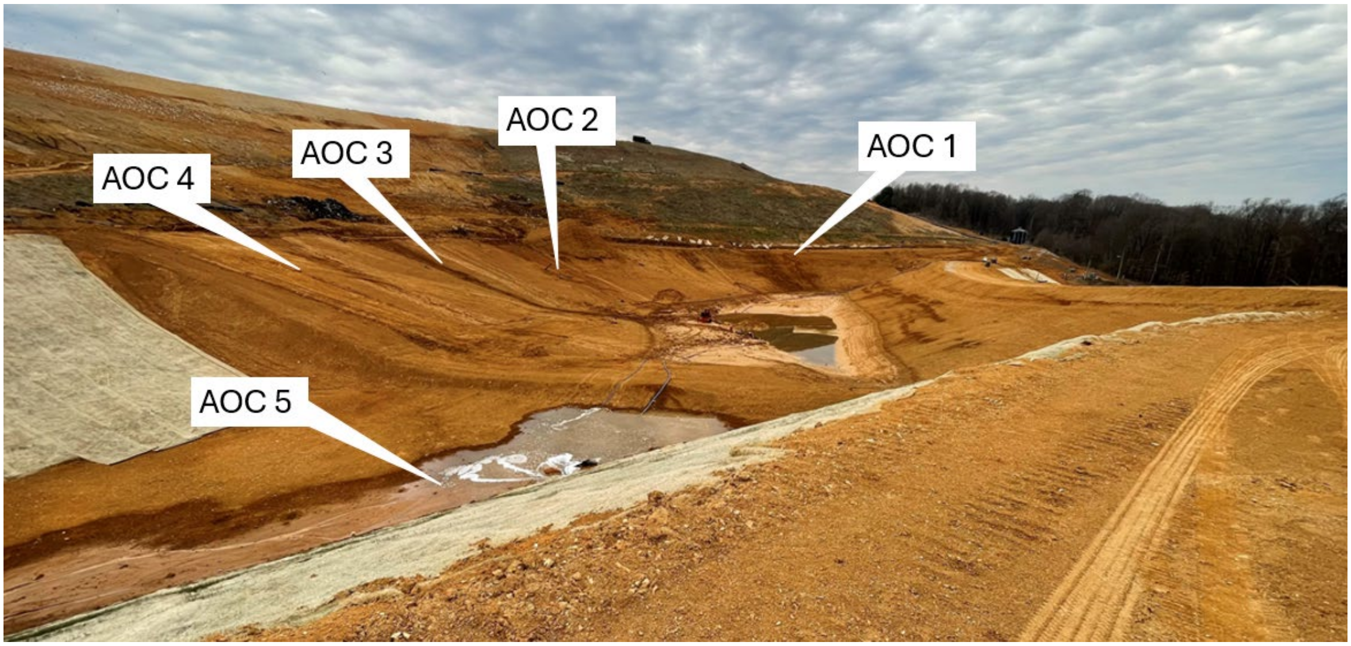


Figure 8: Module 1, 2 and 3 Sump and AOC 1 – 5

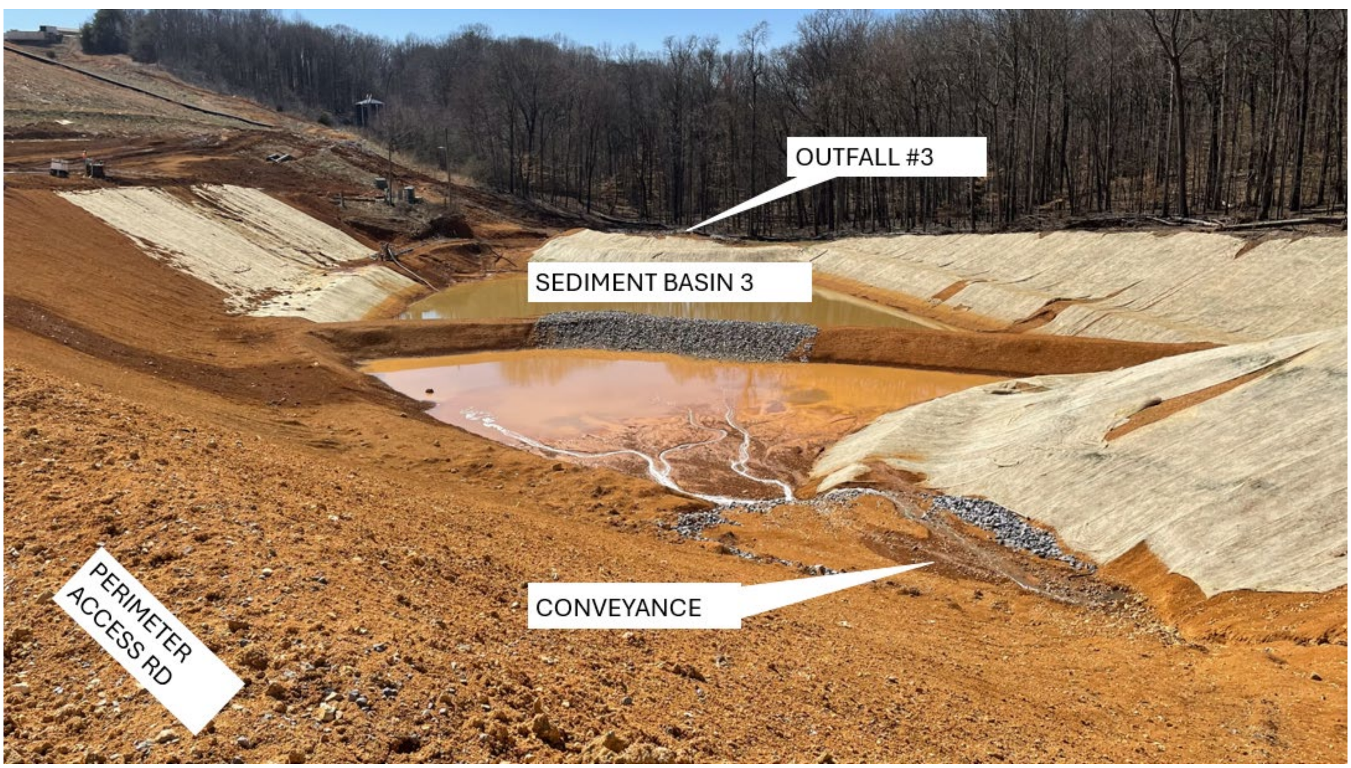


Figure 9: Sediment Pond #3 and Outfall #3 AOC 6

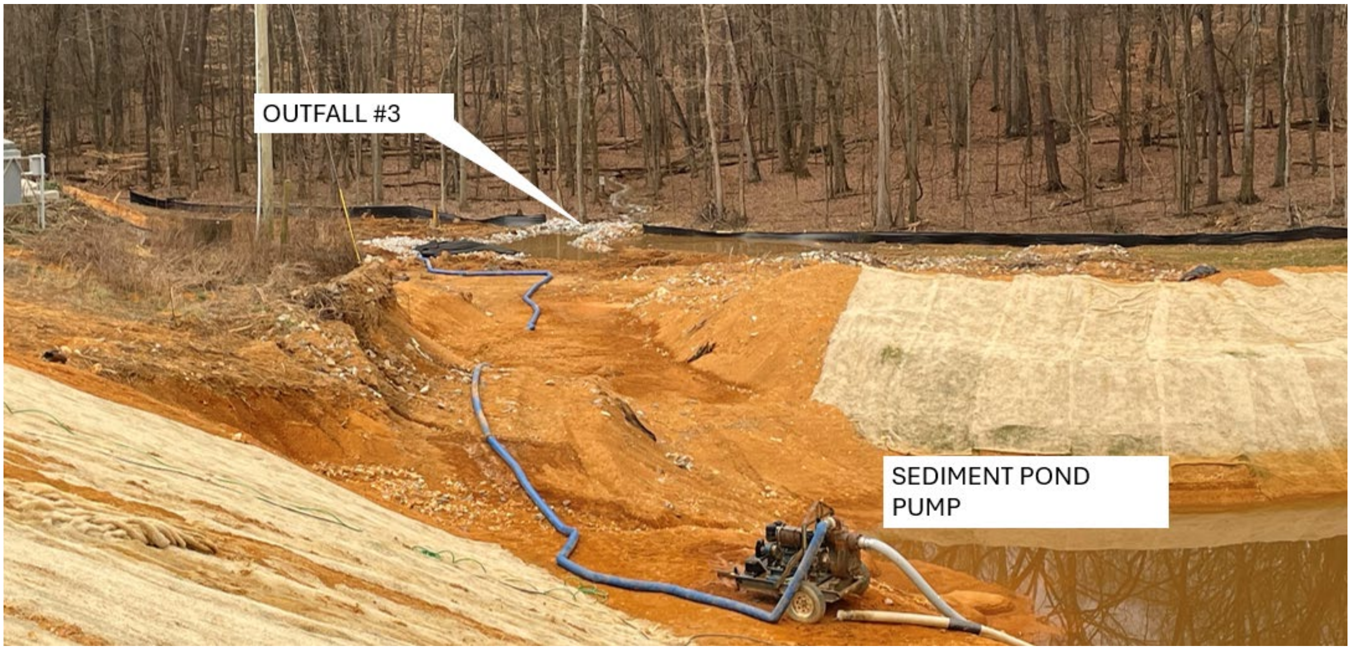


Figure 10: Sediment Pond #3 Outfall (AOC 7)(Woods are off-site)

SECONDARY OBSERVATIONS (8:56AM – 9:30AM)

Shortly after observing the notables above in the "Initial Observation *(8:43AM – 8:47AM)*", all the portable pumps were shut off. As a result, the aqueous conveyances, into the sediment Pond #3, stopped into AOC 5 and subsequently in AOC 6, and the sediment pond outfall stopped flowing. See Figures 11, 12, and 13 as compared to Figure 8, 9 and 10.

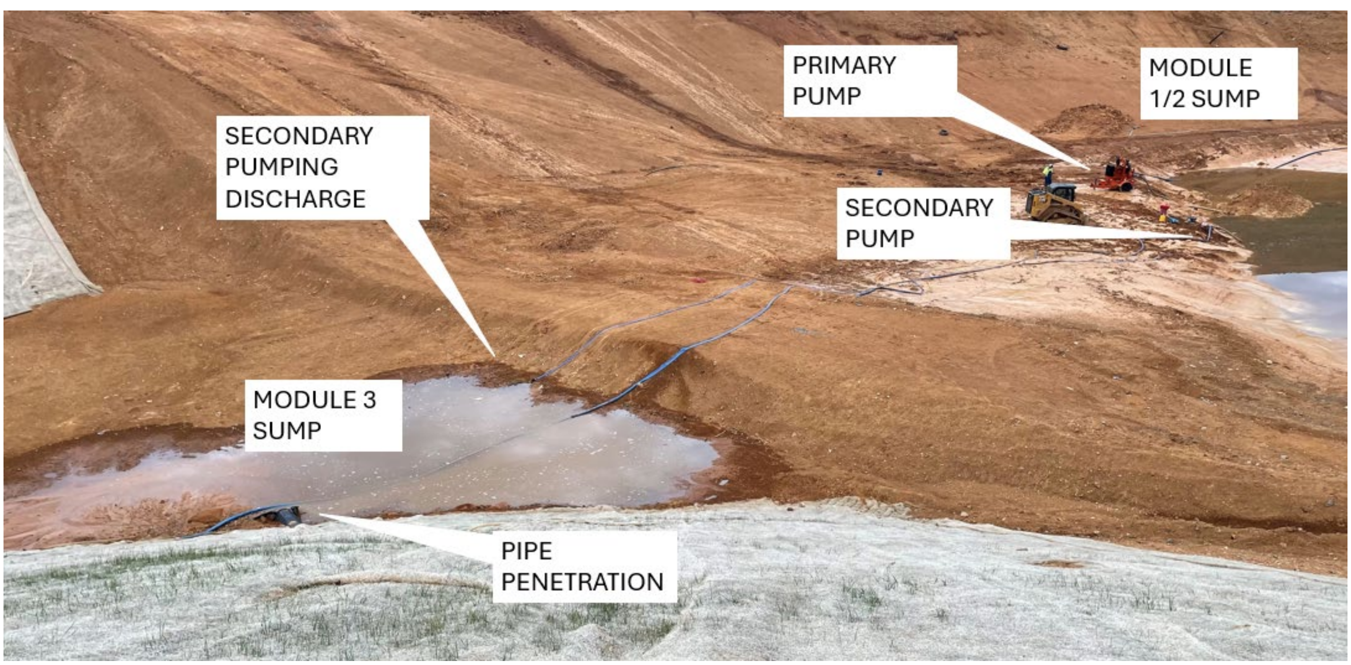


Figure 11: Pumping Discharge (AOC 5)

Figure 12: Sediment Pond #3 and AOC 6

Figure 13: Sediment Pond #3 Outfall

SAMPLING

Following the two observations described previously, water samples were then collected from “Sump 1 & 2”, “Sump 3”, stormwater “Sediment Basin #3”, and a known leachate outbreak on the “East Face” of the landfill; S1, S3, SW3, and EF, respectively. See Figure 14 for samplings sites. Field parameters pH, and Conductivity were collected at all 4 locations using a **Hanna 991301 Multiparameter Meter**. Aqueous samples at all four locations were collected and analyzed for 8 8 analytes including; Ammonium, Chloride, Chemical Oxygen Demand (COD), Sulfate, Calcium, Potassium, Sodium, and Zinc based on the Global landfill leachate characteristics (Qian, Youfen, et al., 2024.) which identified analytes most indicative of leachate characteristics. Utilizing single use collection containers, samples were collected, properly packaged, and shipped to Waypoint Analytical Laboratory in Memphis, TN under strict Chain of Custody.

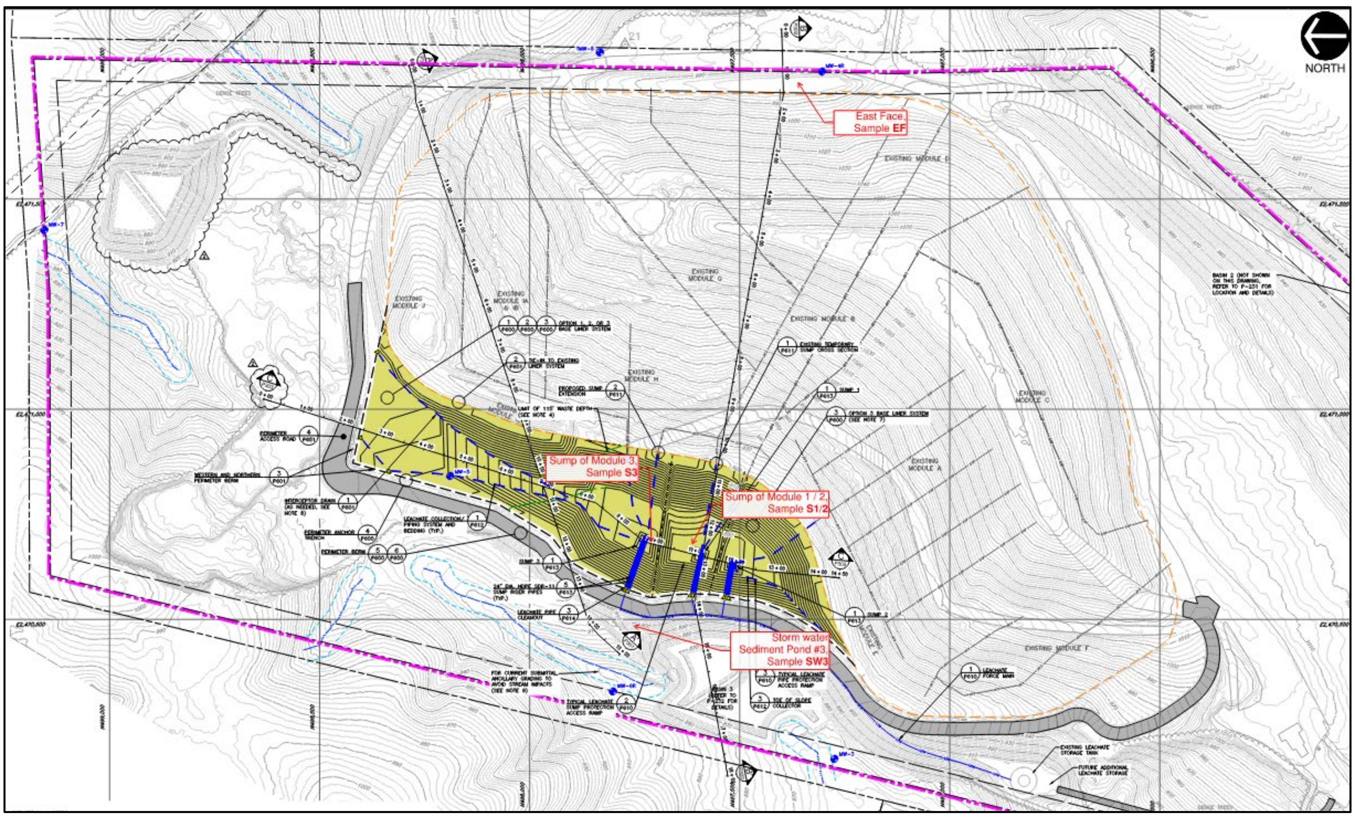


Figure 14: Sampling Locations

ANALYTICAL LAB RESULTS

Field parameters and results of the lab analysis are provided in Table 1 and Table 2 below.

Table 1: Field Parameters Results

Field Parameter	Analytical Method	Units	MCL	Results			
				S 1/2	S3	SW-3	EF
Conductivity	Field	µS/cm	1000**	2290	2700	2640	6140
pH	Field	mol/L	6.5-8.5*	7.49	7.56	7.67	7.99

* EPA Secondary MCL
**Organic Indicator

Table 2: Lab Analytics Results

Analyte	Analytical Method	Units	MCL	Results			
				S 1/2	S3	SW-3	EF
Ammonium	CALC	mg/L	1**	83.4	118	112	286
Chloride	EPA-300.0	mg/L	250*	172	241	232	638
COD (Chemical Oxygen Demand)	5220D-2011	mg/L	100**	326	432	396	888
Sulfate	EPA-300.0	mg/L	250*	96	109	106	65.8
Calcium	EPA-200.7	mg/L		77.8	89.7	83.3	106
Potassium	EPA-200.7	mg/L		53.4	68	63.2	207
Sodium	EPA-200.7	mg/L		158	211	191	542
Zinc	EPA-200.7	mg/L	5*	0.0215	0.0279	0.03	0.0935

* EPA Secondary MCL
**Organic Indicator

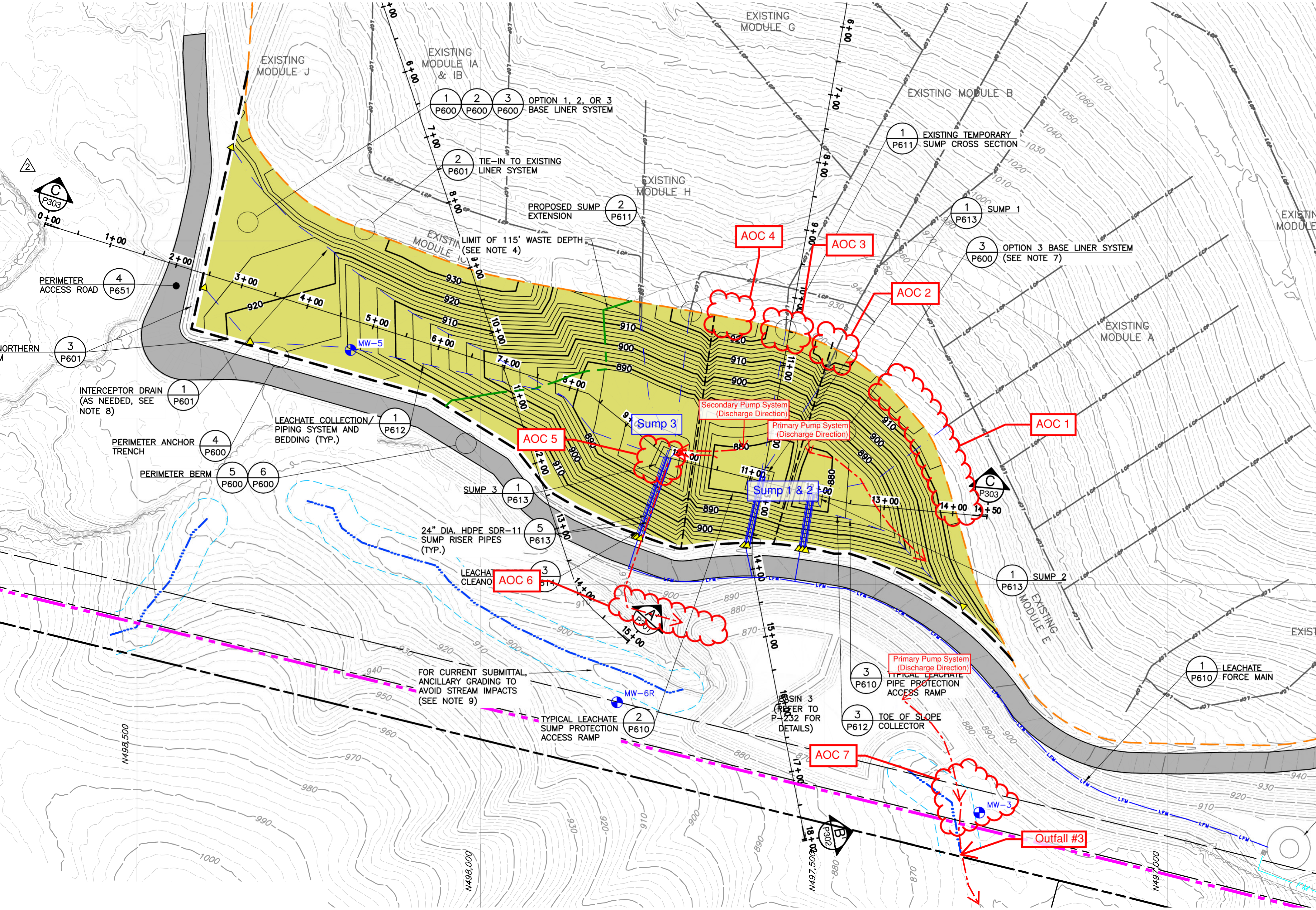
Field parameters and laboratory analyses were compared to EPA Secondary Maximum Contaminant Levels (SMCLs) or typical environmental indicator levels (see footnotes). Higher conductivity serves as an indicator of the presence of inorganic chemicals and dissolved salts, such as chloride, sulfate, calcium, potassium, and sodium. As a comparison the World Health Organization recommends conductivity of tap water to be less than 400 µS/cm and natural water bodies can range between 50 and 1,000 µS/cm. Ammonium and Chemical Oxygen Demand (COD) indicate the presence of decomposed organic matter, which depletes oxygen in water. Generally, ammonium should be less than 1 mg/L and COD for wastewater discharge are less than 100 mg/L. The prevalence of these parameters and other analytes in all sampled areas indicate the presence of leachate across all sampled locations including the Sediment Basin #3.

CONCLUSIONS AND RECOMENDATIONS

Leachate outbreaks at perimeter berms are attributable to trapped or standing leachate, commonly referred to as "Head on Liner." TDEC regulates “head on Liner” to not exceed one foot in depth. The primary leachate outbreak occurring at the south slope of Cell E and A, or AOC 1, is to a high degree of confidence, due to leachate backing up in the waste pile or backed on the liner and not draining through the collapsed leachate collection pipe

or pipe fitting within the existing "Module A," as identified in the detailed in the Technical Memorandum dated February 20, 2025. It is recommended that the collapsed pipe identified in the memorandum be excavated and repaired.
Original information identified a singular leachate outbreak and as part of a plan of action requested by TDEC on February 19, 2025, dewatering activities sent leachate to the Loudon Utility sewer system. Based on observations and sampling results, there were multiple points of leachate from the active landfill Modules A, E, B, and H (AOC 1, 2, 3, & 4) that drained into the sump of Modules 1 / 2. Leachate was then pumped not only to the sewer system but also off site through the stormwater system. Leachate was pumped from the sump of Module 1 / 2 to the pump station and also into the sump of Module 3 (AOC 5). From AOC 5, the leachate drained through a buried conduit, broken or disconnected, to the stormwater Sediment Pond #3 (AOC 6). Leachate was then pumped directly from Sediment Pond #3 to Outfall #3 (AOC 7), and ultimately released offsite. It is recommended that the full extent of contamination be traced and remediation measures be implemented for all affected areas both within and beyond landfill property boundaries. Additionally, it is recommended that the connection between AOC 5 and AOC 6 be assessed, and any necessary repairs be made.

All inspections, remediation efforts, and repairs shall be performed to meet all applicable state, local, and federal regulatory agencies and to the satisfaction of the Owner.


EXISTING MODULE J
EXISTING MODULE IA & IB
OPTION 1, 2, OR 3 BASE LINER SYSTEM
TIE-IN TO EXISTING LINER SYSTEM
PROPOSED SUMP EXTENSION
EXISTING MODULE H
EXISTING MODULE G
EXISTING MODULE B
EXISTING TEMPORARY SUMP CROSS SECTION
SUMP 1
OPTION 3 BASE LINER SYSTEM (SEE NOTE 7)
LIMIT OF 115' WASTE DEPTH (SEE NOTE 4)
EXISTING MODULE A
EXISTING MODULE E
PERIMETER ACCESS ROAD
INTERCEPTOR DRAIN (AS NEEDED, SEE NOTE 8)
LEACHATE COLLECTION/ PIPING SYSTEM AND BEDDING (TYP.)
PERIMETER ANCHOR TRENCH
PERIMETER BERM
SUMP 3
24" DIA. HDPE SDR-11 SUMP RISER PIPES (TYP.)
SUMP 2
FOR CURRENT SUBMITTAL, ANCILLARY GRADING TO AVOID STREAM IMPACTS (SEE NOTE 9)
TYPICAL LEACHATE SUMP PROTECTION ACCESS RAMP
TYPICAL LEACHATE PIPE PROTECTION ACCESS RAMP
BASIN 3 (REFER TO P-232 FOR DETAILS)
TOE OF SLOPE COLLECTOR
LEACHATE FORCE MAIN
AOC 1
AOC 2
AOC 3
AOC 4
AOC 5
AOC 6
AOC 7
Outfall #3
Sump 3
Sump 1 & 2
Secondary Pump System (Discharge Direction)
Primary Pump System (Discharge Direction)
MW-5
MW-6R
MW-3
N498,500
N498,000
N497,500
N497,000

TAB 4

CANNON & CANNON INC

April 11, 2025

Mr. Adam Waller
Chairman
Loudon County Solid Waste Disposal Committee
100 River Road #106
Loudon, TN 37774

RE: Bucket Test Results
Matlock Bend Landfill SNL530000203
Loudon County, Tennessee

Dear Mr. Waller:

The Commission requested a second "Bucket Test" to identify and compare flow rate through the collapsed leachate pipe in Module A. CCI attended the bucket testing to witness the testing on behalf of the Commission. Testing efforts were led by Trent Harrel, PE of CEC and Stoddard Pickrell of Republic.

The four (4) days prior to the event, approximately 1.76 inches of precipitation had been recorded. Ten individual tests were completed back-to-back between 1:00 PM and 2:30 PM on Wednesday, April 9, 2025. See the attached table for results of each test. Prior to testing, an estimated 10-15 gallons of accumulated liquid was purged from the pipe. The peak flow rate was 0.792 gpm and the minimum flow rate was 0.655 gpm. The average of the ten test was 0.671 gpm. Previous bucket testing on February 27, 2024 identified an assumed flow rate of 0.8 gpm. Flow rates during testing were relatively constant and were also consistent with the previous event.

With a high level of confidence, it can be concluded that the consistent flow rates, unaffected by heavy precipitation events, indicate the flow produced at the discharge of the leachate pipe is controlled by the available open space in the collapsed leachate pipe particularly in Module A. Attached are the results of the bucket testing. If you have any questions, please feel free to reach out.

Sincerely,

Chris Cline, P.E.
Project Manager

Attachment: Bucket Test Results Table

Bucket Test Results

Test	Elapse Time (min:sec)	Volume (gallons)	Flow Rate (gpm)
1	7:38	5	0.655
2	6:19	5	0.792
3	6:33	5	0.763
4	6:33	5	0.763
5	6:33	5	0.763
6	6:25	5	0.779
7	6:31	5	0.767
8	6:27	5	0.775
9	6:27	5	0.775
10	6:25	5	0.779
	Average (gpm)	0.761	

TAB 5

MEMORANDUM

To: Stoddard Pickrell – Republic Services (Republic)
Lindsey Turtle - Republic

From: B. Michael Yacyshyn P.E. – Civil & Environmental Consultants, Inc. (CEC)
Timothy Mitchell, P.E. – CEC

Date: April 22, 2025

Subject: Module A Leachate Bucket Flow Test
Matlock Bend Landfill (MBLF)
CEC Project 317-474

INTRODUCTION

A bucket flow test of the gravity drain leachate pipe from the low point of Module A was performed on April 9, 2025. A bucket flow test is a simple test intended to measure flow rate from a gravity drain. Generally, the flow from an existing gravity drain is allowed to flow to a bucket with a known volume (i.e., 5-gallon bucket). The time required to fill the bucket is recorded and a flow rate in gallons per minute is then calculated.

This was the second bucket flow test on the Module A gravity drain pipe. The previous bucket test was performed on this pipe on February 27, 2024. This memorandum (Memo) is intended to summarize the methodology, observations, and conclusions from the April 9, 2025 bucket flow test.

OBJECTIVE

The objective was to measure leachate flow from Module A leachate pipe. The current test was performed to compare current flow rates to the previously determined flow rates. The previous bucket flow test of this pipe yielded the following results:

Table 1 – Bucket Flow Test from February 27, 2024

Elapsed Time (mins)	Gallons Discharged (gal)	Observed Flow Rate (gpm)
2.93	5	1.7
4.17	5	1.2
6.52	5	0.8
6.12	5	0.8
6.33	5	0.8
	Average of All Readings	1.1
	Average of Last Three Readings	0.8

METHODOLOGY

The bucket test was performed by Hinkle Construction Services (Hinkle). CEC representative Trent Harrell, P.E., was onsite to observe and document the testing. Additional personel present onsite to observe the testing consisted of Stoddard Pickrell (Republic), Chris Cline (Cannon & Cannon), along with several representatives from Hinkle crew. A CEC Daily Field Report that includes photos and details of the bucket test is attached. Results of the Bucket Flow Test are summarized as follows:

Table 2 – Bucket Flow Test from April 9, 2025

Elapsed Time (mins)	Gallons Discharged (gal)	Observed Flow Rate (gpm)
7.63	5	0.7
6.32	5	0.8
6.55	5	0.8
6.55	5	0.8
6.55	5	0.8
6.42	5	0.8
6.52	5	0.8
6.45	5	0.8
6.45	5	0.8
6.42	5	0.8
Average of All Readings		0.8
Average of Last Three Readings		0.8

CEC notes that Hinkle excavated a depression below and downslope of the capped leachate pipe (see photos in the attached DFR) to capture leachate spillage during the bucket testing. A vacuum truck removed all leachate. Once the bucket testing was completed and the pipe capped again, impacted soils were excavated and hauled to the active face for disposal.

Ten bucket tests were conducted. Note, the observed leachate was relatively clear and not discolored. The flow rates from the bucket tests were similar, ranging from 0.7 gallons/minute (gpm) to 0.8 gpm, with an average of 0.8 gpm. Excluding the first test result of 0.7 gpm to better represent average flow conditions, yields an average flow of 0.8 gpm. This is equal to the average flow rate measured during the first bucket flow test performed in February 2024.

CONCLUSION

There is consistent flow from the Module A leachate pipe. This indicates the pipe is not blocked to the point of cutting off all flow.

CEC trusts that this memo is sufficient for your needs at this time. However, if not, please contact us at 615-333-7797.

TDM:BMY
Attachment M-317474.Apr17/P

ATTACHMENT 1

DAILY FIELD REPORT

Civil & Environmental Consultants, Inc.

DAILY FIELD REPORT

Date April 9, 2025

PROJECT INFORMATION

PROJECT NAME:	Dual-Contained Leachate Line Flow Testing		
LOCATION:	Matlock Bend Landfill Loudon County, Tennessee	PROJECT NO:	317-474
PLANS AND SPECS:	N/A	WEATHER:	Sunny/Clear
ISSUED DATE:	N/A	TEMP. RANGE (°F)	57

PERSONNEL

CEC FIELD REP:	Trent G. Harrell (TGH)	CEC PROJ. MANAGER:	Tim Mitchell (TDM)/Michael Yacyshyn (MY)
CLIENT:	Republic Services, Inc.	CLIENT CONTACT:	Stoddard Pickrell
CONTRACTOR:	Hinkle Construction	SUPERVISOR:	Chris Barnes

SAFETY MEETING PARTICIPATION

Participation in Contractor's Tailgate Safety Meeting? ☐ **Yes or** ☒ **No**

WORK PERFORMED SINCE CEC'S LAST VISIT?

N/A

SUMMARY OF WORK OBSERVED, LOCATION, AND CONTRACTOR PERFORMING WORK

Bucket flow test for leachate was performed at the northwestern end of the site. Representatives from Republic Waste Services (Stoddard Pickrell), Cannon & Cannon (Chris Cline), Hinkle Construction (Chris Barbes), and CEC (Trent Harrell) were present during this test. Hinkle Construction removed cap from test pipe in order to collect leachate flow in 5-gallon buckets. CEC and Cannon & Cannon recorded results as Hinkle Construction collected/disposed of leachate using a vacuum truck. Collected leachate was vacuumed to the waste collection truck to be properly disposed of. Leachate-impacted soils was fully excavated and transported to the active face for disposal.

UNEXPECTED, UNUSUAL, OR NONCONFORMING OBSERVATIONS (NEW / RESOLVED)

N/A

SUMMARY OF MEETINGS / DISCUSSIONS / TELEPHONE CONVERSATIONS / VISITORS ONSITE

During testing, Stoddard (Republic Waste) contacted TDM (CEC) to confirm if 10 tests would be sufficient as the flow rate appeared to be consistent. CEC and Cannon & Cannon compared field results afterwards for consistency.

ATTACHMENTS

Site photos, leachate flow test data, 5-day weather log

DESCRIPTION OF SAMPLES TAKEN OR MATERIALS DELIVERED TO LAB

Leachate was collected at the end of the uncapped pipe and filled to the 5 gallon mark while time was being recorded. Once collected, leachate was then transported via vacuum pump to the waste collection truck.

APPROVED BY

FIELD REP: TGH DATE: 04/10/2025 CEC MANAGER: MY DATE: 04/11/2025

This document is draft until reviewed and approved by a Project Manager

Civil & Environmental Consultants, Inc.

Date April 9, 2025

SITE PHOTO 1 – EXPOSED LEACHATE DISCHARGE PIPE PRIOR TO UNCAPPING

SITE PHOTO 2 – WASTE COLLECTION TRUCK FOR LEACHATE DISPOSAL

Civil & Environmental Consultants, Inc.

SITE PHOTO 3 – TYPICAL FLOW FROM LEACHATE PIPE AFTER UNCAPPING AND RELEASING INITIAL HEAD

SITE PHOTO 4 – TYPICAL LEACHATE COLLECTION IN BUCKET BY HINKLE

Civil & Environmental Consultants, Inc.

Date April 9, 2025

LEACHATE FLOW TEST DATA

BUCKET	GALLONS	TIME (MIN:SEC)	FLOW RATE (GAL/MIN.)	CHANGE FROM PRIOR READING (+/- %)
1	5	7:38	0.66	---
2	5	6:19	0.79	20.8%
3	5	6:33	0.76	-3.6%
4	5	6:33	0.76	0.0%
5	5	6:33	0.76	0.0%
6	5	6:25	0.78	2.1%
7	5	6:31	0.77	-1.5%
8	5	6:27	0.78	1.0%
9	5	6:27	0.78	0.0%
10	5	6:25	0.78	0.5%

5-DAY WEATHER LOG (LOUDON, TN)

	TEMP (^{o}F)		
DATE	HIGH	LOW	PRECIP. (IN)
Saturday, April 5, 2025	83	69	0.00
Sunday, April 6, 2025	72	64	1.97
Monday, April 7, 2025	62	44	0.15
Tuesday, April 8, 2025	54	35	0.00
Wednesday, April 9, 2025	69	32	0.00

Impacted area following removal of liquids.

Impacted area following removal of soil.

Impacted area following removal of soil.

April 25, 2025
(Revised May 9, 2025)

Mr. Revendra Awasthi, CHMM
Tennessee Department of Environment and Conservation
Division of Solid Waste Management
3711 Middlebrook Pike
Knoxville, Tennessee 37921-6538

Dear Mr. Awasthi:

Subject: Permit Package Revisions
Solid Waste Permit - Part II Application
Matlock Bend Landfill – Proposed 2024 Horizontal Expansion
Loudon County, Tennessee
SNL530000203
CEC Project 317-474

On behalf of Matlock Bend Landfill (MBLF), owned by Loudon County Solid Waste Disposal Commission (Commission) and operated by Santek Environmental, LLC (Santek), Civil & Environmental Consultants, Inc. (CEC) is submitting this permit minor modification request for your review and approval. Portions of four sections of the approved Part II Application and several permit drawings have been revised to address terminology inconsistencies and clarifications and revisions requested by Santek's consultants providing design services for Modules 1 and 2 and the initial partial final closure, as well as Santek's CQA Consultant for Modules 1 and 2. The revised sections and drawings are attached.

In an effort to facilitate your review, two versions of the revised Operations Plan, CQA Plan, Leachate Monitoring Plan, and Landfill Gas Control and Monitoring Plan are provided. One version shows all the revisions using Microsoft Word's Track Changes feature where revisions are shown in RED. The second version of each are 'Clean' copies where all revisions have been accepted. Revisions for the Permit Drawings are 'clouded' to allow quick identification of changes made. A more detailed explanation of the revisions follows.

Operations Plan

Revisions to references to No. 57 gravel used for the leachate collection drainage layer were made. Changes were also made so that terminology throughout the Operations Plan and Permit Drawings are consistent. The term "non-carbonaceous limestone" has been removed. The allowable carbonate content has been revised to allow up to 12% loss when the material is subjected to the ASTM D3042 test using a permeant with a pH equal to 4.0.

Clarifications in Section 1.4, Designation of Responsibility, were made.

CQA Plan

The CQA Plan has been revised so that the terminology used in the CQA Plan is consistent with the Permit Drawings. Additional revisions include:

- Revising Project Meetings language in Section 3.2;
- Revised Section 4.3 to clarify terminology and revise the definition of the function of the geotextile;
- Revising the low-permeability component of the composite liner system from “Recompacted Soil Liner” to “Barrier Soil Layer” to be consistent with the Permit Drawings terminology in Section 4.5;
- Rock and soil clod maximum size revised to 1-1/2 inches in Section 4.5;
- Revising the discussion of the Intermediate Cover Soils and Compacted Soil Layer in Sections 4.7.1 and 4.7.2, respectively, for clarification and consistency and to address questions and comments from Santek’s other consultants;
- Removing the requirement for Los Angeles Abrasion testing for the protective cover/leachate collection system aggregate in Table A-1;
- Removal of TDOT No. 4 stone criteria;
- Revision of the carbonate testing acceptance criteria and test permeant to have a pH = 4.0;
- Narrative in Section and Table A-3 revised to clarify Geologic Buffer layer requirements;
- Revisions to maximum particle size, grain size, lift thickness, permeability for materials functioning as the geologic buffer and barrier soil layer; and
- Addition of material protrusion size on surfaces in direct contact with geomembranes.

Leachate Management Plan

The Leachate Management Plan has been revised so that the revised drawings in Appendix G have been updated.

LFG Control and Monitoring Plan

The LFG Control and Monitoring Plan has been revised so that the terminology used is consistent with the CQA Plan and Permit Drawings. The word ‘limestone’ has been removed and the date of figures referenced in the Plan has been updated.

Drawings

Several drawings were revised to clarify details and make terminology consistent throughout the Paret II Application package. These revisions are summarized in the table below.

Drawing No.	Drawing Title	Revisions Summary
P-000	Cover Sheet	Date changed to April 2025. Revised sheets clouded in the Sheet List Table.
P-231	Sediment Basin 2 Plan and Details	Several revisions were made to values in the Basin Summary Table to match the most recent HydroCAD output included in the Parmit Application. Detail 2 callout for the concrete base was revised. Date changed to April 2025.
P-234	Sediment Basin Details	Detail 3 Sediment Basin 2 Side View and Marlee Float Skimmer basin bottom elevation revised. Date changed to April 2025.
P-600	Liner System Details	Notes for Details 1, 2, and 3 revised to reflect consistent

	(Sheet 2 of 3)	terminology of No. 57 gravel and the maximum calcium carbonate content. Date changed to April 2025.
P-601	Liner System Details (Sheet 1 of 3)	Details 2 and 3: callout for barrier soil layer revised to be consistent with the CQA Plan. Detail 2 revised to show previous cells anchor trench geosynthetics to be removed prior to tying into new call. Date changed to April 2025.
P-611	Leachate Management Details (Sheet 2 of 5)	Detail 2 revised to screen back existing conditions for clarity. Date changed to April 2025.
P-612	Leachate Management Details (Sheet 3 of 5)	Detail 3 revised #57 gravel callout to use consistent terminology and maximum carbonate content. Date changed to April 2025.
P-620	Final Cover Details	Detail 1 Note 2 wording revised for clarification. Details 2 and 3 revised to add Compacted Soil Layer where appropriate. Date changed to April 2025.
P-630	Landfill Gas and Groundwater Monitoring Well Details	Details 1, 2, and 3 revised to replace the term 'limestone' with the word 'gravel'. Date changed to April 2025.

CEC trusts the attached responses and revised portions of the Part II Application are acceptable and allows the Division of Solid Waste Management to complete the technical review process. However, if you have questions or comments, please contact Mr. Stoddard Pickrell at (828) 253-3929 or CEC at (615) 333-7797.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Timothy D. Mitchell, P.E.*
Principal
* In AK, LA, MA, MI, MO, NC, OR, PA, TX, & WA

B. Michael Yacyshyn, P.E.*
Senior Principal
* In CA, TN, and KY

TDM:BMY

Attachments: CN-1509 Form
Revised Operations Plan, April 2025
Operations Plan Revised Appendices:
Revised Leachate Management Plan, April 2025
Revised LFG Control and Monitoring Plan, April 2025
Revised CQA Plan, April 2025
Revised Permit Drawings P-000, P-231, P-234, P-600, P-601, P-611, P-612, P-620, and P-630
Clean Operations Plan, April 2025
Operations Plan Revised Appendices:

Clean Leachate Management Plan, April 2025
Clean LFG Control and Monitoring Plan, April 2025
Clean CQA Plan, April 2025
Revised Permit Drawings P-000, P-231, P-234, P-600, P-601, P-611, P-612, P-620, and P-630

c: Brian Wolf, P.E. (TDEC)
Adam Waller (LCSWDC) [Electronic copy only]
Elizabeth Murphy (LCSWDC Counsel) [Electronic copy only]
Chris Cline (Cannon & Cannon) [Electronic copy only]
Lindsey Turtle (Republic) [Electronic copy only]
Will McWhorter (Republic) [Electronic copy only]
Stoddard Pickrell (Republic) [Hard copy for the site]
Dave Hollinshead (Republic) [Electronic copy only]
Wells Trompeter (Holland & Knight LLP) [Electronic copy only]

**REVISED SECTIONS WITH
RED-LINED REVISIONS**

FACILITY OPERATIONS PLAN
MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES

MATLOCK BEND LANDFILL
21712 HIGHWAY 72N
LOUDON, TENNESSEE 37774

Prepared By:

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
117 SEABOARD LANE, SUITE E-100
FRANKLIN, TENNESSEE 37067

CEC PROJECT 317-474

AUGUST 2024
(REV. 1, APRIL 2025)

TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

1.0 INTRODUCTION

1.1 AUTHORIZATION

Santek Environmental, LLC (Santek), a subsidiary of Republic Services (Republic), is submitting the following Facility Operations Plan (Plan) for the proposed 2024 Horizontal Expansion of the Matlock Bend Class I Disposal Facility in accordance with the Tennessee Department of Environment and Conservation (TDEC), Rule 0400-11-01-.04(9) (Rule) on behalf of the Loudon County Solid Waste Disposal Commission. The facility operates under Permit No. SNL 530000203.

1.2 PURPOSE AND SCOPE

Preparation of this (Plan) is in accordance with the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management's rules. The requirements of Rules 0400-11-01-.04(9) "Narrative Description of the Facility and Operations", and 0400-11-01-.04(2) "General Facility Standards" will be specifically addressed.

1.3 FACILITY DESCRIPTION

The Matlock Bend Landfill (MBLF) is a Class I municipal solid waste landfill Site that serves the sanitary and industrial waste disposal needs of Loudon County (County) and surrounding areas outside of the County. The MBLF is located on approximately 152 acres of land, about 5 miles west of the City of Loudon near State Route 72 and approximately 1.25 miles west of U.S. Interstate Route 75, at N 35° 44' 54.92" latitude and W 84° 24' 42.23" longitude. The referenced latitude and longitude were obtained from the Philadelphia, Tennessee 7.5 quadrangle map that is based on National Geodetic Vertical Datum of 1929 (NGVD29). Permanent benchmarks of known elevation have been constructed on-site as shown on Drawing No. P-100 of the permit drawing package.

A Site Location Map is provided as Figure 1 and a Location Plan and Master Plan are provided on Drawings P-000 and P-100, respectively, of the permit drawing package. Adequate water supply and electrical service is located within 500 feet of the MBLF and will be extended to incorporate the new Site as construction and operation requires.

MBLF currently has 67.2 acres available for waste disposal based on current property owned by the County. Of this total, 40.6 acres are currently permitted and consists of Modules A through J where disposal activities are ongoing. The remaining 26.6 acres includes several streams that have been deemed to be potentially jurisdictional. Because additional permitting is required for the streams and disposal capacity is urgently needed, MBLF is currently seeking approval for additional waste disposal capacity in a portion of the remaining 26.6 acres. This smaller expansion area is designated the 2024 Horizontal Expansion, with the remaining portion to be permitted at a later date. The future, additional expansion area for waste disposal will be addressed in a separate subsequent major permit modification. Detailed engineering design for the individual module development will be performed ahead of the start of construction of each module(s).

The 2024 Horizontal Expansion consists of proposed Modules 1, 2, and a portion of Module 3 that comprises approximately 7 acres. The 2024 Horizontal Expansion satisfies all buffer requirements as described in Table 1. Development of the 2024 Horizontal Expansion area will provide approximately 2,413,800 million cubic yards (mcy) of additional net airspace (waste plus daily cover soil). This volume is anticipated to extend site life by approximately 10 years at the projected waste acceptance rate of 160,000 tons per year (tpy). The remaining life (as of December 15, 2022) of the facility not including the 2024 Horizontal Expansion Area is projected to be approximately 2 years based on an estimated average disposal rate of 500 tons per day. The site life estimate is based on average in-place waste and interim cover soil density of 1,606 lb/cy and 307 operational days per year. Based on these calculations, the MBLF closure date will be extended to 2034. The information above satisfies, in part, Rule 0400-11-01.02. For additional information on solid waste type and source, refer to Section 2.6 of this Plan.

1.4 DESIGNATION OF RESPONSIBILITY

The Loudon County Solid Waste Disposal Commission holds the solid waste permit and owns the facility. Santek, a subsidiary of Republic, is contracted to operate and maintain the site in accordance with the contract and permit terms ~~is ultimately responsible for the operation and maintenance of the MBLF~~. All inquiries and correspondence concerning the landfill's permits and operations should be submitted to his/her attention at the following address:

Chairman Adam Waller
Loudon County Solid Waste Disposal Commission
100 River Road, #106, Loudon, Tennessee 37774
Telephone No. (865) 591-4446

The facility name and address are:

Matlock Bend Landfill
21712 Highway 72 North
Loudon, Tennessee 37774

Daily operation and maintenance of the landfill will be conducted by Santek. Landfill operations shall be supervised by a qualified individual who shall be thoroughly familiar with proper landfill operating procedures and who is trained and certified in accordance with Rule 0400-11-01-.12. Santek personnel will notify the Division of Solid Waste Management within fourteen (14) days upon identifying a significant issue or noncompliance item.

2.0 OPERATIONS PLAN – GENERAL CONSIDERATION

2.1 INTRODUCTION

This Plan is to set forth operating and maintenance procedures necessary to meet the rules of Chapter 0400-11-01 Solid Waste Processing and Disposal and effectively dispose of solid waste. Establishment and enforcement of the proposed procedures for operation and plans for future development will be the ultimate responsibility of landfill management.

The objectives of the Facility Operations Plan are to:

- Present operation details that are compatible with the site characteristics and are useful to, and understandable by, operating personnel;
- Protect the environment; and
- Provide an efficient and economical operation.

2.2 COMPLIANCE WITH BUFFER ZONE STANDARDS

The landfill is located, designed, constructed, operated, and maintained in general accordance with Rule 0400-1l-01-.04(3)(a). The waste limit fill area is surrounded by a 100-foot buffer zone from the facility property line and greater than 500 feet from the nearest resident. The nearest existing downgradient drinking water well is greater than 500 feet from the waste limit. No springs, streams, lakes, or other bodies of water are located within 200 feet of the waste limit.

Table 1 provides a description of the surrounding features and their approximate distance to the waste limit.

TABLE 1: BUFFER DISTANCES

Structure/ Feature	Requirement	Location and estimated distance relative to waste limit
Nearest Property Line	100 feet	A minimum 100-foot buffer will be in place between the property line and the placement of waste.
Nearest Residence	500 feet	Approximately 2,000 feet west of the proposed waste limit boundary.
Nearest Well	500 feet	A total of 55 potential residents may rely on domestic water sources (including 15 suspected private wells and 2 springs) located within a 1-mile radius of the MBLF as described in Section 4.9 of the Supplemental Hydrogeological Report, and all are greater than 500 feet from the waste limit.
Nearest Stream	200 feet	A preliminary jurisdictional determination (PJD) was completed and is included as Appendix F in the Supplemental Hydrogeologic Report. The PJD identified a total of five water features within the study area including: one (1) intermittent stream (INT-1), one (1) perennial stream (PER-1), one (1) wet weather conveyance (WWC-1), and two (2) Ephemeral Wet Weather Conveyances (EPH/WWC-1 and EPH/WWC-2). The five identified features consisted of approximately 783 linear feet of perennial/intermittent stream, 677 linear feet of ephemeral/wet weather conveyance, and 564 linear feet of wet weather conveyance within the proposed future expansion area. The impacted portions of these streams are 367 feet for INT-1 and 553 feet for EPH-1 and -2. In addition, no wetlands were identified during the PJD. Concurrences from TDEC and the US Corp of Engineers are provided in Appendix A.

2.3 FACILITY ACCESS CONTROLS

Entrance to the MBLF property is provided with a locking gate to allow public access to the Site during working hours only. This gate is kept locked when the landfill is closed. Signs erected at the entrance gate describe the following information:

1. Name of the facility
2. Emergency telephone numbers
3. Fees assessed
4. Restricted materials
5. Normal operating hours
6. Penalty for unlawful dumping

7. Tarp policy

Furthermore, signs are posted as needed to notify haulers of speed restrictions and to direct them to the proper disposal areas. Such signs are legible and placed conspicuously to encourage safe operation within the landfill.

A formal record of each authorized vehicle that enters MBLF is kept by the scale house attendant. The log may be in paper or electronic format. Preliminary load inspection occurs as the trucks are being weighed in at the MBLF facility. The scale house operator visually inspects open incoming trucks and randomly questions the drivers about the materials being transported, including the place of origin. If the scale house operator determines that unacceptable material is being conveyed, the driver will be directed to consult a hazardous materials waste contractor for guidance on proper off-site disposal. Trucks carrying acceptable waste are directed by the scale house operator to the proper location for on-site disposal. Signs along the road are placed as required to guide the transporters to the appropriate disposal area.

Random physical inspections of 5% of all incoming vehicles are conducted by MBLF personnel. Records of these inspections are kept including the time, date, type of waste, vehicle identification, driver signature, and name of waste transporter. If unacceptable materials are discovered during unloading of the trucks, the wastes are reloaded, and the driver is directed to consult a hazardous material contractor for guidance on proper off-site disposal. Suspicious loads are also inspected. For more information on the random inspection procedures, refer to Section 2.24, Random Inspection Program, of this Plan.

Review of the solid waste manifest and scale house records aid the landfill staff in tracing the origin of unacceptable loads that are placed and not discovered prior to the hauler leaving the Site. However, when the source is not discovered, it is the responsibility of the MBLF operator to dispose of the material.

The landfill's operations hours for receiving waste are Monday through Friday (7:30 am - 4:00 pm), Saturday (7:30 am - 12:00 pm) and closed on Sunday. However, operations at the facility may take place 24 hours per day, 7 days a week.

2.4 METHOD AND SEQUENCE OF OPERATION

MBLF anticipates the construction of Modules 1 and 2 as the initial phase of construction of this 2024 Horizontal Expansion. Module 3 will be constructed after Modules 1 and 2. Each of these 2024 Horizontal Expansion modules will require placement of waste over existing waste slopes that are covered with soil. In such a case, intermediate soil cover will be stripped, or windows excavated in the soil cover prior to waste placement to promote downward movement of leachate and bonding of the new waste to the existing waste.

- The top 12 inches of soil material in the landfill expansion area is to be considered topsoil and should be stripped and stockpiled separately. It is preferable for stockpiles to be located in areas that will not disrupt construction or traffic flow around the perimeter of the new cell or existing landfill operations.
- After stripping of topsoil, the remaining excavation is to be completed to the grades and elevations shown on the permit drawing package. The materials removed by excavation are to be tested per the quality assurance standards outlined in the Construction Specifications and the Construction Quality Assurance Plan (CQA Plan) provided in Section VII of the permit application. Material having soil properties to obtain a remolded permeability of 1 x 10^{-7} centimeters per second (cm/sec) or less is to be stockpiled separately for use in the construction of barrier soil layer ~~layers~~. Other material will be used as fill materials in the construction of roads and berms. Any excess excavation materials will be stockpiled for future use as operational cover materials.
- Prior to placement of the barrier compacted soil layer, the subgrade will be proof rolled with a loaded, tandem-axle, dump truck or approved, pneumatic-tired construction equipment. Areas that pump, rut, or behave in an unstable manner will be undercut and replaced with engineered fill.
- After inspection of the disposal area is complete, placement and compaction of the barrier soil layer with a maximum permeability of 1 x 10^{-7} cm/sec will begin. The material will be placed in loose lifts not to exceed 9 inches thick and each lift will be compacted to an approximate 6-inch thick lift and observed and tested in accordance with the CQA Plan.
- After the geomembrane liner is installed, approved, and accepted, construction of the leachate drainage system will begin. A geotextile will be placed directly over the geomembrane to provide a cushion for the leachate drainage media. The leachate drainage media will be 12 inches of #57 washed gravel~~limestone~~ as described in the CQA Plan placed over the geotextile cushion. The drainage media will be spread over the geotextile cushion by a tracked dozer. A low-ground pressure dozer will be used to spread a minimum 1-foot bed of drainage media beneath it at all times. A standard-track dozer will supply the small low-ground pressure dozer by pushing a minimum 3-feet bed of rock beneath it at all times. No equipment will be in direct contact with the geotextile.
- Three leachate collection sumps will be constructed in the 2024 Horizontal Expansion area. The first leachate collection sump (Sump 1) will be located within Module 1 and is designed to collect leachate from Modules 1, B, C, D, and G. The second leachate collection sump (Sump 2) will be located within Module 2 and is designed to collect leachate from Modules 2, A, E, and F. The third leachate collection sump (Sump 3)

will be located in Module 3 and will collect leachate from Module 3, H, IA, IB, and J. Leachate from the existing Modules A through I of the existing landfill will be routed and collected in the three new leachate collection sumps as indicated. The sumps have been designed to have up to 4 feet of hydraulic head. The remainder of the leachate collection system is designed for 12 inches of head maximum.

- Leachate collection pipes will be installed during placement of the 12-inch drainage layer. The leachate collection pipes will be placed directly on the geotextile cushion and backfilled with No. #57 washed gravel ~~non-carbonate stone~~ or equivalent to the specified depth of 12 inches. In addition, No. #57 washed gravel ~~non-carbonate stone~~ will be placed at the toe of slopes in the landfill modules.
- The initial lift of waste will be visually screened to eliminate large sharp objects that have the potential to damage the liner system, be at least 6 feet in depth, and will cover the entire lined portion of the disposal area to provide protection for the geomembrane liner.

To increase the overall efficiency and safety of waste placement operations, stormwater segregation berms may be installed. These physical divisions within a module reduce the volume of stormwater runoff that comes in contact with the waste and, consequently, reduces the volume of leachate to be processed. The actual time and location of construction of these berms is a function of the rate of waste placement and the volume of stormwater to be managed. Consequently, actual locations of these berms are not presented in the permit drawing package prior to construction. Stormwater control details are presented on Drawings P-231 through P-235 and P-650 and P-651 of the permit drawing package.

General fill progression is shown on Drawing P-200 of the permit drawing package. A representation of the 2024 Horizontal Expansion sequencing and module phasing is shown on Drawing Nos. P-204 through P-210. The following narrative provides a general description of the fill procedures:

- Following construction of the first stormwater diversion berm (rain flap), waste placement will begin in the active module. Initial lifts of select waste (minimum 6 feet thick) will be placed in the lower portion of the active area. Select waste excludes bulky wastes, rods, poles, fence posts, and other waste with higher potential for damaging the liner. Waste filling will typically progress from the low point of the module and isolation berms upward to the first stormwater diversion berm.
- A sufficient number of pumps of adequate capacity will be maintained and employed at the stormwater diversion berm and the isolation berm bordering the active portion of the module. These pumps will be utilized to remove stormwater that collects along the upstream toe of the berms to manage contact with in-place Class I waste. This will

allow non-contact water runoff to be discharged to the stormwater detention basins or other acceptable structures.

- When the active area reaches the toe of the stormwater diversion berm, the stormwater diversion berm will be removed, and the removed rock material will be stockpiled for later use or spread into the leachate collection layer. If needed, the next stormwater diversion berm will be in place above the active area. A lift of waste will then be placed to the next stormwater diversion berm or isolation berm.
- Once the waste placement progresses to the level where exterior final or temporary slopes are constructed above the perimeter isolation berm or intercell berm, intermediate cover soil will be placed on the slope. Precipitation and other surface water will be directed to flow over the perimeter berm to a perimeter ditch or temporary stormwater pond before being diverted to one of the three stormwater management ponds. Only surface water that has avoided contact with the waste will be treated in this manner. Surface water that contacts the waste will be directed into the cell where it will be collected and handled as leachate.
- When the bottom area from the toe berm (low end) to the isolation berm (high end) within the active module is covered with a lift of select waste, the fill sequence will then progress from the high end of the module back toward the low end.

2.5 SOLID WASTE TYPE, QUANTITY, AND SOURCE

The MBLF accepts Class I wastes for disposal. Class I wastes include: domestic wastes, commercial wastes, institutional wastes, industrial wastes, municipal wastes, demolition/ construction debris, sewage solids, farming wastes, shredded or chipped waste tires, and dead animals. Special waste shall be disposed of in the Class I landfill area only if special provisions are made for such disposal and only if it is approved by the TDEC, Division of Solid Waste Management.

Based on the quantity of solid waste currently accepted, it is estimated that approximately 500 to 700 tons per day of Class I waste will be disposed at MBLF. Waste accepted in 2022[1] was roughly 47% non-hazardous municipal solid waste, 36% construction and demolition debris, 16% special waste, and less than 2% yard, organic, and tires waste. The facility will typically operate a minimum of 307 days a year.

[1] Data from "Summary of Material Activity Report, January 01, 2022 to December 31, 2022, All Materials," provided by Santek.

2.6 LANDFILL ACREAGE

A 152-acre Site, including the required buffer zones, has been designated for the MBLF facility. The design of the 2024 Horizontal Expansion has designated a total of approximately 47.6 acres of this Site for the purpose of Class I waste disposal. The existing permitted modules (Modules A through J) comprise approximately 40.6 acres and the proposed 2024 Horizontal Expansion (Modules 1 through 3) comprises approximately 7 acres.

Presently permitted Modules A through J operational areas have been utilized in the development of this Plan. The operational boundary and phasing plan for the expansion is shown on Drawings P-100, P-200, P-201, and P-202 of the permit drawing package in accordance to Rule 0400-11-01-.02. Modules are anticipated to be constructed in accordance with the phasing plan; however, the phasing plan will be reassessed throughout the operational life of the facility. The module layout and sequence of module construction shown on Drawing P-200 is proposed at the time of this submittal. Modifications to the module layout and sequencing may be required to better facilitate operational and construction needs in the future.

The module limits provide approximate boundaries of the anticipated progression of the landfilling operations. It is possible that changes in the waste stream, schedule or other factors could necessitate variations in the location of these module limits. Consequently, the module locations and limits should be considered approximate, understanding that the minimum buffer requirements will be adhered to. The 2024 Horizontal Expansion perimeter waste boundary will not be extended beyond the limits shown on the permit drawing package.

Also, each module may be constructed in whole or in part as required by operational and construction needs. For example, a module may be constructed in two sections, with each half given a different designation, i.e., Module 3A and Module 3B.

2.7 WASTE HANDLING AND COVERING PROGRAM

The waste hauling vehicles will deposit their loads at the open working face, as directed by MBLF facility personnel. The facility personnel will be present to ensure safety and inspect the waste for acceptability. The solid waste will then be spread in lifts approximately 3 feet thick or less. The dimensions of the open working face, while minimized, will be a sufficient size for proper waste disposal and equipment maneuvering. The slope of the waste placement will be maintained at or less than three horizontal to one vertical (3:1), as shown on the permit drawing package. Lifts of waste will be sloped as required to promote drainage away from the lift. Benches or add on berms will be constructed to provide stormwater drainage and reduce erosion of cover soil.

At the end of each day, one or both of the following methods will be used as daily cover:

1. 6 inches of soil cover material placed on the compacted wastes of the working face
2. Synthetic daily cover material.

In the event that only synthetic daily cover is used, at least once a week a minimum of 6 inches of soil cover material will be placed on the waste.

Soil will be excavated from onsite sources and from a borrow area located adjacent to the site. ~~Note an agreement between Loudon County and Santek is included in Appendix C of this Operations Plan allowing access to the adjacent Commission-owned borrow area. Future operations agreements will also include a similar type of agreement.~~

Intermediate cover soil consists of an additional 6 inches of compacted soil on top of the 6 inches of daily/weekly cover soil or other material approved by the TDEC. Intermediate cover soil will be utilized on all surfaces that will be exposed for a period of 30 days in accordance with Rule 0400-11-01-.04(6)(a)3. The intermediate cover soil will be maintained on all surfaces until either additional waste is placed over the surfaces or final closure cover is applied. Stockpiled soil obtained from excavating the current module or future modules may be used for barrier soil layer construction, daily, weekly, and intermediate cover.

2.8 OPERATING EQUIPMENT

The following is a list of the major equipment available that may be used on the Site:

TABLE 2: SITE EQUIPMENT

Quantity	Description
2	730 CAT ART. Truck
1	Ford Tractor
1	Sterling Water Truck
1	International Service Truck
1	ELGIN Street Sweeper
1	826K CAT Compactor
2	Ford F-150 Pickup
1	D6N T4 LGP
1	D6T CAT Dozer
1	320C CAT Excavator
1	826H CAT Compactor
1	320F CAT Excavator
1	740 CAT Articulated Dump
1	Dodge 1500 Pickup

Back-up equipment is available and included in the list above. In the event that additional back-up equipment is required, it may be rented, leased, or obtained from other landfill operations managed by Santek. The equipment list provided above is proposed at the time of this submittal and may be modified during operations with alternate equipment of various makes and models. Maintenance shall be provided by in-house personnel or at a commercial location in the MBLF area. Tools and supplies necessary for the proper operation and maintenance of the equipment shall be provided as needed.

2.9 LITTER CONTROL

The MBLF shall be kept free of litter and unloading shall be performed to manage scattering of solid waste. Portable fencing may be located near the working face to capture windblown debris. One or more employees on staff shall have part in the responsibility of picking up any material that is windblown, including material caught in the permanent fencing around the perimeter of the property.

2.10 STORMWATER MANAGEMENT

Surface water run-on and run-off may be diverted around the operating area by means of interceptor ditches, sediment traps or diversions berms as needed. Permanent stormwater run-on and run-off structures (i.e., culverts, ditches, etc.) have been designed to manage peak discharge resulting from a 25-year, 24-hour design storm event. Isolation berms may be constructed between modules as required to contain leachate and to prevent stormwater from entering the active area.

Temporary stormwater basins may be constructed outside of the isolation berm to collect stormwater from adjacent cut slopes. Swales and diversion ditches may be used to divert stormwater run-on water and surface water on the slopes. Pumps may be used to remove the water from the temporary basins as needed. Culverts, drainage pipes and/or other controls may be employed as needed. Ponding water will not be allowed on the working face during or after the completion of operations in any area. Finished plateau areas will be graded to provide adequate drainage of the finished area to minimize erosion, decrease runoff velocities and increase filtration of water into the soil and supports vegetation. The final cover grades have been established to maintain positive drainage of surface water even as consolidation of the underlying waste occurs.

Stormwater management basins will be utilized on the Site to control stormwater run-off and migration of sediments. The stormwater management basins have been designed to pass the run-off from a 25-year, 24-hour storm event through a primary spillway and pass the run-off from a 100-year, 24-hour storm event through a primary and an emergency spillway. The basins will be inspected for structural and operational integrity after significant rainfall events.

The stormwater management basins are designed to accumulate naturally occurring sedimentation. A reference post, or equivalent, will be used to gauge sediment depth. Stormwater management basins will be managed to assure the design capacity is maintained by excavating excessive soil sediment that may collect in the pond(s) upon reaching the 35% capacity mark noted on the reference post, or sooner.

As shown on Drawings P-231, P-232. And P-233 of the permit drawing package, Sediment Basin 2 will be enlarged, Sediment Basin 3 will be altered and Sediment Basin 4 will be constructed to manage stormwater at the Site through the completion of the post closure period. During the active operation of MBLF, Basins 2, 3 and 4, as well as temporary structures, may be used to control stormwater. In general, Basins 3 and 4 will be modified (Basin 3) or constructed (Basin 4) as the modules approach final grade elevations. Basin 2 was resized to accommodate additional flows from the expansion area, and to meet TDEC design criteria for wet storage and forebay volume.

Basin 3 is anticipated to be altered as the proposed Modules fill above grade and approaches final grade. Similarly, Basin 4 is anticipated to be constructed as the proposed modules fill above grade. Please refer to Appendix D~~E~~ of this operations plan for correspondence from TVA allowing construction of Basin 4 in the TVA easement.

Silt fences, hay bales and/or other erosion control methods may be constructed at the toe of slopes greater than 100 feet in length. At periodic intervals, not to exceed 200 feet, erosion control methods may be provided in collection ditches until vegetation has been established. Actual spacing of the erosion control device will be adjusted for steepness of the ditch slope. Erosion control devices will be maintained to limit transportation of sediments. Trapped sediments will be removed as needed. Rock check dams may also be used to improve the movement of suspended solids by controlling water velocity in the ditches.

Surface water run-off from soil stockpile area(s) will be controlled using berms, ditches, and/or other erosion control methods to limit siltation of on-site ditches and stormwater management basins. Vegetation will be established as soon as practical on areas not part of daily operation. The vegetation shall be properly maintained (i.e., mowed, fertilized) to assure growth. The erosion control procedures used will be in conformance to the guidelines provided in the TDEC Erosion & Sediment Control Handbook.

2.11 LEACHATE MANAGEMENT

The MBLF landfill's leachate containment system will include a composite liner system consisting of, from top to bottom:

- 12-inch-thick (minimum) protective cover and leachate collection system layer;
- 16-ounce per square yard (oz/sy) non-woven geotextile cushion; and
- Double-sided textured 60-mil thick high-density polyethylene (HDPE) geomembrane liner.
- 2-feet-thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1×10^{-7} cm/sec obtained from on-site sources; alternatively, a reinforced geosynthetic clay liner (GCL) providing a maximum hydraulic conductivity of 5×10^{-9} cm/sec underlain by a 2 feet thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1×10^{-6} cm/sec obtained from on-site sources.

In select areas of Modules 1, 2, and 3 the 16 oz/sy nonwoven geotextile and 60-mil textured HDPE geomembrane will be replaced with a layer of Super GripNet manufactured by Agru America. The use of this material in select Module 1, 2, and 3 areas in lieu of geotextile/geomembrane is due to the need to increase liner system shear strength to provide adequate slope stability. The approximate location where Super GripNet is to be installed is shown on Drawing P-201.

The containment system will be underlain by not less than 5 feet of geologic buffer material (a maximum permeability of 1 x 10^{-6} cm/sec) from the bottom of the composite liner system to the seasonal high-water table. For information and data on the determination of the seasonal high-water table, refer to the Part II A Permit Application Supplemental Hydrogeologic Report, dated February 2023, prepared by Civil & Environmental Consultants, Inc. and submitted to TDEC. This report is also provided as Section II of this Permit Application.

Leachate from the 2024 Horizontal Expansion Area will be pumped by side slope riser sump pumps, located in the leachate collection sumps, to the leachate storage tank. A 100,000-gallon leachate storage tank is currently in-place at the time of this submittal. Additional tank(s) will be added to facilitate operations within one (1) year of waste acceptance in Modules 1 and 2. The 30-day estimated leachate storage volume is included in Section VI Appendix B and is estimated to be 358,481 gallons. Accounting for the existing 100,000-gallon leachate storage tank, a minimum additional 258,481 gallons of leachate storage capacity will be added. The new leachate storage tanks will be glass lined leachate storage tank(s) manufactured by the Aquastore or engineer approved equivalent. Two existing 10,000-gallon interim leachate storage tanks are located within the proposed 2024 Horizontal Expansion area and will be moved prior to the construction of Modules 1 and 2.

The leachate collection sumps will be a minimum of 3 feet deep and will include 24-inch diameter, SDR 11 perforated HPDE pipes as indicated on Drawing P-613 of the permit drawing package. The leachate collection pipes will have cleanouts in the event the collection pipes become clogged, or inspection is required. The cleanout lines, which are attached to the end of each leachate collection pipe, parallel the pipes that house the pump(s) to the surface. Clean water can be flushed into the pipes using a jetting or other system appropriate for the purpose. Inspections and/or cleaning will be done annually until a steady state is reached within the area influencing the leachate collection pipes. Once steady state appears to be achieved (i.e., when siltation becomes minimal), cleaning will be done as needed, such as when leachate flow decreases unexpectedly, or leachate levels are inconsistent with the predicted flow volumes. The drainage layer consists of a minimum of 1 foot of washed No. #57 gravel ~~limestone~~ with a 16-oz/sy cushion geotextile on the bottom. The geotextile will aid in protection of the composite liner system. Module bottoms are sloped toward the collection pipes to promote leachate movement. Final proposed base contours are as illustrated on Drawing P-201 of the permit drawing package. The leachate will be disposed via an existing force main system that direct discharges to an existing Loudon Utilities sewer system.

A discussion of leachate management system compliance points and levels, data tables, sump details with elevations, and typical maintenance schedule is provided in the Leachate Management Plan (Appendix B).

Currently, Loudon County Solid Waste Disposal Commission has authorization from the Loudon Utilities Publicly Owned Treatment Works (POTW) to discharge wastewater (leachate) from the Matlock Bend Landfill to the Loudon Utilities POTW under Industrial User Permit Number 09F that expires on April 30, 2025. A 100,000-gallon aboveground leachate storage tank was certified in February 2012. Based on a 4-year historical monthly average for the Matlock Bend Landfill, this storage tank will provide up to 10 days of storage capacity in the event of repairs, maintenance, or other disruption of the force main or other appurtenances to the Loudon Utilities POTW. The design of the leachate storage tank provides the capability of loading tanker trucks. In the unlikely event of such disruption, leachate will be temporarily rerouted to the leachate storage tank and an immediate plan to pump and haul leachate to a secondary treatment facility will be implemented. When Loudon Utilities POTW becomes operational, the onsite leachate collection system will return to direct discharge. Information regarding the primary and secondary leachate treatment options is provided in the Leachate Management Plan (Appendix B).

As noted above, within one (1) year of Module 1 and 2 waste acceptance, MBLF will install a minimum 258,481 gallons of additional storage capacity. MBLF will contract with a leachate hauling company to provide on call truck and treat capabilities from initial waste acceptance in Modules 1 and 2 to when the new leachate storage capacity is brought online.

The facility Leachate Management Plan that includes effluent limits and other conditions is provided in Appendix B~~C~~. Leachate will be sampled and analyzed annually for the constituents listed in Appendix B~~C~~. The semi-annual ground water analysis report also includes leachate sampling and analysis for the constituents in Tables 3 and 4.

The Hydrologic Evaluation of Landfill Performance (HELP) model was used in the design of the leachate collection system. Additional information and HELP model calculations are provided in Section VI, Appendix B of this Permit Application.

2.12 DUST CONTROL METHOD

Dust control measures shall be taken at the MBLF to prevent dust from creating a nuisance or safety hazard to adjacent landowners or to people engaged in supervising, operating, and using the Site. The on-site haul roads and any off-site borrow area haul roads are expected to be the primary sources of dust. Construction equipment traveling on the haul roads can disturb soil particulate matter, causing them to become airborne, particularly during periods of dry weather. A water truck may be utilized to suppress dust and to mitigate fugitive dust particles from migrating across the landfill property boundary by lightly spraying access roads and haul roads. Existing trees within the buffer zone provide wind breaks and help reduce off-site dust migration. Prompt seeding operations to establish vegetative cover on non-active areas will further minimize the potential for dust problems.

2.13 FIRE PROTECTION

Fire protection at the working face will be prevented by maintaining stockpiled earth for any fires that may occur. Any fires that occur may be smothered by placing soil on the burning area and working it back and forth with a bulldozer or other appropriate equipment. In no case shall operating personnel cross the burning refuse. A water truck is also available as fire protection back-up, if necessary. Supplemental fire protection may also be provided by the Loudon County Fire Department. The Loudon County Fire Department will respond to onsite emergencies if needed. In the event of a fire or explosion on-site that could threaten the environment or human health outside the facility, within 24 hours the Tennessee Emergency Management Agency and the Tennessee Department of Environmental Compliance, Division of Solid Waste Management will be notified.

To avoid injury and damage caused by landfill equipment fires, each piece of heavy landfill equipment shall have a mounted fire extinguisher. Proper cleaning and maintenance of the equipment will also reduce the possibility of equipment fires.

Solid waste that is burning or smoldering will not be deposited into the active portion of the landfill. The solid waste will be directed to a designated area, safely away from the active portion, and extinguished prior to being deposited into the landfill. Open burning of solid waste will not be allowed.

2.14 PERSONNEL FACILITIES AND SERVICES

Three buildings are utilized currently for the landfill site: a combination scale house/manager's office, maintenance building, and a storage/break room.

The scale house/office is a permanent structure approximately 12 feet by 46 feet. It is located adjacent to the entrance road for the purpose of maintaining traffic control, charging for disposal, and landfill security. Sanitary facilities, electricity, and telephone services are provided in this building.

The maintenance building is located south of the active landfill. It is a permanent structure consisting of reinforced concrete for the floor slab and sheet metal for the walls and the roof structure. Plumbing, lighting, heat, and electrical connections are provided in this building. A storage/break room is located adjacent to the maintenance building. The scale house/office is equipped with two-way radios to monitor landfill personnel. The scale house operator will also be able to contact the local hospital and fire department by telephone in case of an emergency.

2.15 LANDFILL GAS CONTROL DEVICES

The migration of landfill gases generated by the decomposition of solid wastes at the MBLF may be controlled through a passive venting system. As described in the Title V Permit Renewal (2021) the facility is currently not subject to a State or federal requirement for landfill gas collection and control. Consequently, the facility does not operate a landfill gas collection and control system (GCCS) as provided in 40 CFR 62 Subpart OOO and 40 CFR 63 Subpart AAAA. The Municipal Solid Waste Landfill transitioned from the requirements of 40 CFR 60 Subpart WWW (New Source Performance Standards for Municipal Solid Waste Landfills) to the federal plan for existing Municipal Solid Waste Landfills as provided in 40 CFR 62 Subpart OOO (Federal Plan Requirements for Municipal Solid Waste Landfills that Commenced Construction on or Before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014). The final rule for 40 CFR 62 Subpart OOO became effective on June 21, 2021. Additionally, the landfill is subject to 40 CFR 61 Subpart M (National Emission Standard for Asbestos). The facility is not subject to 40 CFR 63 Subpart AAAA (National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills), because the NMOC emissions are below the 50 megagram threshold according to the most recent Tier 2 testing.

The gas venting system indicated in this Plan is for a passive gas system that meets the current regulatory requirements for this facility. The closure gas venting system will consist of a series of interconnected gas collection trenches. These trenches will be spaced at a maximum distance of 100 feet and will be 18 inches wide and 18 inches deep. A geotextile fabric will encapsulate the washed crushed gravel ~~stone~~ placed in the trenches. A 3-inch diameter perforated HDPE pipe will be placed in the trenches to convey the gas to the passive gas vents. An active gas system may be designed and installed at this facility in the future. Whether voluntary or required by regulations, a minor modification will be prepared prior to installation of an alternate active gas system.

2.15.1 Landfill Gas Monitoring Plan

To monitor off-site landfill gas migration, methane gas will be monitored at the following locations:

- Underneath or in the low are of each on-site building;
- At the compliance monitoring boundary shown in the permit;
- At any potential gas problem areas, as indicated by dead vegetation or other indicators; and
- At any other points required by the MBLF permit.

Monitoring procedures will be in accordance with Section 3.3, "Post-Closure Landfill Gas Monitoring," of the Closure/Post-Closure Plan. If necessary, gas migration control will be performed in accordance with Rule 0400-11-01-.04(5)(a).

If concentrations of explosive gases at the compliance monitoring boundary exceed the lower explosive limit (LEL), the following precautions shall be met:

- Immediate implementation of all necessary steps to ensure protection to human health;
- Within 48 hours, notification of the TDEC Division of Solid Waste Management;
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health;
- Within 60 days of detection, implement remediation plan for release of methane gas; and
- The TDEC Division of Solid Waste Management will be notified of remedial plan and implementation schedule.

If explosive gas concentrations in facility structures exceed 25% of LEL, the following precautions will be taken:

- Evacuate facility structures;

- Ventilate facility structures;
- Notify the Loudon County Fire Department; and
- Post notification on all facility entrances stating occupying building is prohibited.

2.15.2 Landfill Gas Sampling Protocol

Landfill gas monitoring is described in Appendix C~~D~~, Landfill Gas Control and Monitoring Plan.

2.16 GROUNDWATER MONITORING PLAN

The proposed groundwater monitoring plan consists of eight monitoring wells. Well MW-4R is the upgradient (background) well and wells MW-1A, MW-01, MW-02, MW-03, MW-05, MW-6R, and MW-07 are the downgradient (compliance) wells. All wells are currently installed, including MW-07, which is being proposed to replace MW-5 that will be decommissioned as development proceeds in the 2024 Horizontal Expansion Area. The proposed locations of these monitoring wells are shown on Figure 2 of the Modified Groundwater Monitoring Plan provided in Section III of this Permit Application.

The groundwater sampling will be conducted on a semi-annual basis and will include analysis of the constituents listed in Tables 3 and 4 below. Groundwater monitoring data will be evaluated using statistical methods in accordance with Rule 0400-11-01-.04(7)(a)4(v). Revisions to the constituents listed in Tables 3 and 4 may be requested by the MBLF based upon statistics.

TABLE 3: INORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Antimony	0.006	Lead	0.015
Arsenic	0.01	Mercury	0.002
Barium	2.0	Nickel	0.1
Beryllium	0.004	Selenium	0.05
Cadmium	0.005	Silver	0.10
Chromium	0.1	Thallium	0.002
Cobalt		Vanadium	
Copper	1.3	Zinc	
Fluoride	4.0		

TABLE 4: ORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Acetone		trans-1,3-Dichloropropene	
Acrylonitrile		Ethylbenzene	0.7
Benzene	0.005	2-Hexanone; Methyl butyl ketone	
Bromochloromethane		Methyl bromide; Bromomethane	
Bromodichloromethane	0.08	Methyl chloride; Chloromethane	
Bromoform; Tribromomethane	0.08	Methylene bromide; Dibromomethane	
Carbon disulfide		Methylene chloride; Dichloromethane	0.005
Carbon tetrachloride	0.005	Methyl ethyl ketone; MEK; 2-Butanone	
Chlorobenzene		Methyl iodide; Iodomethane	
Chloroethane; Ethyl chloride		4-Methyl-2-pentanone; Methyl isobutyl ketone	
Chloroform; Trichloromethane	0.08	Styrene	0.1
Dibromochloromethane; Chlorodibromomethane	0.08	1,1,1,2-Tetrachloroethane	
1,2-Dibromo-3-chloropropane; DBCP	0.0002	1,1,2,2-Tetrachloroethane	
1,2-Dibromoethane; Ethylene dibromide; EDB	0.00005	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	0.005
o-Dichlorobenzene; 1,2-Dichlorobenzene	0.6	Toluene	1.0
p-Dichlorobenzene; 1,4-Dichlorobenzene	0.075	1,1,1-Trichloroethane; Methyl chloroform	0.2
trans-1,4-Dichloro-2-butene		1,1,2-Trichloroethane	0.005
1,1-Dichloroethane; Ethylidene chloride		Trichloroethylene; Trichloroethene	0.005
1,2-Dichloroethane; Ethylene dichloride	0.005	Trichlorofluoromethane; CFC-11	
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	0.007	1,2,3-Trichloropropane	
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	0.07	Vinyl acetate	
trans-1,2-Dichloroethylene; trans-1,2- Dichloroethene	0.1	Vinyl chloride	0.002
1,2-Dichloropropane; Propylene dichloride	0.005	Xylenes	10.0
cis-1,3-Dichloropropene			

Samples referred to above will be obtained in accordance with the groundwater monitoring program. Bailers or pumps will be utilized for monitoring well purging and sampling. The groundwater surface elevation will be determined and recorded at each monitoring well before each sample extraction, prior to any pumping or bailing of the well.

Groundwater sample analysis results and the associated groundwater surface elevations will be submitted to the TDEC, in the manner specified in the permit, within 60 days after completing the analysis. Additionally, records of all groundwater monitoring activities will be kept throughout the active life and post closure period of the MBLF facility, as specified in Rule 0400-11-01-.04(4)(a)4(vii).

These monitoring records will include the following information:

- The date, exact place, and time of sampling;
- The individual(s) who performed the sampling;
- The date(s) analyses were performed;
- The techniques (including equipment utilized) used for the analyses; and
- The results of each analysis.

2.17 FLOOD FREQUENCY AND PROTECTION

The Matlock Bend Landfill is not located within a 100-year floodplain. Figure 2 depicts the location of the Site relative to the FEMA Flood Insurance Rate Map.

2.18 FACILITY IMPACTS ON ENDANGERED AND THREATENED SPECIES

The facility design and Operations Plan have been prepared to have no impact on endangered or threatened species of plants, fish, wildlife, and their habitat.

2.19 FAULT AREAS

Rule 0400-11-01-.04(9)(c)4

Describes its compliance with applicable siting requirements for fault areas.

Rule 0400-11-01-.04(2)(u)
Fault Areas - Class I and II disposal facilities shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment.

As described in the Supplemental Hydrogeological Report, fault areas are not known to exist within the Matlock Bend Landfill property. A review of regional geology, described in the Hydrogeological Report, shows that the proposed landfill expansion is also not located within 200 feet of a fault that has experienced displacement in Holocene time.

2.20 SEISMIC IMPACT ZONES

Rule 0400-11-01-.04(9)(c)5

Describes its compliance with applicable siting requirements for seismic impact zones.

Rule 0400-11-01-.04(2)(v)

Seismic Impact Zones - Class I and II disposal facilities shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.

Based on seismic hazard mapping developed by the USGS, the maximum horizontal acceleration of bedrock that has a 10 percent chance of occurring during a 250-year return period is approximately 0.35g at the Matlock Bend Landfill. A copy of this map is provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application.

The Expansion Area was evaluated with respect to stability under site specific spectral response accelerations as described in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The results from that analysis are also provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The evaluation demonstrates that estimated deformations that could occur during an earthquake with the above noted maximum horizontal acceleration will be negligible and within referenced maximum acceptable limits for both the base liner system and final cover system. This indicates that Expansion Area will remain stable and protective of the environment under the maximum design seismic event.

2.21 UNSTABLE AREAS

No unstable areas exist on the landfill expansion Site per the 2023 Hydrogeologic Report. No geologic faults known to have exhibited movement since Holocene time have been identified within 200 feet of the proposed landfill extension. The nearest fault to the Matlock Bend facility is the Beaver Valley fault, which is located approximately 3,000 feet northwest of the facility boundary. The Beaver Valley fault is not known to have experienced any motion since the late Paleozoic Era, per the 1996 hydrogeologic investigation by Theta Engineering, Inc., which is included in the 2023 Supplemental Hydrogeologic Report by CEC.

2.22 FACILITY IMPACTS ON REGULATED WETLANDS

No regulated wetland exists on the landfill expansion Site.

2.23 SEALING OF BORE HOLES

Prior to excavation, all bore holes drilled or dug during subsurface investigation, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled will be backfilled with a bentonite slurry or other approved method by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base, or to the ground surface if the Site will be excavated less than 10 feet.

2.24 RANDOM INSPECTION PROGRAM

A random inspection program will be used to screen for regulated hazardous waste, infectious waste, PCBs (concentration 50 ppm), whole tires, lead-acid batteries, liquid wastes, and unauthorized special waste. At a minimum, 5% of the daily incoming loads will be inspected by MBLF personnel for prohibited wastes. The procedures and guidelines for this inspection program are as follows and are part of Santek Standard Operating Procedures:

A. Complete Solid Waste Manifest on Every Facility User.

   Know your customers. Do not accept wastes from unknown, unlicensed, or otherwise questionable haulers. Manifests will contain, at a minimum, the following:

   - Inspection date;
   - Vehicle identification;
   - Driver signature;
   - Identification of any unauthorized waste;
   - Disposition of any unauthorized waste; and
   - Facility inspector signature.

B. Require Customer to Sign Affidavit on Weight Ticket.

   By signing the affidavit, haulers certify they are "not transporting any hazardous, infectious or regulated waste." This further enhances facility screening efforts and emphasizes to haulers the importance of closely monitoring customers' waste as well as increases awareness of shared liability.

C. Random Daily Inspections

A random selection procedure ensures anyone can be checked anytime.

- Complete the Random Inspection Manifest and return a copy to Santek's corporate office on a weekly basis. Landfill personnel shall retain a copy of the inspection manifest at the landfill in a bound notebook.
- Inspections should occur approximately once per day at different times during the day, but not less than 5% of daily incoming loads.

D. Upon Discovering Prohibited Waste

Use protective equipment (gloves, goggles, respirators) before proceeding if waste is potentially hazardous. The following steps should be taken:

- Segregate waste;
- Question hauler;
- Review Solid Waste Manifest for discrepancies;
- Identify and contact generator;
- Document findings in print and with camera;
- Contact proper authorities, including the TDEC field office;
- Contact laboratory support, if necessary;
- Notify response agency, if required; and
- Prepare for alternative disposal methods, if required.

E. Operator Training - Screening of Wastes

As part of routine safety meetings, the landfill operators are educated to recognize unacceptable wastes and special wastes, and to be aware of the approval conditions of special wastes. Training consists of:

- Reviewing TDEC's regulations and definitions of specific waste streams including solid wastes, bulky wastes, hazardous wastes, industrial wastes, liquid wastes, medical wastes, special wastes, and construction and demolition waste.

- Reviewing the approval process for special wastes which includes receiving the appropriate paperwork issued by the Division Field Office to the waste generator indicating the waste has been granted approval for disposal at the landfill.
- Reviewing operating procedures and restrictions for the disposal of special wastes which require transportation to the landfill separately and securely contained.
- Receiving advance notice from the waste generator and establishing a routine delivery schedule, if necessary, to prepare for the receiving of special wastes.
- Confining unloading and disposal operations to a specific area, if necessary, to assure proper disposal with minimum complications.
- Covering the waste with approved cover material at the end of the working day.
- Maintaining proper records on the receipt and management of certain special wastes and incorporating the records into the daily random inspection program.

F. Communications

Radio contact between the scale house attendant and equipment operator should always be accessible.

The following wastes will not be accepted for landfill disposal at the Matlock Bend Landfill:

- Biomedical wastes;
- Powders & dusts – unless accompanied by State approval;
- Lead acid or other batteries;
- Used oil & other liquids;
- Unapproved sludges;
- Unapproved ash; and
- Fluorescent bulbs – if more than 50 per load.

Other Questionable Materials:

- Barrels and drums – unless (a) rinsed, and (b) ends are removed;
- Refrigerators and air conditioners – unless generator can document that the Freon has been removed; and
- Asbestos – unless accompanied by 24-hour notification to the MBLF (accepted under blanket special waste approval).

Personnel working at the scale house and the active face will be trained to identify suspicious wastes based on inherent characteristics. Landfill personnel will be familiar with the specific and detailed procedures of the screening program if suspicious, hazardous, infectious, or unauthorized special waste is found.

2.25 INSPECTION OF LINERS AND COVERS

Rule 0400-11-01-.04(9)(c) 19

Describes in a construction quality assurance plan:

(i) How each new "as-built" solid waste landfill unit(s) liner(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as required at subparagraph (1)(c) of this rule during construction or installation for uniformity, damage, and imperfections, and

(ii) How each constructed section of the liner system or final cover system will be certified by a registered engineer.

Rule 0400-11-01-.04(1)(c) Project Supervision - A registered engineer must plan, design, and inspect the construction of any Class I, II, III, or IV disposal facility; also, a registered engineer must assist in the start-up of and outline correct operating procedures for any new or altered facility. Any registered engineer herein required shall be governed by the terms of T.C.A. Title 62, Chapter 2.

A detailed Construction Quality Assurance and Quality Control (CQA/QC) Plan for the construction of new landfill cells, final cover, and other appurtenant structures is provided in Section VII of this permit application. The provisions included in the CQA/QC Plan will be followed during the construction sequence, and the construction activities regulated by the CQA/QC Plan will be certified by a professional engineer registered in Tennessee.

2.26 PERMANENT BENCHMARK

Rule 0400-11-01-.04(2)(o)

Permanent Benchmark - There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

There are three (3) existing permanent benchmarks on-site and two (2) will be added in the future as shown in Table 5.

TABLE 5: SITE BENCHMARKS

BM#	Northing	Easting	Elev. (MSL)	Comment
6	497448.00	2471943.27	997.46	Existing
21	497772.83	2471868.18	997.79	Existing
24	497314.07	2470296.78	880.93	Existing
22A	498983.01	2470583.01		Future Benchmark
25	499203.42	2471846.30		Future Benchmark

2.27 AIRPORT SAFETY

Rule 0400-11-01-.04(2)(r)

Airport Safety - The owners or operators of Class I disposal facilities located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used only by piston-type aircraft must include in the Narrative Description of the Facility and Operations Manual a demonstration that the unit does not pose a bird hazard to aircraft. The owners or operators proposing new Class I disposal facility within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the appropriate Federal Aviation Administration (FAA) office.

There are no airports located within 10,000 feet of the disposal facility boundaries, nor is the facility located within 5,000 feet of an airport runway end used by turbojet or piston-type aircraft.

2.28 ANNUAL REPORTING

Rule 0400-11-01-.04(2)(t)

Future Planning – All operators of Class I disposal Facilities within the state of Tennessee shall file with the Department, by May 1st of every year, and estimate of the remaining life of their site. This report shall include the original usable acreage of the site and the remaining unused portion at the time of the report. Where measuring facilities are available, an average monthly weight (or volume) estimate of the incoming waste shall be supplied. The Department shall have final determination of the accuracy of the estimate. If the operator plans to operate a new landfill, a suitable site for the new facility shall be selected at least twelve months before the estimated date for expiration of the operating life of the existing facility, and as applicable, design and construction plans shall be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility or site.

Similar to existing operations, Matlock Bend will file an estimate of the remaining life of the disposal facility with the Division by May 1 of each year. The report will include the original permitted acreage of the site and the remaining unused portion of the facility at the time of the report. In addition, an average monthly volume (by weight) estimate of the incoming materials shall be provided.

At least 12 months prior to the estimated expiration of waste disposal capacity, Matlock Bend will notify the Division of their intentions concerning the continuation of disposal operations at the facility.

2.29 HOLDING AND PROCESSING TANKS

Rule 0400-11-01-.04(2)(x)

<u>*Holding and Processing Tanks*</u> - *Holding and processing tanks for any liquids brought to a landfill facility for waste processing shall not be located within the waste management boundary of the landfill.*

No holding and processing tanks are currently proposed for use at the site for liquids processing.

FIGURES

APPENDIX B
LEACHATE MANAGEMENT PLAN FOR LANDFILL OPERATIONS

LEACHATE MANAGEMENT PLAN FOR MATLOCK BEND LANDFILL OPERATIONS

Prepared for:
Santek Environmental, LLC
Matlock Bend Landfill
Loudon County, Tennessee

Prepared by:
Holly Van Kirk – Environmental Specialist
Luke Cunningham - Environmental Manager

Date:
December 19, 2022

Revision: 0
Rev. 4~~3~~ April~~ugust~~ 2025~~4~~

SIGNIFICANT REVISIONS TO THIS PLAN REQUIRE A MINOR PERMIT MODIFICATION
(See Introduction Section, Pg. 1)

Amendment Schedule

This Leachate Management Plan (LMP) requires periodic updates to address changes in site conditions, facility operations, and/or government regulations, and shall be reviewed for adequacy at a minimum frequency of once per year.

Amendments to the LMP shall be documented on the LMP amendment schedule, included below. Each LMP revision shall be approved by the authorized representative responsible for certifying the LMP. The signature of this representative in the appropriate space below attests that the LMP amendment information is true and accurate. Amendment to the LMP can be inserted into the appropriate section of the original LMP and properly identified as a revision, or the entire document may be revised for clarity.

Amendment	Date	Approved By
Rev. 2, March 2024 (Revised to Address TDEC February 9, 2024 NOD)	April 2024	
Rev. 3, August 2024 (Revised to Address TDEC July 5, 2024 NOD)	August 2024	
Rev. 4, April 2025 (Revised as part of April 2025 Minor Modification Submittal	April 2025	

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ATTACHMENTS

Introduction

This Leachate Management Plan (LMP) for Santek Environmental, LLC, located at 21712 Highway 72 North, Loudon County, TN 37774, contains procedures for leachate minimization, removal, storage, disposal, and recordkeeping responsibilities at this Santek facility. Leachate will be managed and disposed of every working day in such a manner to maintain full compliance with all local, state, and federal operating permit conditions and regulations. Significant changes to this LMP will be discussed with TDEC and may require a minor permit modification. Minor updates to the LMP to include as-built information are excluded from this minor permit modification requirement. Following cell construction and TDEC approval, MBLF will meet with TDEC's local inspector to assess whether a minor permit modification is required for any changes.

It is important that everyone at the facility participate in leachate management. The LMP establishes responsibilities and procedures for collecting, recording and reporting information pertinent to leachate management, and it defines methods for maintaining ongoing compliance at the facility. All facility personnel shall understand the permit requirements and abide by those requirements. In the event that a conflict arises between the permit and LMP, the permit shall always govern the actions of the personnel at the facility.

The LMP should be reviewed annually (at a minimum) by facility personnel throughout the year and updated if site conditions change.

Attachment A drawing that shows the alignment of the leachate force main from the existing 100,000 gal. storage tank to the direct disposal point.

Attachment B includes leachate data tables to define compliance levels and leachate sump on/off setting information for leachate sump pumps. In addition, tables to record daily storage tank levels and volumes of liquid removed from facility storage vessels for disposal at the approved disposal location.

Attachment C includes the list of procedures and management routines outlining what tasks and the recommended frequency by which they should be completed, and the responsible person for each task.

Attachment D provides the Leachate Disposal Permits/Agreements.

Attachment E includes a Leachate Maintenance and Inspection Schedule.

Attachment F includes a narrative description of the transition from current leachate operations to the proposed leachate operations associated with the 2024 Horizontal Expansion at the site.

Attachment G consists of drawings and details associated with the leachate management system.

Attachment H includes an image of the placard from the existing 100,000 gallon onsite leachate storage tank.

Leachate Regulations and Minimum Compliance

Promulgated on October 9, 1991, Subtitle D of the Resource Conservation and Recovery Act (RCRA), (40 CFR Parts 257 and 258) Section 258.40(a) (2), specifies that new municipal solid waste landfill units and lateral expansions shall be constructed with a composite liner and a leachate collection system that is designed and constructed to maintain less than a 30-cm (1 foot) depth of leachate over the liner. The design must consider the volume as well as the physical and chemical characteristics of the leachate. Leachate shall be managed until it can be demonstrated that it no longer poses a threat to human health and the environment.

Presented below are minimal, general leachate collection design and management requirements. In order to determine if the applicable state or facility specific permit has more stringent requirements, a review of state (and local) regulations as well as the facility permit and/or permit application must be conducted.

- Subtitle D leachate systems shall be designed to maintain a maximum head of leachate of one (1) foot or less above the liner.
- The leachate drainage system shall be designed and constructed to operate for the entire design period (i.e. the operating life of the facility plus 30 or more years).
- The drainage layer shall be designed with a graded filter or geotextile as necessary to minimize clogging and to prevent intrusion of fine material.
- Materials used in the leachate collection system shall be chemically resistant to the wastes and to the leachate expected to be produced.
- Collection pipes shall be of a cross-sectional area that allows for cleaning.
- The system shall be equipped with a sufficient number of cleanout risers or other access points to allow cleaning and maintenance of all pipes throughout the design. Leachate force main should have easily accessible cleanouts at intervals of no more than 500 feet and should account for pipe deflection and bends that limit advancement of cleaning equipment.
- The leachate management system shall consist of any combination of storage, treatment, pretreatment, and disposal options designed and constructed to maintain compliance with the requirements of the site-specific permit and local regulations.
- Pumps, meters, valves, and monitoring stations which control and monitor the flow of

leachate from the unit, and which are under the control of the operator shall be considered part of the facility and shall be accessible to the operator at all times.

- Leachate storage capacities should be of sufficient volume to allow for consistent, safe management of liquids, considering potential interruptions in disposal due to weather, holidays, or other factors causing disposal to be interrupted.
- All leachate storage tanks shall be equipped with secondary containment systems.

Compliance Point Identification

In order to comply with applicable regulations and maintain operational excellence standards, facility personnel must have a complete understanding of the leachate collection system components and site-specific operational requirements, and have complete records of the following components:

- The compliance locations that exist (Reference plans in Attachment G),
- The type of equipment and associated components installed,
- How the equipment is installed, and at what elevations, and
- The location-specific, permitted elevation levels.

Facility points of compliance typically include the following:

- Leachate sump: Module H (until Cell 3 is constructed), and Sumps 1, 2, and 3, and
- Leachate Pump #1, and
- Leachate storage tank.

Compliance points are tabulated in Attachment B.1. Sump details and compliance elevations are provided in Attachment B.2.

Compliance Level Establishment

In order to establish confidence that compliance levels are being attained, a review of the facility engineering drawings and details, and/or discussion with the facility engineer of record, is necessary. These sources should provide sufficient information to complete the leachate data tables included in Attachment C. If specific record details are not available, a field inspection of each sump will be necessary to obtain information in order to properly document the elevations of the pumps and required on/off pump setting elevations for each pumping location. Figure 1 (see below) shows a typical leachate sump cross section.

Once the configuration of each sump at the facility is established, a regulatory review should be conducted to understand the site specific federal, state, and local regulatory requirements to operate the leachate collection sumps. The facility operating permit is the primary source that outlines these requirements. However, if the facility operating permit does not clearly define legal requirements, further reference to the state solid waste laws and regulations will be necessary. Collectively, this information is used to determine compliance requirements for leachate elevations.

Example: A review of facility records indicates that the floor of the sump is situated 2 feet below the elevation of the base liner, and the pump and leachate level monitoring device are situated at the bottom of the sump. The facility's operating permit requires that leachate levels do not exceed 12 inches above the liner (not including leachate sump floor elevation). Thus, the compliance leachate level at the location of the leachate monitoring device would be less than 36 inches.

Once the compliance levels for each location have been documented, the appropriate information should be recorded on the appropriate form in Attachment C.

This information should be maintained in a binder at the facility to document all of the leachate sump elevations and settings of the leachate sump pump removal equipment. In addition, a laminated copy of the information for each leachate sump should be placed in each leachate control panel, providing the current elevation settings at each leachate removal location for facility personnel to reference during the course of their daily operations and maintenance of the leachate management system.

In addition to maintaining all of this elevation information in the facility operating file, the Environmental Manager should provide all of this information annually to the appropriate representative in the Corporate Engineering and Environmental Compliance group.

The data review and compilation for the leachate sumps elevations can also be used to verify compliance levels for other leachate conveyance devices, including, but not limited to, lift stations, storage tanks, or containment pond levels. The corresponding readings from other pumping locations at the facility shall be documented on the forms included in Attachment C and the schedule in Attachment E.

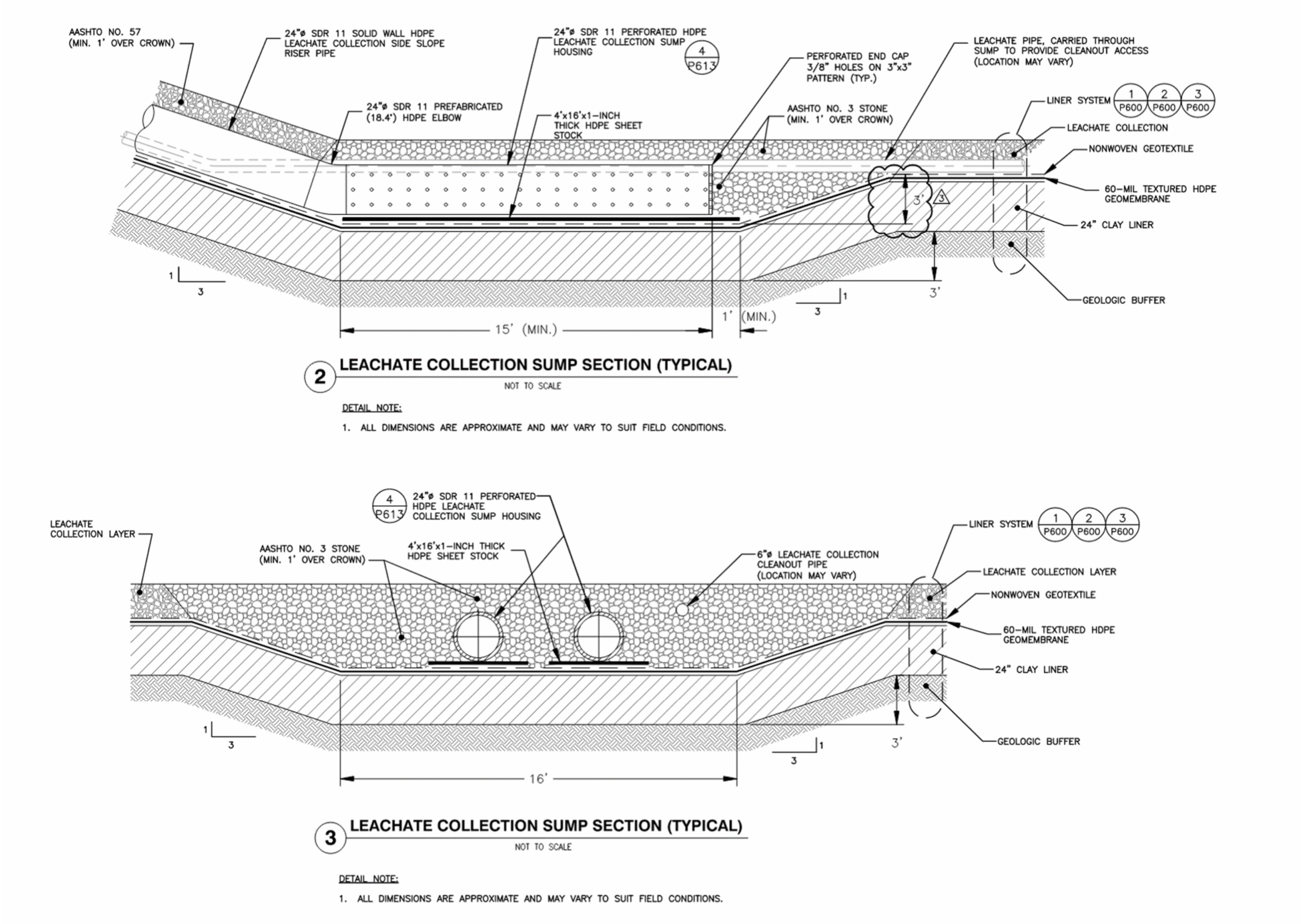


Figure 1 – Typical Leachate Sump Cross Section

Operations Inspection and Documentation

All leachate removal, conveyance, and storage systems shall be operable every day. While it is important to establish site-specific compliance levels for each leachate component, it is just as critical to maintain and confirm ongoing compliance with those established levels. Landfill environments are dynamic, and as such frequent observations are necessary to ensure consistent compliance.

On a daily basis (each working day), the Operations Manager (or their designee) should visit each compliance location and observe and document, at a minimum, the following operational conditions:

- On a daily (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each permit-defined leachate sump and leachate lift compliance locations. At a minimum, the following should be documented:
    - System operational status,
    - Compliance level at location,
    - Liquid level reading at time of inspection, and
    - Amount of liquid removed/pumped since last inspection (gallons or totalizer reading).
- On a daily, (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each leachate storage location. At a minimum, the following should be documented:
    - System operational status,
    - Storage level reading at time of inspection,
    - Comparison of storage level reading at time of inspection to maximum capacity, and
    - Amount of liquid pumped since last inspection (gallons or totalizer reading).

On a monthly basis, the Operations Manager (or their designee) should inspect each compliance location and observe and document the following maintenance conditions:

- Is the area clean, organized, and protected from siltation and standing rainwater?
- Is the area secured/locked/bolted at sump entry points?
- Are all confined space and other warning signs in place and legible?
- Is there evidence of leaks (staining, standing liquid)?
- Are the high/low level alarms properly set and functioning?
- Do all of the exposed piping and controls appear to be intact? Any obvious repairs needed (replacing sun damaged handles on valves, etc.)?
- Is piping permanent intact and protected, and the facility is not using temporary hoses or quick-connects?

- Is the specific compliance level labeled on the control panel?
- What is the condition of the pump control and level indicator system?
- Is the control box secure?
- Is there power to the control box? Is the box hooked to a timer or disconnect which would shut off power?
- Are there any exposed electrical components which should be contained/resealed?
- Does the system appear to be functioning properly?
- If controls are automated, what are the levels that pumps are currently set to come on and then turn off?
- Record the leachate level reading on the proper form and compare to the documented compliance level for that location.
- Is the pump running? If not, the pump must be cycled in manual operation and determination made of the following:
    - With pump running, observe discharge piping and verify that fluid is flowing to force main / discharge points.
- Is there a flow meter or cycle counter on the sump? Record any information.
- Is there an hour meter on the pump? Record any information.
- Describe the discharge pipe from the pump to the surface. Is the pipe hard-walled or flexible tubing? How is the pumps installation depth verified?
- Determine where the liquid collected by the pump is discharged.
- Is heat trace / freeze protection operational and in good working order (seasonal)?
- Repeat process for each compliance location.

If the monthly inspection described above is completed and a deficiency is noted, corrective actions should be scheduled immediately, especially in the event that liquid level readings suggest that the compliance level is exceeded. In the event that the liquid level does not indicate compliance and the system is not operating to lower the level, notification should be made to the General Manager and the facility Environmental Manager.

Additionally, the leachate management system at the Matlock Bend Landfill shall be maintained on a routine basis. Cleaning and inspection shall follow the schedule included in Attachment E of this Leachate Management Plan.

Environmental Compliance Evaluations

The Environmental Manager shall perform routine compliance evaluations of onsite data to confirm appropriate placement and operation of liquid removal equipment at all compliance points for the facility. These evaluations are meant to be a review of the daily observations and record-keeping by the Operations Manager (or their designee) described in the prior section.

A leachate compliance evaluation shall be performed annually at a minimum and any time that:

- System components are adjusted and / or changed,
- Site records are incomplete and do not contain specified information, or
- A greater than 50% change (up or down) in discharge quantity is recorded. This requires consistent review and trending of discharge quantity data.

Leachate compliance evaluations shall contain:

- Design review,
- Regulatory review, historical volume information review,
- Operating records review,
- Sump Location Inspection, and
- Inspection of Storage Tanks.

The results of these evaluations shall be presented to the General Manager for review. If any deficiencies are noted in the evaluation, the General Manager shall direct the appropriate responsible party (Operations Manager, Environmental Manager, or another designee of the General Manager) to correct the deficiency in a timely manner. The time to complete the corrective action shall be reasonable based on the specific item to be repaired, but by no means be delayed beyond the next scheduled environmental compliance evaluation.

Preventative Maintenance and System Verification Procedures

On a minimum annual basis, confirm equipment placement and operational compliance verification for all aspects of the leachate collection removal, conveyance, storage, and disposal systems. These procedures should include, but not be limited to:

- Removal, Cleaning, and Visual inspection of:
  - Leachate sump pump and liquid level control (transducer, float, etc.) for each leachate sump,
  - Lift station, manhole, storage tank/containment pond, cleaning (mechanical pump inspections, manhole/tank/pond integrity verification), and
  - Evaporation pond is clean and any accumulated sediment is removed so required storage capacity is maintained.
- Verification of integrity of piping:
  - Leachate collection and conveyance line jetting, and
  - Forcemain conveyance piping line jetting.
- Verification of pump and liquid level settings
  - Verify correct elevation settings are in place for every leachate sump pump and liquid level control,
  - Verify correct high/low elevations are in place for proper pump operations for every lift station and storage tank, and
  - Verify containment ponds or evaporation ponds are clean, and that any pumping equipment is properly calibrated with the required high/low elevation settings.

All preventative maintenance activities should be completed using leading industry practices.

Additionally, the leachate management system at Matlock Bend Landfill shall be maintained on a routine basis. Cleaning and inspection shall follow the schedule included in Attachment E of this Leachate Management Plan.

Annual Leachate Sampling Requirement

On an annual basis, a composite leachate sample shall be collected, which is representative of total landfill leachate. The Environmental Manager shall coordinate internal or external efforts to collect and analyze a representative sample of total landfill leachate.

The sample shall be analyzed (at a minimum) for ammonia, TKN, BOD, COD, metals, total sulfates, pH, TSS, TDS and other permit required parameters (if applicable) in order to confirm consistency with permit and regulatory requirements and internal guidance.

Leachate samples are taken by a qualified third-party vendor. The third-party vendor is escorted to both Leachate tanks where the sample is taken. One sample is taken at both tanks for a total of two samples. The third-party vendor completes a chain of custody, performs analytical testing, and provides results to the Environmental Manager.

Analytical Reports should be maintained in the facility operating file and shared with the appropriate representative in the Corporate Engineering and Environmental Compliance group.

Leachate Contingency Plan

Disposal methods may vary from facility to facility. Regardless of what onsite disposal options are used, the facility should have a primary offsite disposal. In the event that a primary location is unavailable, a secondary disposal location should be identified.

Primary Disposal Location   Most Recent Verification Date: 12/19/22

Disposal Facility Name	Loudon Utilities
Facility Address	2360 TN-72, Loudon, TN. 37774
Facility Contact Name/Phone Number	Brianna Baxter; (423) 478-9337
Distance to Facility	3.3 miles
Active Permit or Agreement (Y/N) (if "Y", then provide permit or agreement number)	Yes
Volume/Flow Limitations (if any)	No limitations apply
Discharge Constituent Limits (if any)	Varies

Secondary Disposal Location   Most Recent Verification Date: 07/31/2024

Disposal Facility Name:	Onsite Environmental
Facility Address	3900 N. Hawthorne Street, Chattanooga, TN 37406
Facility Contact Name/Phone Number	Valerie Fancher/ (423) 721-8836
Distance to Facility	78 miles
Active Permit or Agreement (Y/N) (if "Y", then provide permit or agreement number)	Y
Volume/Flow Limitations (if any)	132,360 gpd
Discharge Constituent Limitation (if any)	None

Note: Santek reserves the right to haul leachate to other secondary leachate disposal sites at their discretion, provided it is a licensed treatment facility.

Semi-annually, the Operations Manager and Environmental Manager or their designee will confirm the status of the primary and secondary disposal locations/options.

Leachate Disposal Agreements

The proper disposal of leachate from our post-collection facilities is a critical component for compliance and technical health of our landfills. As such, maintaining appropriate relationships, including compliance with permits and agreements, with our third-party disposal facilities is critical. Whether these relationships are directly with a municipal or privately owned treatment facility or a broker, it is important to maintain a professional working relationship and remain in good standing with those entities.

Third-party disposal entities may utilize a variety of mechanisms to establish an official relationship with users. These entities may require discharge permits, disposal agreements, contracts, or a combination thereof. State agency permits for discharge may also be required in conjunction with the specific agreement with the disposal entity. In rare circumstances, some small entities may not require any agreement whatsoever. It is Santek's policy that at a minimum, a disposal agreement or contract must be in place with all third-party disposal entities. This would include relationships with municipal treatment plants, privately owned treatment facilities, brokers, and leachate transporters. Service agreements from treatment facilities or brokers should be routed through normal contract review channels, beginning with a review from the Manager of Engineering and Environmental Management and assisted by our Legal Department. For contracting with transporters, the Corporate Procurement Department can assist with bidding and contracting.

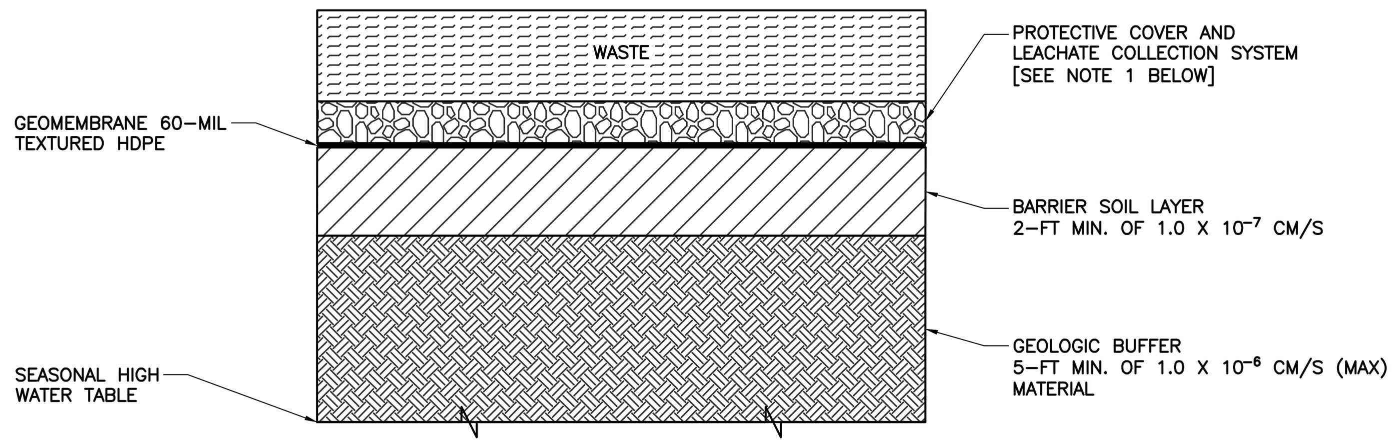
The relationship between third-party disposal entities and the local Santek facility is unique. Our facility is a customer of the third-party disposal outlet, but at the same time is regulated by that facility via a permit or disposal agreement. Because responsibility for and liability associated with our leachate goes beyond simply "getting it offsite," it is critical to maintain a close relationship with the disposal facility, much as one would with a regulator.

The most effective way to manage this relationship is through communication. Some suggestions for communication opportunities include:

- Invitations for tours, or touring the disposal facility,
- Communicating changes that may affect the quality or quantity of leachate (e.g. opening a new cell, installing additional pumps, change in waste stream), and
- Develop an understanding of changes the treatment facility may be planning in its processes.

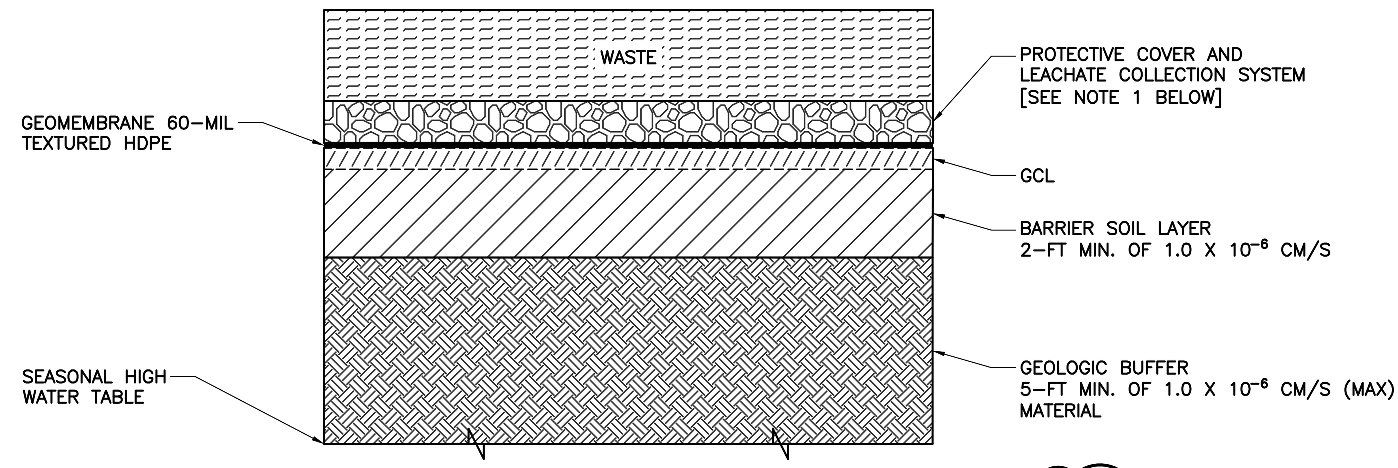
ATTACHMENT G
DRAWINGS AND DETAILS ASSOCIATED WITH THE LEACHATE MANAGEMENT PLAN

Note that the drawings and details shown in this section have been reproduced and are identical to the drawings included in the Part II – 2024 Horizontal Expansion Permit Plans, last revised April~~July~~ 202~~4~~5. Drawings are included here for reference and completeness of the Leachate Management Plan. Refer to the Part II – 2024 Horizontal Expansion Permit Plans for additional information.



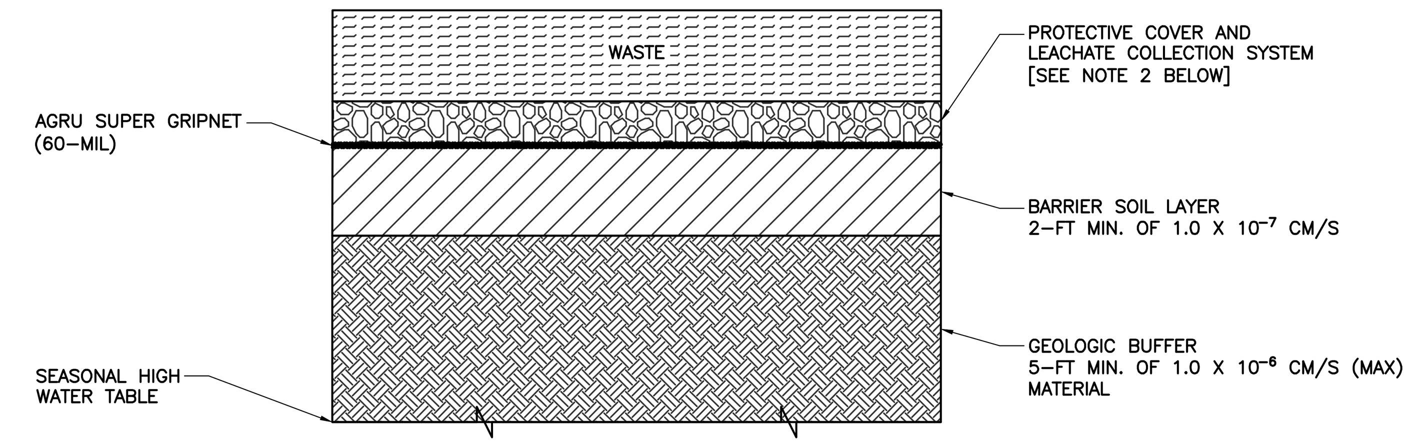
NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

1 OPTION 1 BASE LINER SYSTEM
NOT TO SCALE



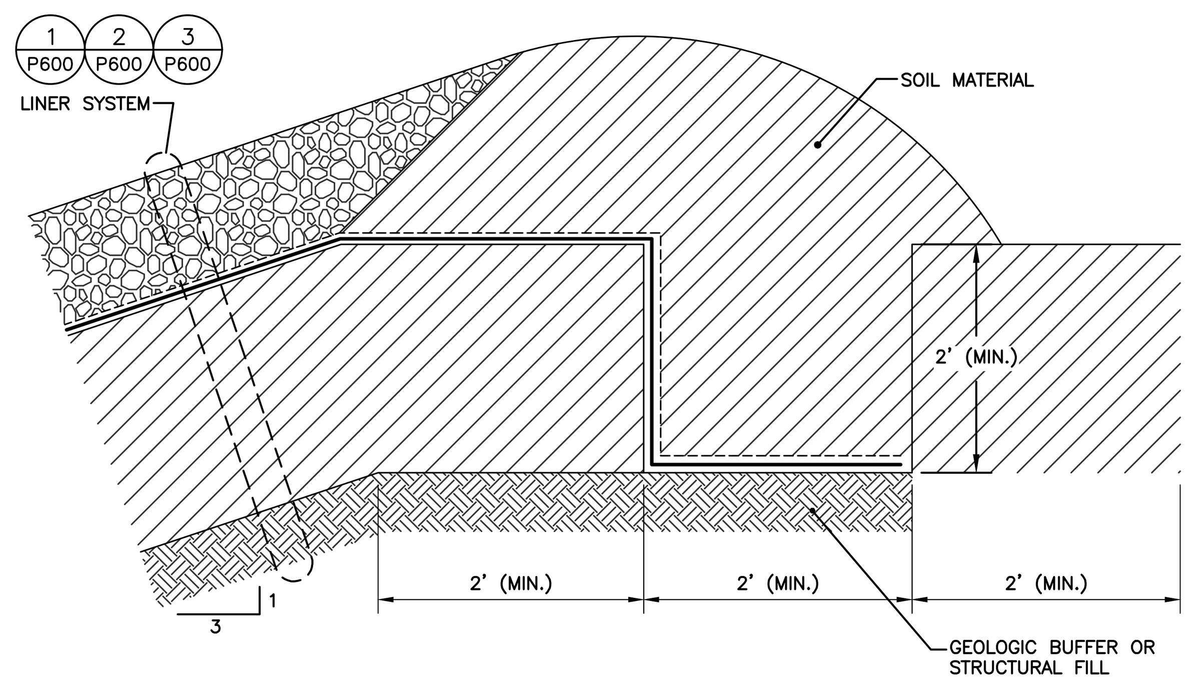
NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

2 OPTION 2 BASE LINER SYSTEM
NOT TO SCALE

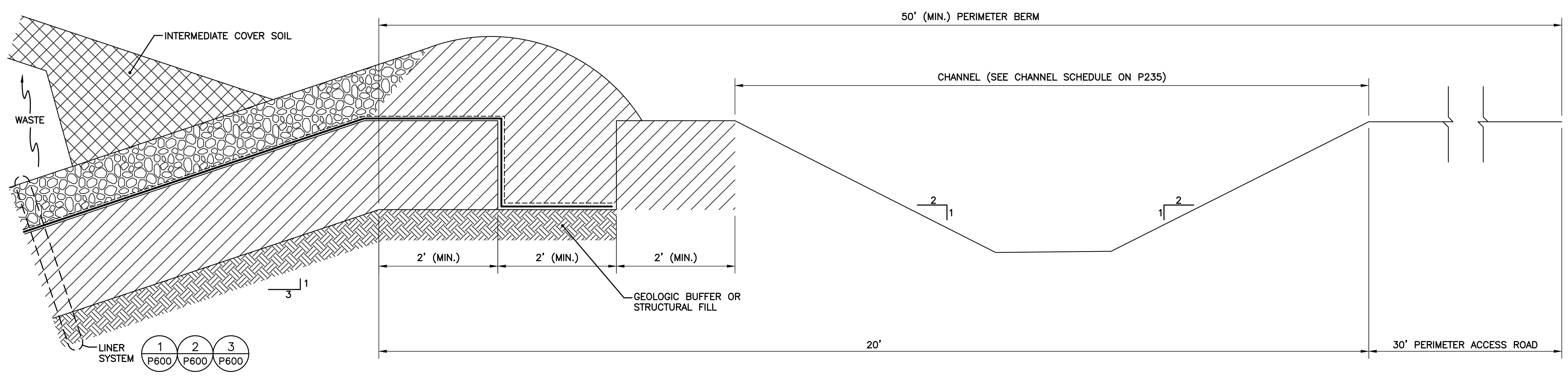


NOTE:
1. AGRU SUPER GRIPNET LINER SYSTEM SHALL BE INSTALLED IN MODULES 1, 2, AND 3 IN THE APPROXIMATE LOCATIONS SHOWN ON DRAWING P201.
2. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

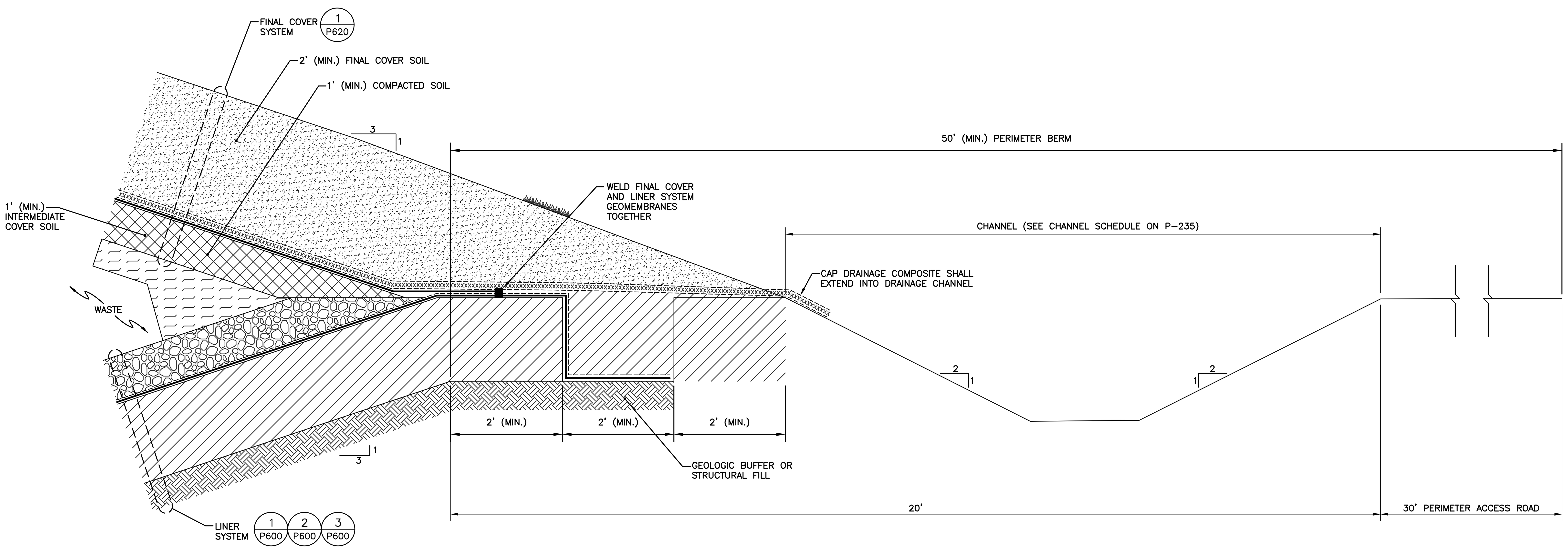
3 OPTION 3 BASE LINER SYSTEM
NOT TO SCALE



4 PERIMETER ANCHOR TRENCH
NOT TO SCALE

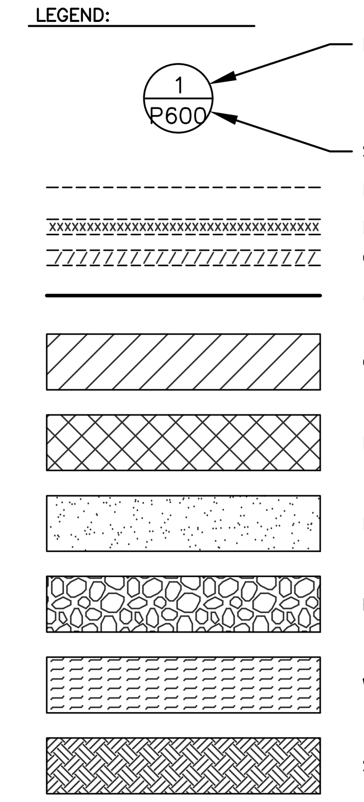


5 INTERIM PERIMETER BERM
NOT TO SCALE



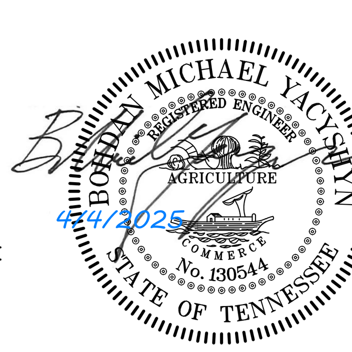
6 PERIMETER BERM AT CLOSURE
NOT TO SCALE

LEGEND:



- DETAIL DESIGNATION
- SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LINERSYSTEMDETAILS (SHEET 1 OF 3)

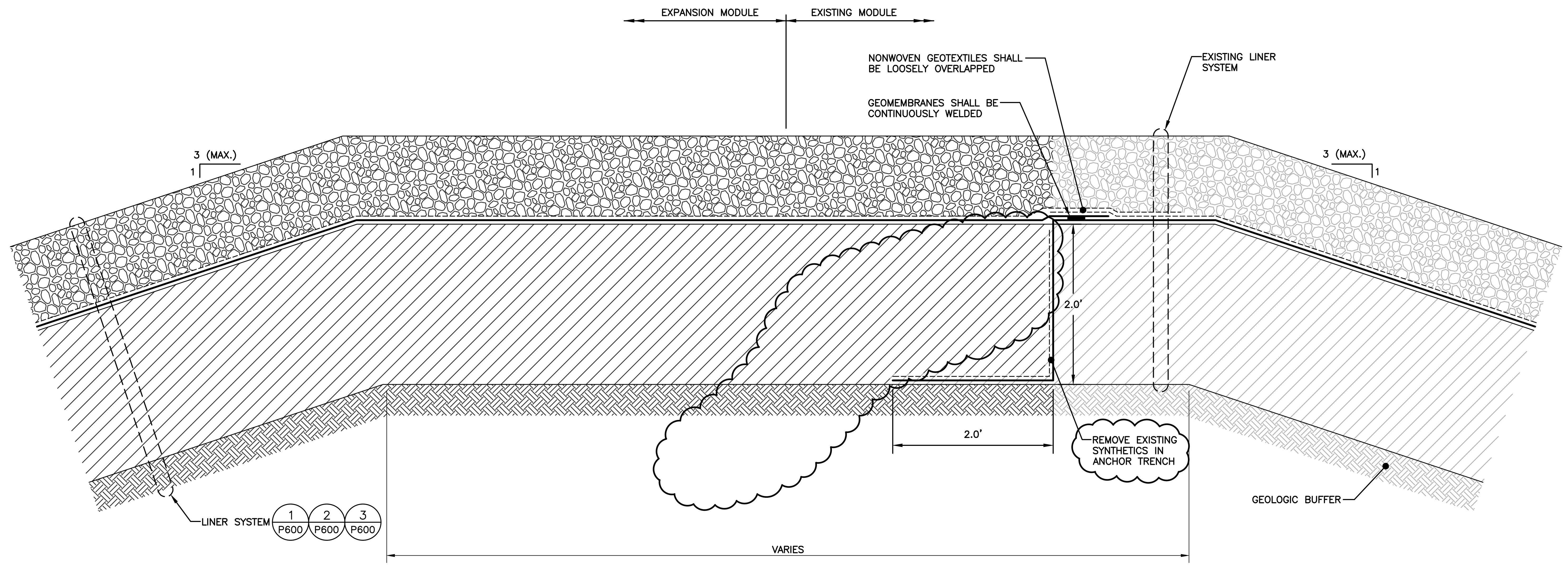
DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

DRAWING NO.: P-600

P:\310-000\317-474\-0400\Dwg\SWDP\317474-SWDP-P600-DETAILS.dwg[P-600] LS:(3/18/2025 - kunderwood) - LP: 4/3/2025 2:52 PM

DETAIL REMOVED

1 **INTERCEPTOR DRAIN**
NOT TO SCALE

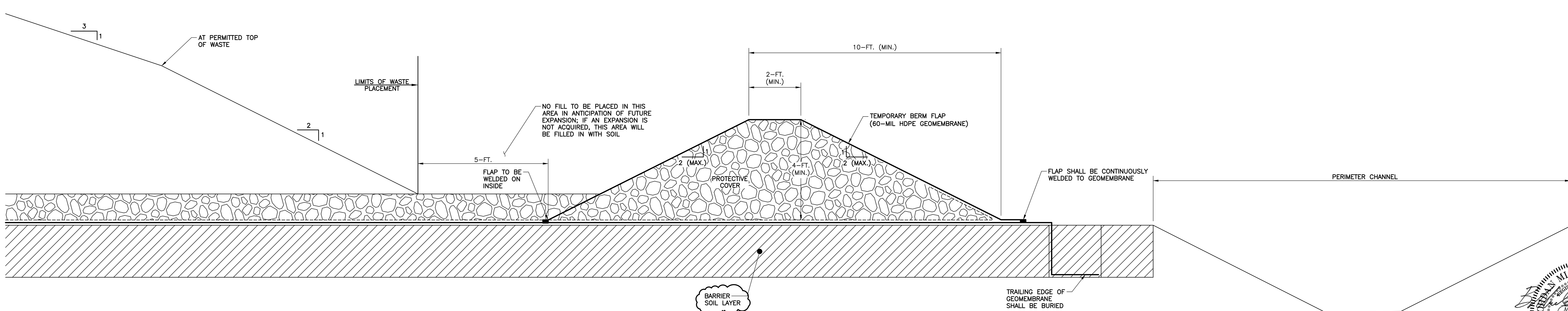


2 **TIE-IN TO EXISTING LINER SYSTEM**
NOT TO SCALE

LEGEND:

- DETAIL DESIGNATION (1)
- SHEET WHERE DETAIL IS SHOWN (P600)
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



3 **WESTERN AND NORTHERN PERIMETER BERM**
NOT TO SCALE

REVISION RECORD

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

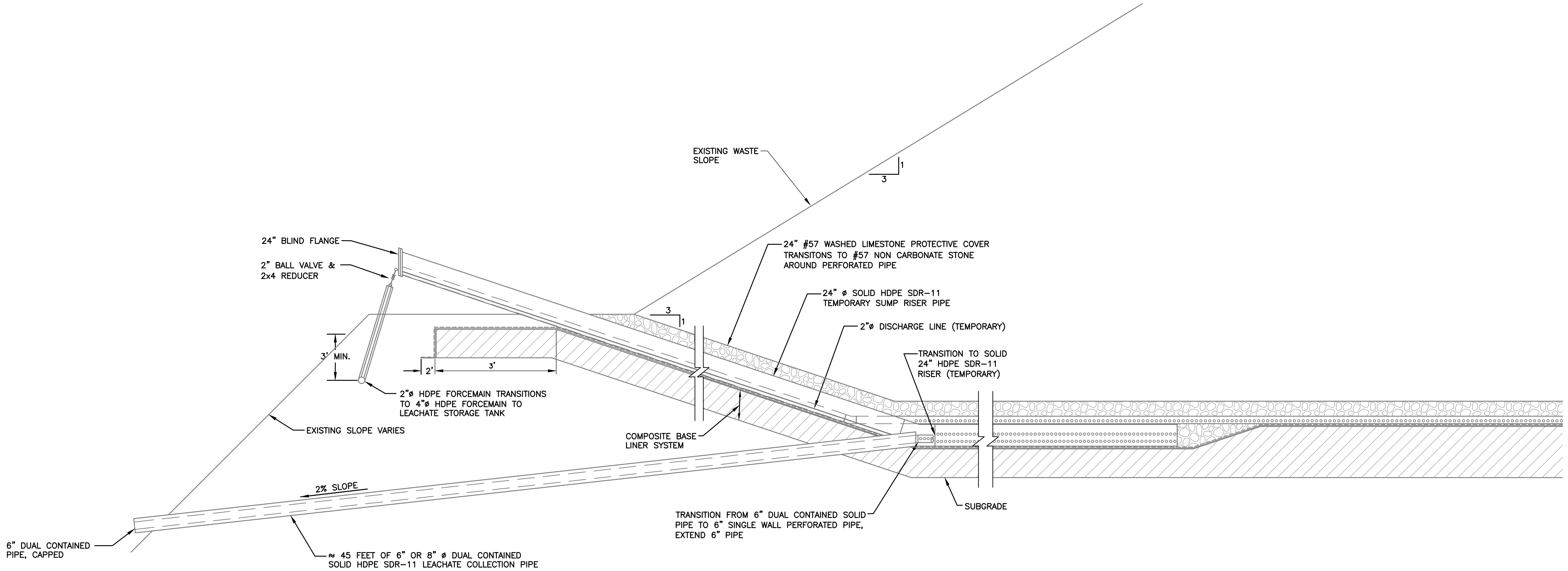
LINER SYSTEM DETAILS
(SHEET 2 OF 3)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	*BMY

BOHDAN MICHAEL YACYSHYN
STATE OF TENNESSEE
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 130544
4/4/2025

*HAND SIGNATURE ON FILE

DRAWING NO.:
P-601



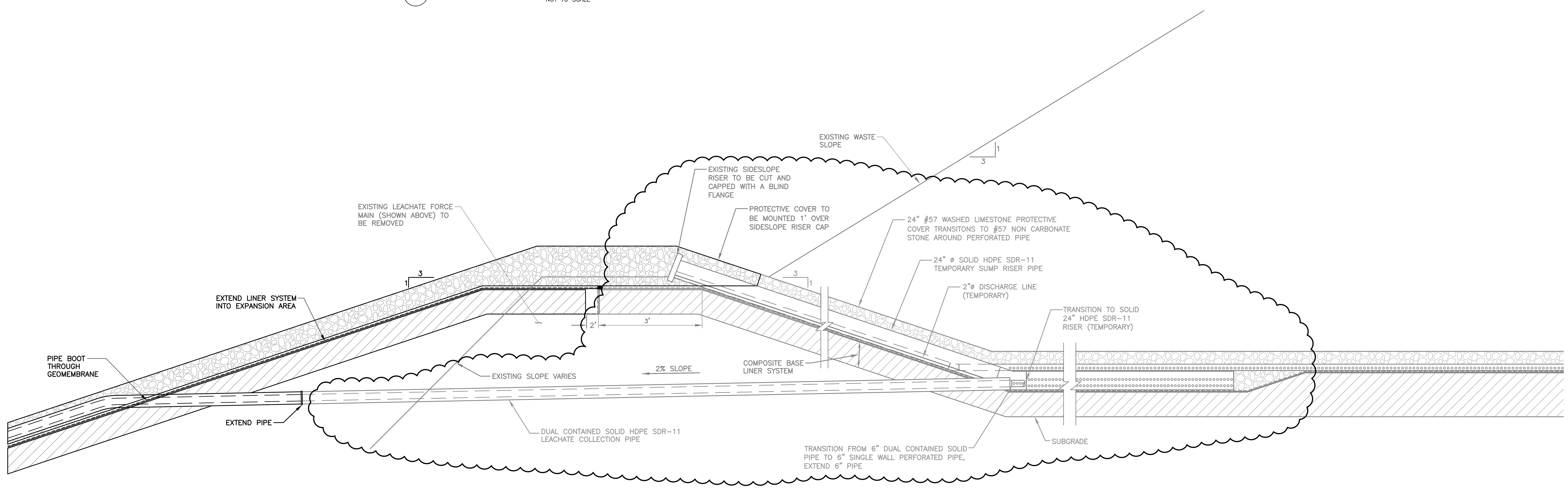
NOTE:
THIS DETAIL SHOWS THE APPROXIMATE CONFIGURATION OF THE SUMP IN EXISTING MODULE H. THE EXISTING SUMPS IN MODULES A AND B ARE SIMILAR, EXCEPT THEY DO NOT HAVE THE 2 INCH FORCE MAIN CONNECTED THE THEIR SUMP PUMPS. REFER TO DETAIL 2 ON THIS SHEET FOR HOW THESE SUMPS WILL BE EXTENDED TO DRAIN BY GRAVITY INTO EXPANSION MODULES 1, 2, AND 3.

1 EXISTING TEMPORARY SUMP CROSS SECTION
NOT TO SCALE

LEGEND:

1 / P601	DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- - - - -	NONWOVEN GEOTEXTILE
	DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
	GEOSYNTHETIC CLAY LINER
———	60-MIL TEXTURED HDPE GEOMEMBRANE
	CLAY LINER
	INTERMEDIATE COVER SOIL
	FINAL COVER SOIL
	PROTECTIVE COVER STONE
	WASTE
	STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 EXISTING LEACHATE COLLECTION PIPE TIE-IN TO NEW MODULES
NOT TO SCALE

REVISION RECORD

NO	DATE	DESCRIPTION

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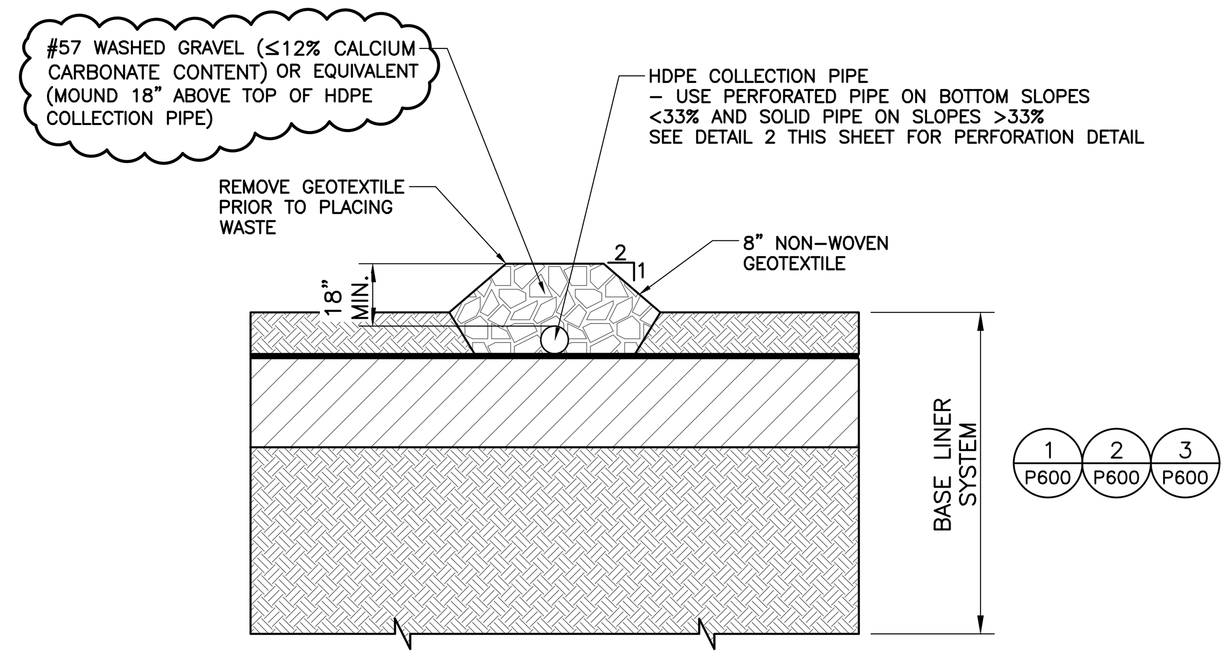
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT
DETAILS (SHEET 2 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	EDC*

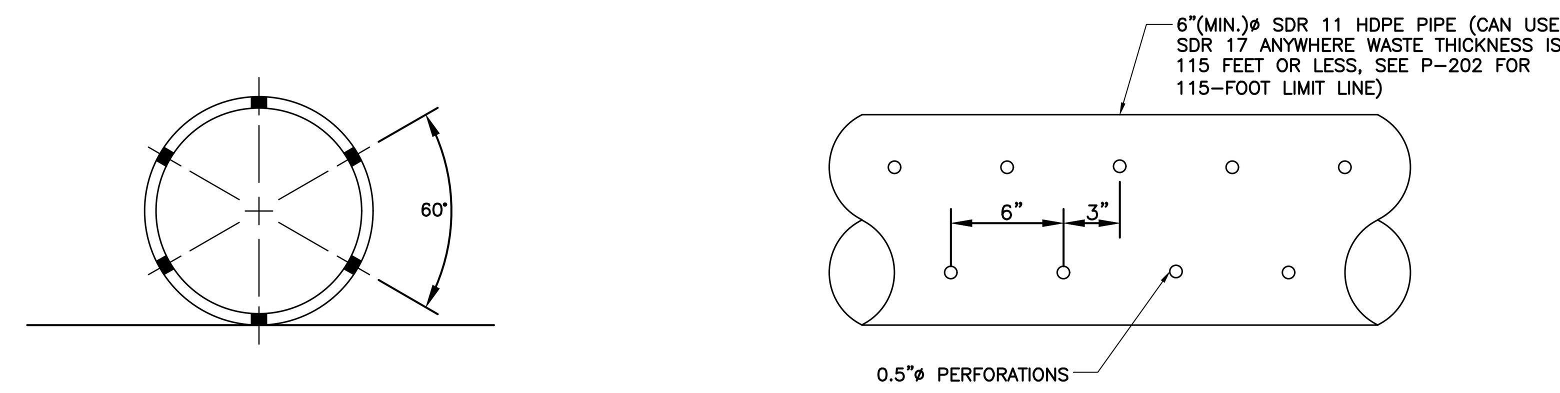
BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 120544
STATE OF TENNESSEE
4/4/2025
*SIGNATURE ON FILE

DRAWING NO.:
P-611



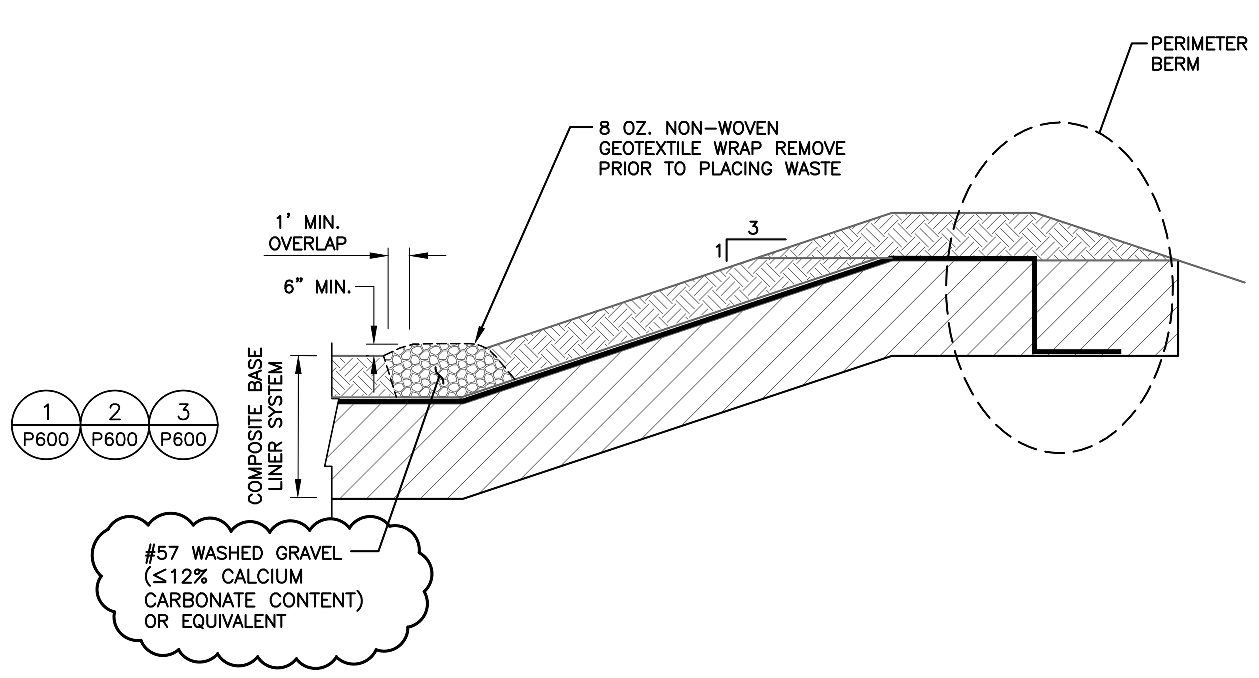
1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

NOT TO SCALE



2 PERFORATED PIPE DETAIL

NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:

- 1 / P601 — DETAIL DESIGNATION / SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

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2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025
SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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615-333-7797 · 800-763-2326
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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT
DETAILS (SHEET 3 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474		
APPROVED BY:	*BMY		

DRAWING NO.:
P-612

APPENDIX C~~D~~
LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION MAJOR PERMIT MODIFICATION APPLICATION

LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

REPUBLIC SERVICES

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES
MATLOCK BEND LANDFILL
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Prepared By:

CEC

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CEC PROJECT 317-474

AUGUST 2024
(REV. 1, APRIL 2025)

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INTRODUCTION

The following Landfill Gas Control and Monitoring Plan is designed to ensure compliance with applicable TDEC DSWM regulations. Generally, the most prevalent issues associated with landfill gas (LFG) are explosiveness, the asphyxiation hazard, and nuisance odors. As part of the 2024 Horizontal Expansion permit application, Matlock Bend Landfill (MBLF) is proposing to install a passive LFG venting system designed to control gas migration.

As described in the Narrative Description of the Facility and Operations, and as shown on the Engineering Plans, the proposed LFG management system will fulfill the following objectives:

- Allow LFG to vent at its point of generation, to reduce the potential for off-site migration;
- Control odor generation and surface emissions; and
- Avoid the build-up of pressure beneath closed and capped portions of the landfill.

The remainder of this attachment describes the proposed plan to control LFG and to evaluate the effectiveness of the control plan through the implementation of a monitoring plan.

LANDFILL GAS CONTROL PLAN

1.0 BACKGROUND

The following describes the design concepts and methods that will be used to construct the 2024 Horizontal Expansion gas control system to achieve the objectives stated above. Installation of the gas control system will occur in a phased manner that will follow the approximate phasing of cell and waste placement development shown on the phasing plans in the Engineering Plans. Specifically, as areas reach final grades, select gas venting features will be installed to control these areas. It is noted that the cell divisions and areas at final grade shown on the phasing plans are approximate and will depend in large part on the rate of waste deposition. Accordingly, phasing of the individual gas components may vary to meet field conditions.

Landfill gas will be vented from the waste to the atmosphere. The 2024 Horizontal Expansion LFG venting system will consist of the components listed below, which are discussed in depth in the following narrative.

- Passive Landfill Gas Venting Features;
- Landfill Gas Management System Installation;
- Landfill Gas Management System Operation;
- Maintenance; and
- Monitoring.

Refer to the figures included at the end of this Landfill Gas Control and Monitoring Plan for proposed locations of the gas vents and associated LFG details.

2.0 LANDFILL GAS GENERATION

The facility permit currently requires a passive landfill gas venting system to be installed at the time of final cover construction. Based on the current design capacity and site-specific Non-Methane Organic Compounds (NMOC) rate, the site is not required to submit an active Gas Collection and Control System (GCCS) Design Plan at this time for an active GCCS. An initial design capacity and NMOC emissions report was submitted to EPA on September 20, 2021, showing that the landfill will remain below 34 Mg/yr of NMOC through 2024 when the Tier II sampling results will need to be retested. This testing will reconfirm the site specific NMOC rate, but based on current rates, and it is not expected to require an active GCCS through the projected life of the site.

3.0 PASSIVE LANDFILL GAS VENTING SYSTEM CONSTRUCTION

The overall collection efficiency of the gas venting system depends largely upon the location and design of the 2024 Horizontal Expansion passive gas vents. Site-specific characteristics, such as existing and final topography, terrace/stormwater channel locations, limits and depths of waste, and cell development and sequencing are important factors in vent locations. Based on a consideration of these factors, the 2024 Horizontal Expansion passive gas vents were spaced on approximate 200-foot centers, which is similar to typical vertical landfill gas well spacing.

To allow LFG to vent, the passive vents will be installed over the disposal area in a phased manner throughout the life of the site. Due to variable field construction conditions, actual as-built locations may vary slightly from that shown on the Engineering Plans, but the approximate center-to-center spacing described above will be maintained.

Generally, passive gas vents will be installed after final waste elevations are achieved, but prior to installation of the final cover system. However, there may be instances (i.e., long periods when large intermediate slopes are exposed) when temporary gas vents may be installed. There may also be interim periods when temporary collection piping is necessary. Temporary vents and piping, if any, are not shown on the Engineering Plans, because they will be installed as needed. Additionally, if it is determined that the passive gas vent network is not effectively removing LFG from the waste mass (as indicated by odor or elevated methane concentrations), additional vents may be installed.

Passive gas vents will consist of several components including a 12” x 8’ x 8’ rock pocket installed in the intermediate cover layer, 4” diameter Schedule 40 PVC standpipes, LLDPE boot at the liner penetration, and a 24” diameter concrete standpipe.

After intermediate cover is placed, the rock pocket will be constructed in the intermediate cover layer. The rock pocket will be an 8’ x 8’ square filled with 12” of AASHTO #57 washed ~~lime~~gravel~~stone~~ or an equivalent aggregate. A 6’ x 6’ gas collection “H” will be constructed from perforated 4” diameter Schedule 40 PVC pipe and placed in the rock pocket. A tee in the center of the “H” will allow for a vertical standpipe to surface. Compacted soil will be mounded around the vertical standpipe to direct stormwater runoff away from the gas vents. Each vent will be protected by a 24” diameter reinforced concrete pipe. Details of the passive gas vents are provided in the Engineering Plans.

LANDFILL GAS MONITORING PLAN

The purpose of the landfill gas monitoring plan is to provide a process so that the MBLF operates in conformance with state and federal rules and regulations governing the management of landfill gases. The gas monitoring probe system will detect gas migration at the landfill boundary and around on-site structures. In addition, the LFG monitoring program will also monitor the effectiveness of the landfill gas passive venting system.

1.0 GAS MONITORING PROBE LOCATIONS

There is one gas monitoring probe currently installed at MBLF. Additionally, six temporary barhole probes are installed and sampled during quarterly events. The location of the LFG probe and approximate locations for the six barhole probes after the 2024 Horizontal Expansion are shown on Figure 1. In the event that LFG is detected in excess of specified maximum allowable levels, additional intermediate gas monitoring probes may be installed to enhance gas migration monitoring in that particular area.

2.0 STRUCTURE SAMPLING LOCATIONS

On-site buildings that have foundations and/or floor slabs constructed at or below grade have been and will continue to be monitored for combustible gas. These buildings include the scale house, office, and maintenance buildings. Tests should be performed along exterior walls at columns and/or construction joints. In addition, cracks or expansion joints of building slabs on grade are possible monitoring locations. In these structures, the air will be sampled with a calibrated gas detector, with samples obtained at floor level and in floor drains.

3.0 MONITORING FREQUENCY

During active landfill operations, the probes and structures will be monitored once per quarter, and following final closure, the probes will be monitored quarterly for percent combustible gas by volume. Gas monitoring will continue after closure until the end of the post-closure period.

Combustible gas levels will be measured to assess if these levels equal or exceed the following criteria:

- 25 percent of the lower explosive limit (LEL) in a structure within the landfill site; and
- The LEL at the boundaries of the landfill site.

The LEL is defined as the lowest percent by volume concentration at which an explosive gaseous mixture will propagate a flame in air at 25°C and atmospheric pressure. As methane is the main combustible constituent of LFG, the LEL for landfill gas is typically 5 percent methane in air.

4.0 MONITORING PROCEDURES

Monitoring will be accomplished using a portable combustible gas indicator (CGI) capable of registering 0 to 100 percent of the methane lower explosive limit and 0 to 100 percent combustible gas by volume. The CGI units will be appropriately calibrated and maintained.

Monitoring Methodology

- Always extinguish all smoking materials before testing for LFG;
- Monitor ambient air for landfill gas at one LFG probe, inside structures, and at six locations that have been historically monitored inside/along the compliance monitoring boundary;
- Methodology at location of LFG migration signs that are not in a final cover area:
    a. Punch a barhole approximately 12 inches deep.
    b. Take readings in the bottom of hole.
    c. Record readings after 120 seconds and location.
- Methodology at location of LFG migration signs that are in a final cover area:
    a. Inspect the area for cracks or signs of damage to the final cover.
    b. Take readings in areas of vegetative stress.
    c. Record readings and location.

5.0 REPORTING

All monitoring data will be recorded on an appropriate reporting form, and results kept on file at the landfill office. Results required for submission will be submitted to TDEC DSWM.

6.0 CONTINGENCY RESPONSE PLAN

During quarterly gas monitoring events, landfill personnel will note possible signs of LFG migration that may include:

- Stress in vegetation in or around site (stress could include stunted growth, wilting, color changes, etc.); and
- Inability to grow vegetation (bare spots) in or around Site.

Upon noting possible gas migration indicators noted above, the cause of the stress shall be verified. If the cause of the stress is determined to be gas migration, the area of stressed vegetation shall be monitored for the presences of landfill gas through bar hole methods as describe below under

Monitoring Methodology. If the cause of the stress is determined not to be from gas migration, gas monitoring will continue along the compliance monitoring boundary.

If concentrations in the monitoring probe and barhole probes equal or exceed the appropriate compliance level, the LEL (5 percent combustible gas by volume), The Tennessee Division of Solid Waste Management (TDSWM) will be notified within 24 hours. In such a situation, appropriate remedial action such as additional monitoring probe installations and/or installation/expansion of the gas venting/collection system may be required to return the site into compliance.

The following actions will be considered when gas concentrations in excess of the above levels are detected:

- Immediate implementation of all necessary steps to ensure protection to human health.
- Within 48 hours, notification of the TDSWM.
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health.
- Within 90 days of detection, propose remediation plan for release of methane gas. The TDSWM will be notified of the remedial plan and implementation schedule.
- Monitoring frequencies may be increased. Samples may be collected for more precise laboratory analysis, and to determine if the source of gas is landfill related. Nested monitoring wells could also be installed to more precisely determine the depth of occurrence of the detected LFG.

If monitoring results indicate a safety concern for buildings or building occupants, appropriate measures to remedy the situation shall be immediately implemented.

FIGURES

Note that the drawings and details shown in this section have been reproduced and are identical to the drawings included in the Part II – 2024 Horizontal Expansion Permit Plans, last revised April ~~March~~ 202~~4~~5. Drawings are included here for reference and completeness of the Landfill Gas Control and Monitoring Plan. Refer to the Part II – 2024 Horizontal Expansion Permit Plans for additional information.

CONSTRUCTION QUALITY ASSURANCE/ QUALITY CONTROL PLAN (CQA/QC PLAN)

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES

MATLOCK BEND LANDFILL
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Prepared By:

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CEC PROJECT 317-474

AUGUST 2024
(REV. 1, APRIL 2025

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APPENDICES

CONSTRUCTION QUALITY ASSURANCE / QUALITY CONTROL PLAN

EXECUTIVE SUMMARY

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) addresses the construction of the liner system, leachate management system, landfill gas system, final cover system, sedimentation basins, and ancillary components. This CQA/QC Plan also addresses the inspection and documentation procedures that will be utilized before, during, and after construction.

The CQA/QC Plan describes the following:

- Field and laboratory sampling and testing procedures;
- Testing frequency;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to follow if a test fails;
- Management structure;
- Experience and training of the testing personnel; and
- Contingency plan for anticipated construction difficulties.

In the context of this CQA/QC Plan, the terms CQA and QC are defined as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to ascertain if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements.
- Quality Control (QC) refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements.

The principal parties involved in the CQA process include the Permitting Agency [Tennessee Department of Environment and Conservation (TDEC)], the Owner [Loudon County Solid Waste Disposal Commission, Matlock Bend Landfill], the operator, Santek Environmental, LLC (Santek), a subsidiary of Republic Services, Inc., the Construction Manager, the Area Environmental Manager (AEM), the Environmental Manager (EM), the Permit/Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer(s), the Geosynthetics Installer(s), and the Surveyor. Note that the EM and Construction Manager are representatives of the Operator and may be the same person. The Permit Engineer and the Design Engineer may also be the same person and/or engineering firm. The

CQA Consultant is responsible for observing and documenting activities related to the permit documents and the CQA/QC Plan. The CQA Consultant is also responsible for issuing documentation reports.

The CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for construction of base liner systems and final cover systems. These components will include:

- Excavation;
- Structural Fill;
- Liner System Barrier~~Recompacted~~ Soil Layer~~iner~~;
- Liner System Protective Cover/Leachate Collection System; and
- Final Cover Soil (compacted soil cover~~foundation layer~~, final cover soil~~low-permeability soil barrier~~, and vegetative cover).

Tables A-1 and A-2 included in Appendix A present the laboratory and field test methods that will be used to characterize and evaluate the construction quality of soils and aggregates. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given. Table A-3 provides recommended minimum test frequencies to characterize and evaluate the quality of soils and aggregates, and to test the construction. Table A-3 also presents the sample size, acceptance criteria, and sample locations for soils and aggregate testing. Both field and laboratory tests will be performed prior to construction to confirm that the characteristics of the soil and aggregate from the proposed sources meet the material acceptance requirements.

The CQA Consultant shall document the inventory, testing, and placement of geosynthetics. Accordingly, this CQA/QC Plan presents information related to the manufacture, shipment, storage, testing, and installation of geosynthetic products (i.e., geomembranes, geosynthetic clay liners, geotextiles, geonets, and geocomposites) required for the construction of both liner systems and final cover systems. Each proposed geosynthetic test, along with its corresponding methodology and conformance testing frequency, are summarized in Tables A-4(a) through A-8.

Surveying shall be conducted at the site as part of the CQA/QC activities. Surveying of lines and grades shall be conducted on a continuous basis during the construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, to document quantities of soils and geosynthetics used in the construction, and to assist the Earthwork Contractor in complying with the required landfill grades. Survey results for record drawings shall be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

The CQA Consultant shall document that the quality assurance requirements presented in the

CQA/QC Plan have been addressed and satisfied. Accordingly, the CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, logs, and reports to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain a file of design drawings, the CQA/QC Plan, checklists, test procedures, daily logs, and other relevant information at the project site.

At the completion of the work, the CQA Consultant shall prepare a final documentation report, which shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

1.0 USE AND APPLICATION OF CQA/QC PLAN

1.1 INTRODUCTION

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) has been prepared for use at the Matlock Bend Landfill, owned by the Loudon County Solid Waste Disposal Commission and operated by Santek Environmental, LLC (Santek), a subsidiary of Republic Services.

1.2 SELECTION AND TESTING OF SOILS AND AGGREGATES

The CQA/QC Plan shall be used to confirm soil and aggregate material quality and installation. The selection of soils and aggregates shall be based on the permitted design for the facility. Given the selected soils and aggregates to be utilized for a project, this CQA/QC Plan shall be used to govern the material testing and installation. The CQA/QC Plan narrative and Table A-3 included in Appendix A have been prepared utilizing general terminology so that the CQA/QC Plan would be applicable to a range of soil and aggregate materials selected from the permitted design.

1.3 SELECTION AND TESTING OF GEOSYNTHETICS

The CQA/QC Plan shall be used to confirm geosynthetic material quality and installation. The geosynthetic materials shall be selected for a given project to satisfy applicable site-specific design requirements.

Following selection of suppliers or manufacturers for each geosynthetic component required for a given project, the applicable conformance testing tables provided in Appendix A shall be completed. The CQA Consultant or Operator's Representative shall insert the Manufacturer MARV values into the last column of each geosynthetic conformance testing table to be used for the project. Conformance testing shall be completed and reviewed with respect to the Manufacturer MARV values in each conformance test table. These completed conformance testing tables shall be provided to the Geosynthetic CQA Laboratory prior to the start of testing. These tables shall also be included with the certification report.

1.4 MINIMUM FIELD MONITORING FREQUENCY

This CQA/QC Plan addresses the selection, testing, and installation of materials needed for the construction of various landfill components. During the installation/construction phase of a project, field monitoring is necessary to ensure that the desired materials are utilized and installed in a proper fashion. Consistent with the personnel requirements specified in Section 3.3.1 of the CQA/QC Plan, the field personnel shall be trained and act under the control of a professional engineer registered in Tennessee. The scope of field monitoring activities may vary, depending on the type of construction being completed. During a given construction project, certain aspects may be monitored with part-time field visits, or on a full-time basis.

- Part-time monitoring is where a CQA/QC technician is not on-site full-time. Sufficient visits are made to the project to inspect each key item of construction prior to being covered by the next. During these visits to the project, the CQA/QC Technician will most likely be on-site for a limited time, less than the full workday.
- Full-time monitoring is where the CQA/QC technician is on-site for the full work period during each day when work is performed. The CQA/QC technical would typically be on-site and at the project area when key construction is taking place, or when monitoring the work prior to the covering with the next component.

During a typical disposal cell or closure construction project, the CQA/QC technician(s) shall provide full-time monitoring starting with preparation of the subgrade and/or buffer layer and continuing throughout installation of the protective cover layer. Generally, other construction monitoring activities may be performed on a part-time basis.

2.0 GENERAL

2.1 INTRODUCTION

This CQA/QC Plan addresses the construction of the base liner system, leachate management system, final cover system, sedimentation basins, and ancillary components.

Work shall be performed to the lines, grades, and dimensions indicated within the permit drawings. This CQA/QC Plan addresses the inspection and documentation procedures that shall be utilized before, during, and after construction to provide assurance, with a reasonable degree of certainty, that the facility meets the permitted design standards and specifications.

2.2 SCOPE OF THE CQA/QC PLAN

This CQA/QC Plan describes:

- Sampling and testing procedures to be used in the field and in the laboratory;
- Testing frequencies;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to be followed if a test fails;
- The management structure, experience, and training of testing personnel; and
- Contingency plan for anticipated construction difficulties.

2.3 DEFINITIONS AND USE OF TERMS

The following provides general information regarding specific terms, references, and units used within this CQA/QC Plan.

2.3.1 Use of Terms

In the context of this CQA/QC Plan, the terms CQA and QC are used as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to determine if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements;
- QC and Quality Control refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements; and

- Manufacturer MARV values refer to the property or test values as published on the most recent manufacturer's standard specification sheet.

Note: For the purposes of this CQA/QC Plan, the term "geosynthetics" refers to geomembrane, geotextile, geonet, geocomposite, geosynthetic clay liner, or other manufactured component materials.

2.3.2 References to Standards

The CQA/QC Plan includes references to standard test procedures defined by the ASTM International (ASTM), and the Geosynthetic Institute.

2.3.3 Units

Properties and dimensions given in the CQA/QC Plan are expressed in U.S. units and may be followed by approximate equivalent values of International System of Units (SI) shown in parentheses. The values given in SI are typically accurate within ten percent of the governing U.S. units specification. In cases of conflict, the U.S. units govern.

3.0 RESPONSIBLE PARTIES AND LINES OF AUTHORITY GENERAL

3.1 RESPONSIBILITY AND AUTHORITY

The principal parties involved in the CQA process include the Permitting Agency, the Owner, the Construction Manager, the Environmental Manager, the Permit Engineer, the Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer, the Geosynthetics Installer, and the surveyor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings.

3.1.1 Permitting Agency

The Permitting Agency (TDEC) is authorized to issue the permit for construction of the waste containment facility based on review and acceptance of the permit application. Additionally, the Permitting Agency provides formal acceptance of the Construction Certification Report prior to the use of the constructed item.

3.1.2 Owner

The Owner is the Loudon County Solid Waste Disposal Commission. The Owner contracts with the Operator, Santek, to operate the facility and to engage the various services needed to permit, design, and construct the facility.

3.1.3 Operator

The Operator, Santek, is responsible for coordinating the design and construction of the landfill. The Environmental Manager and Construction Manager are the two representatives of the Operator responsible for coordinating the design and construction of the landfill facility.

- Environmental Manager is responsible for the management of the Design Engineer, CQA Consultant, and other entities directly contracted to the Owner for engineering, surveying, laboratory testing, or other professional services. This responsibility includes compliance with the permit and review/submission of the CQA documentation demonstrating that the facility was constructed in general accordance with the approved permit and design specifications. The Environmental Manager is responsible for procuring a consultant to provide the surveying necessary for the certification documentation. The Environmental Manager has the authority to select and dismiss parties charged with design and CQA. The Environmental

Manager also has the authority to accept or reject design drawings and specifications, CQA/QC Plans, and CQA reports.

- Construction Manager, if used, is the official representative of the Owner responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to the Operator, CQA Consultant, Surveyor, Contractors, Manufacturers, and other involved parties. The Construction Manager has the authority to select and dismiss parties charged with construction activities. The Construction Manager also has the authority to direct contractors hired by the Owner and to accept or reject their materials and workmanship. Construction Manager responsibilities may be fulfilled by on-site facility employed personnel or a selected representative assigned by the Owner.

3.1.4 Permit/Design Engineer

The Permit/Design Engineer is a firm or person, retained by the Operator, to prepare documents for acceptance by the Permitting Agency and/or construction of the facility. The permit documents establish the limits, type, and details of the liner system, leachate management system, and other components of the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises. Optional construction documents and drawings may be prepared in some cases to provide additional information for a specific construction project.

During construction, the Permit/Design Engineer may prepare applications to the Permitting Agency for approval of substantive changes to the design drawings or specifications of the facility. Substantive changes include changes that modify or impact the technical basis for engineered components of the facility design. Such changes will require the approval of the Permitting Agency.

3.1.5 CQA Consultant

The CQA Consultant is responsible for observing and documenting activities related to the permit documents and CQA/QC Plan. The CQA Consultant is represented on-site by the CQA Resident Engineer and supported on-site by CQA monitoring personnel, the specific number of which will be determined by workload.

In general, the responsibilities and authorities of the CQA Consultant include:

- Having a complete understanding of the permit documents, drawings, and specifications;
- Attending construction meetings and preparing meeting minutes;
- Scheduling, coordinating, and performing CQA activities;
- Verifying that the selected geosynthetic products meet or exceed the design;

- Performing independent on-site observation of the work in progress to assess compliance with the CQA/QC Plan, permit documents, drawings, and specifications (if applicable);
- Recognizing and reporting deviations from the CQA/QC Plan, permit documents, drawings, and/or specifications (if applicable) to the Environmental Manager and Construction Manager;
- Verifying that test equipment meets testing and calibration requirements, and that tests are conducted according to standardized procedures defined in the CQA/QC Plan;
- Recording and maintaining test data accurately;
- Identifying CQA tested work that should be accepted, rejected, or further evaluated;
- Verifying that corrective measures are implemented;
- Documenting and reporting CQA activities;
- Collecting data needed for record documentation; and
- Maintaining open lines of communication with other parties involved in the construction.

The CQA Consultant is also responsible for issuing certifications for major construction activities. Certifications shall bear the seal of a Professional Engineer registered in the state of Tennessee. Possible construction activities include:

- Structural Fill;
- Geologic Buffer Layer;
- Barrier~~Recompacted~~ Soil Layer~~iner~~;
- Geomembrane Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System Piping;
- Erosion and Sedimentation Control Structures;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Intermediate and Final Cover Soil;
- Gas Monitoring System; and
- Groundwater Monitoring System.

3.1.6 Soils CQA Laboratory

The Soils CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the soils and aggregates. The Soils CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Soils CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.7 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the geosynthetics. The Geosynthetics CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work performed by the Geosynthetics CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.8 Earthwork Contractor

The Earthwork Contractor is responsible for all activities assigned by the Operator, these may include such things as: moving earth to establish the liner grades, installing structural fill, installing the barrier~~recompacted~~ soil layer~~iner~~, placing pipe and granular materials for construction of the leachate collection and management systems, preparing the intermediate cover surface, placing final cover soils, or other related work items. The Earthwork Contractor may also be responsible for construction of sedimentation and erosion control facilities, anchor trenches for liner installation, and other support activities outside the immediate project area.

It is the responsibility of the Earthwork Contractor to supply equipment and perform work that results in completed project components that are in conformance with the CQA/QC Plan.

3.1.9 Geosynthetics Manufacturer

The Geosynthetics Manufacturer is responsible for the production of geosynthetics that meet the requirements of the CQA/QC Plan. The Geosynthetics Manufacturer is also responsible for providing adequate documentation regarding the characteristics of the resin and the finished product, the testing performed to determine the characteristics, and the quality control measures taken during manufacturing.

The Geosynthetics Manufacturer is responsible for safe transportation of the geosynthetics between the manufacturing plant and the site. The Geosynthetics Manufacturer is responsible for carefully loading and transporting geosynthetics and accepts full responsibility for damage to the geosynthetics that may occur during these operations.

3.1.10 Geosynthetics Installer

The Geosynthetics Installer is responsible for unloading, field handling, storing, placing, seaming, temporarily anchoring against wind, and other aspects of geosynthetics installation in accordance with the CQA/QC Plan. The Geosynthetics Installer may also be responsible for the preparation and completion of anchor trenches.

Prior to installation, the Geosynthetics Installer is responsible for preparation of the panel layout drawing, which identifies fabricated and field seams including dimensions and details. Prior to site mobilization, the Geosynthetics Installer is responsible for providing the installation schedule and a list of proposed field personnel and their qualifications. The Geosynthetics Installer is responsible for providing quality control documentation and subgrade acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane installation certification, the Manufacturer's warranty, and the installation warranty.

3.1.11 Surveyor

The Surveyor is a firm or person, retained by the Operator or Construction Manager, responsible for delineating and documenting the lines and grades associated with construction of the landfill. Activities include surveying of construction grades, including original ground surface, excavation and placement of structural fill, ~~recompacted soil liner~~barrier soil layer, and subsequent liner components. Additionally, the surveyor shall delineate the limits of the soils construction area and geosynthetic components, the location and elevation of pipes, and the limits and elevations of perimeter ditches, roads, and other relevant features. The Surveyor is also responsible for preparation of the construction Record Drawings which include plan views of constructed components or cross-sections necessary to estimate quantities of construction materials.

3.2 PROJECT MEETINGS

Clear, open channels of communication are essential to achieve a high degree of quality during ~~installation~~ installation. The following meetings should be held when appropriate ~~.~~to coordinate activities between the Operator, CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting. The type and purpose of meetings to be held for this project are described in this section. The actual meeting discussion points ~~s held~~ and meeting timeframes should be agreed to by the affected parties at the beginning of each construction project. The Owner shall be kept informed in a timely manner by the Operator of all construction schedules, work interruptions and delays, developments that may produce a work delay of more than several days, all changes to the construction schedule, and receive advance notice of meetings and inspections with the State permitting authority related to the foregoing. Notice shall be provided in writing to the Loudon County Solid Waste Disposal Commission Chair, Vice Chair and the appointed engineer for the Commission.

3.2.1 Pre-Construction Meeting

A Pre-Construction Meeting may be held at the site prior to earthwork construction and prior to geosynthetics placement. At a minimum, the meeting shall be attended by the Environmental Manager, the Construction Manager, the CQA Consultant's Certifying Engineer (registered in Tennessee), the CQA Consultant's Lead Monitor(s), the Geosynthetics Installer's Superintendent, the Earthwork Contractor's Superintendent, and the Permit/Design Engineer and other involved parties. The Permit Agency (TDEC) shall be invited to attend all Pre-Construction Meetings. Possible topics to be discussed shall follow the Pre-Construction Meeting Agenda in Appendix B.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties and delays in construction, and, above all, present the CQA/QC Plan to the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted.

The meeting shall include the following activities:

- Distribute relevant documents;
- Review critical design details of the project;
- Review the CQA/QC Plan;
- Make appropriate modifications to the CQA/QC Plan to include CQA activities specific to the project;
- Select testing equipment and review protocols for the testing of materials;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and
- Confirm the lines of authority and communication.

A mandatory topic during the Pre-Construction Meeting will be the selection of geosynthetic materials. The CQA Consultant shall present a table for each geosynthetic material which lists the Manufacturer MARV values. This table will be reviewed and used to verify that the selected materials meet or exceed the design requirements.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted, within 24 hours, to the parties involved.

3.2.2 Daily Meetings

A daily meeting may be held between the CQA Consultant, the Geosynthetics Installer, the Earthwork Contractor, the Construction Manager, and other involved parties on an as-needed basis. Those attending will discuss, plan, and coordinate the work and CQA activities to be completed that day. These meetings may be held informally, and meeting minutes summarizing these meetings are not necessary.

3.2.3 Progress Meetings

Progress meetings may be held between the Environmental Manager, the Construction Manager, the CQA Consultant, the Geosynthetic Installer, the Earthwork Contractor, and other involved parties, on an as-needed basis, approximately one per week. Those attending will discuss current progress, planned activities for the next week, and new business or revisions to the work. The CQA Consultant will log problems, decisions, or questions arising at this meeting. The meeting shall be documented by the CQA Consultant, and minutes shall be transmitted to involved parties within 48 hours of the meeting.

3.2.4 Problem or Work Deficiency Meetings

A special meeting shall be held when, and if, a problem or deficiency that would impact the construction schedule is present or likely to occur. At a minimum, the meeting shall be attended by the affected contractors, the Construction Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted within 24 hours to the parties involved.

3.3 QUALIFICATIONS OF KEY PERSONNEL AND ORGANIZATIONS

The following qualifications shall be required of the key personnel and organizations involved in the construction of solid waste containment systems.

3.3.1 CQA Consultant

The CQA Consultant shall be pre-qualified and approved by the Operator. The CQA Consultant shall be a qualified firm with experience in construction quality assurance and quality control, particularly on projects involving similar facets as the project to be completed. The CQA Consultant shall designate a Certifying Engineer who is a Professional Engineer registered in Tennessee. The Certifying Engineer shall be responsible for the CQA personnel and their activities, as well as the preparation of a certification report to certify the project has been constructed in substantial compliance with the CQA/QC Plan, permit documents, drawings, and specifications (as applicable). The CQA Consultant shall be capable of assigning technically qualified personnel to the project, including an on-site Lead CQA Monitor and CQA Monitors, as needed. The CQA Consultant may utilize multiple Lead CQA Monitors, such that each Lead CQA Monitor may be brought on-site when project tasks for which the Lead CQA Monitor is experienced or specifically trained are being performed. The person designated as the Lead CQA Monitor shall possess a thorough knowledge of all aspects of earthwork and geosynthetic construction.

CQA Monitors shall be specifically trained in quality assurance of geosynthetics, earthwork, etc. Unless otherwise approved by the Operator, the Lead Geosynthetic CQA Monitor shall be experienced in supervising the installation of a minimum of 1,000,000 ft^2 (92,900 m^2) of various geosynthetic materials, or otherwise approved by the Operator.

3.3.2 Soils CQA Laboratory

The Soils CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Soils CQA Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQA/QC Plan. The Soils CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate calibrated equipment to perform the tests.

3.3.3 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Geosynthetics CQA Laboratory shall be experienced in performing laboratory tests to determine geosynthetics characteristics as required by this CQA/QC Plan. The Geosynthetics CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate, calibrated equipment to perform the tests.

3.3.4 Earthwork Contractor

The Earthwork Contractor shall be pre-qualified and approved by the Operator. The Earthwork Contractor shall be capable of assigning the personnel and equipment required to perform the work within the project schedule.

3.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer shall be able to provide sufficient production capacity and experience to meet the demands of the project. The Geomembrane Manufacturer shall be pre-qualified and approved by the Operator.

3.3.6 Geosynthetics Installer

The Geosynthetics Installer shall be trained and qualified to install geosynthetics. Prior to execution of contractual agreements with the Operator, the Geomembrane Installer shall provide the Construction Manager with information demonstrating qualifications as required by this CQA/QC Plan.

The Geomembrane Installer shall provide the Construction Manager with a list of proposed seaming personnel and their professional resumes. This certificate shall be reviewed by the Construction Manager and CQA Consultant. Proposed seaming personnel deemed inexperienced shall not be accepted by the Construction Manager.

The Geomembrane Installer shall designate one representative as a Superintendent, who will represent the Installer on-site and at site meetings. The Superintendent shall be qualified by experience. The Superintendent must have supervised the installation of a minimum of 2,000,000 ft^2 (185,800 m^2) of geomembrane, 500,000 ft^2 (46,450 m^2) of geotextile, 500,000 ft^2 (46,450 m^2) of geocomposite, and must also exhibit good management skills. The Superintendent shall be approved by the Construction Manager. The Superintendent or designee approved by the Environmental Manager shall be on-site at all times during geosynthetic deployment and seaming activities.

In addition, the Geomembrane Installer shall designate a Master Seamer, who shall not be the Superintendent. The Master Seamer shall be present during seaming operations and shall have a minimum of 5,000,000 ft^2 (464,500 m^2) of field seaming experience. The Master Seamer shall also be experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

4.0 SOILS AND AGGREGATES

4.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for the construction of liner systems and final cover. These components include:

- Structural Fill;
- Excavation;
- Geologic Buffer Material (if native material requires processing);
- Barrier~~Recompacted Soil Liner~~ Soil Layer;
- Protective Cover; and
- Intermediate Cover, Compacted Soil Cover, and Final Cover Soils.

The above components shall meet requirements related to material characteristics and construction quality. The proposed soils shall undergo field and laboratory testing to evaluate that the proposed soils meet the specifications included in Appendix A. Throughout construction, field and laboratory testing shall be performed to ensure that the in-place soil material meets the requirements of this CQA/QC Plan with regard to material acceptance and construction quality.

4.2 TEST METHODS AND SAMPLING REQUIREMENTS

Tables A-1 and A-2 (Appendix A) present the laboratory and field test methods that shall be used to characterize and evaluate the construction quality of the installed foundation soils. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given.

Table A-3 (Appendix A) provides minimum test frequencies. The table presents the sample size, acceptance criteria, and general locations of where samples shall be collected. Four types of sampling location methods shall be used for the various soil and aggregate components, including:

- As required by the CQA Consultant to evaluate material characteristics prior to use of the material in construction. These samples may come from the source of a potential material such as an aggregate production plant or from a test pit/stockpile/ borrow area;
- For specific bulk volumes of material in stockpiles [e.g., 1 sample per 5,000 cy (3,800 m^3)]. These samples are usually taken from material which has been processed or segregated for a particular purpose;

- For materials placed over a long linear extent (such as roads and embankments), using stationing, offsets, and approximate elevation. Stationing should be designated as 1+00, 2+00, etc. and offsets should be designated as left or right of the stationing line based on view toward increased stations; and
- Grid pattern sampling methods shall be used on placed material. These samples are usually taken from within a liner/final cover construction area or other aerially extensive construction project. Grids and stations shall be clearly marked and the perimeter or station markers should be surveyed.

Tables A-1, A-2, and A-3 shall be used in conjunction with the text of this section of the CQA/QC Plan.

4.3 STRUCTURAL FILL

Structural fill is used within low areas to raise existing grades to design grades, construct perimeter berms, construct intercell berms, or other items. The areas where structural fill will be placed shall be stripped of topsoil and proof-rolled as an initial step. Deleterious materials such as soft soils or organics shall be removed and the resulting void shall be filled with structural fill. In areas that require structural fill to establish design grades, structural fill shall be placed on the proof-rolled surface. Structural fill shall be placed and the structural fill material selected to prevent voids or bridging within the fill.

Refer to Appendix A for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for structural fill material and placement requirements. In addition to the testing and confirmation of placed structural fill lifts, the CQA Monitor shall periodically observe structural fill placement to confirm construction practices. The CQA Consultant shall prepare a certification report for the structural fill based on a review of the CQA information and CQA monitoring performed during installation of structural fill.

4.3.1 Structural Fill Repair

During placement of structural fill, the CQA Monitor shall monitor placement and compaction. Monitoring activities include both field and laboratory soils testing outlined in Appendix A, as well as visual observation of lift thickness and compaction. As structural fill is placed and compacted, pumping~~,~~ or rutting shall be noted. If pumping or rutting is determined to be excessive by either the CQA Monitor or the Operator~~wner~~, the material exhibiting pumping shall be removed and replaced with competent structural fill material, using the following general procedures:

- The deficient material shall be removed from the structural fill area;

- Efforts shall be made to remove all materials contributing to the pumping or rutting;
- Repairs may include (but not limited to):
  - The installation of drains and piping to de-water the area;
  - The installation of a re-enforcing ~~separation~~ geotextile or geogrid prior to backfilling the excavated area;
  - The first structural fill lift placed over the soft materials shall be one and a half (1.5) times the normal lift thickness. This initial structural fill lift, specifically containing a dry, higher rock content material than normal structural fill, shall act as a 'bridge'. The purpose of the initial lift is to provide a solid base for subsequent lifts of overlying structural fill and ~~recompacted soil liner~~barrier soil layer soils;
- Should pumping or rutting persist, excavation of deficient soils shall be performed again; and
- If pumping is suspected to be a result of decaying trees and/or vegetation, efforts shall be made to remove the organic and deficient materials.

4.4 EXCAVATION GRADE

The excavation grade refers to the top of the natural soil layer functioning as the geologic buffer below the liner system. The geologic buffer provides an additional barrier to liquid migration. Field exploration and laboratory testing documented in the MBLF Supplemental Hydrogeologic Investigation Report demonstrate that a 5-feet thick geologic buffer with a maximum hydraulic conductivity of 1×10^{-6} cm/sec is provided by the native soils underlying the proposed cells at the site. Excavation grade refers to the bottom of the barrier soil ~~barrier~~ layer, which also equals the upper surface of the geologic buffer.

Prior to placement of the barrier soil layer component of the liner system, the Earthwork Contractor shall excavate overburden materials to the excavation grade elevations shown on the Drawings. The prepared excavation grade should conform to the contours shown on the grading plan, as verified by the surveyor. The excavation of existing soils or placement of structural fill meeting the requirements of the geologic buffer specifications may be required to establish these grades.

Upon completion of the subgrade preparation and prior to placement of any of the barrier soil ~~barrier~~ layer soils, the CQA Monitor shall visually observe the exposed subgrade materials for signs of unsuitable materials such as isolated lenses or pockets of sand, organic materials, or other unsuitable materials. If these materials are present, the unsuitable materials will be removed by undercutting the full 5 feet depth of the geologic buffer. Replace the material excavated with compacted geologic buffer soils per the Technical Specifications. Removal and replacement of unsuitable soils shall extend laterally as far as necessary to remove the unsuitable soils.

The excavation grade shall be proof rolled by the Earthwork Contractor with suitable compaction equipment. The excavation grade should be accepted by the CQA Consultant if it does not pump or rut excessively. If excessive pumping or rutting occurs, the area should be reworked or removed by excavating the deficient soil until competent soils are exposed. The procedure outlined within Section 4.3.1, Structural Fill Repair, shall be followed for excavation and reconstruction of the excavation grade due to pumping or rutting.

4.5 ~~RECOMPACTED SOIL LINER~~BARRIER SOIL LAYER

The ~~recompacted soil liner~~barrier soil -layer is a uniform, compacted 24-inch-thick soil layer placed over the subgrade (i.e. top of geologic buffer) surface for liner construction projects prior to the placement of the landfill liner geosynthetic components. The 24-inch thick ~~recompacted soil liner~~barrier soil -layer shall consist of relatively homogenous, fine-grained soils that are free of rock-sized particles or clods greater than 1-1/2 inches in any dimension, frozen material, organic material, and other foreign debris. The CQA Consultant shall obtain samples from within the identified borrow area and subject the soils to the testing indicated in Table A-3 of Appendix A. Table A-3 provides information regarding the minimum test frequencies associated with the ~~recompacted soil liner~~barrier soil -layer. The table presents the sample size, acceptance criteria, and locations of where the samples shall be collected.

Soil laboratory test results will identify borrow sources that are acceptable for potential use as ~~recompacted soil liner~~barrier soil -layer material, as determined by the Operator or CQA Consultant. The material will also be subjected to laboratory remolded permeability tests to develop~~termine~~ a moisture/density relationship. Subsequently, a window of moisture/density values corresponding to the required permeability shall be delineated based upon the results of laboratory testing. This window will then be used as the acceptable range of moisture/density values for field compaction CQA testing.

4.5.1 Test Pad

After the ~~recompacted soil liner~~barrier soil layer borrow source has been selected and preliminary testing has been performed, a test pad shall be constructed for each borrow source to establish construction details or verify or amend the construction details proposed in the approved permit. In addition, a test pad shall be constructed whenever there is a significant change in soil material properties. The test pad shall be used to evaluate the following:

- Material handling and placement requirements;
- Lift thickness;
- Water content necessary to achieve the desired compaction;
- Compaction equipment type, weight, and number of passes; and
- Field permeability.

The results of test pad construction may be used to verify or amend construction details proposed in the approved permit for the site. Test pads shall be constructed using the same material, equipment, and procedures to be used in construction of the ~~recompacted soil liner~~barrier soil layer. The test pad will have a minimum width of three times the width of the compaction equipment and a length that is two times the length of the compaction equipment, including power equipment and attachments. The test pad will consist of at least four lifts with in-situ density and moisture testing performed at least three times per lift. The construction of the pad shall be closely monitored, and the following tests shall be performed at a frequency of at least twice per lift:

- Maximum dry density; and
- Optimum moisture content.

Following construction of the test pad, a determination of permeability through field testing shall be performed.

The test results shall be used to verify that the specified construction procedures yield recommendations that meet the design and performance criteria. Refer to Table A-3 for a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the test pad.

4.5.2 Construction Quality Assurance

Prior to placement of the ~~recompacted soil liner~~barrier soil layer, the surface of the excavation grade shall consist of relatively homogenous, fine-grained soils that are free of debris, rocks greater than 1/2 inch~~es~~ in diameter, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft areas. The surface shall be non-yielding~~hard~~, uniform, and smooth.

Lifts of the ~~recompacted soil liner~~barrier soil layer shall be placed in uniform layers not to exceed 8 inches in uncompacted thickness. The lift thickness shall be determined manually throughout construction. The finished thickness of the ~~recompacted soil liner~~barrier soil layer shall be verified by the measurement of survey points before and after installation of the ~~recompacted soil liner~~barrier soil -layer is completed. The minimum total thickness of the ~~recompacted soil liner~~barrier soil layer shall be 2 feet. Soil clods shall be broken down to 1-1/2~~3~~ inches or half the lift thickness, whichever is less. Moisture conditioning shall be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content throughout the soil mass. The moisture content of the ~~recompacted soil liner~~barrier soil -layer shall be field tested during placement and compaction. Each lift shall be scarified prior to placing the subsequent lift to sufficiently bond it to the previous lift. Each lift of the ~~recompacted soil liner~~barrier soil layer shall be rolled and compacted to the moisture content and density as specified in Table A-3.

Visual monitoring of the ~~recompacted soil liner~~barrier soil layer construction shall consist of observing and verifying ~~the following~~:

- Identification of changes in material characteristics causing a change in construction specifications;
- Adequate spreading of ~~recompacted soil liner~~barrier soil layer material to obtain complete coverage and loose lift thickness;
- Removal of debris, rocks, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft and/or wet areas;
- Adequate clod-size reduction of the ~~recompacted soil liner~~barrier soil layer material;
- Spreading and incorporation of water to obtain full penetration through clods and uniform distribution of the specified water content;
- Proper adjustment of the water content of in-place material in the event of prolonged rain or drought during construction;
- Prevention of significant water loss and desiccation cracking before and after compaction;
- Use of compaction equipment of the proper type, configuration, and weight;
- Appropriate equipment speed and number of equipment passes used for compaction;
- Uniformity of coverage by compaction equipment, particularly at fill edges, in equipment turn-around areas, and on slopes;
- Use of sufficient methods to tie lifts together;
- Use of sufficient methods to blend new barrier layer soils into existing clay layer soils at tie-ins to existing cells;
- Proper repair of penetrations resulting from the use of density and moisture probes using bentonite or a soil-bentonite mixture;
- Sealing the working surface at the close of each day's work or when work is stopped for a period of time by compacting the surface and sloping it to allow run-off of precipitation;
- All loose or dry materials have been removed from the final surface prior to FML deployment;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface are removed;
- Depressions and holes in excess of ¾ inch deep shall be filled with a clean, uniform sand;
- The final surface is prepared such that the deployment of the final cover geomembrane would not dislodge large particles that would remain beneath the geomembrane;
- Timely placement of protective covers or the overlying FML to prevent desiccation of ~~recompacted soil liner~~barrier soil layer material between the installation of lifts or after completion of the ~~recompacted soil liner~~barrier soil layer;
- Prevention of accidental damage or weather-related degradation to installed portions of the ~~recompacted soil liner~~barrier soil layer; and

- Observation and verification of activities to correct conditions not meeting specifications for the construction of the ~~recompacted soil liner~~barrier soil layer.

Perforations in the ~~recompacted soil liner~~barrier soil layer ~~layer~~ created by nuclear density gauge probes, sample retrieval, stakes, or other penetrating objects shall be filled with fine grained soil from the ~~recompacted soil liner~~barrier soil layer stockpile, bentonite, a soil-bentonite mixture, or an approved equal. Test holes in the ~~recompacted soil liner~~barrier soil layer ~~layer~~ that are filled with fine grained ~~recompacted soil liner~~barrier soil layer material shall be backfilled with maximum 0.25-inch soil particles and compacted in three equal compacted lifts. The finished surface of the ~~recompacted soil liner~~barrier soil layer ~~layer~~ shall be uniform, non-yielding,~~hard~~ and smooth. Surveying shall be performed to document that the finished ~~recompacted soil liner~~barrier soil layer thickness and dimensions are as specified in the design.

Refer to Table A-3 for sample locations, sample sizes, test frequencies, the specific test methods to be used, a summary of the field and laboratory testing to be performed, and acceptance criteria for the ~~recompacted soil liner~~barrier soil layer ~~layer~~.

The ~~recompacted soil liner~~barrier soil layer ~~layer~~ shall be maintained and protected by the Earthwork Contractor until formal written acceptance of the ~~recompacted soil liner~~barrier soil layer is given to the CQA Consultant by the Geosynthetics Installer. The Earthwork Contractor shall protect, maintain and repair (at no additional cost to the Operator), the ~~recompacted soil liner~~barrier soil layer from excessive desiccation, cracking, water, or wind erosion and damage during construction.

4.6 PROTECTIVE COVER LAYER

The protective cover layer shall be composed of aggregate meeting the gradation and general requirements of protective cover as specified within Table A-3 in Appendix A. Soil may also be used for the protective cover layer as long as aggregate is still used above leachate collections pipes as indicated on the drawings. The aggregate and soil shall be substantially free of organics, frozen material, deleterious materials, and other foreign objects.

Table A-3 presents the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the protective cover material.

Low ground-pressure equipment shall be used to grade and smooth the protective cover layer aggregate. The low-ground pressure equipment shall only be allowed to move across the protective cover over the full protective cover placement thickness. Equipment utilized to haul the protective cover material shall only be allowed to travel over 3-foot-thick roadway areas. These roadway areas shall be reduced in thickness by the low-ground pressure equipment once the road is no longer needed.

4.7 COVER SOILS

Soils for the operation and closure of the landfill include daily covers, intermediate cover soil, compacted soil cover, and the final cover soil. This CQA Plan addresses the field and laboratory tests to be performed, prior to and during construction, to evaluate the suitability of the proposed soils. Table A-3, within Appendix A, provides a summary of the necessary tests and minimum testing frequency for the final cover soils. This table includes a summary of the sample size and acceptance criteria.

4.7.1 Intermediate Cover Soils

Intermediate cover shall meet the gradation and requirements described in Table A-3 in Appendix A. Intermediate cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Intermediate cover soil shall be placed in one loose lift resulting in a final layer thickness of at least 12 inches. After spreading, the soil shall be tracked-in and densified with at least four passes using a Cat D6 bulldozer or similar. The CQA technician shall observe the densification process and verify the layer is firm. This material should meet the gradation requirements for intermediate cover described in Table A-3.

4.7.1.1 Intermediate Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing intermediate cover soil layer shall be verified by the CQA Consultant. The intermediate cover soil layer shall be a minimum 12 inches thick and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the intermediate cover shall be verified by field test pits, dug with a hand shovel or power equipment. The frequency of this testing is one test per acre, as noted in Table A-3.

Following installation of the densified~~compacted~~ 12~~6~~-inch-thick intermediate cover~~ soil~~, the thickness of the intermediate~~compacted~~ cover~~soil~~ shall be verified through field survey, excavation of test pits, or use of depth gauges during placement. The frequency of this testing is provided in

Table A-3. ~~Testing, as outlined in Table A-3, shall be performed on the same day as final cover geomembrane is to be installed for the final cover.~~

4.7.2 Compacted Soil Layer Soils

Compacted soil layer soils shall meet the gradation and other requirements described in Table A-3 in Appendix A. Compacted soil layer soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Compacted soil layer soil shall be placed in loose lifts with a maximum compacted thickness of ~~at~~ 6 inches. After spreading, the soil shall be moisture conditioned and compacted using appropriate equipment.

4.7.2.1 Compacted Soil Layer Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing Compacted Soil Layer ~~intermediate cover soil~~ shall be verified by the CQA Consultant. The Compacted Soil Layer ~~intermediate cover soil~~ shall be a minimum 12 inches thick~~, uncompacted,~~ and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the Compacted Soil Layer shall be verified by field test pits, dug with a hand shovel or power equipment, or use of depth gauges during placement. The frequency of this testing is one test per 10,000 square feet, as noted in Table A-3. Testing, as outlined in Table A-3, shall be performed as close as practical to the day the geomembrane is to be installed for the final cover.

4.7.2~~1~~.2 Compacted Soil Layer ~~Intermediate Cover~~ Surface Inspection

Prior to the installation of final cover geosynthetics, the CQA Consultant and Geosynthetics Installer shall inspect the exposed compacted soil ~~intermediate~~ layer~~cover~~ area for wet areas, large or non-round rocks, or other items which could~~may~~ compromise the integrity of the final cover system. This inspection should occur as close as practical ~~prior~~ to ~~and on the same~~ the day ~~as~~the geomembrane installation is planned. All degraded areas as described below will be restored prior to geomembrane deployment.

Excessively dry desiccated, w~~W~~et, frozen, and soft areas identified with during~~the~~ surface inspection ~~that are believed to be due to leachate migration~~ shall be repaired. The full extent of the unacceptable~~wet~~ area shall be excavated and repaired. Excavated waste and ~~soils~~leachate-impacted soil must be re-disposed within active portions of the landfill. Any~~The~~ excavation into the waste shall be backfilled with tire chips, sand, drainage aggregate, or other high permeability material to allow wet areas to drain back into the waste mass. The excavation shall be backfilled to within 1-foot of the top of the intermediate cover, then 1-foot-thick intermediate cover soil and the 1-foot-thick compacted soil layer shall then be replaced over the repaired area returning the area to surrounding grade.

Before the installation of final cover components, the surface of the compacted soil ~~intermediate~~ cover soil shall be graded smooth and rolled with a smooth drum roller. Depressions in excess of ¾ inch deep shall be filled with a clean, uniform sand.
~~. The compacted intermediate cover surface shall be inspected for the determination if a geotextile cushion is necessary.~~ For the direct deployment of the final cover flexible membrane liner (FML) on to the compacted soil layer~~intermediate cover~~, the prepared ~~intermediate cover~~ surface ~~shall~~:

- Shall n~~N~~ot contain loose or dry materials;
- Shall n~~N~~ot contain sharp ~~or protruding~~ objects;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface shall be removed;
- Not be excessively wet, or contain ponded water;
- Not contain fragments greater than ¾ inch on the surface;
- Be prepared such that the deployment of the final cover FML would not dislodge large particles which would remain beneath the FML; and
- Shall not contain localized significant grade changes (holes).

~~If these criteria cannot be satisfied for the intermediate cover soil preparation, a geotextile cushion shall be installed beneath the final cover FML.~~

4.7.3~~4.8~~ Final~~INAL~~ Cover~~OVER~~ Soil~~OIL~~

Following the installation of the final cover geosynthetics, the contractor shall place the final cover soil. The final cover soil shall be 24 inches thick and the upper 12 inches of the soil must be capable of supporting and sustaining vegetative growth and satisfy the requirements of Table A-3 in Appendix A.

The 24-inch-thick final cover soil shall be spread by a low ground pressure dozer in one lift to its full depth. The contractor shall place the soil by working across final cover benches with the soil then proceeding uphill from each bench. The only compactive effort to be exerted to the final cover soil shall be that applied by the bulldozer spreading the soil. Haul equipment shall travel to the placement area over roadways of thickened final cover soil with a minimum thickness of 3 feet. During the hauling and placement of final cover soil, the dozer operator shall grade and shape the placed final cover soil and final cover soil roadways to prevent excessive pumping or rutting by the equipment. Maintenance of roadway or other areas of thickened final cover soil placement may be performed by non-low ground pressure equipment. At no time shall final cover soil be placed where the soil is inadequate to provide support for the haul or placement equipment.

The thickness of the final cover soil shall be verified following placement through field survey or excavation of test pits or use of depth gauges during placement. If test pits are to be used for the verification of thickness, care must be taken to not damage the underlying geosynthetics. Depth gauges may be utilized to aid in placement of the soil and provide quality assurance of thickness of placed material during construction. Depth gauges shall be collapsible materials such as Styrofoam, non-rigid plastic, cardboard, or other material which would not result in damage to the final cover geosynthetics if the gauges were hit by construction equipment. If the depth gauge is of a known height or a marker line is added to the gauge prior to placement of the soil, visual confirmation of the soil height relative to the marker is sufficient confirmation of final cover soil thickness.

Independent of the method utilized to confirm the thickness of the final cover soil, a field survey of the bench area shall be completed. The field survey shall be oriented along the benches to ensure that the benches have the appropriate drainage features, i.e., slope and width.

4.8~~9~~ CONTINGENCY PLAN FOR ANTICIPATED CONSTRUCTION DIFFICULTIES

During construction, the frequency of testing may be increased at the discretion of either the CQA Consultant or the Owner when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when the following conditions are observed:

- Excessive pumping or cracking of material;
- Adverse weather conditions;
- Work conducted in difficult areas; and
- High frequency of failing tests.

If a defect is discovered in the earthwork construction, the CQA Consultant shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. All deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant and the Owner.

4.8~~9~~.1 Notification

The CQA Consultant shall notify the Earthwork Contractor immediately upon discovering the defect. After determining the extent and nature of the defect, the CQA Consultant shall notify the Construction Manager as necessary.

4.8~~9~~.2 Repairs and Retesting

The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Owner. If a design specification criterion cannot be met, or unusual weather conditions hinder the work, the CQA Consultant shall develop and present to the Owner suggested solutions for approval.

The CQA Consultant shall schedule appropriate retests after the work deficiency has been corrected. Retests recommended by the CQA Consultant must document that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

5.0 GEOMEMBRANE

5.1 INTRODUCTION

This section of the CQA/QC Plan presents information related to geomembrane products for use in both liner system and final cover construction.

Following selection of the geomembrane manufacturer, as described in Section 1.3, the manufacture, shipment, and installation of geomembrane shall be conducted in accordance with the conformance test tables included in Appendix A. Throughout this section, laboratory and field tests will be referred to by name. Appendix A outlines each proposed geomembrane test and corresponding methodology and also lists the corresponding required testing values for each test. The CQA Consultant shall document the inventory, testing, and placement of geosynthetics.

5.2 MANUFACTURE, SHIPMENT, AND STORAGE

The following text addresses the activities associated with the manufacture of the geomembrane; the shipment, handling, and delivery of geomembrane to the site; conformance testing of delivered geomembrane; and the storage of the geomembrane prior to installation.

5.2.1 Manufacture of Geomembrane

The Geomembrane Manufacturer shall provide documentation that the material meets the requirements of the design specifications and that adequate quality control measures have been implemented during the manufacturing process.

5.2.1.1 Resin Quality

The raw material composing the geomembrane shall be first quality resin containing no more than 2 percent clean recycled polymer by weight. Prior to the shipment of geomembrane material, the Geomembrane Manufacturer shall provide the Construction Manager and CQA Consultant with the following information:

- The origin (Resin Supplier's name and resin production plant), identification (brand name, and number), and production date of the resin;
- A copy of the quality control certificates issued by the Resin Supplier;
- Reports of the tests conducted by the Manufacturer that document the quality of the resin meets the requirements indicated above; and
- A statement that reclaimed polymer is not added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done correctly with

appropriate cleanliness and if recycled polymer does not exceed 2 percent of the total resin by weight).

At the Owner's discretion and cost, testing may be carried out on the resin by the Geosynthetics CQA Laboratory for purposes of documenting conformance. If the results of the Manufacturer and the Geosynthetics CQA Laboratory testing differ, the testing shall be repeated by the Geosynthetics CQA Laboratory. The Geomembrane Manufacturer will be permitted to monitor the retesting. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

5.2.1.2 Certification of Property Values

In addition to information regarding the raw material, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with the following prior to shipment of the geomembrane:

- Manufacturer certification values for all test properties presented in Table A-4(a) for 60-mil High Density Polyethylene (HDPE) Geomembrane, and Table A-5(a), Final Cover Geomembrane; and
- Manufacturer typical content range (expressed as percent of total resin) of polyethylene, carbon black, and additive package. The additive package may be described in general terms for major constituents if valid copyrights/trademarks are held by the manufacturer or manufacturer's supplier.

The CQA Consultant shall utilize the property values certified by the Geomembrane Manufacturer to complete the Manufacturer's MARV information for the conformance testing tables.

5.2.1.3 Quality Control Certificates

Prior to shipment, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with quality control certificates for the geomembrane. The quality control certificates will be signed by a responsible party employed by the Geomembrane Manufacturer. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests.

The Manufacturer shall be required to perform, at a minimum, the testing scope and frequency presented in Tables A-4(a) and A-5(a) included in Appendix A.

The CQA Consultant shall:

- Verify that quality control certificates have been provided at the frequency defined by the Manufacturer QC Test Frequency specified within the conformance tables included in Appendix A;
- Review the quality control certificates to document that the testing methodology and resulting values comply with the requirements specified within the conformance tables included in Appendix A; and
- Verify that the quality control results meet or exceed the Manufacturer MARV values.

5.2.2 Shipment and Handling

Shipment of the geomembrane to the site is the responsibility of the Geomembrane Manufacturer. Handling the geomembrane on-site is the responsibility of the Installer.

The CQA Consultant shall observe that:

- Handling equipment used on-site pose minimal risk of damage to the geomembrane; and
- The Geomembrane Installers personnel handle the geomembrane with care.

Upon delivery to the site, the Installer and the CQA Consultant shall conduct a surface inspection of the exposed geomembrane rolls for defects, damage, and labeling. This examination shall be conducted without unrolling rolls unless defects or damages, are found or suspected. All labels identifying rolls shall be weatherproof. The CQA Consultant will indicate to the Construction Manager:

- Rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws;
- Rolls that have minor repairable flaws; and
- Rolls that do not have proper identification.

Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

5.2.3 Conformance Testing of Geomembrane

Upon, or if possible prior to, delivery of geomembrane rolls, the CQA Consultant shall document that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to document conformance with the test methods and values presented within Tables A-4(a) and A-5(a). Samples shall be taken and tested at the minimum frequency specified by the tables included in Appendix A.

Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

5.2.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency specified in Tables A-4(a) and A-5(a). If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.

Samples will be recovered from a geomembrane roll by removing a 3-foot (1-m) length of geomembrane across the entire width of a roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.

5.2.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample meet the requirements presented in Tables A-4(a) and A-5(a) included in Appendix A, as well as the Design Requirement values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Extra tests required by an additional evaluation shall be at no expense to the Owner.
   a. In the case of failing parameter(s), two additional tests for the failing parameter shall~~may~~ be performed on sub-samples taken from the failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
   b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
   c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet conformance testing requirements, the roll will be rejected and samples will be collected from the closest numerical roll on both sides of the failed roll and tested again for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.2.4 Storage

The Installer shall be responsible for the storage of the geomembrane on-site. Storage space should protect the geomembrane from theft, vandalism, passage of vehicles, water, and weather.
The CQA Consultant shall document that storage of the geomembrane provides adequate protection against dirt, shock, and other sources of damage.

5.3 GEOMEMBRANE INSTALLATION

The installation of the geomembrane involves three primary tasks; earthwork, placement of geomembrane field panels, and seaming of the field panels.

5.3.1 Earthwork

The earthwork immediately beneath the geomembrane and the anchoring of the geomembrane are crucial to the performance of the material. Earthwork construction activities shall be closely monitored by the CQA Consultant.

The CQA Consultant shall document that:

- A qualified Surveyor has verified lines and grades; and
- The requirements of the CQA/QC Plan are satisfied.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. This subgrade acceptance certificate shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration. The Construction Manager will be given a copy of this certificate by the CQA Consultant.

It is the Installer's responsibility to protect the contacting soil beneath the geomembrane after it has been accepted. After the soil has been accepted by the Installer, it shall be the responsibility of the Installer and the CQA Consultant to indicate to the Construction Manager changes in the soil condition that may require repair work.

5.3.2 Geomembrane Placement

The placement of geomembrane field panels is the responsibility of the Installer and shall be performed in accordance with the approved panel layout drawing and the following specifications.

5.3.2.1 Panel Layout

On or before a Pre-Construction Meeting, the Geomembrane Installer shall provide the Construction Manager and the CQA Consultant with a drawing of the facility to be lined showing expected seams (panel layout drawing). The CQA Consultant shall review the panel layout drawing and document it as consistent with the accepted state of practice and the CQA/QC Plan. The panel layout drawing shall be approved by the CQA Consultant's Certifying Engineer (registered in Tennessee) or Environmental Manager (EM) or Area EM. The Geosynthetics Installer is responsible, at no cost to Owner, for the repair or re-installation of any materials installed prior to the verbal or written approval of the panel layout drawing by the Certifying Engineer (registered in Tennessee) or EM or AEM.

Geomembrane panel seams should be oriented parallel to the line of maximum slope, i.e., placed along the length of the slope, not perpendicular to it. In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should be avoided on slope areas 3H:1V or steeper, and within 5 feet (1.5 m) from the toe of a 3H:1V or steeper slope, or areas of potential stress concentration, unless otherwise authorized.

5.3.2.2 Field Panel Identification

The CQA Consultant shall document that the Installer labels each field panel with an "identification code" (number and/or letter) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Installer, and CQA Consultant. It is the responsibility of the Installer and the CQA Consultant to document that each installed field panel can be traced back to the original roll number. The identification code will be marked at a location agreed upon by the Geosynthetics Installer, and CQA Consultant at the Pre-Construction Meeting.

The CQA Consultant shall establish a table or chart showing correspondence between geomembrane roll numbers and installed field panel identification codes. The field panel identification code will be used for quality assurance records.

5.3.2.3 Location

The CQA Consultant shall document that field panels are installed at the location indicated on the Installer's panel layout drawing, as approved or modified.

5.3.2.4 Installation Schedule

Field panels shall be placed one at a time unless otherwise approved by the CQA Consultant and the Construction Manager. Each field panel shall be seamed after its installation in order to minimize the number of unseamed field panels exposed to weather.

It is beneficial to "shingle" panel overlaps in the downward direction to facilitate drainage in the event of precipitation. It is also beneficial to proceed in the direction of prevailing winds. Scheduling decisions shall be made during installation, depending upon varying weather and other construction conditions. The Installer shall be fully responsible for the decision made regarding placement procedures.

The CQA Consultant shall record the identification code, location, date of installation, time of installation, and ambient temperature of each field panel. The CQA Consultant shall also evaluate field changes by the Installer which may affect the original schedule proposed by the Installer and advise the Construction Manager on the acceptability of that change.

5.3.2.5 Weather Conditions

Geomembrane panel installation shall not proceed when measured sheet temperature exceeds the constraints as specified in Section 5.3.3.4. Deviations from this temperature criteria shall only occur when authorized by the Construction Manager and with concurrence of the CQA Consultant based on passing trial welds at sheet temperatures identical or in excess of the anticipated liner temperature. Geomembrane placement shall not be performed during precipitation, fog, snow, in an area of ponded water, or in the presence of excessive winds.

The CQA Consultant shall document that the above conditions are fulfilled and shall inform the Construction Manager of deviations from the accepted installation procedures.

5.3.2.6 Geomembrane Anchor Trench

Anchor trenches shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the drawings prior to geomembrane installation. The CQA Consultant shall document that anchor trenches have been constructed according to the design drawings.

Slightly rounded corners shall be provided along the trench length where the geomembrane enters the trench to avoid sharp bends that could increase geomembrane stress concentrations and potentially damage the geomembrane. Loose soil shall not underlie the geomembrane within the trench. Panel seaming shall continue through the anchor trench. Following the placement of each geosynthetic layer within the trench, the geosynthetics installer is responsible for temporary anchorage within the anchor trench. Temporary anchorage shall be achieved with sandbags, rolls of geosynthetic material, or other material which allows for removal from the trench for the placement of additional geosynthetic layers. The Earthwork Contractor is responsible for the placement and compaction of soil within the anchor trench as permanent anchorage, following notice of backfill request by the Construction Manager. Backfilling of anchor trenches shall be performed in accordance with this CQA/QC Plan and Table A-3.

5.3.2.7 Method of Placement

The following is the responsibility of the Geomembrane Installer, and the CQA Consultant shall document that these conditions are satisfied:

- The geomembrane is not damaged by equipment through handling, traffic, excessive heat, leakage of liquids, or other means;
- The prepared soil surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane installation;
- Geosynthetic materials immediately underlying a proposed geomembrane layer to be installed are clean and free of debris;
- Personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane;
- The method and equipment utilized to deploy panels does not cause scratches or crimps in the geomembrane and does not damage the ~~recompacted soil liner~~barrier soil layer;
- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- Adequate temporary loading and/or anchoring (e.g., sandbags, geosynthetic rolls), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along the edges of panels to minimize the risk of wind flow under the panels); and
- Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by a sacrificial layer of geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQA Consultant shall inform the Construction Manager if the above conditions are not fulfilled.

5.3.2.8 Damage

The CQA Consultant shall visually inspect each panel after placement and prior to, during, or following seaming for damage. The CQA Consultant shall advise the Construction Manager if any panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in Section 5.3.4.

As a minimum, the CQA Consultant shall document:

- The panel is placed in such a manner that is unlikely to be further damaged; and
- Tears, punctures, holes, thin spots, etc. are either marked for repair or the panel is rejected.

5.3.3 Field Seaming

Field seaming is the responsibility of the Installer and shall be performed in accordance with the following.

5.3.3.1 Requirements of Personnel

At the Pre-Construction Meeting, the Geomembrane Installer will provide the CQA Consultant with a list of proposed seaming personnel and their professional resumes. This documentation will be reviewed and approved by the Construction Manager and the CQA Consultant.

5.3.3.2 Seaming Equipment and Products

HDPE Geomembrane shall be used for all FML components within the baseliner. Approved processes for HDPE Geomembrane field seaming are extrusion seaming and fusion seaming. Proposed alternate HDPE Geomembrane field seaming processes shall be documented and submitted to the Owner and TDEC for approval. Only alternate seaming equipment which has been specifically approved by make and model shall be used. The Installer shall submit seaming equipment documentation to the Construction Manager and the CQA Consultant for approval.

Non-HDPE Geomembrane products may be used as the FML within the final cover system; however, the specific type of FML and the method proposed to seam the FML are subject to the Construction Manager and the CQA Consultant for approval.

The following is the responsibility of the Installer, and the CQA Consultant shall document these conditions are met:

- The Installer maintains on-site a number of spare operable seaming devices that were approved for seaming at the Pre-Construction Meeting;
- Equipment used for seaming is not likely to damage the geomembrane;
- The extruder is purged prior to beginning a seam until heat-degraded extrudate has been removed from the barrel;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to seaming;
- The electric generator is placed upon a flat smooth base and a rub sheet such that no damage occurs to the geomembrane; and
- A smooth insulating plate or fabric is placed beneath the hot seaming apparatus after usage.

- **Extrusion Process**
  - The extrusion seaming apparatus shall be equipped with gauges that show extrudate, nozzle, and preheat temperatures of the apparatus.
  - The Installer shall provide documentation on the extrudate to the Construction Manager and the CQA Consultant and shall certify that the extrudate is compatible with the design specifications and is comprised of the same resin as the geomembrane sheeting.
  - The CQA Consultant shall log apparatus temperatures, ambient temperatures, extrudate temperatures, and sheet temperatures at appropriate intervals.

- **Fusion Process**
  - The fusion seaming apparatus must be an automated mechanical device, equipped with gauges giving the applicable temperatures. Pressure settings shall be verified by the Installer prior to each seaming period. The CQA Consultant shall log ambient temperatures, sheet temperatures, and seaming apparatus temperatures, speeds, and pressures. The Geosynthetic Installer shall maintain at least one spare, operable seaming unit on-site at all times.
  - The single-track fusion seaming method shall be allowed only with prior approval of the Owner. Any alternative seaming methods proposed by the Geosynthetic Installer must be approved by the Owner and TDEC prior to use on the project.

5.3.3.3 Seam Preparation

The following is the responsibility of the Installer; the CQA Consultant shall document these conditions are met:

- Prior to seaming, the area to be seamed shall be clean and free of moisture, dust, dirt, oils, greases, foreign material, and debris. The geomembrane panels to be welded together shall be wiped with a clean cloth, brush or other cleaning equipment just prior to seaming;
- A rub sheet shall be used to protect the liner while cutting materials;
- If seam overlap grinding is required, the process will be completed within 1 hour of the seaming operation, adhering to the Geomembrane Manufacturer's instructions, and performed in a way that does not damage the geomembrane;
- No abrasions are visible when welding is complete;
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths"; and
- No metal objects that could potentially damage the liner are permitted to be used within the lined area.

5.3.3.4 Weather Conditions for Seaming

The required weather conditions for seaming are as follows:

- The sheet temperatures shall be measured on the surface of the geomembrane sheet with a thermometer;
- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at a sheet temperature above 120°F for extrusion welding and 140°F for fusion welding; in both fusion and extrusion welding, no seaming shall be attempted at a sheet temperature below 32°F; and
- The geomembrane shall be dry and protected from wind.

If the Installer wishes to use methods which ~~may~~ allow seaming at ambient temperatures above 120°F for extrusion welding, and above 140°F for fusion welding or below 32°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are equivalent to seams produced at ambient temperatures above 32°F and below 120°F for extrusion welding and 140°F for fusion welding. The Installer shall also demonstrate that the overall quality of the geomembrane is not adversely affected and the Construction Manager and CQA Consultant shall concur with the installer.

The above specified temperature constraints apply to general construction for disposal areas and final cover projects. However, if repair activities are necessary for previously constructed areas and the repairs cannot await improved weather due to construction considerations, scheduling, or importance of the repair, these repairs may be completed at a wider range of ambient temperatures. For these repair situations, welding may be performed at ambient temperatures between 120°F and 20°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are acceptable when compared to the seam requirements of Tables 4(b) and 5(b) in Appendix A. When these repairs are performed outside of normal ambient welding temperatures, trial welds shall be performed once per four hours. The CQA Consultant shall document that these weather conditions are complied with and will advise the Construction Manager accordingly.

5.3.3.5 Overlapping and Temporary Bonding

The following shall be the responsibility of the Installer and shall be verified by the CQA Consultant:

- In general, geomembrane panels shall have a finished overlap of a minimum of 3 inches (75-mm) for extrusion seaming and 4 inches (100 mm) for fusion seaming (or otherwise specified by the manufacturer), but in any event, sufficient overlap will be provided to allow peel tests to be performed on the seam; and
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane (in particular, the temperature of hot air at the nozzle of a spot seaming apparatus will be controlled such that the geomembrane is not damaged).

The CQA Consultant shall log appropriate temperatures and conditions and shall log and report deviations to the Construction Manager.

5.3.3.6 Trial Seam, Geomembrane Seaming

Trial seams shall be made on scrap pieces of geomembrane liner under the same weather and field conditions to be encountered during the seaming period to document that seaming conditions and procedures are adequate and in accordance with Appendix A. Such trial seams shall be made at the beginning of each seaming period, and at least once every 5 hours, whichever time period is less. A passing trial seam shall be made for each seaming device and technician.

For fusion welding with a self-propelled machine, re-trial welding shall be required if any setting on the machine is altered from those used for the preparation of the previous passing trial seam. With fusion welding, once a machine has passed trial weld testing, any qualified welding technician may utilize that machine. For extrusion or other manually advanced welding equipment, a change in technician, machine, or machine settings from that used for the preparation of the previous passing trial weld shall warrant completion of a new passing trial weld. With extrusion or other manually advanced welding equipment, only a qualified technician who utilized that machine shall be allowed to use that machine without the preparation of a new trial weld.

A trial seam shall also be made in the event that the sheet temperature varies more than 20°F since the last passing trial seam. Trial seams shall be made under the same conditions as actual seams. If the seaming apparatus is turned off for any reason, a new passing trial seam must be completed for that specific seaming apparatus.

The Installer shall provide the tensiometer required for field trial seam shear and peel testing. The tensiometer shall be automatic and have a direct digital readout. The tensiometer shall be calibrated at the site prior to use. The Installer shall provide the CQA Consultant with the calibration certification.

The trial seam sample shall be at least 5 feet (1.5 m) long by 1-foot (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.2.3.5. Six specimens, 1 inch (25-mm) wide each, shall be cut from the trial seam sample by the Installer. Three specimens shall be tested in shear and three in peel (each track for a double track fusion welder) using a field tensiometer. A passing welded seam is achieved in peel and shear when the specimen meets the criteria presented in Tables A-4(b) and A-5(b).

If a specimen fails, the trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive, successful, trial seams are achieved.

The CQA Consultant shall observe trial seam procedures. The remainder of the successful trial seam sample shall be assigned a number and marked accordingly by the CQA Consultant, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The remainder of the successful trial seam sample shall be archived at the site until the Permitting Agency has approved the final documentation.

5.3.3.7 General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follows:

- While fusion seaming, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to help prevent moisture build-up between the panels to be seamed;
- If required, a firm substrate will be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support;
- Wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. Cut wrinkles will be seamed and portions where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6-inches (150 mm) beyond the cut in all directions;
- With respect to the anchor trench, seaming will extend to the outside edge of panels installed within the anchor trench; and
- No field seaming shall take place without the on-site presence of the Geosynthetic Installer's Master Seamer.

The CQA Consultant shall document that the above seaming procedures are followed and shall inform the Construction Manager of deviations.

5.3.3.8 Non-Destructive Seam Continuity Testing

The Installer shall non-destructively test field seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test, or other Owner approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive testing is to inspect the continuity of geomembrane panels seams. Continuity testing shall be carried out simultaneously, as the seaming work progresses (maximum of 3,000 lineal feet (1,000 m) of seam), not at the completion of all field seaming, unless otherwise approved by the Construction Manager. The Installer shall complete required repairs in accordance with Section 5.3.4. Non-destructive testing shall not be permitted to occur before sunrise or after sunset unless the Installer demonstrates the capabilities to do so.

Air Pressure Testing

Unless otherwise specified, the general air pressure testing procedure used by the Installer shall be as follows:

- Inflate the test channel to a range of 30 to 35 pounds per square inch (psi). Close valve;
- Provide an Initial 2-minute relaxation period after pressurization prior to start of test;
- Observe and record the air pressure 5 minutes after start of test, record ending and initial pressures. If loss of pressure exceeds 3 psi, or if the pressure does not stabilize, locate the faulty area and repair;
- At the conclusion of the pressure test, the end of the seam opposite the pressure gauge shall be cut. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected;
- Remove needle or other approved pressure feed device and seal the resulting hole by extrusion welding; and
- Testing will be recorded by the CQA Consultant.

Non-Complying Air Pressure Test

In the event of a non-complying air pressure test, the following procedure shall be followed:

- Check the seals at the end of the seam and retest the seam;
- If deviation with specified maximum pressure differential reoccurs, cut 1-inch (25 mm) samples from each end of the suspect area; and
- Perform destructive peel tests on the samples using the field tensiometer.

If all samples pass destructive testing, the Installer may:

- Cap-strip the suspect area;
- When sufficient overlap exists [2-inch (50 mm)], heat tack the overlap and extrusion weld the entire seam. Test the entire length of the repaired seam by vacuum testing; or
- Further isolate the air pressure failure as agreed upon by the CQA Consultant and Construction Manager;
- If one or more samples fail the peel tests, additional samples will be taken. When two passing samples are located, the suspect area between the passing tests will be considered geomembrane material that is in non-compliance. This section of failing seam shall be cap stripped, or the overlap created by the wedge welder will be heat tacked in place along the entire length of the seam and the entire length of the seam will be extrusion welded. Subsequently, the entire length of the repaired seam will be inspected by vacuum testing;

- If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant and the Construction Manager; and
- All sections shall be retested and repaired in accordance with Section 5.3.4.2.

Vacuum Testing

Unless otherwise specified, the general vacuum testing procedure used by the Installer shall be as follows:

- Turn on vacuum pump to reduce pressure within the vacuum box to approximately 5 psi (0.35 kg/cm^3);
- Apply a generous amount of a solution composed of liquid soap and water to the area to be tested;
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;
- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles; and
- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch (75 mm) overlap and repeat the process.

Non-Complying Vacuum Test

In the event of a non-complying vacuum test, the following procedure shall be followed:

- Mark all areas where soap bubbles appear and repair the marked areas, as specified in Section 5.3.4.2; and
- Retest repaired areas.

CQA Responsibilities

The CQA Consultant shall:

- Document all continuity testing;
- Record location, date, test unit number, name of tester, and outcome of testing; and
- Inform the Installer and Construction Manager of required repairs.

When defects are located, the CQA Consultant shall:

- Observe the repair and retesting of the repairs;
- Mark on the geomembrane that the repair has been made; and
- Document the results.

Non-Testable Areas

The Installer shall use the following procedures at locations where seams cannot be non-destructively tested.

- Spark testing or other method approved by the CQA Consultant and Owner shall be employed, if possible;
- All such seams shall be cap-stripped with the same geomembrane material;
- If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation; and
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the CQA Consultant and Installer for uniformity and completeness.

The seam number, date of observation, name of tester, and outcome of the test or observation shall be recorded by the CQA Consultant.

5.3.3.9 Destructive Testing, Geomembrane Seaming

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses [maximum of 3,000 lineal feet (1,000 m) of seam], not at the completion of all field seaming, unless otherwise approved by the Construction Manager or CQA Consultant. Seam lengths shall be tracked separately for each type of welding.

Location and Frequency

The CQA Consultant shall select locations where geomembrane panel seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

- A minimum frequency specified in Tables A-4(b) and A-5(b). This minimum frequency is to be determined as an average taken throughout the entire facility;
- The minimum frequency specified in Table A-4(b) and A-5(b) shall be satisfied for each type of welding (i.e., extrusion and fusion); and

- Test locations will be determined during seaming at the CQA Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset seams, or other potential cause of defective seaming.

The Installer shall not be informed in advance of destructive seam tests locations.

Sampling Procedure

Samples shall be cut by the Installer as the seaming progresses in order to have passing laboratory test results before the geomembrane is covered by another liner material. The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample and mark it accordingly;
- Record the destructive sample location on the appropriate geomembrane panel layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine or suspicious feature of the geomembrane).

Holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described in Section 5.3.4.2 of the CQA/QC Plan. The continuity of the new seams in the repaired area will be tested according to Section 5.3.3.8.

Size of Samples

At a given sampling location, two types of samples shall be taken by the Installer. Initially, two specimens for field testing shall be taken. Each of these specimens will be 1-inch (25 mm) wide by 12 inches (300 mm) long, with the seam centered parallel to the width. The distance between these two specimens will be 42 inches (106 cm) (or 30 inches (76 cm).

The sample for laboratory testing shall be located between the two specimens for field testing. The destructive sample will be 12 inches (30 cm) wide by 42 inches (106 cm) long, if the Geomembrane Installer requests a sample; otherwise, the destructive samples will be 12 inches (30 cm) wide and 30 inches long (76 cm) with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- One portion to the Installer for laboratory testing, 12 inches x 12 inches (30 cm x 30 cm);
- One portion to the Owner for archive storage, 12 inches x 12 inches (30 cm x 30 cm); and
- One portion for Geosynthetics CQA Laboratory testing, 12 inches x 18 inches (30 cm x 45 cm).

Final determination of the sample sizes shall be made at the Pre-Construction Meeting. The CQA Consultant shall witness destructive sample collection and label samples and portions with their number. The CQA Consultant shall also log the date and time, seam identification, and sample location.

Field Testing

The two 1-inch (25 mm) wide specimens described in the previous section may be tested in the field with a tensiometer, for peel and shear respectively, and shall meet the minimum requirements presented in Tables A-4(b) and A-5(b), included in Appendix A. If any field test sample fails to pass, the procedures outlined in the Destructive Test Failure section will be followed. The CQA Consultant shall observe and document the results of the field tests.

Geosynthetics CQA Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, by the CQA Consultant in a manner that will not damage the test sample. The Construction Manager shall be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetics CQA Laboratory.

At least five specimens will be tested, each for shear and peel as shown in Tables A-4(b) and A-5(b). A maximum of one non-Film Tear Bond (FTB) failure is acceptable for each method provided the strength requirements are met on that sample.

The Geosynthetics CQA Laboratory shall provide test results, in writing, no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available and make appropriate recommendations to the Construction Manager. If a sample fails, the procedures given in the Destructive Test Failure section shall be followed.

Installer's Laboratory Testing

The Installer's laboratory test results shall be presented to the Construction Manager and the CQA Consultant for review within 24 hours of sample collection.

Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Installer's laboratory, or by the field tensiometer.

- The Installer can reconstruct the seam between any two passed destructive seam test locations; or
- The Installer can trace the seaming path to an intermediate location [at least 10 feet (3 m) from the point of the failed test in each direction] and take a small sample for an additional field test at each location. If these additional samples pass field tensiometer testing, then full destructive laboratory samples are taken. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping via extrusion or fusion welds. If either the field tensiometer or the laboratory test sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

If a fusion type seam fails destructive testing and the Installer chooses to cap the seam, the only acceptable capping method is as described in Section 5.3.4.2.

All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases exceeding 150 feet (45 m) of reconstructed seam, a sample shall be taken from the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

5.3.4 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be examined by the CQA Consultant for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if the amount of dust or mud inhibits examination.

5.3.4.1 Evaluation

Each suspected defect location, both in seam and non-seam areas, shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.9. Each location which fails the non-destructive testing shall be marked with an identification code by the CQA Consultant and repaired by the Installer. Work shall not proceed with any subsequent materials which will cover locations which have been repaired until field or laboratory test results with passing values are available.

5.3.4.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, failing a destructive test, or failing a non-destructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be approved by the Construction Manager and the CQA Consultant. The procedures available include:

- Patching - Apply a new piece of geomembrane sheet over, and at least 6 inches (150 mm) beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane. This method should be used to repair holes, tears, destructive test locations, undispersed raw materials, contamination by foreign matter, dents, pinholes, and pressure test holes;
- Capping - Apply a new strip of geomembrane along the length of a delineated faulty seam. The cap strip shall extend at least 6 inches (150 mm) beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seams; and
- Replacement - The faulty seam is removed and replaced.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to the repair;
- All surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;
- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Installer;
- Patches or caps will extend at least 6 inches (150 mm) beyond the edge of the defect and all patch corners will be rounded; and
- Seam repairs over 150 feet (45 m) long will require a destructive test to be taken from the repair.

5.3.4.3 Verification of Repairs

Each repair shall be numbered and logged by the CQA Consultant and the Installer. Each repair shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.8. Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. However, if the CQA Consultant suspects a repair to be questionable, although it passes non-destructive testing, a destructive test can be requested. Failed tests will require the repair to be redone and retested until a passing test result is achieved. The CQA Consultant shall observe non-destructive testing of repairs and shall record the repair test date, location, and test outcome.

5.3.4.4 Large Wrinkles

When seaming of the geomembrane panels is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying liner materials, the CQA Consultant shall inspect the geomembrane for the presence of wrinkles. The CQA Consultant will indicate to the Construction Manager which wrinkles should be cut and re-seamed by the Installer. The resulting seam produced by removing the wrinkle will be tested like any other repair.

5.3.5 Backfilling of Anchor Trench

Anchor trenches will be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. Anchor trenches shall be backfilled and compacted as soon as possible. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

The CQA Consultant shall observe the backfilling operation and advise the Construction Manager of any problems. Testing of the anchor trench backfill shall be completed and monitored consistent with the requirements of Table A-3.

5.3.6 Installed Geomembrane Certification/Acceptance

The Installer and the Manufacturer shall retain ownership and responsibility for the geosynthetics installed within the facility until acceptance by the Owner.

The liner system shall be accepted by the Owner when:

- The installation is finished;
- Verification of the adequacy of seams and repairs, including associated testing, is complete;
- Installer’s representative furnishes the Construction Manager with certification that the geomembrane was installed in accordance with the Manufacturer's recommendations as well as the design drawings and specifications;
- All documentation of installation is completed including the CQA Consultant’s final report; and
- Certification, including record drawings, sealed by a Professional Engineer registered in Tennessee has been received by the EM or AEM.

The CQA Consultant shall provide certification that installation has proceeded in accordance with this CQA/QC Plan for the project except as noted to the EM or AEM or Construction Manager.

5.3.7 Materials in Contact with the Geomembranes

The quality assurance procedures indicated in this subsection are only intended to document that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures provided in subsequent sections of this CQA/QC Plan are necessary to document that the systems built with these materials are constructed to perform as designed.

5.3.7.1 Appurtenances

The Design Engineer shall provide design specifications for appurtenances to the Construction Manager and the CQA Consultant.

The CQA Consultant shall document that:

- Installation of the geomembrane in appurtenance areas and connection of geomembrane to appurtenances have been made according to the design specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Consultant will inform the Construction Manager if the above conditions are not fulfilled.

5.3.8 Geomembrane Rain Flaps

Geomembrane rainflaps may be installed to subdivide lined areas for leachate quantity management. The purpose of the flap is to prevent stormwater from entering the leachate collection system. The CQA Consultant shall document the material, configuration, and installation of the rainflap. Additionally, the CQA Consultant shall confirm that the berm installation does not harm the liner system.

5.4 TESTING OF SUMP AREAS

Liner construction projects which include the installation of a leachate sump area shall include additional inspection in these areas. Additional inspection shall be performed to verify that the liner material and installation has been completed with no identifiable defects. This inspection may be achieved through complete vacuum box testing, spark testing or a hydrostatic test. Inspection of the sump area shall be performed following the installation and detailing of the liner installation throughout the sump area. The inspection of the sump area shall be clearly noted and discussed in the field reports prepared by the CQA Consultant.

5.4.1 Vacuum Box Testing of Sump Areas

Following installation of the liner throughout the sump area, complete vacuum box testing can be performed to provide adequate testing of the sump area. Standard vacuum box testing procedures, as outlined in Section 5.3.3.8 shall be followed for the inspection of all seams and sheet material within the limits of the depressed portion of the sump. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.2 Spark Testing of Sump Areas

Following installation of the liner throughout the sump area, complete spark testing can be performed to provide adequate testing of the sump area. With the testing equipment and liner properly powered, the spark testing wand shall be moved slowly over all seam and sheet area within the limits of the depressed portion of the sump. The geosynthetic installer technician performing the spark testing shall be properly trained and demonstrate this training with written certification or resume experience. The speed and distance above the liner which the wand is moved shall be initially confirmed with the testing of a trial seam or liner material with a known defect to ensure that the sparking can be seen. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.3 Hydrostatic Testing of Sump Areas

Following installation of the liner throughout the sump area, a hydrostatic test of the sump area can be performed to document its integrity. The sump shall be tested by filling the sump with clean water to a minimum of 2 inches (51 mm) above the crest of the depressed portion of the sump, unless otherwise specified by Owner and CQA Consultant. The horizontal limits of the water surface shall be delineated on the primary liner at the start of the testing period with markers or paints. The water shall remain in the sump for a minimum of 8 continuous hours. Loss of test water may be determined by comparing horizontal limits of the water surface with the interim limits. At a minimum of once every 1 hour (more frequently as possible), the test water level in the sump interim water loss amounts and time shall be noted as part of the test.

At the end of the testing period, the level of liquid in the sump shall be evaluated. If no liquid loss is noted, the hydrostatic test is deemed to pass. If appreciable liquid decrease is noted, the test is deemed as non-passing and the sump shall be emptied and inspected for leaks or hydrostatic testing may be run at various liquid depths within the sump to locate possible leaks. If no possible leaks are located, other possible avenues of infiltration through the sump shall be investigated and the test shall be re-run.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 INTRODUCTION

The manufacture, shipment, and installation of a Geosynthetic Clay Liner (GCL) shall be in accordance with this section of the CQA/QC Plan. GCLs shall be utilized in accordance with the permitted design for the facility, as an alternative to the upper 1-foot of the 2-foot thick ~~recompacted soil liner~~barrier soil layer. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-8. These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of all GCLs.

6.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the GCL Manufacturer shall provide documentation which demonstrates that the GCL property values of the material adheres to project specifications. Site delivered rolls of GCL shall be appropriately labeled.

6.2.1 Certification of Property Values

The GCL Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for the specific type of GCL to be supplied. The GCL Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate GCL Manufacturer representative. The certification shall state that the site delivered GCLs have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

6.2.2 Labeling

The GCL Manufacturer shall identify all rolls of GCL. Each GCL roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and

- Roll dimensions.

In addition, if any special handling of the GCL is required, it shall be marked on the top surface of the GCL, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

6.3 SHIPMENT AND STORAGE

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. GCL rolls shall be wrapped in plastic sheets or otherwise protected. In addition to maintaining in-tact wrappings for the GCLs, the rolls shall be stored off of the ground and covered with an additional tarp, stored in a truck, van, building or other area that would provide protection against damage and exposure. Wrappings protecting the GCL rolls should not be removed more than one hour prior to unrolling the GCL.

GCLs shall not be exposed to precipitation prior to being installed. Wet GCLs are heavy which makes them difficult to deploy, can degrade the desired performance of the material and can also affect liner welding when the geomembrane is adjacent to the GCL.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviation from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

6.4 CONFORMANCE TESTING OF GCL

Upon or prior to delivery of GCL rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

6.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-8 in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA

Consultant shall inform the Construction Manager. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The sample shall be marked with the machine direction on the samples with an arrow.

6.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values (as listed in Table A-8), the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on the sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If one or more of the average test values do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and the samples shall be tested for the failed parameter(s). If one or both of these samples do not meet requirements, the failing roll(s) shall be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

6.5 HANDLING AND PLACEMENT

The Installer shall handle GCLs in such a manner as to minimize damage and shall comply with the following:

- GCL shall not be deployed by allowing the roll to freely unroll down a slope;
- GCLs shall be cut using an approved cutter only. If the GCL is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the GCLs;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the GCLs;

- During placement of GCLs, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the GCL, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the GCL shall be examined and harmful foreign objects, such as needles, shall be removed;
- Geomembrane installation shall immediately follow the GCL installation. In-place GCL shall be covered with geomembrane before the Contractor leaves the site at the end of the day that the GCL was placed. Geomembrane seams shall be welded after each geomembrane panel is placed;
- Geomembrane shall not be placed on a GCL which has sufficiently hydrated. Degree of hydration shall be determined by visual inspection by the CQA Consultant;
- Geomembrane defects and destructive sample locations shall be immediately repaired; and
- The CQA Consultant shall be present during cutting of the material overlaying the GCL to ensure that no incisions have been made into the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.6 SEAMS AND OVERLAPS

GCLs shall be overlapped a minimum of 6 inches on the edges of the panels and 12 to 18 inches between roll ends. Manufacturer's recommendations shall be consulted with respect to the need for loose bentonite on the seam overlaps. Horizontal seams on side slopes steeper than 25 percent (3H:1V) shall be made with a 3-foot overlap. Horizontal seams on side slopes steeper than 25 percent (4H:1V) shall also be offset by a minimum of 10 feet. The Installer shall pay particular attention that no material is inadvertently inserted beneath the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.7 REPAIRS

Holes or tears in the GCL shall be repaired by the Installer as follows:

- A patch made from the same GCL shall be placed and anchored over the defect or other method to "tack" it in place and lie no closer than 12 inches from any edge. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

Care shall be taken to remove soil or other material which may have penetrated the torn GCL. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

6.8 PLACEMENT OF MATERIALS ON GCLS

The Installer shall place materials on the GCL in the following manner:

- In a way that causes no damage to the GCL and underlying geosynthetics;
- Allows minimal slippage of the GCL on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the GCL, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

7.0 GEOTEXTILE

7.1 INTRODUCTION

The manufacture, shipment, and installation of geotextiles shall be in accordance with this section of the CQA/QC Plan. Geotextiles shall be utilized in accordance with the permitted design for the facility. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-6(a) through A-6(c). These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of geotextiles.

7.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the Geotextile Manufacturer shall provide documentation which demonstrates that the geotextile property values of the material adhere to project specifications. Site delivered rolls of geotextile shall be appropriately labeled.

7.2.1 Certification of Property Values

The Geotextile Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for each specific type of geotextile to be supplied. The Geotextile Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Geotextile Manufacturer representative. The certification shall state that the site delivered geotextiles have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

7.2.2 Labeling

The Geotextile Manufacturer shall identify the rolls of geotextile. Each geotextile roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;

- Roll weight; and
- Roll dimensions.

In addition, if special handling of the geotextile is required, it shall be marked on the top surface of the geotextile, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

7.3 SHIPMENT AND STORAGE

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls should not be removed less than one hour prior to unrolling the geotextile.

Geotextiles shall not be exposed to precipitation prior to being installed. Wet geotextiles are heavy, which makes them difficult to deploy and can also affect liner welding when the geomembrane is adjacent to the geotextile. During cold weather, geotextiles must be protected from freezing.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

7.4 CONFORMANCE TESTING OF GEOTEXTILE

Upon or prior to delivery of geotextile rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

7.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-6(a) through A-6(c), in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA Consultant shall inform the Construction Manager immediately. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Samples will be recovered across the entire width of the roll and will not include the first 3 lineal feet (1 m). Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

7.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

7.5 HANDLING AND PLACEMENT

The Installer shall handle geotextiles in such a manner as to minimize damage and shall comply with the following:

- After the wrapping has been removed, a geotextile shall not be exposed to sunlight for more than the time specified by the Geotextile Manufacturer;
- On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension;

- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlying liner material;
- Sandbags shall be filled with fine grained material and must be handled with care to avoid rupture;
- Geotextiles shall be kept continually under tension to minimize the presence of wrinkles forming within the geotextile;
- Geotextiles shall be cut using an approved cutter (hook blade only if within a cell project area). If the geotextile is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the geotextiles;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the geotextiles;
- During placement of geotextiles, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the geotextile shall be examined and harmful foreign objects, such as needles, shall be removed; and
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.6 SEAMS AND OVERLAPS

Geotextiles shall be continuously joined. Geotextiles shall be sewn using thread, which is as chemically and UV resistant as the geotextile itself. Thread shall be approved by the CQA Consultant and Owner.

Geotextiles shall be overlapped a minimum of 6 inches (150 mm) prior to seaming. The Installer shall pay particular attention that no material is inadvertently inserted beneath the geotextile.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.7 REPAIR

Holes or tears in the geotextile shall be repaired by the Installer as follows:

- On slopes steeper than 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and lie no closer than 12 inches from the edge of the defect. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced; and

- On slopes less than or equal to 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and have a minimum of 24 inches (600 mm) of overlap in all directions.

Care shall be taken to remove soil or other materials which may have penetrated the torn geotextile. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

7.8 PLACEMENT OF MATERIALS ON GEOTEXTILES

The Installer shall place materials on the geotextile in the following manner:

- In a way that causes no damage to the geotextile and underlying geosynthetics;
- Allows minimal slippage of the geotextile on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the geotextile, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

8.0 GEOCOMPOSITE

8.1 INTRODUCTION

The manufacture, shipment and installation of geocomposites shall be in accordance with this section of the CQA/QC Plan. A geocomposite consists of a HDPE geonet core, heat-bonded on both sides to a nonwoven geotextile. Table A-7 has been included in Appendix A to address the geonet component and finished geocomposite to be utilized as a final cover drainage layer. The geotextile component of geocomposites shall be tested separately for all parameters at the prescribed testing frequencies required for geotextiles, as presented in Section 7 of this CQA/QC plan.

The CQA Consultant shall document the inventory, testing, and placement of geocomposites.

8.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the manufacturer shall provide documentation which demonstrates that the property values of the material adhere to the design specifications. Delivered rolls of geocomposite shall be appropriately labeled.

8.2.1 Certification of Property Values

The geocomposite Manufacturer (Manufacturer) shall provide the Construction Manager with a list of guaranteed “minimum average roll value" properties (as defined by the Design Engineer) for the type of geocomposite to be supplied. The Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Manufacturer representative. The certification shall state that the site delivered geocomposite has properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

8.2.2 Labeling

The Manufacturer shall identify geocomposite rolls. Each roll shall have a weatherproof label which contains the following:

- Manufacturer's name;
- Product identification;
- Lot number;

- Roll number; and
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

8.3 SHIPMENT AND STORAGE

Geocomposite cleanliness is essential to performance, therefore, measures must be taken during shipment and storage to protect them from dust and dirt. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the rolls should be removed less than one hour prior to unrolling the geocomposite.

The CQA Consultant shall document that the geocomposites are free of dirt and dust prior to being installed. If the roll is dirty or dusty, it shall be washed by the Installer prior to installation. Washing operations shall be observed and approved by the CQA Consultant.

The CQA Consultant shall examine rolls upon delivery and prior to installation. Deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner. Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

8.4 CONFORMANCE TESTING OF GEOCOMPOSITE

Upon or prior to delivery of geocomposite rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

Sample Collection

Using the packing list provided by the Manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency specified in Table A-7. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet (1 m) of the roll. Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed samples is not performed, or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll, and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

8.5 HANDLING AND PLACEMENT

The Installer shall handle geocomposites in such a manner as to minimize damage and comply with the following:

- On slopes, the roll shall be secured in the anchor trench and then rolled in a parallel direction down the slope while maintaining a constant tension on the sheet. If necessary, the material shall be positioned by hand after being unrolled to minimize wrinkles. Efforts shall be made to place geocomposites parallel to the slope. However, in some landfill locations and/or some instances (e.g., at the toe of the slope, or if an extra geocomposite layer is required) the layer may be placed in the horizontal direction (i.e., across the slope). Such locations and cases shall be identified by the Design Engineer in the drawings;
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material;

- Sandbags shall be filled with fine grained material and must be handled with care to prevent rupture;
- Unless otherwise specified, geocomposites shall not be welded or attached to geomembranes;
- Geocomposites shall only be cut using appropriate equipment after deployment;
- The Installer shall take necessary precautions to prevent damage to underlying geosynthetic or granular layers during installation. Care should be taken not to leave tools on or beneath the geocomposite; and
- During placement, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geosynthetics. If dirt, excessive dust, and/or stones are entrapped in or below the geocomposite it shall be washed or swept prior to placement of material over it.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.6 JOINING

Adjacent geocomposites shall be joined according to the drawings and design specifications. As a minimum, the following requirements shall be met:

- Adjacent rolls shall be overlapped by at least 4 inches (100 mm);
- These overlaps shall be secured by tying;
- Tying shall be achieved with net ties. Tying devices may be white or yellow for easy observation. Metallic devices are not permitted;
- Tying devices shall be placed every 5 feet (1.5 m) down the slope, every 2 feet (0.6 m) across the slope, every 6-inches (150 mm) in the anchor trench, and every 6 feet (2 m) on horizontal surfaces; and
- In the corners of the side slopes of rectangular landfills, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled from top to bottom of the slope and placed upon the top of the previously installed geocomposites.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.7 REPAIR

Holes or tears shall be repaired by placing a geocomposite patch extending 2 feet (0.6 m) beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by tying placed at a frequency of every 6 inches (150 mm). Tying devices shall be as indicated in Subsection 8.6. If the hole or tear width across the roll is more than one-half the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Subsection 8.6.

The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

8.8 PLACEMENT OF MATERIALS ON GEOCOMPOSITE

The placement of materials on geocomposite shall be as soon as possible, such that:

- The geocomposite and underlying geomembrane are not damaged;
- Minimal slippage of the geocomposite on the underlying geomembrane occurs;
- No excess tensile stresses occur in the geocomposite;
- A minimum thickness of 1 foot (30 cm) of soil must be maintained between light, low ground pressure equipment and the geocomposite; and
- Equipment used for placing overlying material shall not be driven directly on the geocomposite unless approved by the CQA Consultant and Construction Manager.

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the subsequent construction activities. Before a subsequent layer of material is placed on the geocomposite, the CQA Consultant should observe the geocomposite and underlying liner to determine if dirt, excessive dust, or stones are entrapped in or beneath the liner. If so, the geocomposite and geomembrane must be washed or the geocomposite removed so that the liner can be cleaned. Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

9.0 LEACHATE MANAGEMENT SYSTEM

9.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with the Leachate Management System (LMS). These components include:

- Protective Cover Layer (See Section 4.6); and
- Polyethylene Pipes and Fittings.

The above components shall meet requirements related to material characteristics and construction quality. Both field and laboratory tests shall be performed prior to construction to evaluate if the characteristics of soil and aggregate from proposed sources and the quality of pipes meet the material acceptance requirements of the permit and design specifications. Throughout construction, additional field and laboratory testing shall be performed to evaluate if the placed material meets the requirements of the permit and construction documents with regard to material acceptance and construction quality.

9.2 PROTECTIVE COVER LAYER

See Section 4.6 of this CQA/QC Plan for information related to the Protective Cover Layer.

9.3 POLYETHYLENE PIPE AND FITTINGS

9.3.1 Material Requirements

HDPE pipe and its associated fittings and joints shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.3.1.1 Pipe

HDPE pipe shall consist of Standard Dimension Ratio (SDR) pipe, as specified in the design specifications, and must conform to the requirements of ASTM D2837, Class PE3408 for a pressure rating of 160 psi at 73.4 F. HDPE pipe shall comply with the following standards:

- ASTM F714 - pipe S.T.D;
- ASTM D1248 - Type III, Class C, Category 5 - Grade P34; and
- PPI - PE3408.

9.3.1.2 Fittings

HDPE pipe fittings shall be furnished by the Manufacturer of the pipe with which they are used and shall conform to the requirements of ASTM D3261 for standard fittings.

9.3.1.3 Joints

Pipe joints shall be fusion welded, using only Manufacturer-approved methods and equipment. Unless otherwise approved, joints inside manholes shall be joined with mechanical transition couplings.

9.3.2 Fusion Process for Joints

HDPE pipes and fittings shall be joined by the Pipe Installer using the procedures outlined below, unless otherwise specified.

9.3.2.1 Preparation

Delivered pipes and fittings shall be examined by the Pipe Installer. The Installer shall document that pipes and fittings are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to fusing, the Installer shall document that the fusion surface area is clean and free of moisture, dust, dirt, debris, and foreign material.

The CQA Consultant shall notify the Construction Manager of deviations.

9.3.2.2 Weather Conditions for Butt-Fusion

Butt-fusion of HDPE pipe joints is normally performed in uncontrolled atmospheres. Fusion of the HDPE joints shall be performed at temperatures above 20°F, unless otherwise authorized by the Construction Manager.

9.3.3 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the Pipe Installer using the pressure test procedures outlined below. The CQA consultant shall report nonconformance of testing methods or test results to the Project Manager.

9.3.3.1 Segment Testing: Pre-Installation

- Similar sizes of polyethylene piping shall be butt-fused 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;
- 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 10 psi for gravity leachate piping and 40-psi for other piping with working pressure/static head up to 90 psi. For those cases with high pressure systems over 90 psi, the testing pressure shall be established as the working pressure/static head by estimating the minimum test pressure as [Head in feet / 2.3 = Test Pressure in psi];
- Contractor shall submit verification and results of gauge calibration prior to (no later than 60 days) and after completion of project;
- The allowable pressure drop observed during the test shall not exceed one percent of the test pressure over 30 minutes. Pressure drop shall be corrected for temperature changes before determining pass or failure;
- The Owner shall be notified before the testing procedure and shall have the option of being present during the test; and
- Equipment for this testing procedure will be furnished by the contractor. This shall consist of a polyethylene flange adapter 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 212°F (0° to 100°C), a pressure gauge 0 to 75-psi, a valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of the test. Polyethylene reducers shall be utilized to adapt the flange to the size of pipe being tested.

9.3.3.2 Test Failure

The following steps shall be performed when a pipe segment fails the 1 percent pressure drop per 30-minute test.

- The pipe and welds shall be inspected for cracks, pinholes, or perforations;
- 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;
- Pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe; and
- After leaks are repaired, a retest shall be performed in accordance with Section 9.5.3.1.

9.3.3.3 Final Test

- When the total length of the conveyance pipeline exceeds 2,000 feet, a final test shall be made on the completed conveyance pipeline in accordance with Section 9.3.3.1 and 9.3.3.2; and
- The completed system when tested should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test.

9.3.3.4 Test Reporting

Testing shall be reported in writing to the Owner and shall include the following information:

- Date and time;
- Person performing test;
- Name of CQA Consultant;
- Pipe length, size(s), and location;
- Test pressure at 10-minute intervals; and
- Ambient temperature at 10-minute intervals measured in trench for final test.

The following information shall be reported in writing if a failure occurs:

- Nature of leaks found; and
- Details of repair.

The CQA Consultant shall report deviations of testing methods or test results to the Construction Manager.

9.3.4 Cleaning of Pipes

All pipe installed as part of new cell construction shall be cleaned out to remove trimmings, dirt and other deleterious materials prior to placing waste in the new cell.

9.4 HDPE MANHOLES

Manholes constructed from HDPE materials shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.4.1 Manholes

The acceptability of manholes which routinely hold leachate shall be evaluated using a hydrostatic test evaluation. This test will consist of filling the manhole to the design level with water and taking water level measurements over a 30-minute period. The manhole will be acceptable if the water level does not change more than 1-inch.

10.0 FINAL COVER

10.1 INTRODUCTION

This section of the CQA/QC Plan addresses the activities related to construction of the final cover system. The final cover system shall be installed over areas that have received waste and have reached final grades. The final cover system shall consist of the following components (from bottom to top):

- Intermediate Cover (See Section 4.7);
- Final Cover Textured Flexible Membrane Liner (See Section 5.3);
- Geocomposite Drainage Layer (See Section 7 and 8); and
- Final Cover Soil Layer (See Section 4.7).

Each of these components will be discussed in this section of the CQA Plan.

During construction of the final cover system, care will be taken to ensure that existing landfill structures such as gas wells, gas trenches, and bench drains are not damaged or their performance compromised by moving equipment, laborers, or the placement of final cover components. Prefabricated boots or fittings shall be placed around gas wells or other landfill structures that penetrate the landfill final cover to ensure a complete seal. Throughout construction near final cover structures, CQA/QC inspectors, laborers, and equipment operators shall look for possible damage or unusual conditions to structures.

10.2 FINAL COVER GEOSYNTHETICS

Geosynthetics within the final cover system consist of a textured flexible membrane liner (FML) and a geocomposite drainage layer. ~~An additional geotextile cushion layer may be necessary over the intermediate cover soil layer to provide a clean surface for the FML to rest upon (see Section 4.7.1.2 of this CQA/QC Plan for a discussion of this geotextile cushion).~~ The geocomposite drainage layer will be placed upon the FML and collect and drain infiltration from the final cover to designated surface water collection points.

This CQA Plan addresses the field and laboratory tests needed to be performed, prior to and during construction, to evaluate the suitability of the proposed geosynthetics to be used within the final cover system. The sections presented below reference the specific sections that outline the CQA requirements for each geosynthetic within the final cover system.

~~10.2.1 Final Cover Geotextiles~~

~~Section 7.0 Geotextiles, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geotextile materials to be installed with the final cover system.~~

10.2.1~~2~~ Final Cover Geocomposite Drainage Layer

Section 8.0, Geocomposite, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geocomposite to be installed with the final cover system.

10.2.2~~3~~ Final Cover FML

Section 5.0, Geomembrane, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for the proposed FML to be installed with the final cover system.

11.0 SURVEYING

11.1 INTRODUCTION

Surveying of lines and grades shall be conducted during construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, document quantities of soils and geosynthetics, and to assist the Earthwork Contractor in complying with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.

11.2 SURVEY CONTROL

Benchmarks have previously been established for the sites. The vertical and horizontal controls for each site benchmark have been established within normal land surveying standards.

11.3 SURVEYING PERSONNEL

Surveying will be performed under the direct supervision of a qualified Land Surveyor or Professional Engineer licensed in the State of Tennessee. The survey crew will consist of the Senior Surveyor and as many Surveying Assistants as are required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, in addition to preparing detailed and accurate documentation.

11.4 PRECISION AND ACCURACY

The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.01 foot (3.1 mm) with a setting accuracy of 10 seconds. Calibration certificates for survey instruments shall be submitted to the CQA Consultant prior to initiation of surveying activities.

11.5 LINES AND GRADES

When required, the following surfaces shall be surveyed to determine the lines and grades achieved during construction:

- Original ground surface;
- Surface of excavation/structural fill;
- Surface of the ~~recompacted soil liner~~barrier soil layer (for disposal area construction, including edges, bottom, and limits of anchor trenches and sumps);
- Surface of the protective cover layer (including edges, bottom, and limits of pipes and sump);

- Surface of the intermediate soil cover and bench locations following placement of final cover soil layer, see Section 4.7;
- Surface and limits of geosynthetics;
- Anchor trench;
- Alignment and inverts of piping and tanks (both inside and outside the landfill); and
- Profiles, cross sections, ditch inverts, roads, and sedimentation basins.

11.6 FREQUENCY AND SPACING

Surveying shall be performed as soon as possible after completion of a given component installation to facilitate progress and avoid delaying the installation of subsequent components. When survey is utilized to confirm grades and thickness of various liner components, sufficient density of survey points shall be provided to determine that the constructed configuration is consistent with the permitted design. This density shall consist of spot elevations on a frequency of a 100-ft grid in base areas with additional shots at grade breaks, the limit of the area, trenches and other breaks in grade or configuration of the cell.

11.7 TOLERANCES

Acceptable tolerances on survey coordinates, within the waste containment areas, shall be ±0.20 feet (60 mm) on elevations and ±0.20 feet (60 mm) on coordinates, provided minimum permit conditions and state regulations are adhered to (i.e., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to ensure accurate construction of this component.

11.8 DOCUMENTATION

Original field survey notes shall be retained by the Surveyor. A copy of these notes will be given to the CQA Consultant prior to the covering of the surveyed component. The results from the field surveys will be used as the basis for preparation of record drawings. At a minimum, these drawings shall show the final elevations of the surfaces listed in this section of the CQA/QC Plan at a scale of 1-inch (25 mm) equals 100 feet (30 m) with contour intervals no greater than 2 feet (0.6 m).

11.9 CERTIFICATION

Survey results will be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

12.0 DOCUMENTATION

12.1 INTRODUCTION

An effective CQA/QC Plan depends largely on recognition of construction activities that should be monitored and also upon assigning responsibilities for the monitoring of each construction activity. This is most effectively accomplished by the documenting of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, and logs to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain at the job site a complete file of design drawings, design specifications, the CQA/QC Plan, checklists, test procedures, daily logs, and other pertinent documents.

Appendix C contains some example field forms. Additional forms may be necessary for documentation of a specific project. The CQA Consultant may use different forms, but the level of information shall be equal or greater than the forms presented in Appendix C. Additional geosynthetic and soil testing forms will be required to be prepared by the CQA Consultant.

12.2 DAILY RECORDKEEPING

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of a daily summary report including memoranda of meetings and/or discussions with the Owner and/or site contractors, observation logs, and test data sheets. Other forms of daily record keeping being used, as needed, include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Construction Manager.

12.2.1 Daily Summary Report

The CQA Consultant shall prepare a daily summary report which shall include the following information:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- Information on meetings held or discussions which took place:
    - Names of parties to discussion;
    - Relevant subject matter or issues;
    - Decisions reached; and

- Activities planned and their schedule.

- A reduced-scale site drawing showing proposed work areas and test locations;
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found;
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets;
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and
- The CQA Consultant's signature.

12.2.2 Observation Logs and Test Data Sheets

The CQA Consultant's monitoring staff shall record observations of construction and CQA-related activities on project-specific logs and data sheets. At a minimum, the logs and data sheets shall include the following information:

- An identifying sheet numbered for cross referencing and document control;
- Date, project name, location and other identification;
- Description or title of activity monitored;
- Location of activity and locations of samples collected;
- Locations of field tests performed and their results;
- Results of laboratory tests received;
- Results of monitoring activity in comparison to specifications; and
- The CQA Monitor's signature.

12.2.3 Construction Problem and Solution Report

Reports describing special construction situations, as required by the Owner, shall be prepared by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control;

- A detailed description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the corrective action taken to address the situation or deficiency;
- Final results of responses;
- Measures taken to prevent a similar situation from occurring in the future; and
- The signature of the Lead CQA Monitor, EM or AEM, and the Construction Manager indicating concurrence.

The Construction Manager shall be made aware of significant recurring non-conformances with the design specifications. The Construction Manager shall then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the EM or AEM. These changes will be submitted to the Design Engineer for Approval. When this type of evaluation is made, the results shall be documented and revisions to procedures, design specifications, or permit specifications will be approved by the EM or AEM, Design Engineer, and if necessary, TDEC DSWM~~the Permitting Agency~~.

12.2.4 Photographic Reporting

Photographic reporting, where used, shall be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives shall be stored in chronological order. In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

12.2.5 Design and/or Specification Changes

Design and/or permit specifications changes may be required during construction. In such cases, the CQA Consultant shall notify the EM or AEM and Construction Manager. The EM or AEM shall seek the approval of TDEC DSWM~~the Permitting Agency~~ prior to the implementation of substantive changes.

Design and/or permit specification changes shall be made only with the written agreement of the EM or AEM and the Design Engineer and shall take the form of an addendum to the specifications.

12.3 REPORTS

The CQA Consultant shall prepare periodic reports that summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to document the status of the work. Certifications shall be prepared at the completion of major construction activities.

At the completion of the work, final documentation shall be prepared and shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

12.3.1 Progress Reports

The CQA Consultant shall prepare a progress report at regular time intervals established at the Pre-Construction Meeting and submit it to the Construction Manager and EM or AEM. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities performed during the reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the reporting period;
- A summary of test results, failures, and retests; and
- The signature of the CQA Consultant's representative.

The Construction Manager shall distribute copies of the Progress Reports as decided at the Pre-Construction Meeting.

12.3.2 Certification of Major Construction Activities

The CQA Consultant shall prepare a certification for the following items:

- Structural Fill;
- Geologic Buffer Material;
- ~~Recompacted Soil Liner~~Barrier Soil Layer;
- Geosynthetic Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System;
- Erosion and Sedimentation Control Structures;
- Intermediate Cover Soil;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;

- Final Cover Soil;
- Gas Monitoring System;
- Gas Extraction System; and
- Groundwater Monitoring System.

At the time of the Pre-Construction meeting, the landfill construction certification issue will be resolved as to either present certification documentation of each constructed landfill component separately or present the entire completed landfill construction documentation package at the end of construction to satisfy the permitting agency. The certification shall describe activities associated with the construction of the item including construction procedures, observations, and tests performed by CQA personnel. Each certification shall be signed and sealed by a professional engineer registered in Tennessee and submitted to the EM.

12.3.3 Certification Documentation

At the completion of the work, the CQA Consultant shall submit to the EM or AEM the signed Final Certification Documentation. At a minimum, the Final Report shall include:

- Summaries of construction activities;
- Tables demonstrating that the Manufacturer's MARV values for each geosynthetic material meet or exceed the design requirements for the site;
- Observation logs and test data sheets including sample location drawings, supporting field test results, and laboratory test results;
- Construction problem and solution reports;
- Changes from design and material specifications;
- Record drawings; and
- Completed, signed, and sealed TDEC Certification Statement.

The record drawings shall include scaled drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, drawing dimensions, elevations, soil component thicknesses, etc.). Surveying and base maps required for development of the record drawings shall be prepared by a qualified land surveyor.

12.4 STORAGE OF RECORDS

Handwritten data sheet originals, especially those containing signatures, shall be stored by the CQA Consultant in a safe repository on-site. Other reports may be stored by standard methods which will allow for easy access.

APPENDIX A

CQA/QC PLAN TESTING SUMMARIES

TABLE A-1
LABORATORY TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Grain Size Distribution and Hydrometer Analysis	Particle Size Distribution of Coarse- and Fine-Grained Soils. USDA Classification	ASTM D6913/D7928
Grain Size Distribution for Aggregates	Particle Size Distribution for Aggregates	ASTM C136
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
~~LA Abrasion~~	~~Resistance to degradation of small- and large-sized coarse aggregate~~	~~ASTM C131/C535~~
Standard Proctor	Moisture / Density Relationship, 5.5 lb. hammer and 12-inch drop	ASTM D698
Flexible Wall Permeability	Permeability of Undisturbed or Remolded Samples	ASTM D5084
Constant Head Permeability	Permeability of Aggregates	ASTM D2434
Carbonate Content	Carbonate Content of Aggregates	ASTM D3042[1]

(1) Testing shall be performed at a pH equal to 4.0. See additional requirements in Table A-3.

TABLE A-3
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
EXISTING GRADE & PREPARED EXCAVATION GRADE – GEOLOGIC BUFFER ~~ZONE~~	Visual Inspection	As Required	NA	No Excessive Pumping or Rutting are evident from Proof Rolling (1) If rock pinnacle is present, identify lateral extent of rock, and isolate the pinnacle to sufficient depth (2 to 3 feet) by overexcavation, and backfill with soil.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \le 1x10^{-6}$ cm/sec max. for fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	8-inch Max. Compacted, No Bridging
STRUCTURAL FILL (See Note 3)	Grain Size (ASTM D6913)	Borrow Areas or Stockpiles: One test per soil type	75 lbs.	100% ≤ 12~~24~~ ~~-~~inch 80-100% ≤ 6 ~~-~~inch 50-100% ≤ 2- ~~inch~~inch 20-100% ≤ No. 10 sieve 40~~0~~-10~~5~~0%≤ No. 200 sieve
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement (2)	NA	12~~4~~-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area/stockpile
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One per soil type	(taken from grain size sample)	None – This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \le 1x10^{-6\cancel{5}}$ cm/sec max. for structural fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Field Density (ASTM D6938)	Placed: One test per acre per lift	NA	95% of MDD Min. and ± 4% of OMC as determined by the Standard Proctor test
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	12~~24~~-inch Max. Uncompacted, No Bridging

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
BARRIER~~RECOMPACTED~~ SOIL LINER	Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 24-inch thickness	50 lbs.	No protrusions ~~Fragments~~ > 3/4~~2~~ inch~~es~~ on Surface 100% ≤ 1-1/2 inches 90-100% ≤ ¾-inch sieve 25-90 % ≤ No. 200 sieve 18-90% ≤ 0.002 mm PI ≥ 10
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One test per 5,000 cubic yards for each soil type	50 lbs.	None. This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One test per 10,000 cubic yards for each soil type	(taken from Proctor samples)	k ≤ $1x10^{-7}$ cm/sec max. Used to establish moisture-density/permeability window.
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content as determined by remolded samples with permeabilities less than or equal to $1x10^{-7}$ cm/sec
	Flexible Wall Permeability (Undisturbed) (ASTM D5084)	Placed: One Shelby tube per lift per 3 acres	Shelby Tube	k ≤ $1x10^{-7}$ cm/sec max.
	In-Place Moisture Confirmation	Visual inspection of each lift, during or following placement	N/A	Visually confirm that moisture of recompacted soil liner is uniform and that test location is representative of area to be covered by test. (Utilize Field Form for Documentation of Visual Inspection)
	Lift Thickness Verification	Placed: 4 per acre per lift	NA	Individual lifts ≤ 8 inches compacted thickness Completed barrier soil layer ~~liner~~ 24 inches min. (surveyed)

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
ANCHOR TRENCH BACKFILL	Grain Size	Placed: Visual during or following placement of each lift	NA	Utilize Barrier~~Recompacted~~ Soil Liner material or similar fine-grained material
	Field Density (ASTM D6938)	Placed: One test per 200-lf per lift, starting with second lift of backfill	N/A	Equal to or greater than 90% of the MDD and ±4% the OMC
	Lift Thickness Verification	Placed: Visual, as required	NA	18-inch compacted, maximum

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM PASSIVE LFG VENTING SYSTEM (AGGREGATE)	Grain Size Distribution (ASTM C136)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs.	Washed AASHTO No. 57 100% ≤1½-inch sieve 95-100% ≤1-inch sieve 25-60% ≤½-inch sieve 0-10% ≤ No 4 sieve 0-5% ≤ No 8 sieve 0-5% ≤ No 200 sieve (In-Place) 0-2% ≤ No. 200 sieve (Stockpile) Washed AASHTO No. 3 100% ≤ 2~~1~~½-inch sieve 90~~5~~-100% ≤ 2~~1~~-inch sieve 3~~2~~5-7~~6~~0% ≤ 1-½-inch sieve 0-15~~0~~% ≤ 1-inch sieve~~No. 4 sieve~~ 0-5% ≤ ½-inch sieve~~No. 8 sieve~~ ~~TDOT No. 4~~ ~~100% ≤ 1½-inch sieve~~ ~~95-100% ≤ 1-inch sieve~~ ~~25-60% ≤ ½-inch sieve~~ ~~0-10% ≤ No. 4 sieve~~ ~~0-5% ≤ No. 8 sieve~~
	Constant Head Permeability (ASTM D2434)	Stockpile: One per 20,000 tons, Minimum one test per source	(taken from grain size sample)	$1x10^{-2}$ cm/sec Minimum
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.
	Carbonate Content (ASTM D3042) (Test solution pH equal ~~modified~~ to 4.0) [5]	Stockpile: One per 10,000 tons, Minimum one test per source	(taken from grain size sample)	12~~5~~% Max., by weight
	~~Los Angeles Abrasion (ASTM C151/C535)~~	~~Stockpile: One per 10,000 tons, Minimum one test per source~~	~~75 lbs~~	~~≤30% mass loss after 500 revolutions or ≤20% mass loss between 200 and 1000 revolutions~~

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (SOIL)	Grain Size Distribution (ASTM D6913/D7928)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs.	100% ≤1-1/2-inch sieve 75-100% ≤3/4- inch sieve 55-90% ≤1/2-inch sieve 35-90% ≤ No 4 sieve 35-80% ≤ No 8 sieve 0-70% ≤ No 200 sieve (In-Place)
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
SUMP AGGREGATE	Grain Size (ASTM C136)	Stockpile: One per source	100 lbs.	Washed AASHTO No. 3 100% ≤ 2½-inch sieve 90-100% ≤ 2-inch sieve 35-70% ≤ 1-½-inch sieve 0-15% ≤ 1-inch sieve 0-5% ≤ ½-inch sieve ~~100% ≤ 2.5-inch~~ ~~90-100% ≤ 2-inch~~ ~~35-70% ≤ 1.5-inch~~ ~~0-15% ≤ 1-inch~~ ~~0-2% ≤ ½-inch~~
	Carbonate Content (ASTM D3042) (Test solution pH to be equal to 4.0.)[5]	Stockpile: One per source	(taken from grain size sample)	12~~5~~% Max., by weight
	~~Los Angeles Abrasion (ASTM C151/C535)~~	~~Stockpile: One per 10,000 tons, Minimum one test per source~~	~~25 lbs~~	~~≤30% mass loss after 500 revolutions or ≤20% mass loss between 200 and 1000 revolutions~~

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
INTERMEDIATE COVER AND COMPACTED SOIL~~INTERMEDIATE~~ COVER	Composition/Performance	Placed: Intermediate Cover - Visual Observation by Landfill Personnel Place: Compacted Soil Cover – Observation and Testing by CQA Consultant	N/A N/A	Intermediate Cover shall be: (1) Prevent odors, blowing li~~e~~tter and other nuisances. (2) Cover solid waste after it is placed without change in its properties and without regard to weather. (3) Allow loaded vehicles to maneuver over it after placement. (4) Capable of controlling flies and other vectors~~ile~~. (5) Control infiltration of precipitation and erosion & sedimentation. ~~(6) Support germination and propagation of vegetative cover.~~ Compacted Soil Cover shall: (1) Provide uniform support for the overlying FML. (2) Be firm and non-yielding. (3) Not have rocks, debris, or protrusions greater than 3/4 inch size on the top surface.
	Compacted Soil ~~Intermediate~~ Cover – Surface Preparation	Placed: Visual Inspection Following Placement, prior to installation of final cover geosynthetics, rework/restore as necessary	N/A	Upper surface shall be smooth and not contain deleterious materials. See CQA/QC Plan Text Section 4.7.2~~1~~.2~~1~~.
	Compacted Soil Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 12-inch thickness	50 lbs.	No protrusions > 3/4 inch on Surface 100% < 1-1/2 inches 90-100% < ¾-inch sieve 25-90 % < No. 200 sieve 18-90% < 0.002 mm PI ≥ 10
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content within 0 to 4% of Optimum per ASTM D698

	Lift Depth Check	Placed: Test pit as needed during placement, 1 per acre for Intermediate Cover and 1 per 10,000 square feet for Compacted Soil Cover prior to FML deployment~~cap construction~~.	NA	Soil or Soil-like: the layer shall be 12-inch thick for both intermediate cover~~,~~ and 8~~6-inch thick for~~ compacted soil ~~intermediate~~ cover.

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
FINAL COVER SOIL	Grain Size (ASTM D6913/D7928) and USDA Classification	Borrow Area or Stockpile: One test on a composite sample per soil type Placed: One Test per acre	25 lbs.	6~~12~~-inch Max., 40% Min. Passing No. 10 sieve
	Fertilizer and Lime Requirements	NA~~Placed: One Test per 5-acre composite~~	NA~~2 lbs~~	Testing and acceptance per Project Technical Specifications~~Used to determine lime and fertilizer application rates~~
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement	NA	3~~12~~-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area
	Thickness	Placed: One test per acre	NA	2~~3~~-feet Min. (test pits or survey following installation of final cover soil)

(1) If firm strata cannot be established utilizing excavation and replacement of suspect soils, a layer of geotextile overlain by structural fill, or other prudent repair activities may be utilized.

(2) In addition to the inspection of completed structural fill lifts, the CQA Technician shall monitor placement of structural fill to confirm construction materials and practices.

(3) Santek/Republic shall use a modified structural fill material on the approximate interior half of the perimeter berms. More specifically, for portions of the perimeter berm which require fill to meet design grades, the interior slope of the perimeter berm shall be constructed using a modified structural fill material. The modified structural fill material shall be capable of providing a hydraulic conductivity of 1 x 10^{-5} cm/s or less. Modified structural fill material shall consist of soils with Unified Soils Classification System (USCS) soil designations of CH, GC, CL, or SC. The top size of the material shall be 6 inches. Santek/Republic shall perform sampling and laboratory testing for a proposed modified structural fill material source one time per construction event to demonstrate it is capable of achieving the parameters identified here. Also, with the exception of the parameters identified here, all other structural fill test, frequency, sample size, and acceptance criteria apply to the modified structural fill material.

(4) Testing~~,~~ of the compacted soil cover ~~intermediate cover~~ soil should occur as close as practical to the day the FML installation is planned. All degraded areas as described in Section 4.7.2.2 will be restored prior to FML deployment.

(5) Leachate pH testing to be completed by an independent certified laboratory selected by the CQA Consultant. Information about the

material supplier and quarry location will be provided. Written test results signed by the CQA Consultant shall be provided to the Owner prior to purchasing the material. It is the Operator's responsibility to manage and adhere to this process.

REVISED PERMIT DRAWINGS

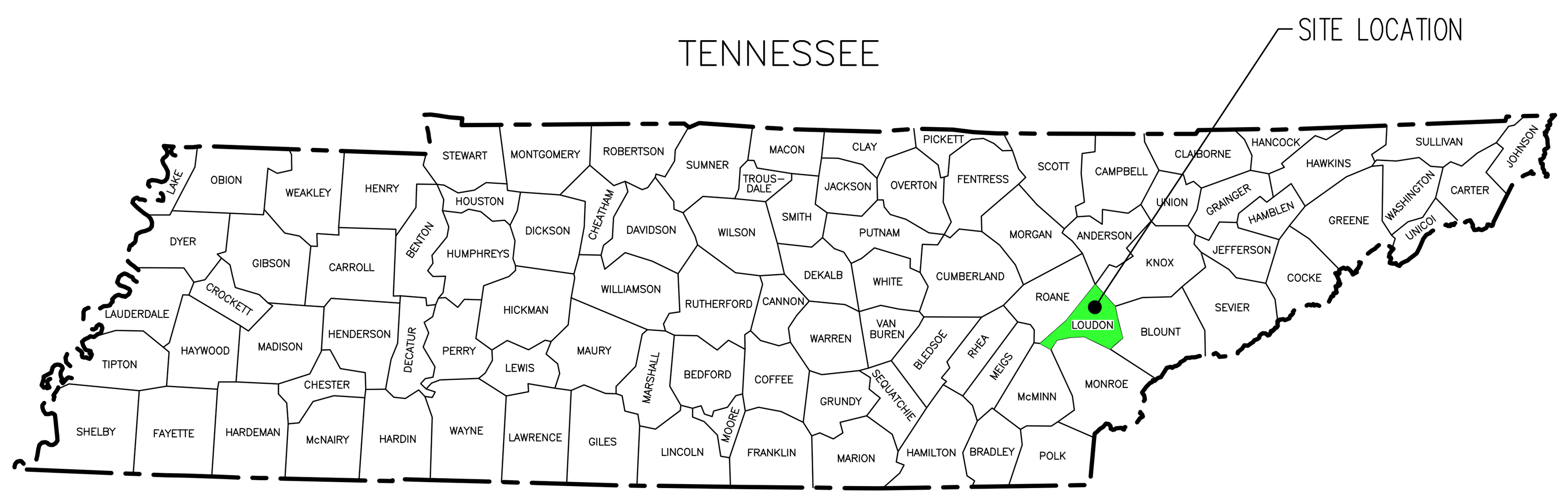
MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

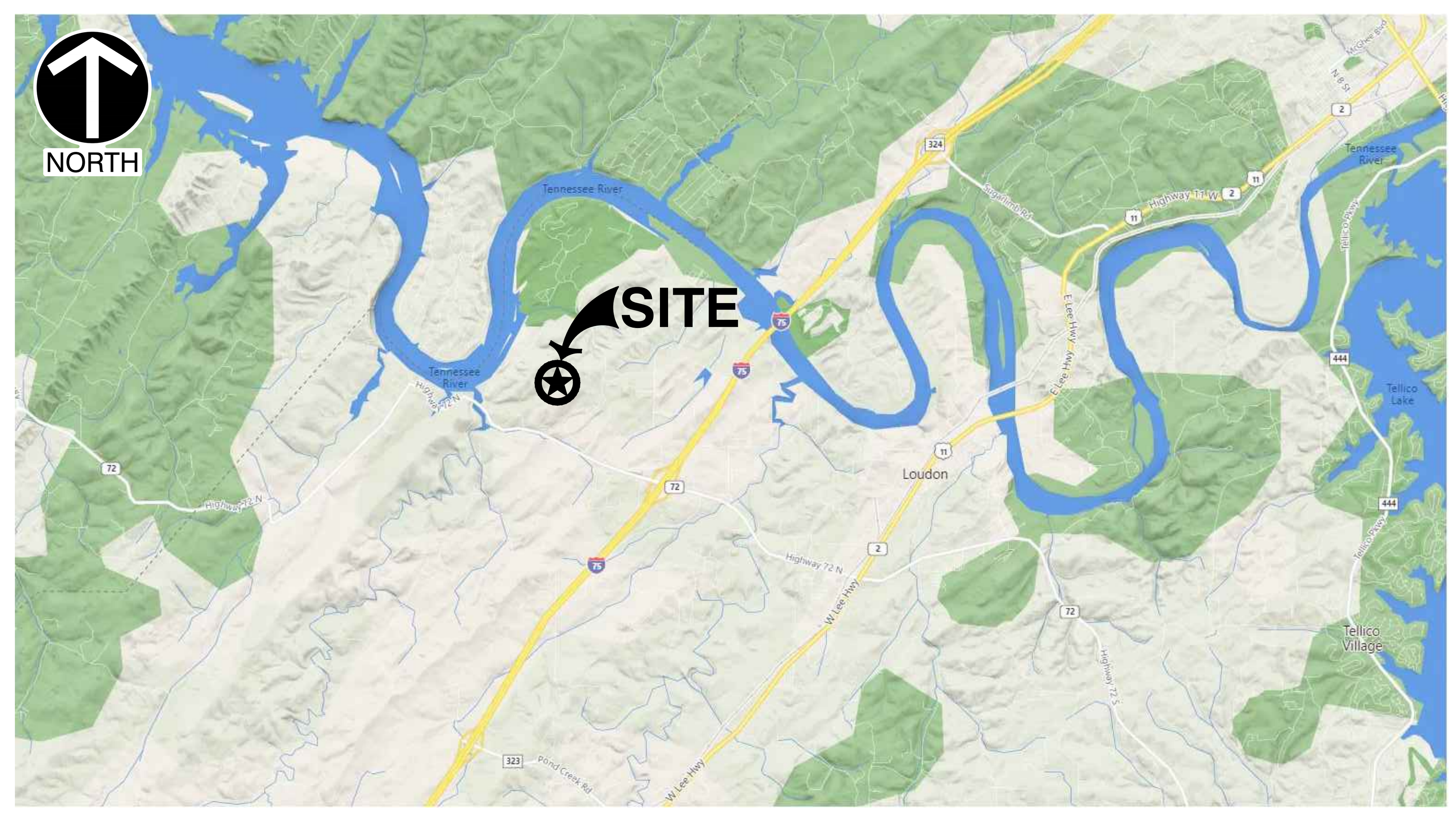
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
PERMIT NO. SNL #530000203

SEPTEMBER 2023
REVISED AUGUST 2024
REVISED APRIL 2025

PREPARED FOR:

REPUBLIC SERVICES





VICINITY MAP
NOT TO SCALE

CEC
Civil & Environmental Consultants, Inc.
117 Seaboard Ln; Suite E-100
Franklin, Tennessee 37067
(615) 333-7797 (800) 763-2326

SHEET LIST TABLE

DRAWING NUMBER	SHEET TITLE	REV. NUMBER
P-000	COVER SHEET	3
P-100	OVERALL EXISTING SITE CONDITIONS	3
P-101	PHASE 1 EXPANSION EXISTING CONDITIONS	2
P-200	PROPOSED FILL PROGRESSION	3
P-201	TOP OF PROTECTIVE COVER GRADING PLAN	3
P-202	LEACHATE MANAGEMENT PLAN	3
P-204	PHASING DRAWING - MODULES 1 AND 2 DEVELOPMENT	2
P-205	PHASING DRAWINGS - MODS 1 AND 2 INTERIM GRADING AND CA-1 FINAL	2
P-206	PHASING DRAWINGS - MOD 3 DEVELOPMENT F	2
P-207	PHASING DRAWINGS - MOD 3 FILLING AND CLOSURE AREA CA-2	2
P-208	PHASING DRAWINGS - CLOSURE AREA CA-3	2
P-209	PHASING DRAWINGS - CLOSURE AREA CA-4	2
P-210	PHASING DRAWINGS - CLOSURE AREA CA-5	3
P-215	TOP OF INTERMEDIATE GRADES	3
P-220	FINAL GRADING PLAN	3
P-230	STORMWATER MANAGEMENT PLAN	3
P-231	SEDIMENT BASIN 2 PLAN AND DETAILS	
P-232	SEDIMENT BASIN 3 PLAN AND DETAILS	
P-233	SEDIMENT BASIN 4 PLAN AND DETAILS	3
P-234	SEDIMENT BASIN DETAILS	
P-235	SEDIMENT BASIN DETAILS AND STORMWATER MANAGEMENT TABLE	
P-250	LANDFILL GAS VENTING PLAN	3
P-301	CROSS-SECTION A-A'	2
P-302	CROSS-SECTION B-B'	2
P-303	CROSS-SECTION C-C'	2
P-600	LINER SYSTEM DETAIL (SHEET 1 OF 3)	2
P-601	LINER SYSTEM DETAIL (SHEET 2 OF 3)	2
P-602	LINER SYSTEM DETAIL (SHEET 3 OF 3)	
P-610	LEACHATE MANAGEMENT DETAILS (SHEET 1 OF 5)	2
P-611	LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)	
P-612	LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)	2
P-613	LEACHATE MANAGEMENT DETAILS (SHEET 4 OF 5)	
P-614	LEACHATE MANAGEMENT DETAILS (SHEET 5 OF 5)	2
P-615	PIPE PENETRATION DETAILS (SHEET 1 OF 4)	2
P-616	PIPE PENETRATION DETAILS (SHEET 2 OF 4)	2
P-617	PIPE PENETRATION DETAILS (SHEET 3 OF 4)	2
P-618	PIPE PENETRATION DETAILS (SHEET 4 OF 4)	3
P-620	FINAL COVER DETAILS (SHEET 1 OF 1)	3
P-630	LANDFILL GAS AND GROUNDWATER MONITORING DETAILS (SHEET 1 OF 1)	
P-640	EROSION AND SEDIMENT CONTROL DETAILS (SHEET 1 OF 1)	
P-650	STORMWATER MANAGEMENT DETAILS (SHEET 1 OF 1)	2
P-651	MISCELLANEOUS DETAILS (SHEET 1 OF 1)	2

NOTE:
ALL DRAWINGS IN THIS SET ARE PERMIT-LEVEL AND ARE NOT FOR CONSTRUCTION

BOGDAN MICHAEL YACISHYN
STATE OF TENNESSEE
No. 130544
4/4/2025
*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
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615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

COVER SHEET

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	EDC*

DRAWING NO.: P-000

P:\310-000\317-474\-0400\Dwg\SWOR_317474-SWOR-P000-COVER.dwg{P-000} LS:(4/4/2025 - kunderwood) - LP: 4/4/2025 8:32 AM

STAGE STORAGE TABLE

Elevation	Surface area (sf)
844	11313
845	12118
846	13219
847	14356
848	15528
849	16735
850	21699
851	23608
852	25667
853	27764
854	30454
855	32019
856	33640
857	35261
858	36929
859	38530
860	40156
861	42192
862	44096
863	46021

Existing Peak Outflows

25-YR	12.15
100-YR	66.35

Proposed Peak Inflows

Event	Flow (cfs)
5-YR	72.28
25-YR	119.30
100-YR	162.59

Proposed Peak Outflows (Req. skimmer only)

Event	Flow (cfs)
25-YR	36.52
100-YR	53.80

Proposed Peak Outflows (All Skimmers)

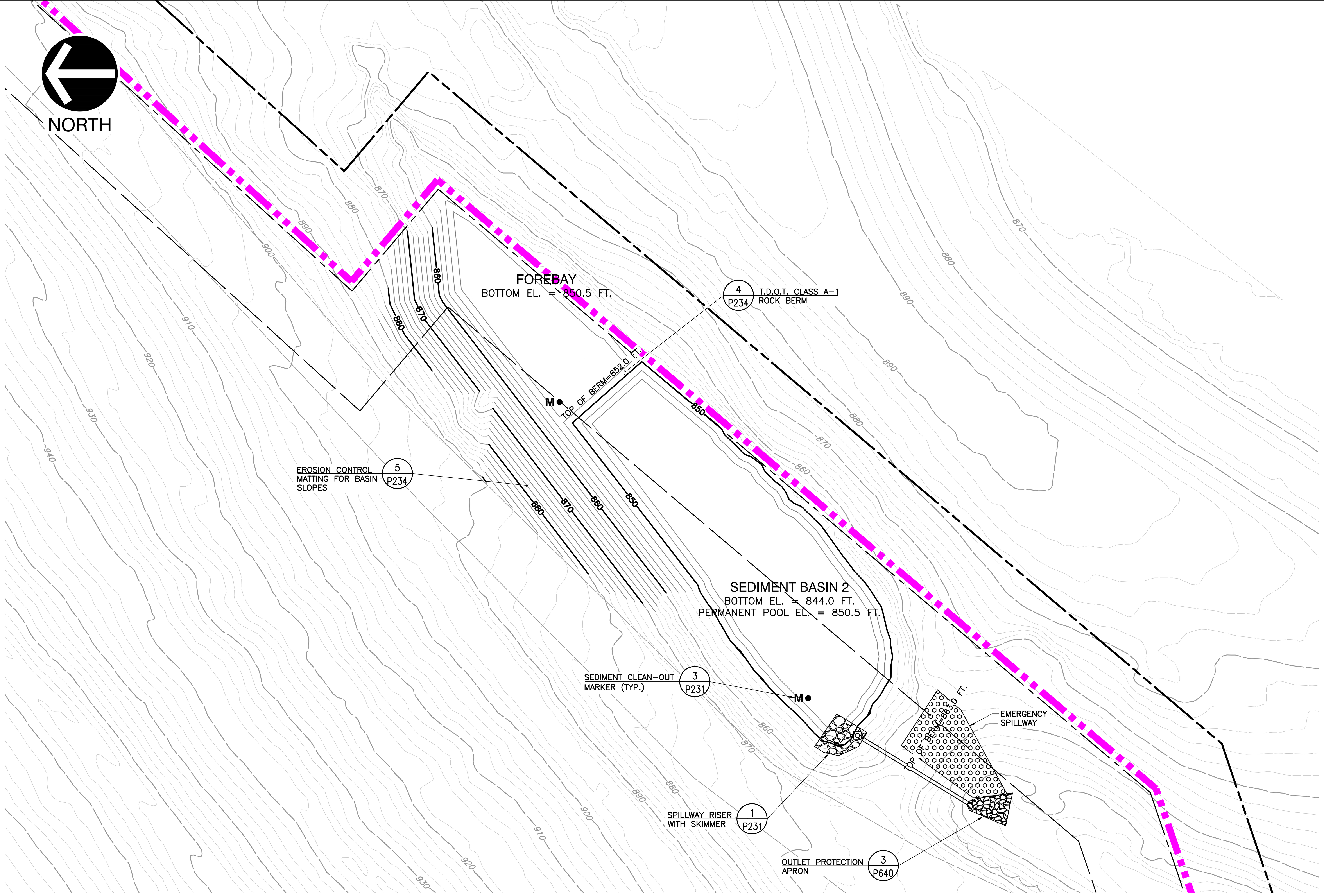
Event	Flow (cfs)
25-YR	35.24
100-YR	53.28

Proposed Peak Outflows (Worst Case)

Event	Flow (cfs)
25-YR	21.99
100-YR	51.19

BASIN SUMMARY TABLE

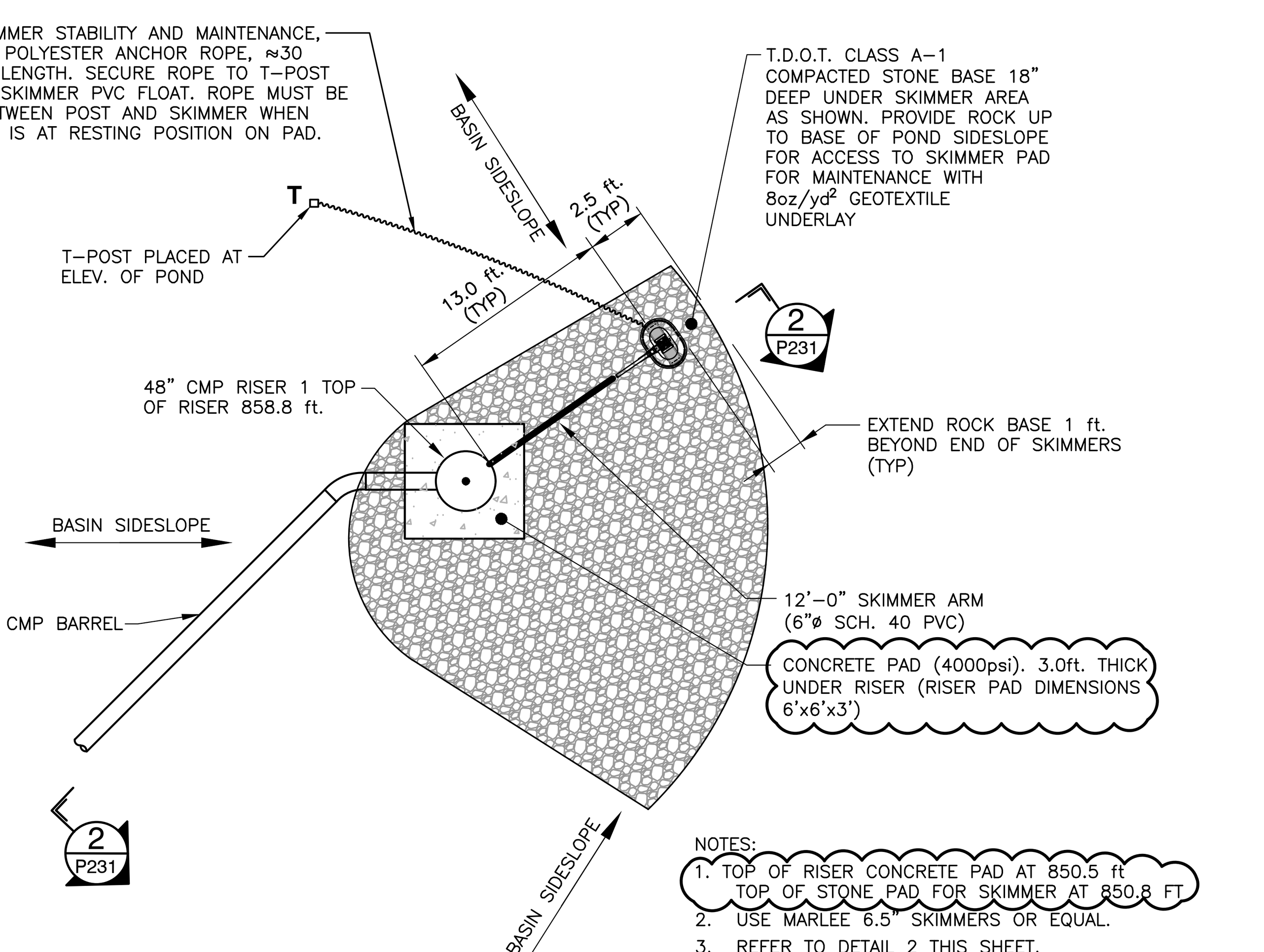
BASIN DESIGN DETAILS			
Total Watershed Area for Proposed Basin		50.448	acres
Number of SubWatersheds		20	
TDEC EPSC Handbook Required Volume for Wet Storage (67 cy/acre drainage area)		3,380	cy
Actual Wet Storage Volume		3,693	cy
TDEC EPSC Handbook Required Volume for Dry Storage (67 cy/acre drainage area)		3,380	cy
Actual Dry Storage Volume from Top of Rock Pad for Skimmer to Top of Riser		9,501	cy
Required Minimum Surface Area (0.01 x 5-Year 24-Hour Peak Inflow)		0.72	acres
Actual Basin Surface Area at Top of Riser		0.86	acres
Approximate Length:Width Ratio		3:1	
Required Forebay Storage (Minimum of 25% of Required Dry Storage Volume)		2375	cy
Actual Forebay Volume		2,377	cy
Forebay Spillway Elevation		852.00	ft
Maximum Water Storage Volume for Basin from Bottom to Top Crest of Dam		12.22	ac-ft
Maximum Height of Dam from Top of Dam to Downstream Toe		13	ft
Does Basin Fall Under TN Safe Dams Regulation?		No	
Principal Spillway Riser Type and Diameter		48" CMP	
Barrel Type and Diameter		36" CMP	
Barrel Slope and Length		80 ft. at 4.37%	
Base Elevation of Riser (Top Elevation of Riser Concrete Base)		850.50	ft
Elevation of Top of Riser Pipe		858.80	ft
Number of Skimmers Required		1	
Size of Each Skimmer	Marlee	6.5	in. or equal
Maximum Discharge Rate of Skimmer		1.17	cfs
Length of Skimmer Arm		12.0	ft
Inter-Storm Event Drain Rate for Basin for 25 yr/24 hr event		2.90	days
*Allowable Basin Maximum Flux Rate for 5 Micron Capture (90% reduction of Fine Silt to Course Clay)		1.3E-04	cfs/ft²
Actual Basin Maximum Flux rate		7.5E-05	cfs/ft²
Peak Elevation in Basin During 25/yr Storm		859.70	ft
Combined Peak Discharge for Riser and Skimmer System During 25 yr/24-hr Storm		36.00	cfs
Barrel Peak Velocity During 25/yr/24-hr Storm		3.18	fps
Required Erosion Protection at Barrel Outlet Based on Peak Shear and Velocity		TDOT Class A1 Stone (D_{50} = 9 inches)	
Peak Elevation in Basin During 100/yr Storm		859.98	ft
Type of Emergency Spillway Weir		Broadcrested / V-Shaped Opening	
Emergency Spillway Crest Elevation		861.14	ft
Emergency Spillway Crest Width		0	ft
Barrel Peak Velocity During 100/yr/24-hr Storm		3.59	fps
Required Erosion Protection at Barrel Outlet Based on Peak Shear and Velocity		TDOT Class A1 Stone (D_{50} = 9 inches)	
Peak Elev. for 100/yr Storm with W.S.E starting at Em. Spillway Crest and Riser/Skimmers Plugged		861.41	ft
Peak Flow through Spillway (Plugged Scenario)		51.19	cfs
Peak Velocity through Weir Section (Plugged Scenario)		1.63	fps
Maximum Shear Within Weir Section (Plugged Scenario)		0.79	psf
Required Erosion Protection at for Weir Section Based on Peak Shear and Velocity (Plugged Scenario)		Flexamat (NAG C350, or equiv.may be substiuted within weir)	
Peak Velocity through Down-Chute of Spillway (Plugged Scenario)		12.79	fps
Maximum Shear on the Down-Chute Section (Plugged Scenario)		17.09	psf
Required Erosion Protection for Down-Chute Based on Peak Shear and Velocity (Plugged Scenario)		Flexamat	



PLAN VIEW - SEDIMENT BASIN 2

SCALE: 1"=40'

PRINCIPAL SPILLWAY TABLE							
PIPE	RISER DIA. (in)	BARREL DIA. (in)	BARREL LENGTH (ft)	BARREL SLOPE (%)	BARREL OUTLET I.E. (ft)	TOP OF RISER (ft)	BARREL INLET (ft)
CMP	48	36	80	4.37	847	858.8	850.5



NOTES:
1. TOP OF RISER CONCRETE PAD AT 850.5 ft
   TOP OF STONE PAD FOR SKIMMER AT 850.8 FT
2. USE MARLEE 6.5" SKIMMERS OR EQUAL.
3. REFER TO DETAIL 2 THIS SHEET.

1 SPILLWAY RISER WITH SKIMMER DETAIL

NOT TO SCALE

DETAIL 2 NOTES:

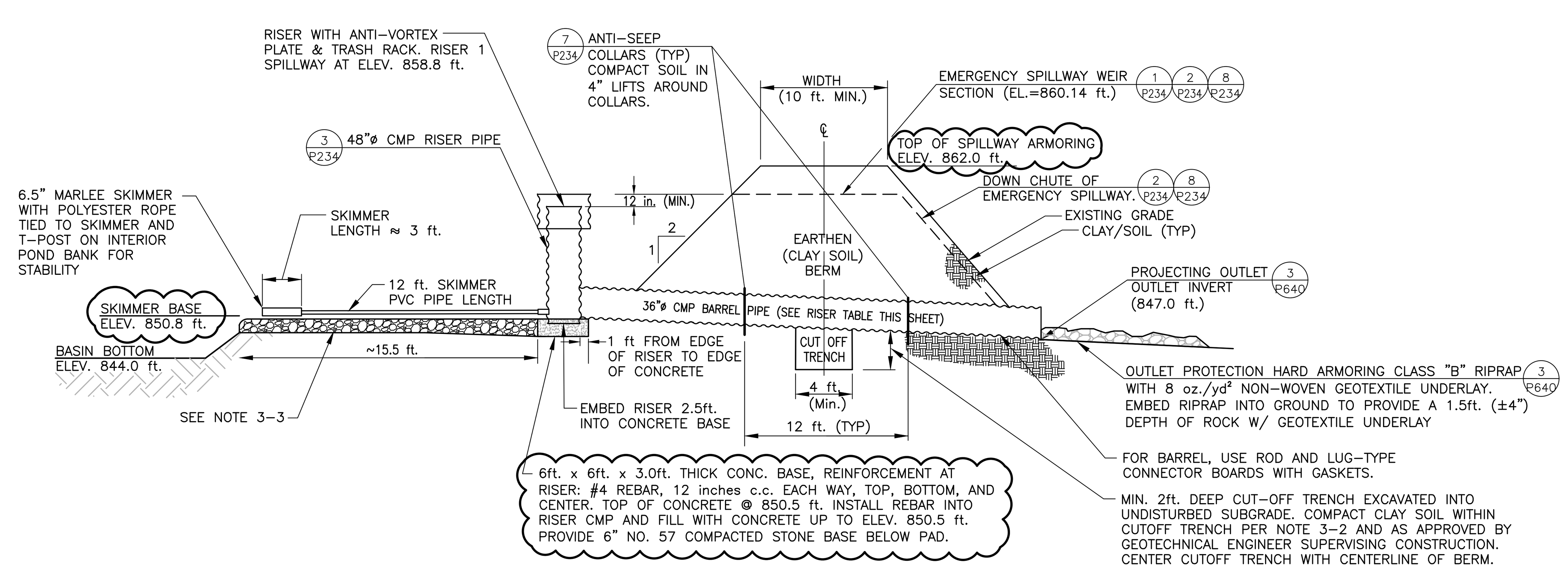
3-1. PROVIDE PERMANENT STAKE OR POST MONUMENT IN WET POOL AREA THAT SHALL BE MARKED AT THE CLEAN-OUT ELEVATION. POND SHALL BE CLEANED AS DEEMED NECESSARY BY ON-SITE INSPECTIONS.

3-2. BERM SOIL MATERIAL SHALL BE PLACED UNDER THE SUPERVISION OF A TN REGISTERED PROFESSIONAL GEOTECHNICAL ENGINEER. MINIMUM REQUIREMENTS FOR PLACEMENT OF SOIL FOR BERM CONSTRUCTION IS TO REMOVE ALL ORGANICS (TOP SOIL), VEGETATION, TREES, STUMPS, ETC. AND SCARIFY SURFACE 8-10 INCHES. PLACE BERM SOIL IN 8" LOOSE LIFTS, COMPACTED TO 95% STANDARD PROCTOR DENSITY, ± 3% OF OPTIMUM. SOIL USED FOR BERM CONSTRUCTION SHALL BE CLASSIFIED AS CLAY SOILS AND APPROVED BY THE GEOTECHNICAL ENGINEER SUPERVISING CONSTRUCTION.

3-3. USE T.D.O.T. CLASS A-1 STONE (COMPACTED) FOR SKIMMER PAD BEDDING WITH 8oz/yd² GEOTEXTILE UNDERLAY. (18" THICK).

3-4. BOTH RISER AND BARREL OF PRINCIPAL SPILLWAY SHALL BE POLYMER-COATED CORRUGATED METAL PIPE.

3-5. SEED, FERTILIZE AND MULCH BERM TOP AND SIDE SLOPES TO PROMOTE VEGETATIVE STABILIZATION. COVER SIDE SLOPES WITH NORTH AMERICAN GREEN (NAG) OR EQUAL MATTING.



2 CROSS-SECTION: SPILLWAY RISER WITH SKIMMER

NOT TO SCALE

LEGEND

EXISTING CONTOUR (10' INTERVAL)
EXISTING CONTOUR (2' INTERVAL)
PROPOSED CONTOUR (10' INTERVAL)
PROPOSED CONTOUR (2' INTERVAL)

FLEXAMAT

RIP-RAP (T.D.O.T. CLASS A-1 (D_{50} = 9 INCHES) @ 1.5 ft. DEEP WITH 8oz/yd² NON-WOVEN NEEDLE-PUNCHED GEOTEXTILE UNDERLAY)

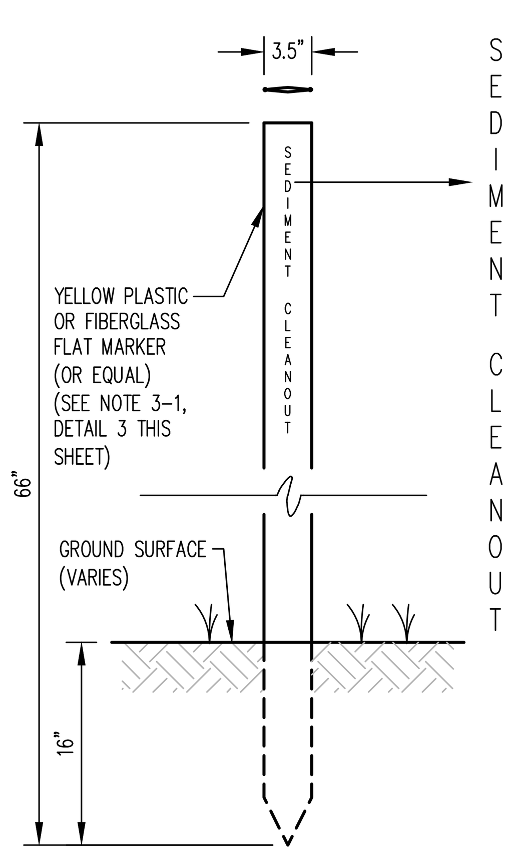
RIP-RAP (T.D.O.T. CLASS B (D_{50} = 15 INCHES) @ 1.5 ft. DEEP WITH 8oz/yd² NON-WOVEN NEEDLE-PUNCHED GEOTEXTILE UNDERLAY)

NAG C350 TURF REINFORCEMENT MAT (OR EQUAL) 6 P234 8 P234

M● SEDIMENT CLEAN-OUT MARKER 3 P231

T▫ 1.25 lb/ft., 60-INCH LENGTH METAL T-POST WITH ANCHOR PLATE WITH MIN. 14 sq. INCHES.

POLYESTER ROPE FOR SKIMMER STABILITY



3 SEDIMENT CLEAN-OUT MARKER

NOT TO SCALE

OPERATIONS NOTE:

1. AN INSPECTION OF THE PRINCIPAL SPILLWAYS AND SKIMMERS MUST BE PERFORMED PRIOR TO ANY FORECASTED STORM EVENTS TO ENSURE THERE ARE NO OBSTRUCTIONS. THE INSPECTION SHOULD ALSO INCLUDE VISUAL CONFIRMATION THAT THE WATER LEVEL INSIDE THE BASIN IS AT THE SAME ELEVATION AS THE INVERT OF THE PVC ARM OF THE SKIMMER ASSEMBLIES AT THE INTERSECTION WITH THE RISER (I.E., THE SKIMMER IS RESTING ON TOP OF THE GRAVEL BASE).

GENERAL NOTES

1. THE DESIGN OF THIS BASIN IS INTENDED TO MEET THE REQUIREMENTS FOR BASINS IN THE TENNESSEE DIVISION OF SOLID WASTE MANAGEMENT REGULATIONS, RULE 0400-11-01-04(2)(i).
2. SEED, FERTILIZE AND COVER WITH EROSION-CONTROL MATTING ON THE INTERIOR AND EXTERIOR SIDE SLOPE SURFACE AREA OF PROPOSED BASIN.
3. PROVIDE ANTI-VORTEX PLATE AND TRASH RACKS ON THE RISER ASSEMBLY.
4. PROVIDE ONE 6.5 INCH MARLEE SKIMMERS FOR RISERS.
5. PROVIDE OUTLET PROTECTION (HARD ARMORING) BELOW BARREL OUTLETS.
6. CLEAN-OUT ELEVATION IN BASIN IS TO BE ESTABLISHED AT 847.0 FT. WITHIN BASIN AND 851.0 FT. IN FOREBAY.
7. CLEAR PROPOSED POND LOCATION OF ALL TOPSOIL, VEGETATION INCLUDING TREES AND STUMPS. FILL ALL STUMP HOLES AND CREVICES WITH LOW-PERMEABILITY SOILS.
8. SCARIFY POND BASE SOILS TO A DEPTH OF 8-10 INCHES WITH A DISK, ROTO-TILLER OR OTHER SIMILAR EQUIPMENT. REMOVE ALL ROCKS AND TREE ROOTS.
9. COMPACT THE SOIL SUB-GRADE MAKING 4-6 PASSES WITH A SHEEPSFOOT ROLLER OVER THE SCARIFIED LAYER, ADDING MOISTURE AS NEEDED TO MAXIMIZE COMPACTION.

REFERENCES:

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED DECEMBER 15, 2022.
2. PROPERTY LINE, ADJACENT PROPERTY LINES, MONITORING WELLS, AND BUFFER ZONES FROM SOUTHERN RESOURCES MAPPING CORPORATION PLAN, DATED FEBRUARY 2016.

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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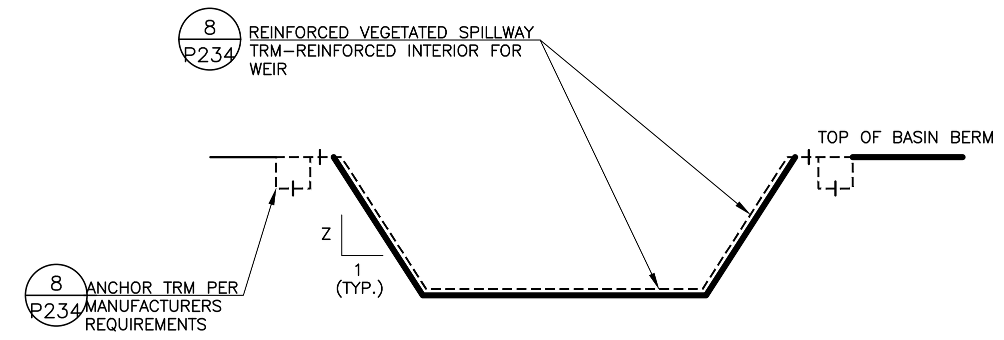
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

SEDIMENT BASIN 2 PLAN AND DETAILS

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

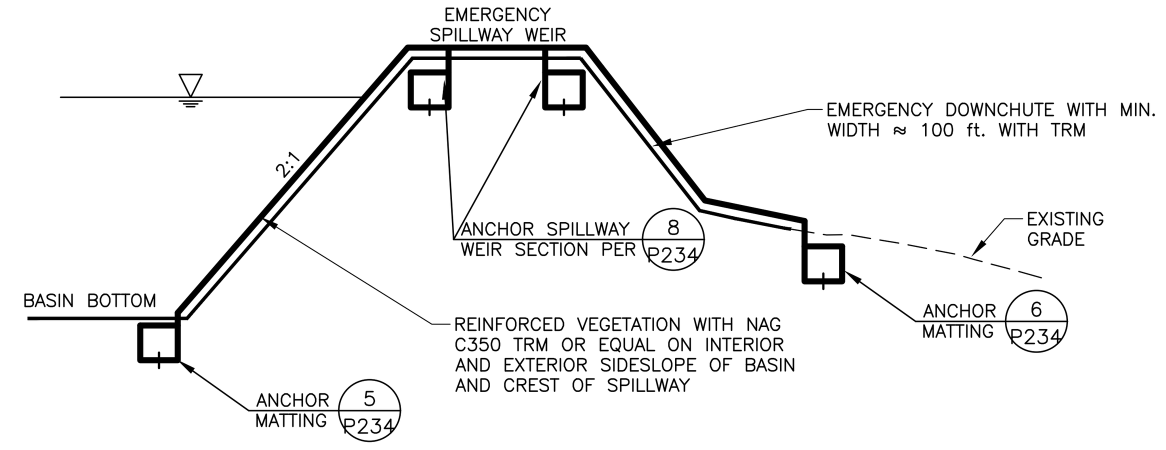
DRAWING NO.: P-231



Emergency Spillway Weir				
Basin	Elevation (FT)	Bottom Width (FT)	Depth (FT)	Z
Sediment Basin 2	861.14	0	1.86	9.6
Sediment Basin 3	872	65	1.86	3
Sediment Basin 4	909	19.3	1.86	3

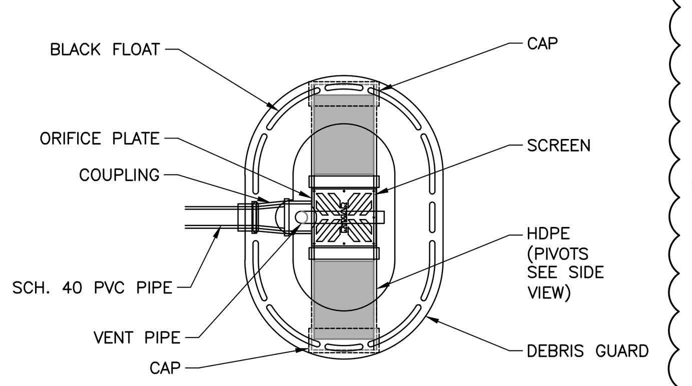
1 EMERGENCY SPILLWAY WEIR SECTION (TYP.)

NOT TO SCALE

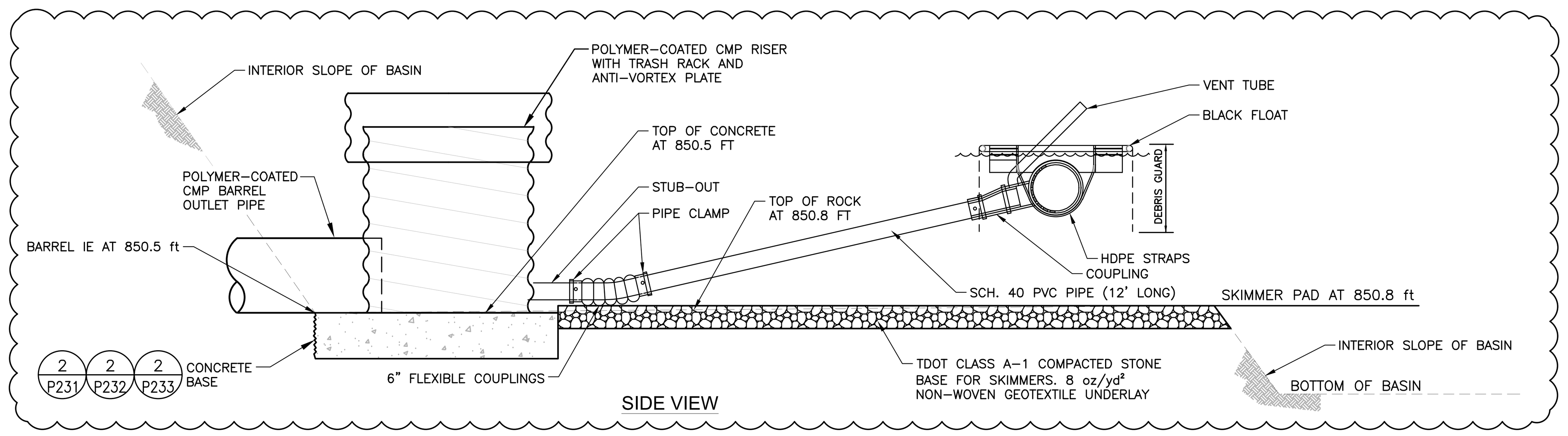


2 EMERGENCY DOWNCHUTE SECTION (TYP.)

NOT TO SCALE



TOP VIEW



SIDE VIEW

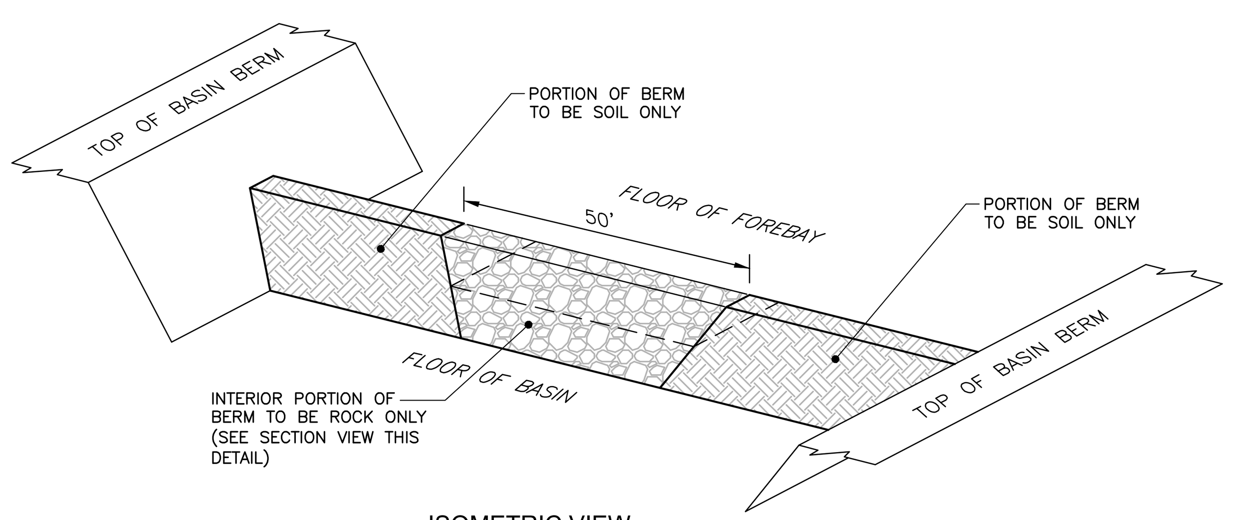
SKIMMER NOTES:

1. SCH. 40 PIPE SHOULD BE 1.4 TIMES THE HEIGHT OF OUTLET STRUCTURE (MIN. 8').
2. SEE SHEETS P–231–233 FOR SKIMMER SIZES.
3. CONTRACTOR PROVIDES SCH. 40 PVC PIPE. ALL OTHER SKIMMER MATERIALS AND PARTS PROVIDED BY VENDOR.
4. WEIGHT PROVIDED BY 40 LBS. OF STONE BALLAST ON EACH SIDE OF SCREEN/ORIFICE. TOTAL OF 80 LBS.

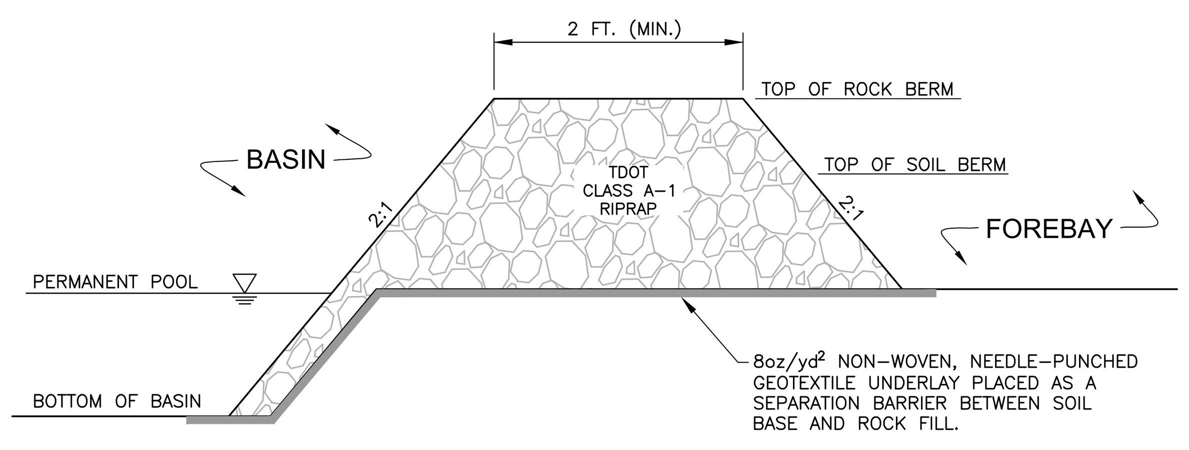
Marlee Float Skimmers				
Basin	Number of Skimmers	Bottom of Basin (FT)	Skimmer Pad Elevation (FT)	Skimmer Size (IN)
Sediment Basin 2	1	844.0	850.8	6.5
Sediment Basin 3	2	861.0	865.0	4.5
Sediment Basin 4	2	900.0	903.0	4.0

3 MARLEE SKIMMER® DISCHARGE SYSTEM WITH OUTLET STRUCTURE (TYP.)

NOT TO SCALE



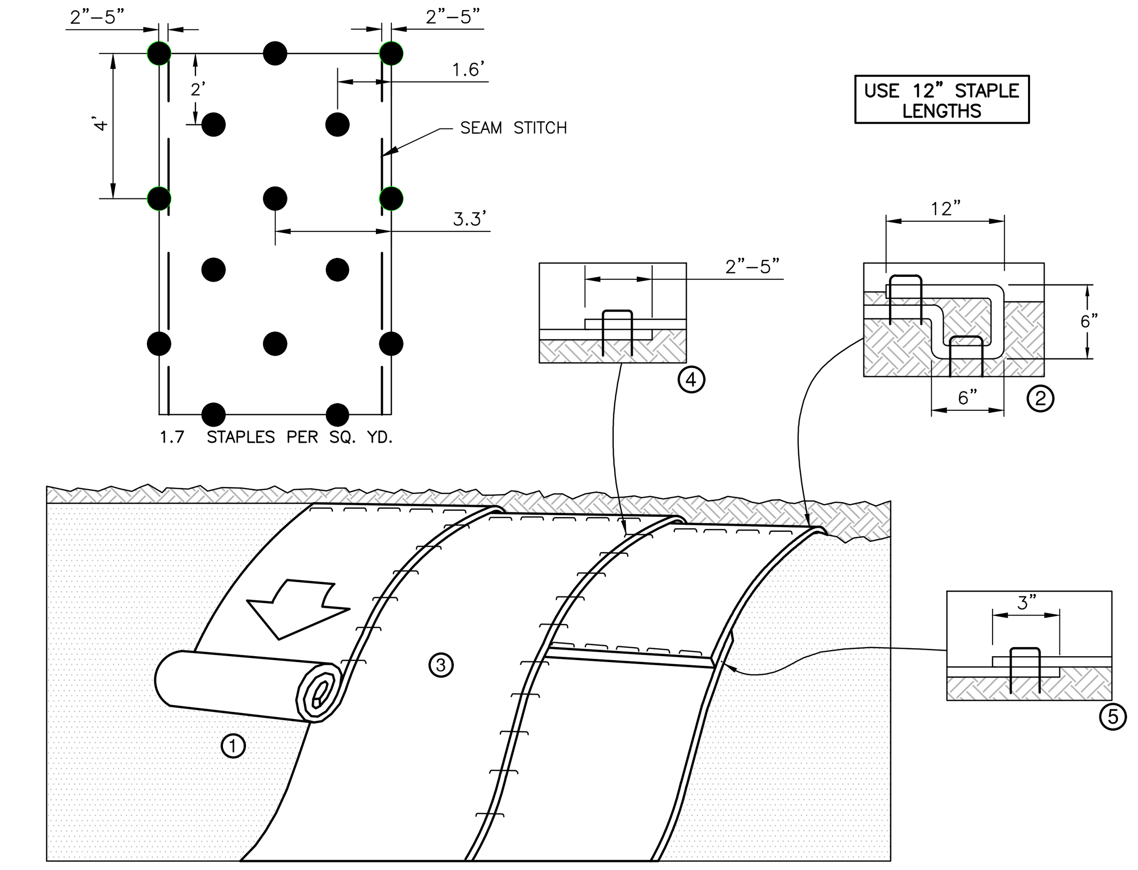
ISOMETRIC VIEW



SECTION VIEW - ROCK PORTION OF BERM

4 T.D.O.T. CLASS A-1 ROCK BERM

NOT TO SCALE

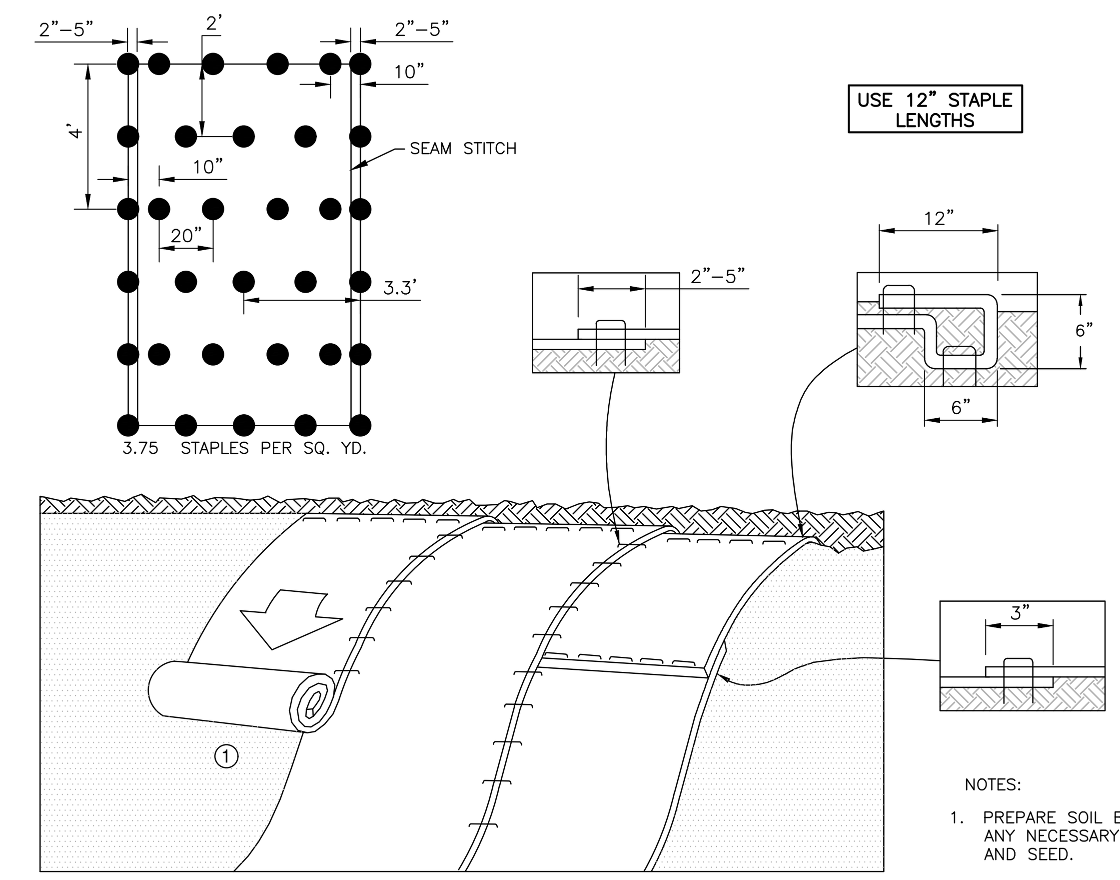


NOTES:

1. PREPARE SOIL BEFORE INSTALLING RECPs, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL EROSION CONTROL MATTING PER MANUFACTURER RECOMMENDATIONS.

5 EROSION CONTROL MATTING FOR BASIN SLOPES (TYP.)

NOT TO SCALE

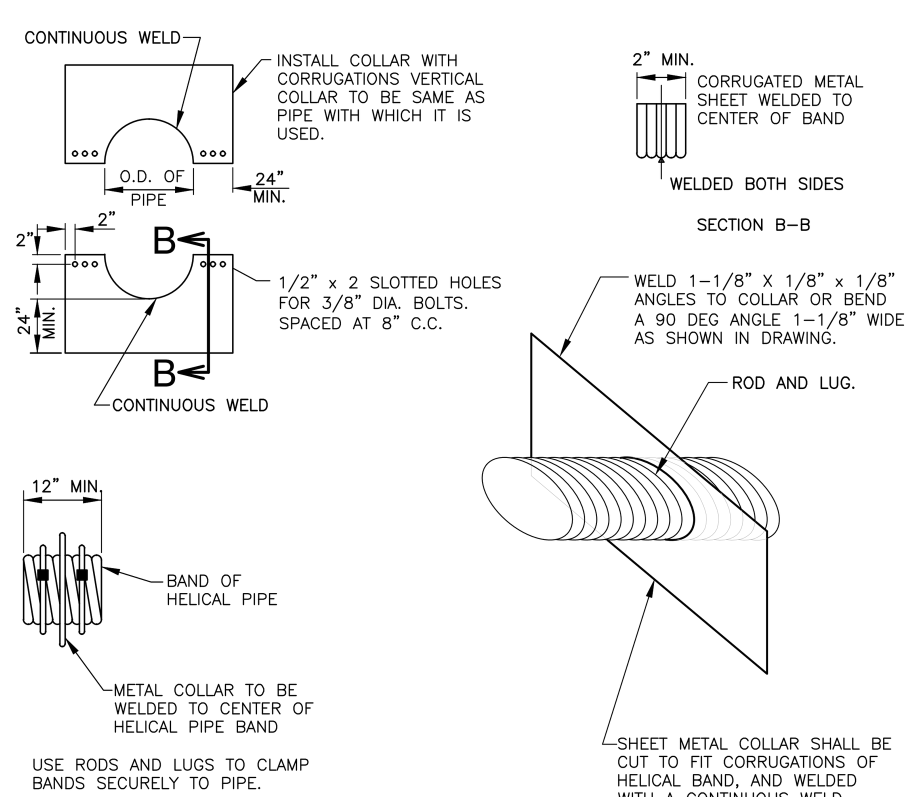


NOTES:

1. PREPARE SOIL BEFORE INSTALLING TRM, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL TURF REINFORCEMENT MATTING PER MANUFACTURER RECOMMENDATIONS.

6 TURF-REINFORCEMENT FOR BASIN SLOPES (TYP.)

NOT TO SCALE



NOTES FOR COLLARS:

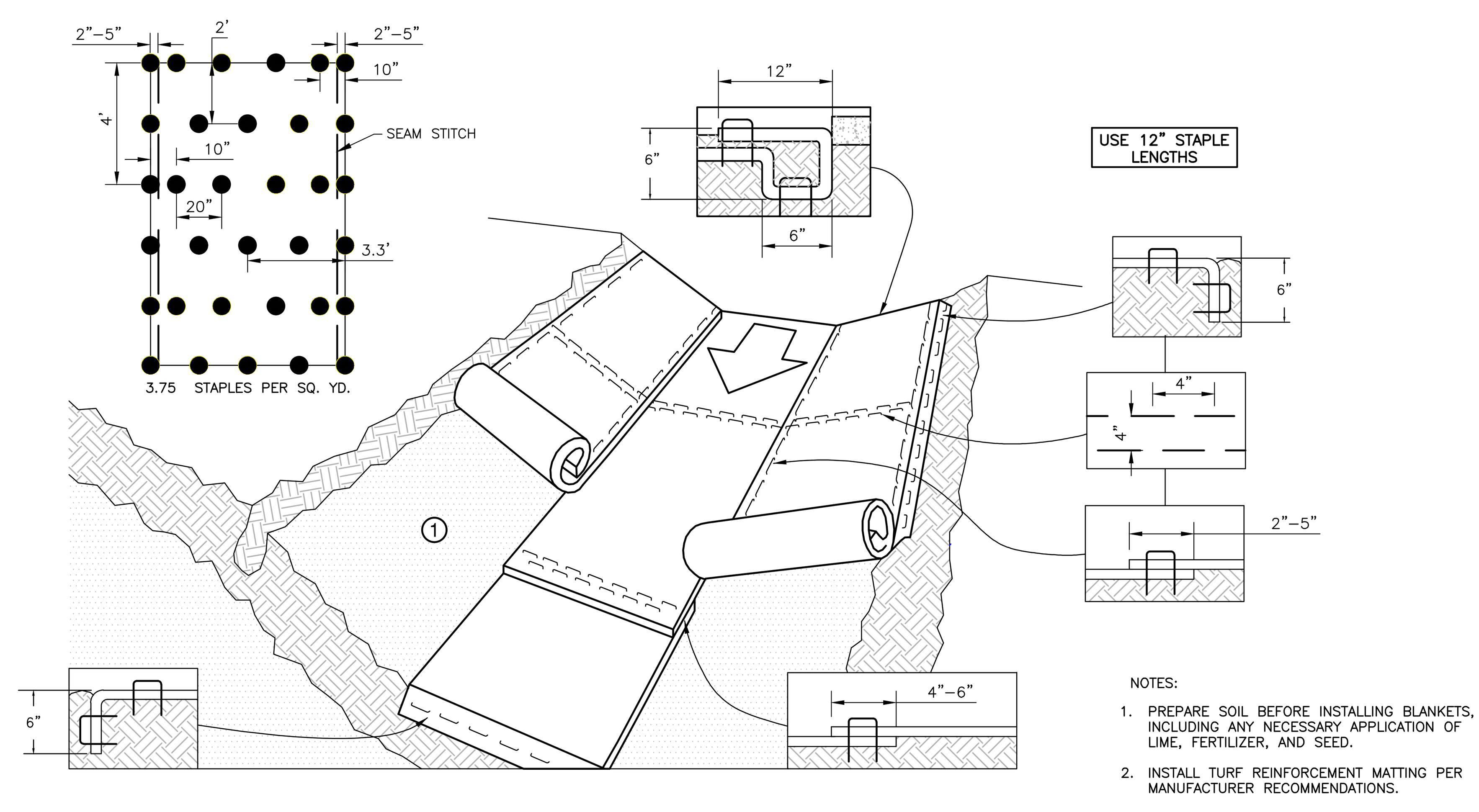
1. UNASSEMBLED COLLARS SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PAIRS
2. THE LAP BETWEEN THE HALF SECTIONS AND BETWEEN THE PIPE AND CONNECTING BAND ASPHALT MASTIC AT INSTALLATION.
3. EACH COLLAR SHALL BE FURNISHED WITH TWO 1/2" DIAMETER RODS WITH STANDARD TANK LUGS FOR CONNECTING COLLARS TO PIPE.

NOTE:
FOR BANDS AND COLLARS: MODIFICATIONS OF THE DETAILS SHOWN MAY BE USED PROVIDING EQUAL WATERTIGHTNESS IS MAINTAINED AND DETAILED DRAWINGS ARE SUBMITTED AND APPROVED BY THE ENGINEER PRIOR TO DELIVERY.

NOTE:
COLLARS SHALL BE POLYMER–COATED CORRUGATED METAL.

7 ANTI SEEP COLLARS (TYP)

NOT TO SCALE

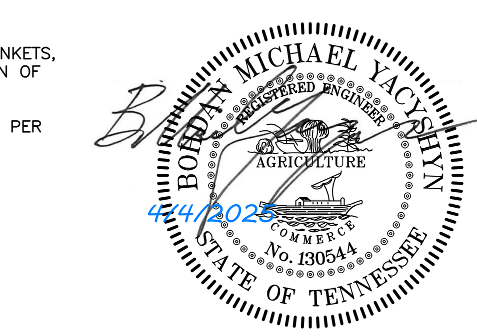


NOTES:

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL TURF REINFORCEMENT MATTING PER MANUFACTURER RECOMMENDATIONS.

8 TURF-REINFORCEMENT FOR EMERGENCY SPILLWAY WEIR SECTION (TYP.)

NOT TO SCALE



*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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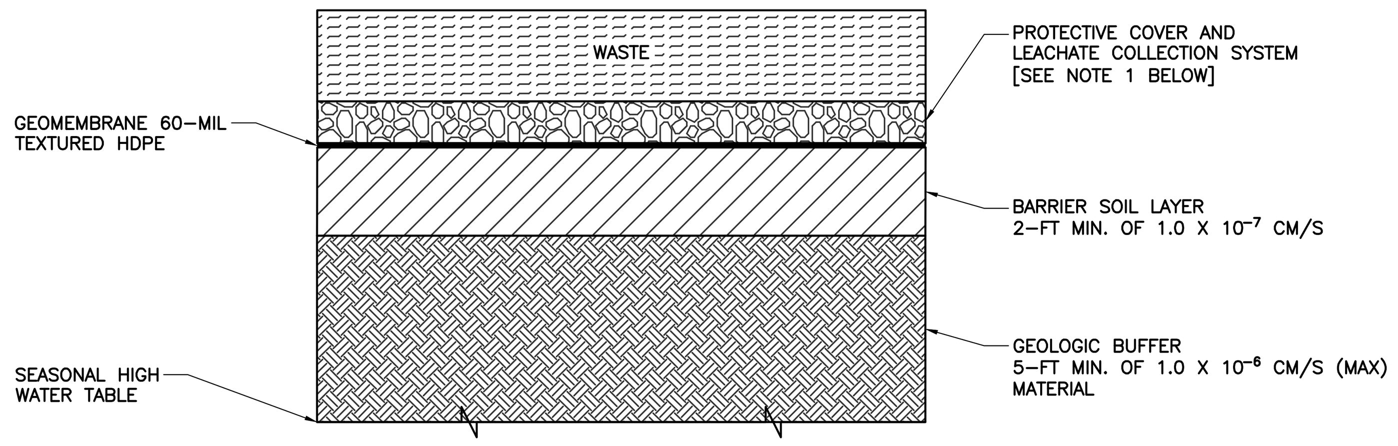
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

SEDIMENT BASIN DETAILS

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

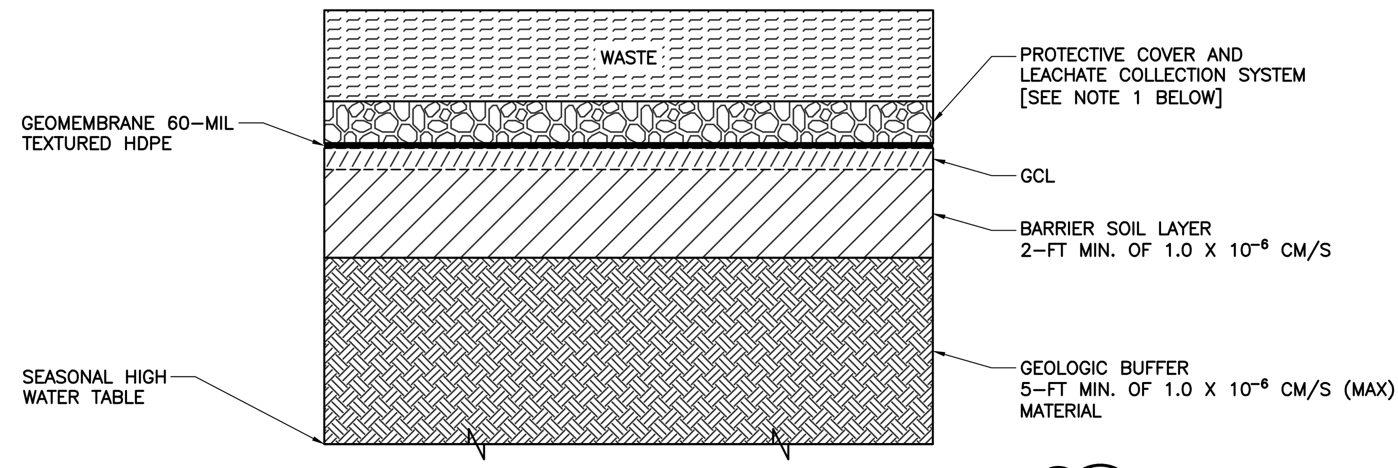
DRAWING NO.:
P-234



NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

1 OPTION 1 BASE LINER SYSTEM

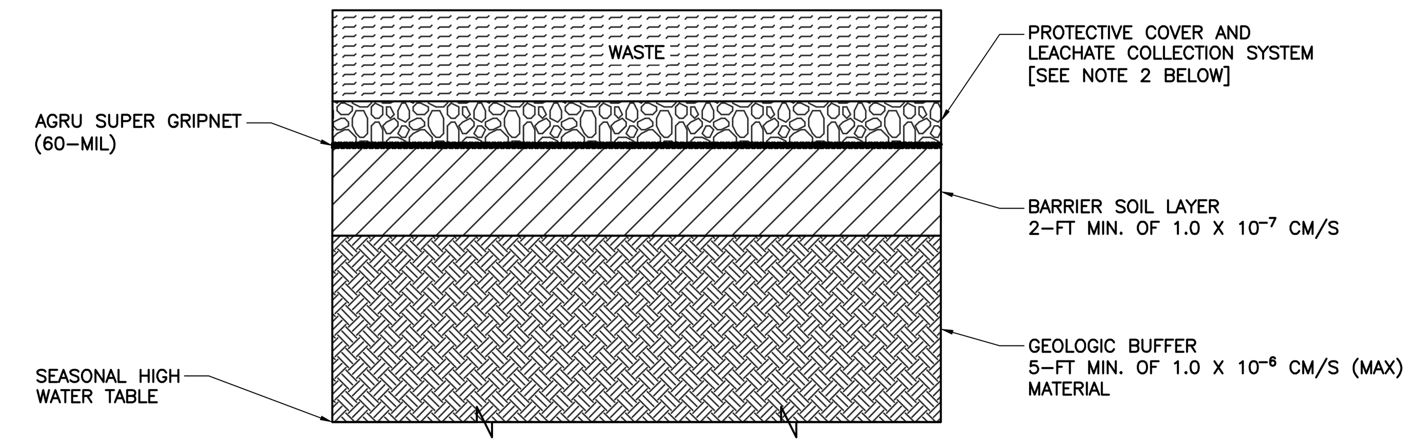
NOT TO SCALE



NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

2 OPTION 2 BASE LINER SYSTEM

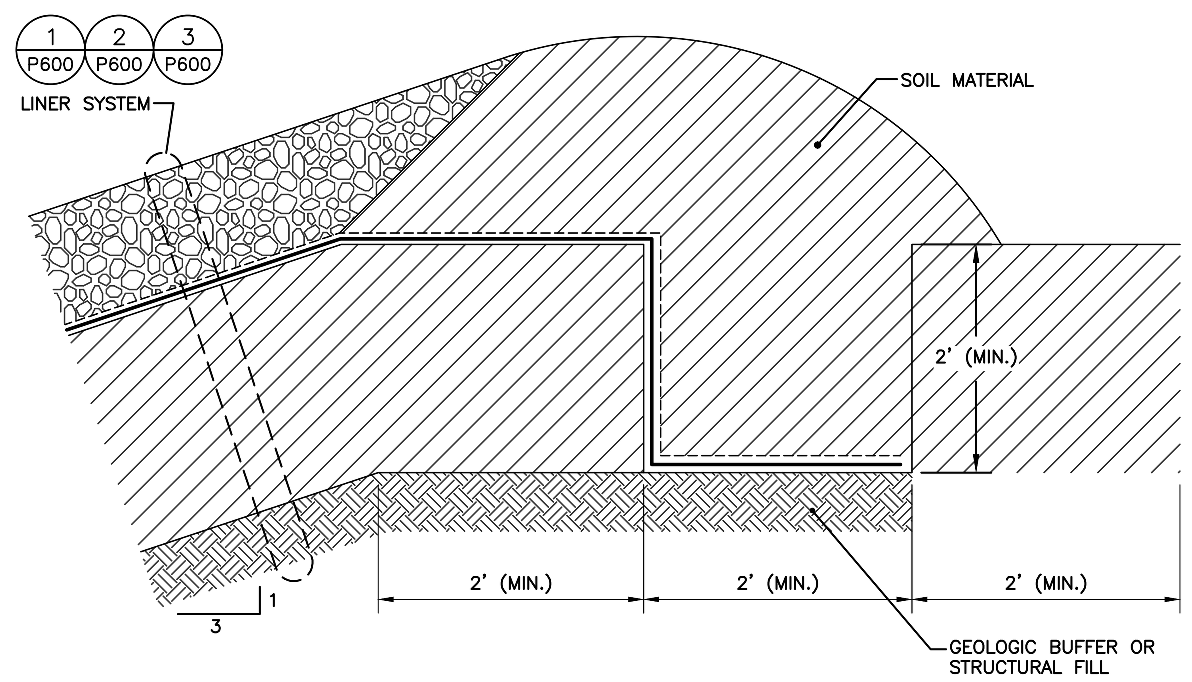
NOT TO SCALE



NOTE:
1. AGRU SUPER GRIPNET LINER SYSTEM SHALL BE INSTALLED IN MODULES 1, 2, AND 3 IN THE APPROXIMATE LOCATIONS SHOWN ON DRAWING P201.
2. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

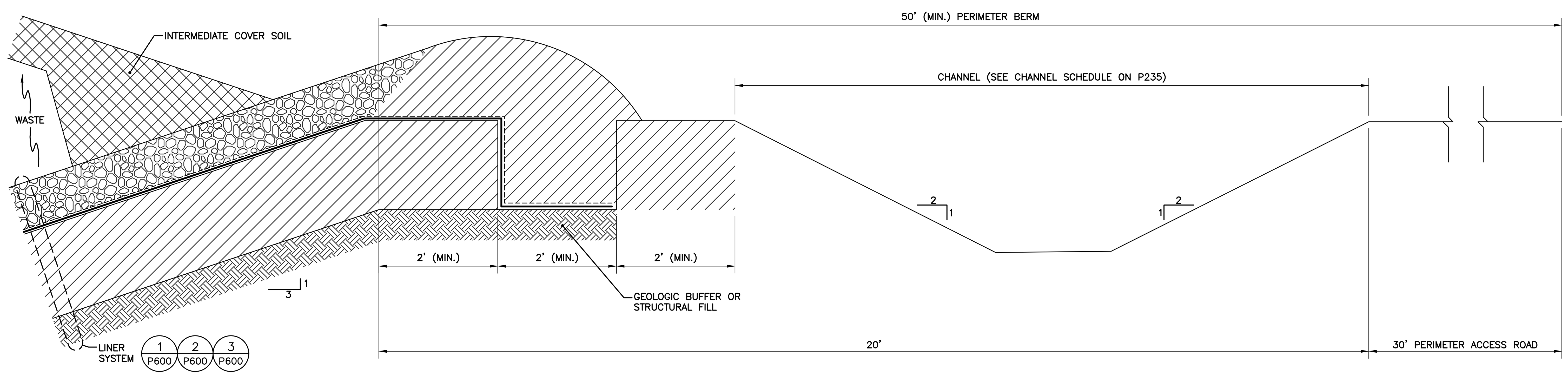
3 OPTION 3 BASE LINER SYSTEM

NOT TO SCALE



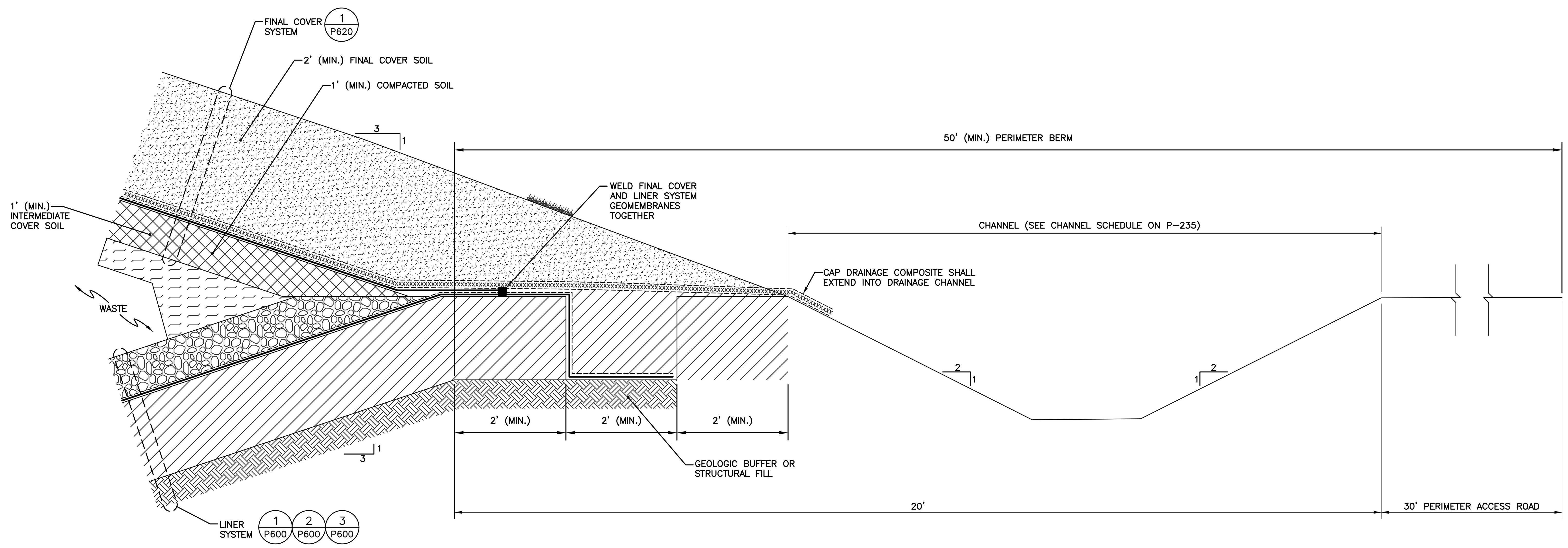
4 PERIMETER ANCHOR TRENCH

NOT TO SCALE



5 INTERIM PERIMETER BERM

NOT TO SCALE



6 PERIMETER BERM AT CLOSURE

NOT TO SCALE

LEGEND:

1 / P600 — DETAIL DESIGNATION / SHEET WHERE DETAIL IS SHOWN

- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

4/4/2025

*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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615-333-7797 · 800-763-2326
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MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LINERSYSTEMDETAILS (SHEET 1 OF 3)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

DRAWING NO.: P-600

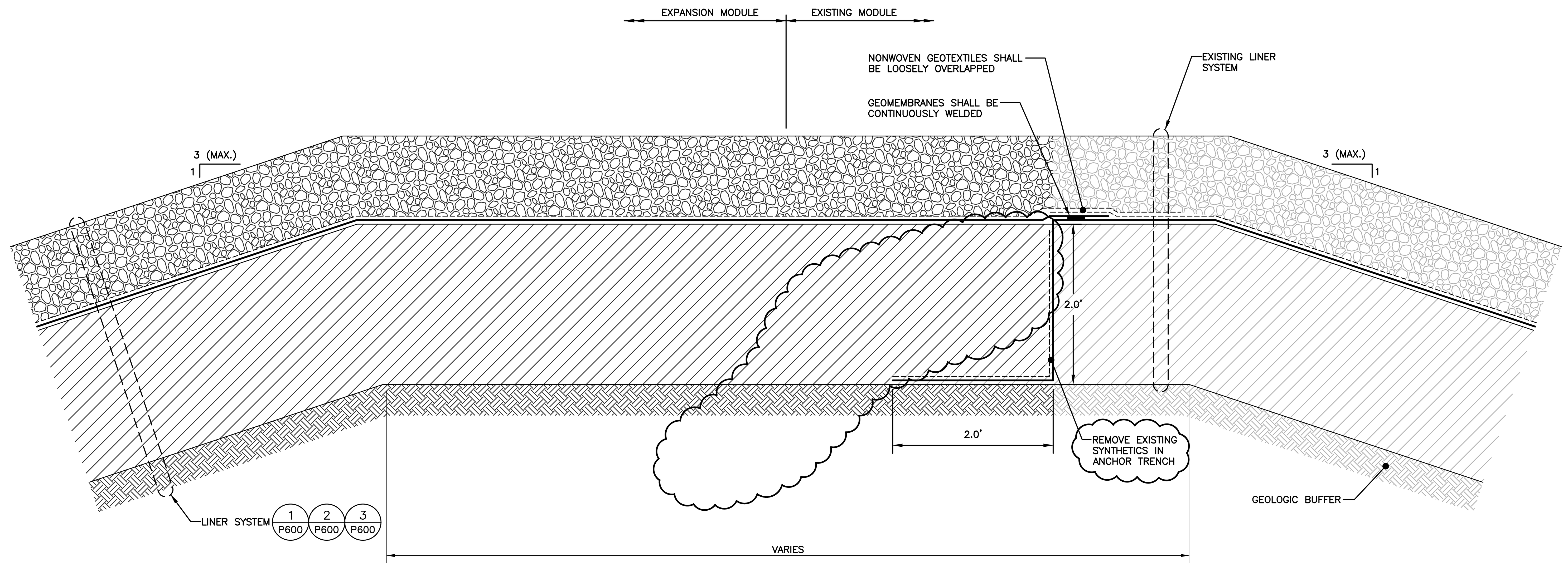
DETAIL REMOVED

1 INTERCEPTOR DRAIN
NOT TO SCALE

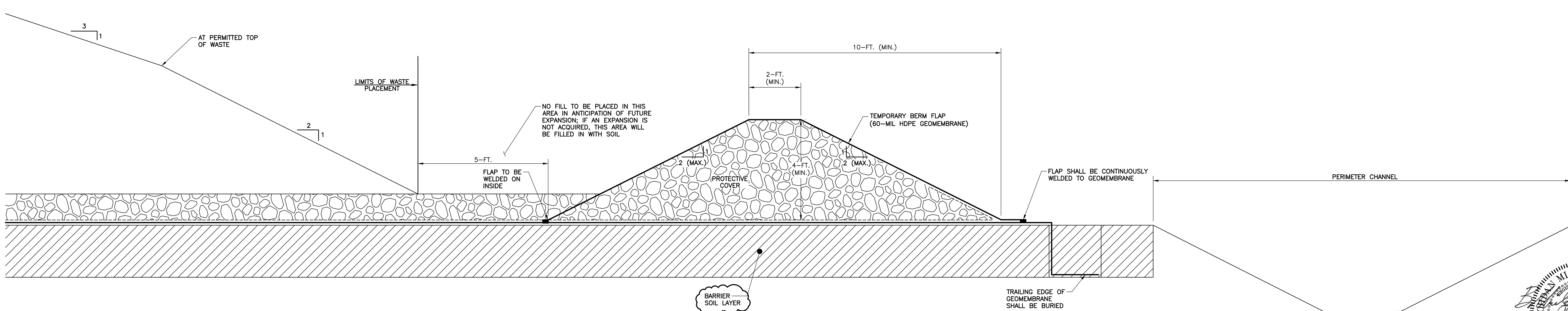
LEGEND:

- 1 / P600 — DETAIL DESIGNATION / SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 TIE-IN TO EXISTING LINER SYSTEM
NOT TO SCALE



3 WESTERN AND NORTHERN PERIMETER BERM
NOT TO SCALE

REVISION RECORD

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINER SYSTEM DETAILS
(SHEET 2 OF 3)

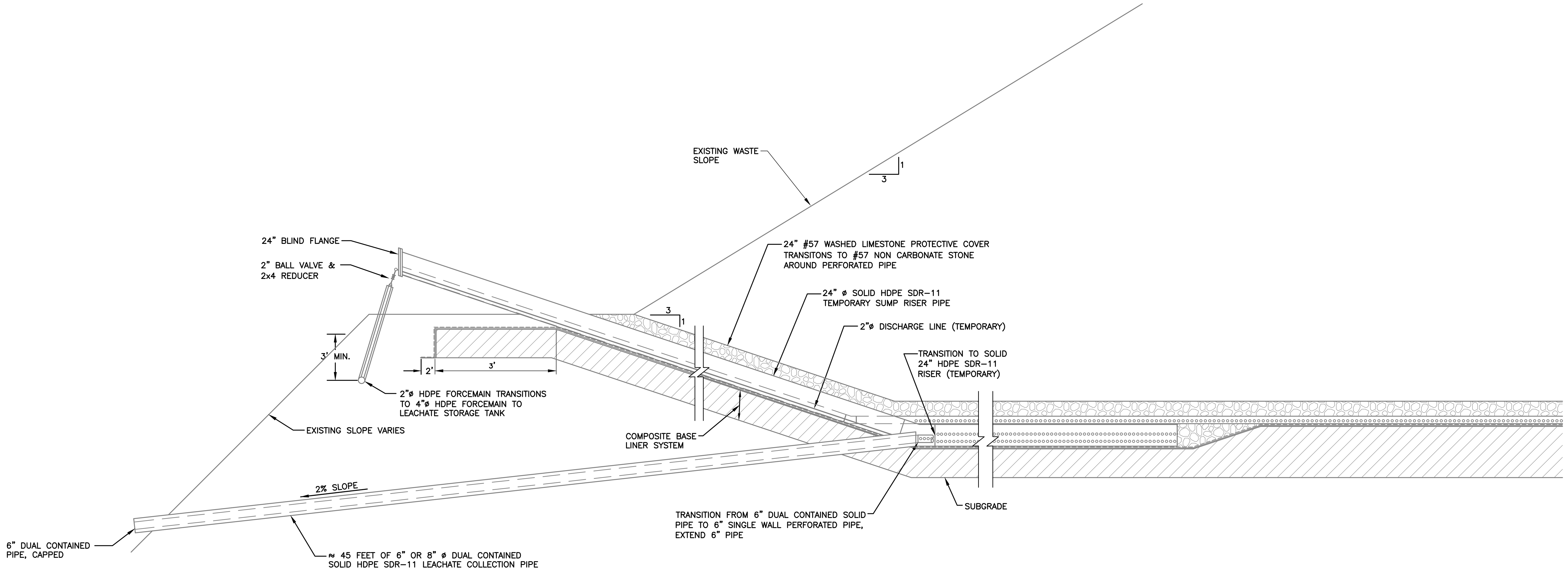
DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	*BMY

BOHDAN MICHAEL YACYSHYN · REGISTERED PROFESSIONAL ENGINEER · AGRICULTURE · COMMERCE · No. 130544 · STATE OF TENNESSEE
4/4/2025

*HAND SIGNATURE ON FILE

DRAWING NO.:
P-601

P:\310-0001\317-474\-CADD\Dwg\SWDR\SWDR\317474-SWDR-P600-DETAILS.dwg{P-601} LS:(4/3/2025 - bunderwood) - LP: 4/4/2025 10:01 AM



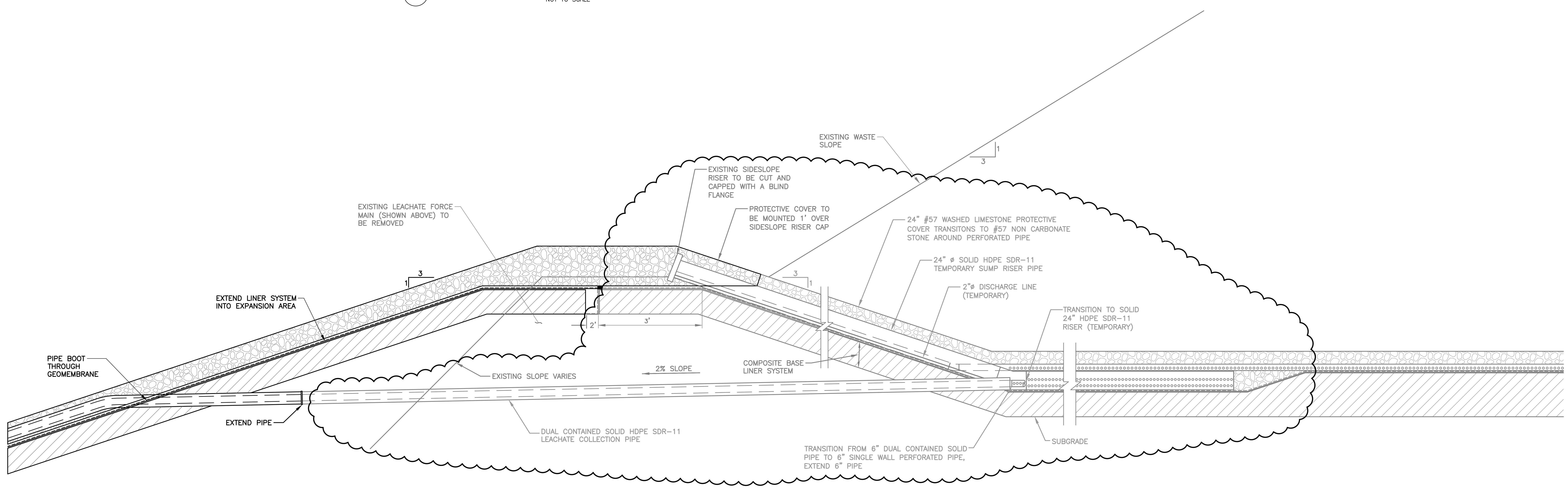
NOTE:
THIS DETAIL SHOWS THE APPROXIMATE CONFIGURATION OF THE SUMP IN EXISTING MODULE H. THE EXISTING SUMPS IN MODULES A AND B ARE SIMILAR, EXCEPT THEY DO NOT HAVE THE 2 INCH FORCE MAIN CONNECTED THE THEIR SUMP PUMPS. REFER TO DETAIL 2 ON THIS SHEET FOR HOW THESE SUMPS WILL BE EXTENDED TO DRAIN BY GRAVITY INTO EXPANSION MODULES 1, 2, AND 3.

1 **EXISTING TEMPORARY SUMP CROSS SECTION**
NOT TO SCALE

LEGEND:

- 1 / P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



2 **EXISTING LEACHATE COLLECTION PIPE TIE-IN TO NEW MODULES**
NOT TO SCALE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

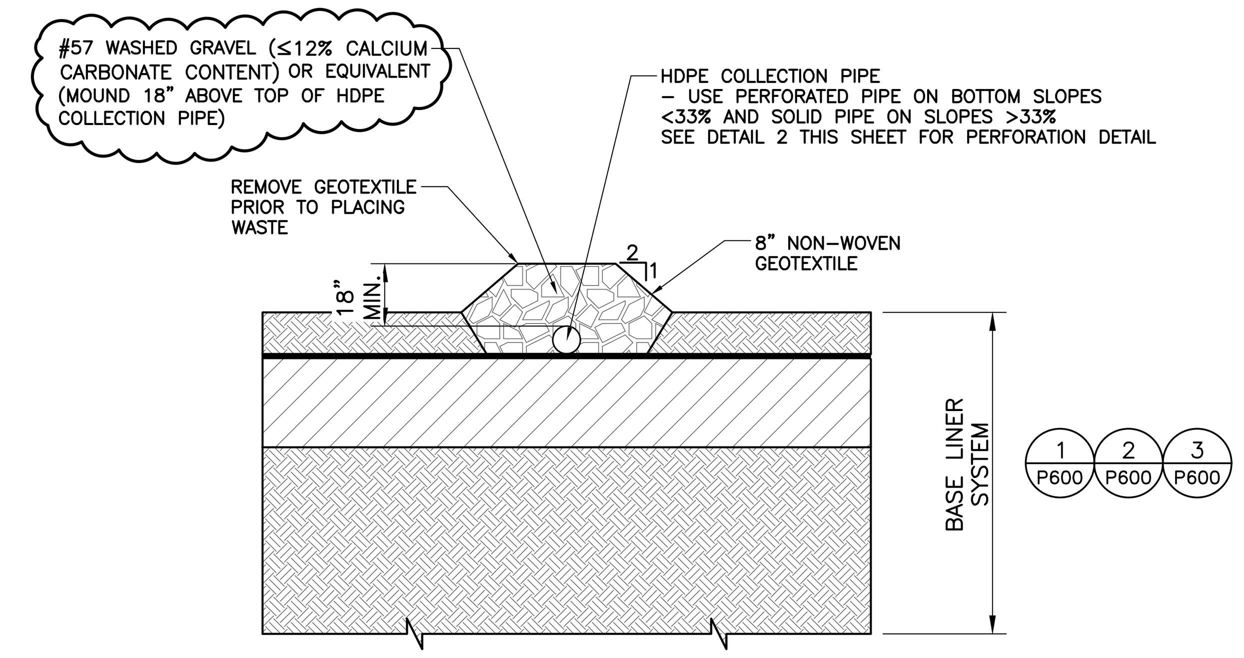
LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	EDC*

BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 120544
STATE OF TENNESSEE
4/4/2025
*ORIGINAL SIGNATURE ON FILE

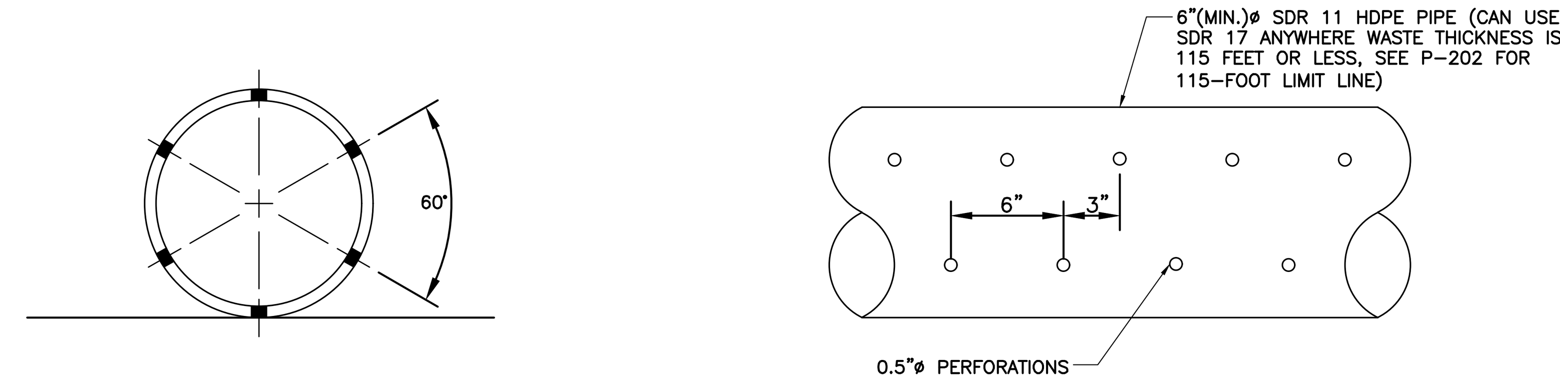
DRAWING NO.:
P-611

P:\310-0001\317-474\-CADD\Dwg\SWOR\SWOR\317474-SWOR-P610- DETAILS.dwg[P-611] LS:(3/18/2025 - kunderwood) - LP: 4/3/2025 2:52 PM



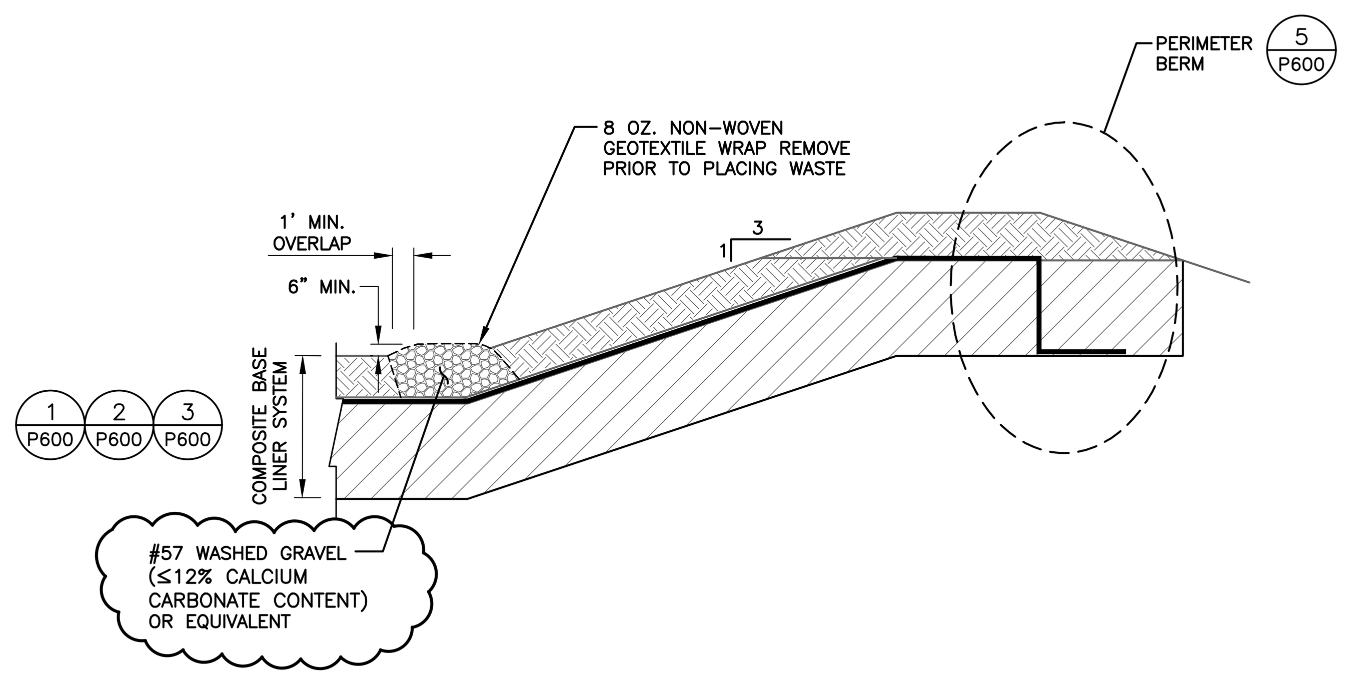
1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

NOT TO SCALE



2 PERFORATED PIPE DETAIL

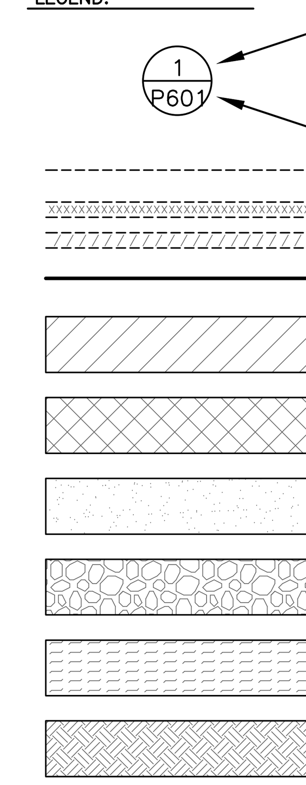
NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:



DETAIL DESIGNATION

SHEET WHERE DETAIL IS SHOWN

NONWOVEN GEOTEXTILE

DOUBLE–SIDED GEOCOMPOSITE (SEE NOTE 2)

GEOSYNTHETIC CLAY LINER

60–MIL TEXTURED HDPE GEOMEMBRANE

CLAY LINER

INTERMEDIATE COVER SOIL

FINAL COVER SOIL

PROTECTIVE COVER STONE

WASTE

STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE–SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT–BONDED TO AN INNER CORE OF HDPE GEONET.

REVISION RECORD

NO	DATE	DESCRIPTION

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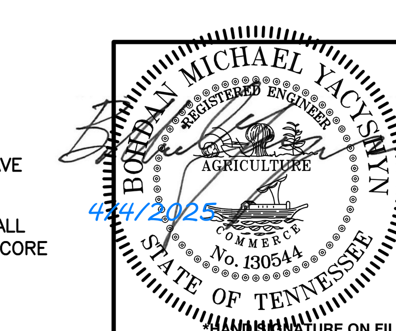
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

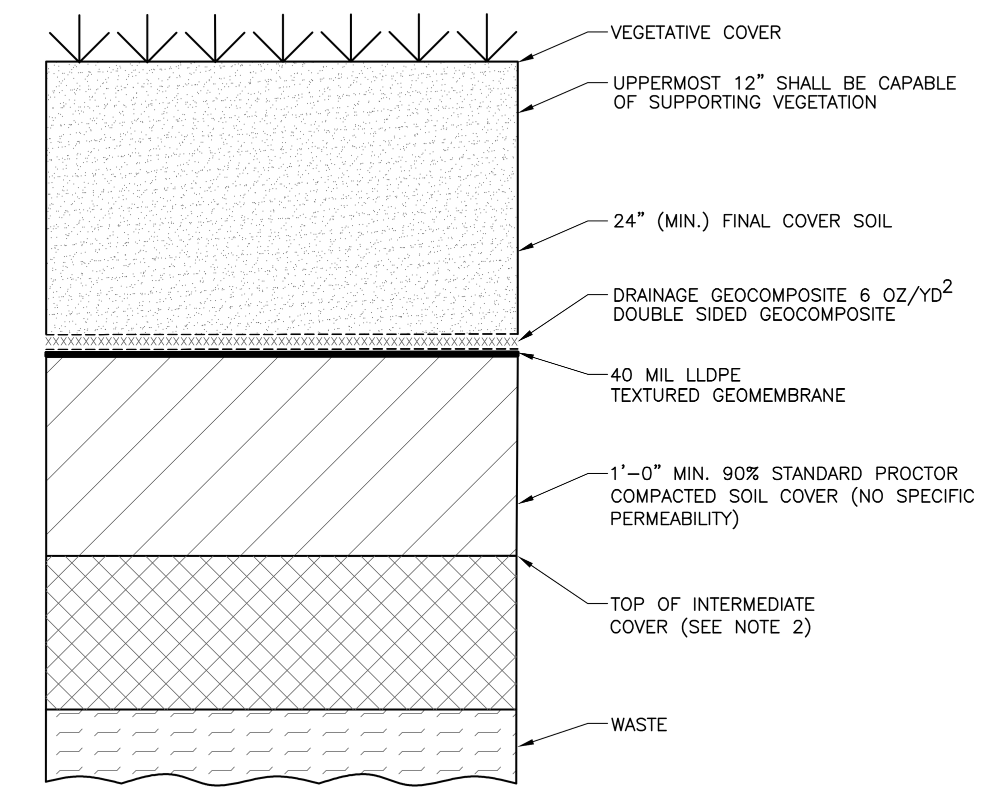


LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

DRAWING NO.:

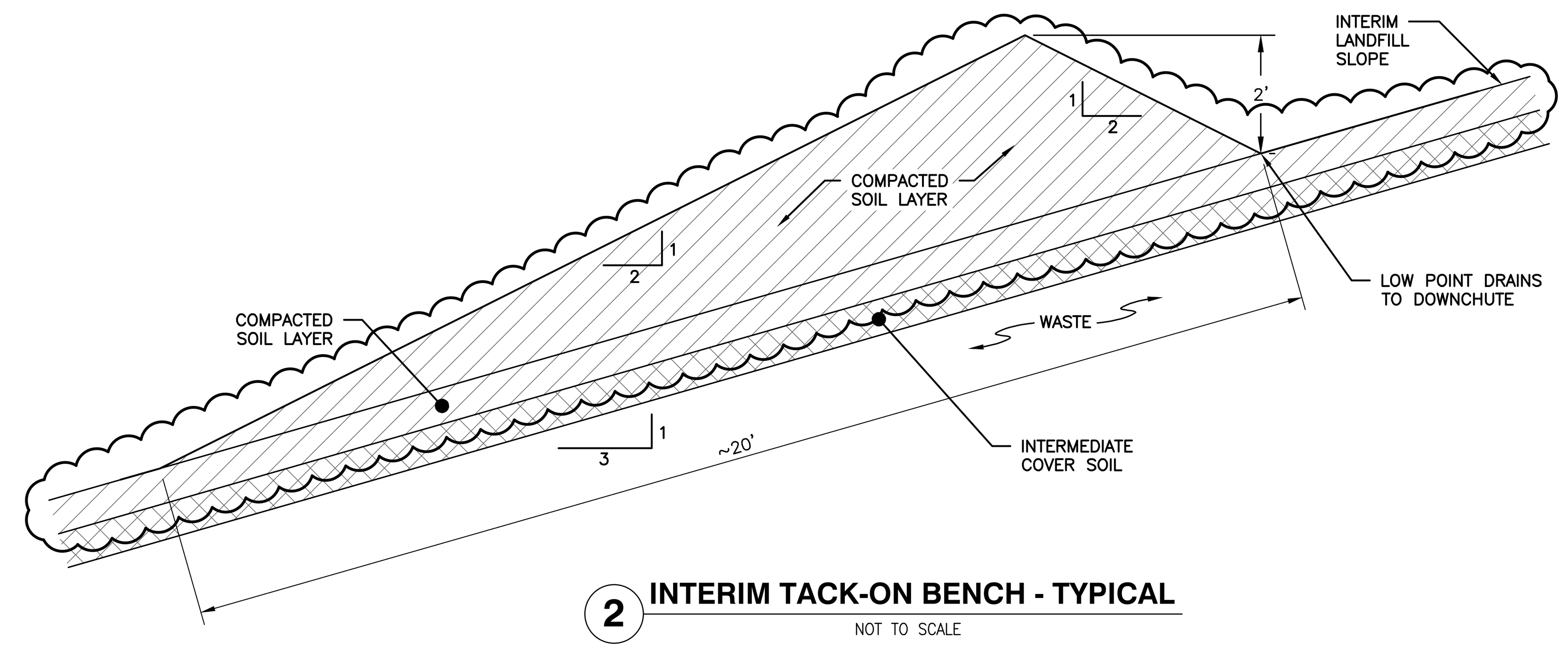
P-612



NOTES:

1. GAS COLLECTION TRENCHES TO BE INSTALLED IN WASTE. SEE THE GAS COLLECTION TRENCH DETAILS ON DRAWING P-630.
2. INTERMEDIATE COVER SHALL BE SOIL OR SOIL-LIKE. INTERMEDIATE COVER SHALL BE 12 INCH THICK.

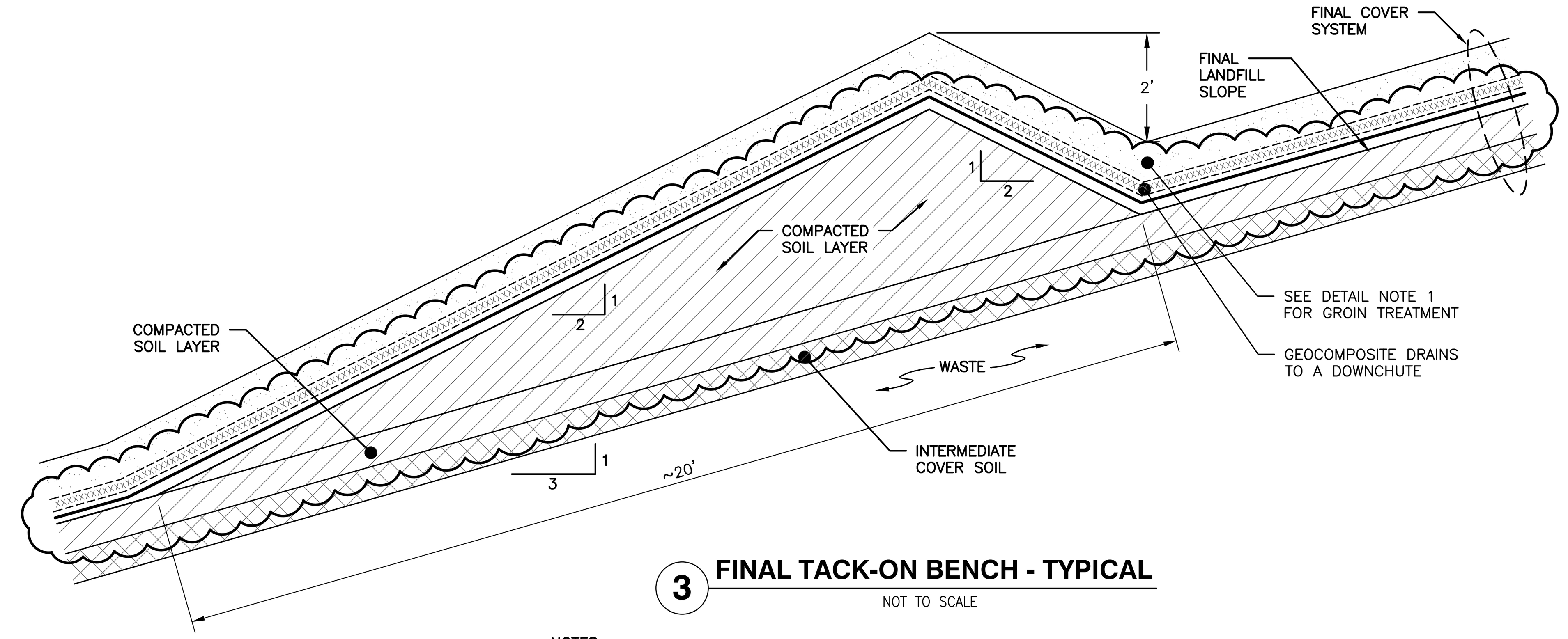
1 FINAL COVER SYSTEM
NOT TO SCALE



2 INTERIM TACK-ON BENCH - TYPICAL
NOT TO SCALE

NOTES:

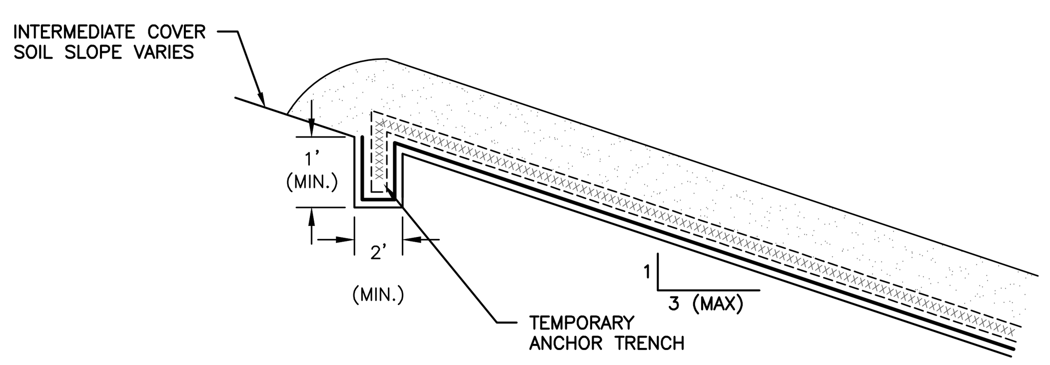
1. TOP SURFACE OF COMPACTED SOIL LAYER SHALL BE INSPECTED AND RESTORED AS NEEDED PRIOR TO FML DEPLOYMENT PER THE CQA PLAN.



3 FINAL TACK-ON BENCH - TYPICAL
NOT TO SCALE

NOTES:

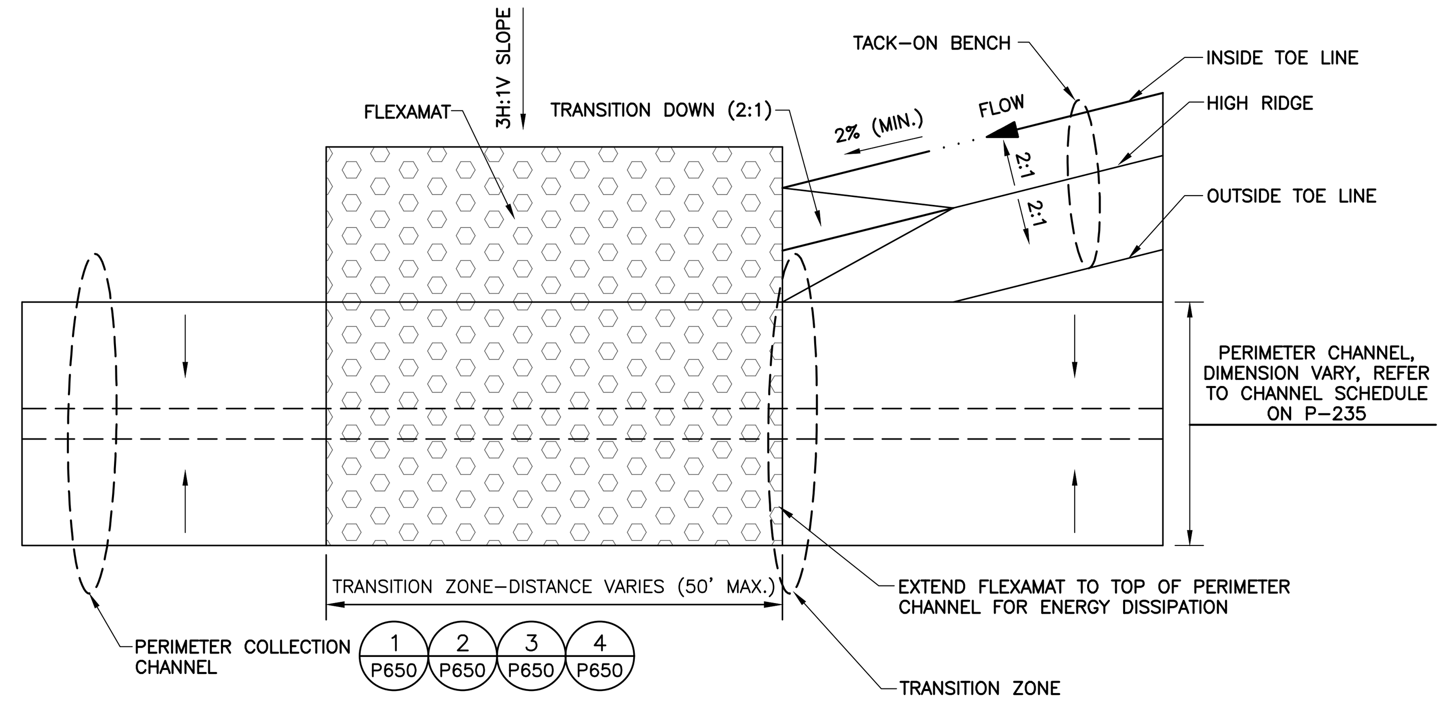
1. ADS 12-INCH ADVANEDGE HDPE PIPE WITH GEOTEXTILE WRAP SHALL BE INSTALLED ALONG THE GROIN OF TACK-ON BENCHES. ALTERNATIVELY, AN ADDITIONAL 3-FOOT WIDE STRIP OF 6 OZ/SY (MIN.) DOUBLE-SIDED DRAINAGE COMPOSITE MAY BE INSTALLED IN THIS LOCATION.
2. TOP SURFACE OF COMPACTED SOIL LAYER SHALL BE INSPECTED AND RESTORED AS NEEDED PRIOR TO FML DEPLOYMENT PER THE CQA PLAN.



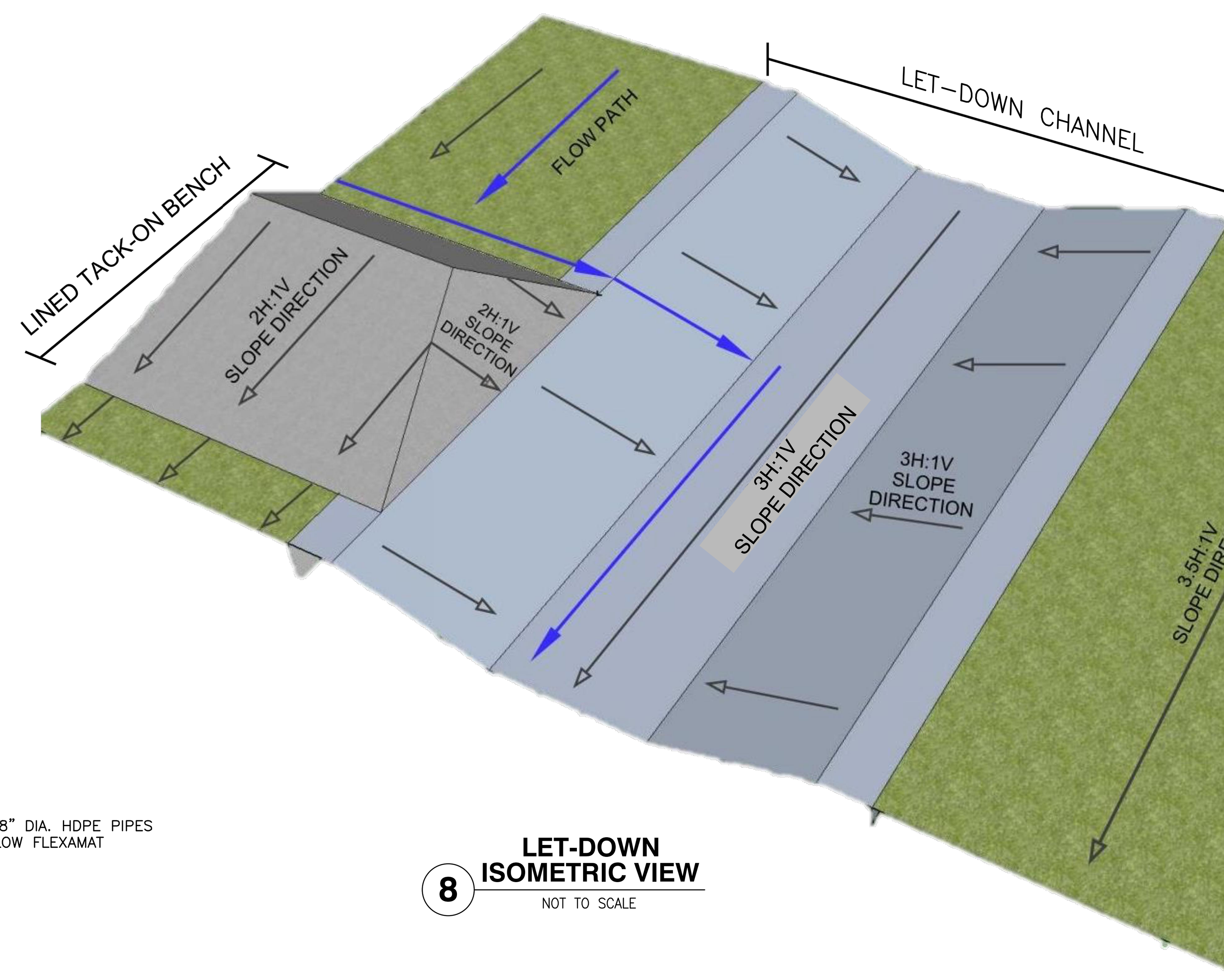
4 INCREMENTAL CAPPING DETAIL
NOT TO SCALE

NOTES:

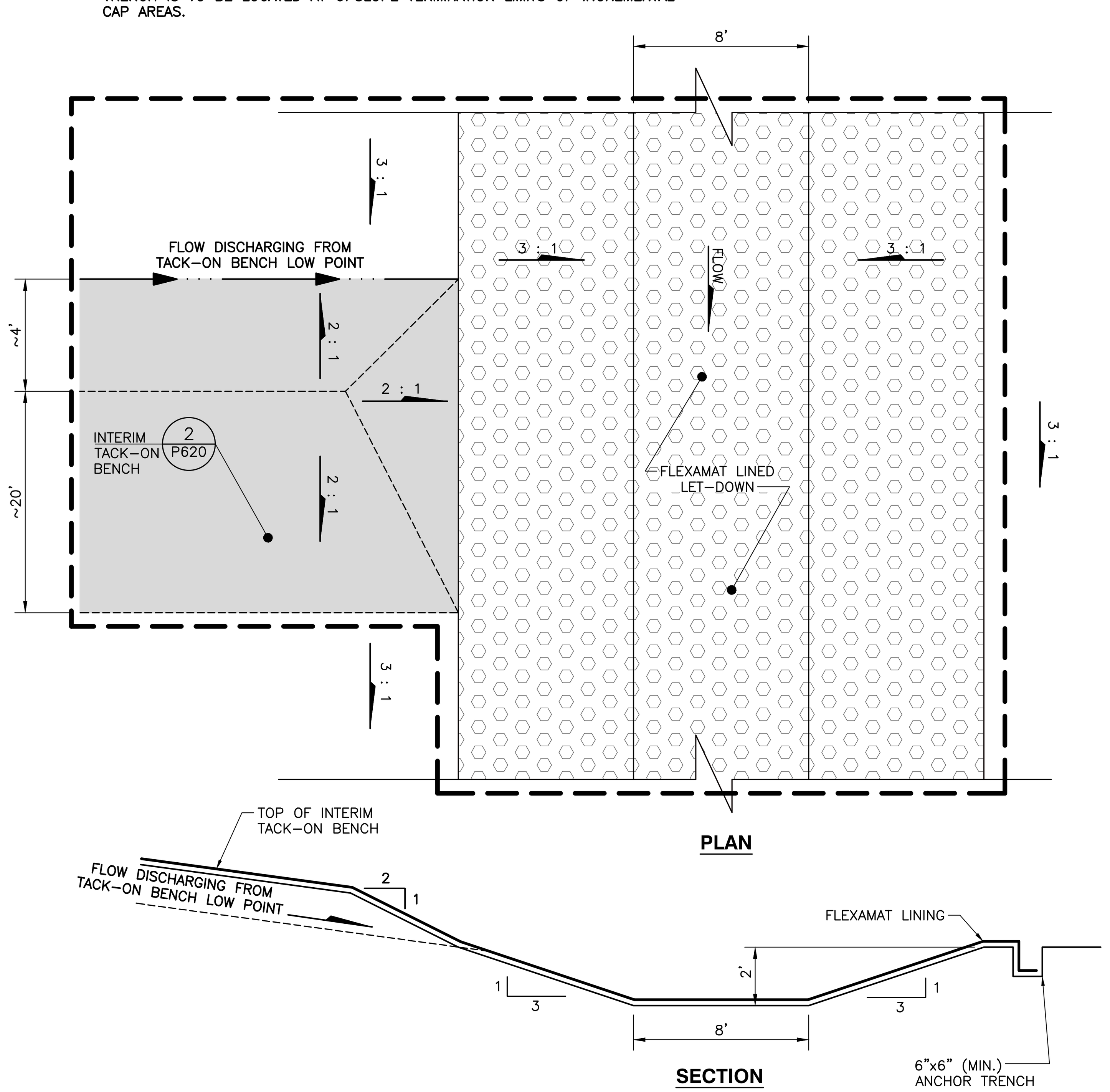
1. THIS INCREMENTAL CAPPING DETAIL IS TO BE USED TO TEMPORARILY ANCHOR FINAL COVER SYSTEM GEOSYNTHETIC COMPONENTS. THE TEMPORARY ANCHOR TRENCH IS TO BE LOCATED AT UPSLOPE TERMINATION LIMITS OF INCREMENTAL CAP AREAS.



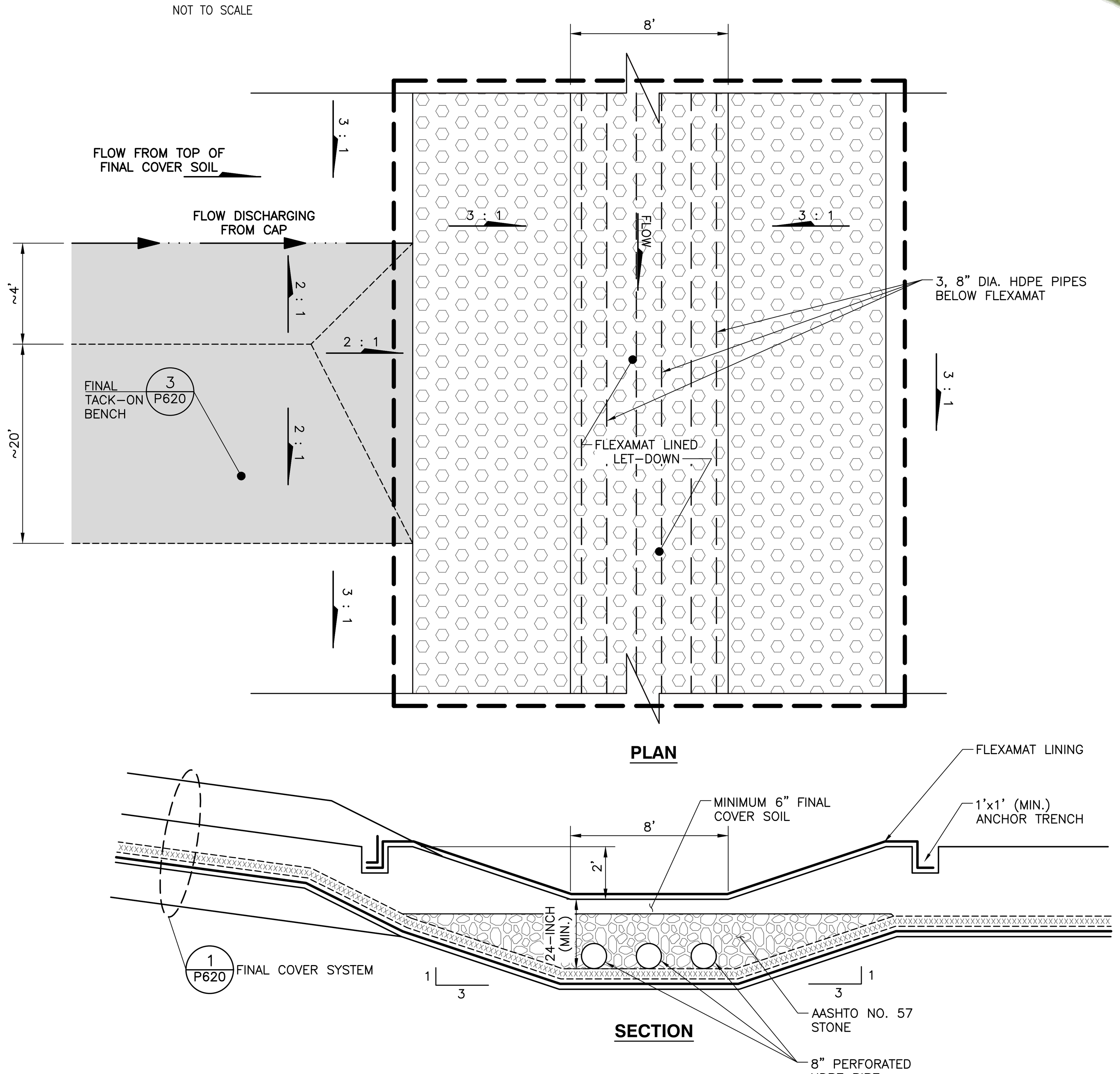
5 TACK-ON BERM CONNECTION TO PERIMETER CHANNEL
NOT TO SCALE



8 LET-DOWN ISOMETRIC VIEW
NOT TO SCALE



6 LET-DOWN - INTERIM
NOT TO SCALE



7 LET-DOWN - FINAL
NOT TO SCALE

NOTE:

UNDER FINAL SLOPE CONDITIONS, THE TACK-ON BENCHES WILL BE VEGETATED AND THE DOWNCHUTES WILL BE LINED WITH FLEXAMAT.

LEGEND:

- 1 / P600 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- COMPACTED SOIL COVER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.
3. INSTALL FLEXAMAT PER MANUFACTURER INSTRUCTIONS

REVISION RECORD

NO	DATE	DESCRIPTION

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615-333-7797 · 800-763-2326
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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

FINAL COVER DETAILS

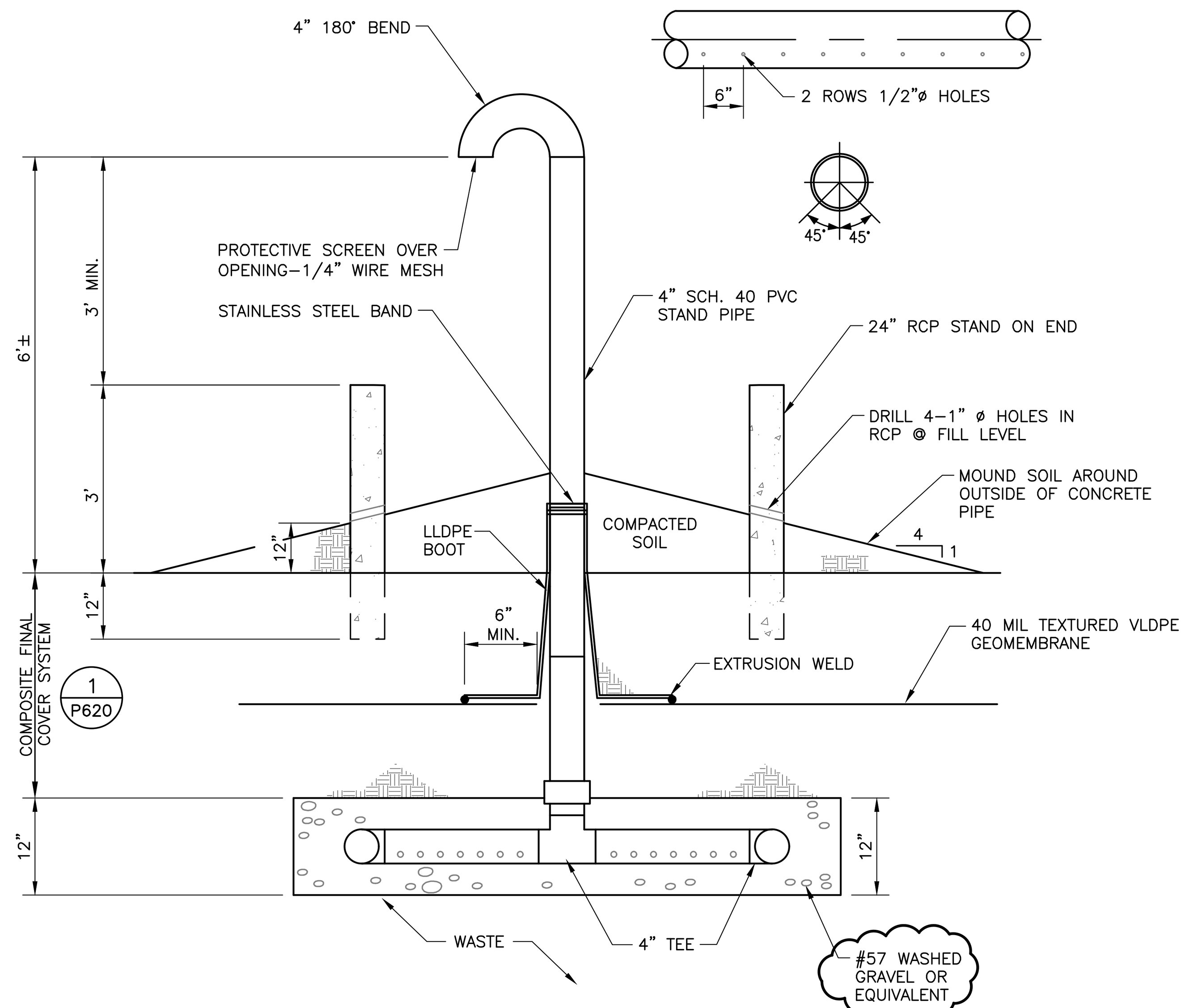
DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025

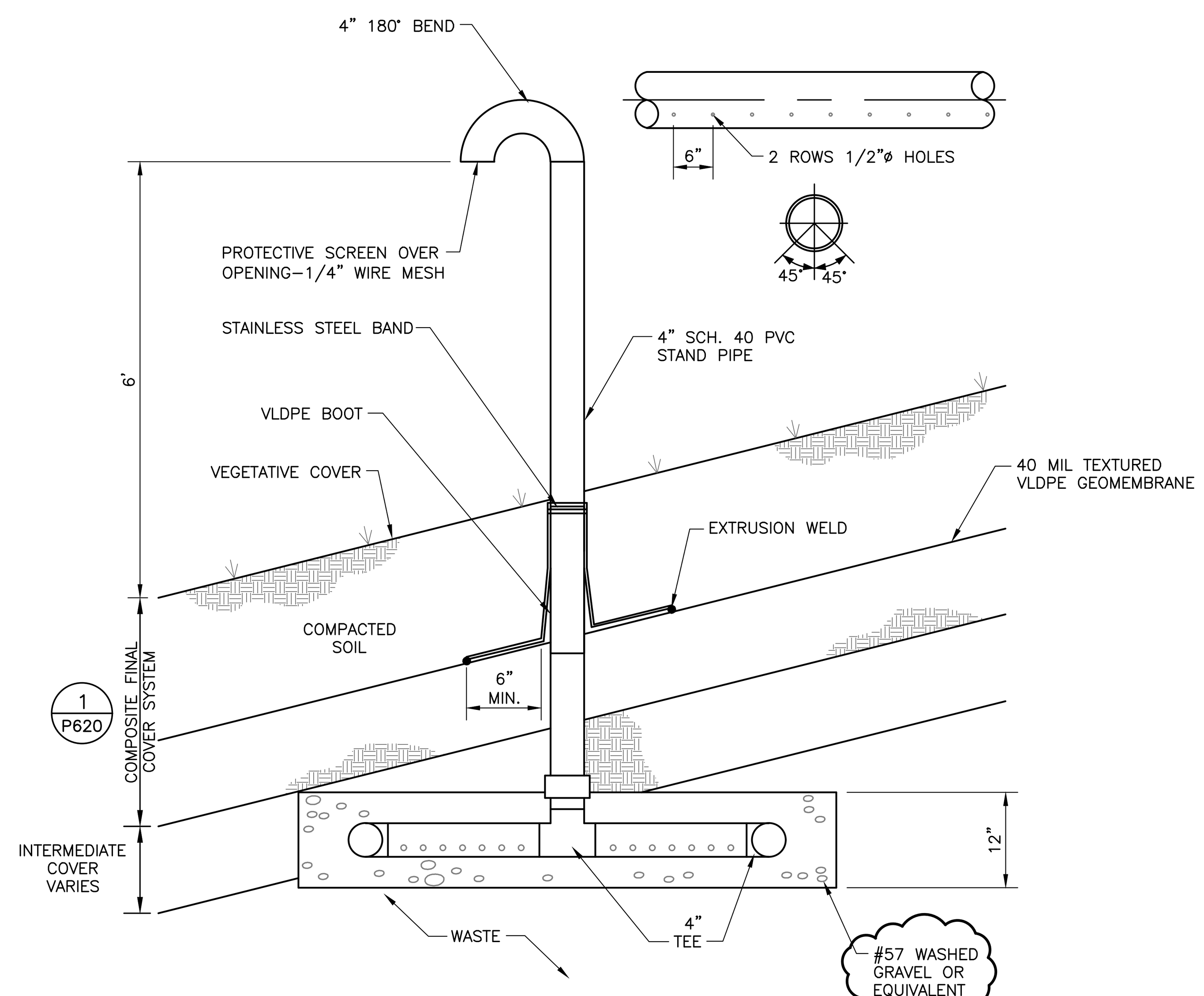
*HAND SIGNATURE ON FILE

DRAWING NO.:
P-620

P:\310-0001\317-474\-CADD\Dwg\SWGR\317474-SWGR-P620- DETAILS.dwg{P-620} LS:(3/18/2025 - kunderwood) - LP: 4/3/2025 2:51 PM



CASE 1

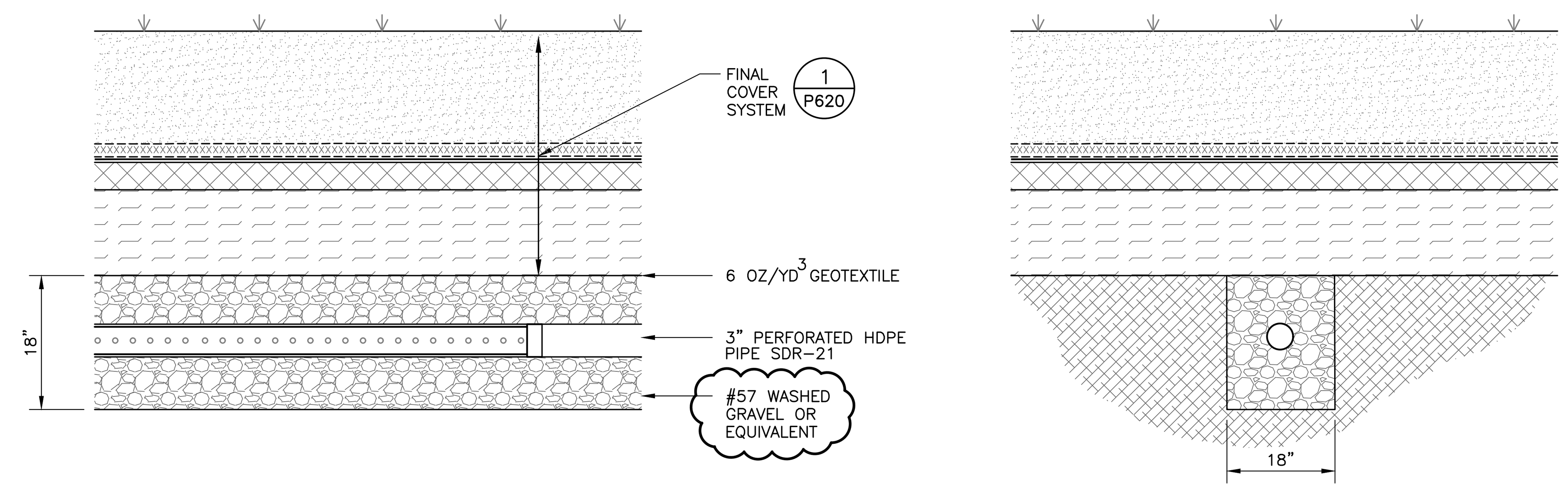


CASE 2

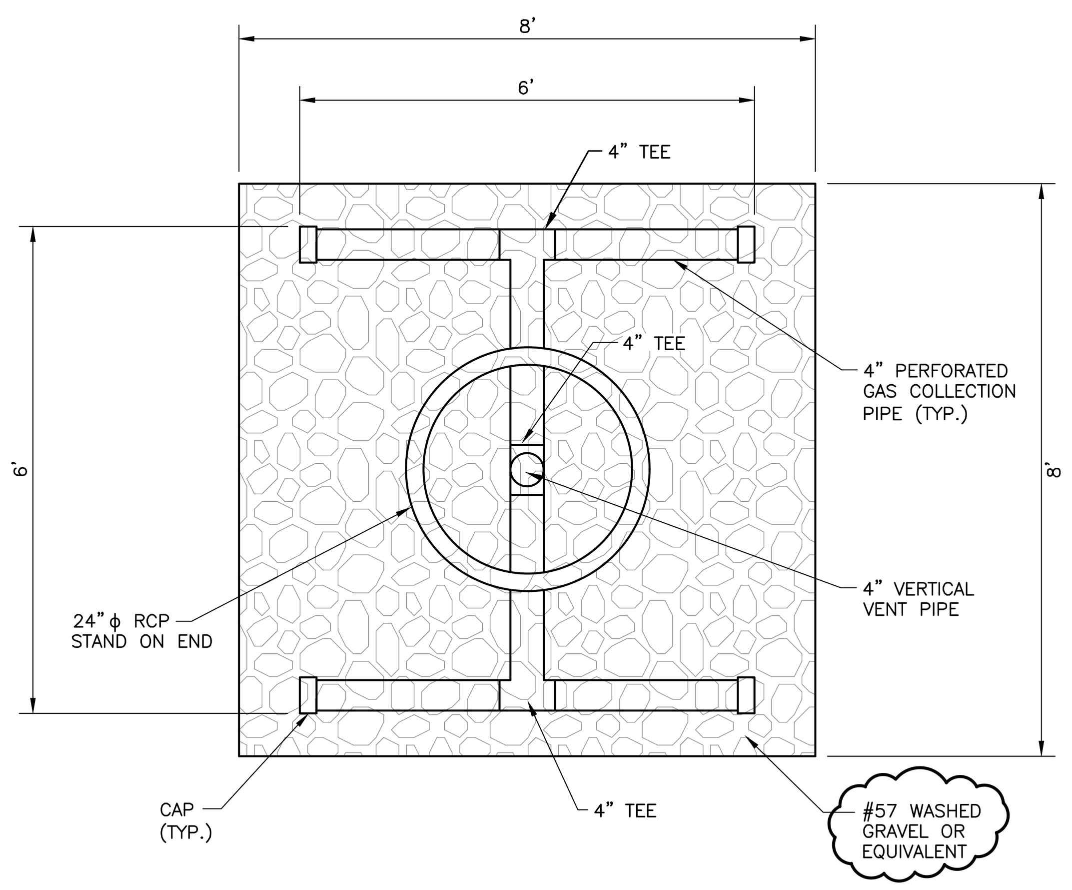
NOTE:
1) THIS DETAIL FOR GAS VENTS ON SLOPES <10% & ALONG ACCESS ROADS.
2) 12" X 8' X 8' ROCK POCKET TO BE INSTALLED IN INTERMEDIATE COVER LAYER.
3) GAS VENTS SHALL BE INSTALLED ON AN APPROXIMATE 200' X 200' (MAX.) GRID SPACING.

NOTE:
1) THIS DETAIL FOR GAS VENTS ON SLOPES ≥10%.
2) 12" X 8' X 8' ROCK POCKET TO BE INSTALLED IN INTERMEDIATE COVER LAYER.
3) GAS VENTS SHALL BE INSTALLED ON AN APPROXIMATE 200' X 200' (MAX.) GRID SPACING.

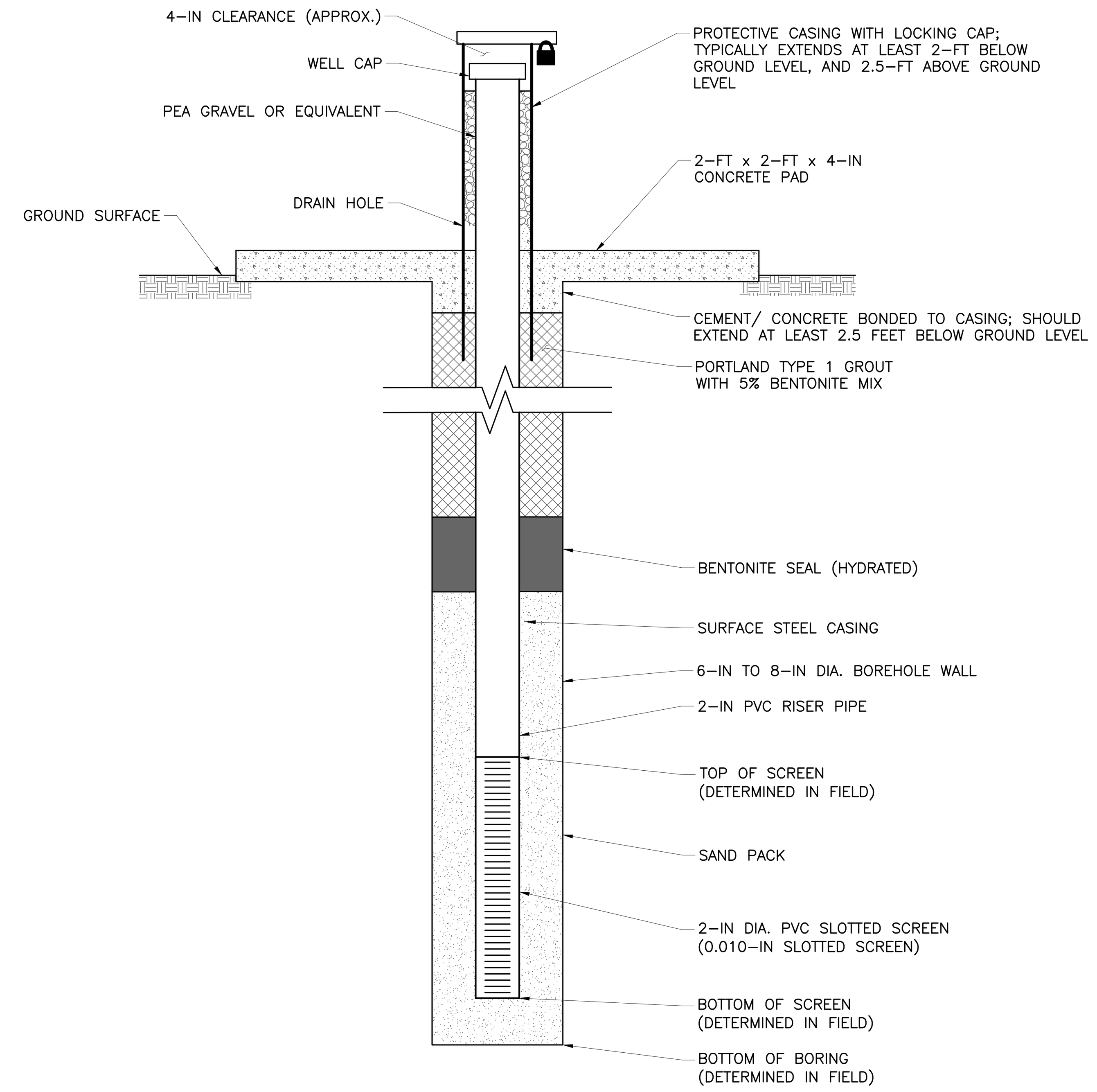
1 PASSIVE GAS VENT
NOT TO SCALE



2 PASSIVE GAS COLLECTION TRENCHES FOR CLOSURE PROFILE
NOT TO SCALE



3 PASSIVE GAS VENT PLAN
NOT TO SCALE



4 TYPICAL GROUNDWATER MONITORING WELL DETAIL
NOT TO SCALE

GAS MONITORING NOTES

1) TRENCHES TO BE SPACED NOT MORE THAN 200 FT. ON CENTERS AND WILL GENERALLY BE ORIENTED PERPENDICULAR TO THE CONTOURS
2) GAS COLLECTION PIPING WILL BE CONNECTED TO THE PASSIVE GAS VENTS AT REGULAR INTERVALS.
3) THE LOCATION OF THE PASSIVE GAS VENTS MAY VARY TO COORDINATE WITH THE TRENCH TIE–INS. SUCH VARIATION WILL NOT RESULT IN INCREASED SPACING NOR COVERAGE AREA THAN WHAT IS SHOWN.
4) THE GAS VENTING SYSTEM INDICATED IN THIS PERMIT DRAWING PACKAGE IS FOR A PASSIVE GAS SYSTEM WHICH MEETS THE CURRENT REGULATORY REQUIREMENTS FOR THIS FACILITY.
5) AN ACTIVE GAS SYSTEM MAY BE DESIGNED AND INSTALLED AT THIS FACILITY IN THE FUTURE. WHETHER VOLUNTARILY OR REQUIRED BY REGULATIONS.

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LANDFILL GAS AND GROUNDWATER MONITORING WELL DETAILS

DATE: APRIL 2025 | DRAWN BY: BPR
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4/24/2025

*HAND SIGNATURE ON FILE

DRAWING NO.:
P-630

CLEAN REVISED
SECTIONS

FACILITY OPERATIONS PLAN
MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION

Prepared For:

SANTEK ENVIRONMENTAL, LLC
A SUBSIDIARY OF REPUBLIC SERVICES

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1.0 INTRODUCTION

1.1 AUTHORIZATION

Santek Environmental, LLC (Santek), a subsidiary of Republic Services (Republic), is submitting the following Facility Operations Plan (Plan) for the proposed 2024 Horizontal Expansion of the Matlock Bend Class I Disposal Facility in accordance with the Tennessee Department of Environment and Conservation (TDEC), Rule 0400-11-01-.04(9) (Rule) on behalf of the Loudon County Solid Waste Disposal Commission. The facility operates under Permit No. SNL 530000203.

1.2 PURPOSE AND SCOPE

Preparation of this (Plan) is in accordance with the Tennessee Department of Environment and Conservation (TDEC), Division of Solid Waste Management's rules. The requirements of Rules 0400-11-01-.04(9) "Narrative Description of the Facility and Operations", and 0400-11-01-.04(2) "General Facility Standards" will be specifically addressed.

1.3 FACILITY DESCRIPTION

The Matlock Bend Landfill (MBLF) is a Class I municipal solid waste landfill Site that serves the sanitary and industrial waste disposal needs of Loudon County (County) and surrounding areas outside of the County. The MBLF is located on approximately 152 acres of land, about 5 miles west of the City of Loudon near State Route 72 and approximately 1.25 miles west of U.S. Interstate Route 75, at N 35º 44' 54.92" latitude and W 84º 24' 42.23" longitude. The referenced latitude and longitude were obtained from the Philadelphia, Tennessee 7.5 quadrangle map that is based on National Geodetic Vertical Datum of 1929 (NGVD29). Permanent benchmarks of known elevation have been constructed on-site as shown on Drawing No. P-100 of the permit drawing package.

A Site Location Map is provided as Figure 1 and a Location Plan and Master Plan are provided on Drawings P-000 and P-100, respectively, of the permit drawing package. Adequate water supply and electrical service is located within 500 feet of the MBLF and will be extended to incorporate the new Site as construction and operation requires.

MBLF currently has 67.2 acres available for waste disposal based on current property owned by the County. Of this total, 40.6 acres are currently permitted and consists of Modules A through J where disposal activities are ongoing. The remaining 26.6 acres includes several streams that have been deemed to be potentially jurisdictional. Because additional permitting is required for the streams and disposal capacity is urgently needed, MBLF is currently seeking approval for additional waste disposal capacity in a portion of the remaining 26.6 acres. This smaller expansion area is designated the 2024 Horizontal Expansion, with the remaining portion to be permitted at a later date. The future, additional expansion area for waste disposal will be addressed in a separate subsequent major permit modification. Detailed engineering design for the individual module development will be performed ahead of the start of construction of each module(s).

The 2024 Horizontal Expansion consists of proposed Modules 1, 2, and a portion of Module 3 that comprises approximately 7 acres. The 2024 Horizontal Expansion satisfies all buffer requirements as described in Table 1. Development of the 2024 Horizontal Expansion area will provide approximately 2,413,800 million cubic yards (mcy) of additional net airspace (waste plus daily cover soil). This volume is anticipated to extend site life by approximately 10 years at the projected waste acceptance rate of 160,000 tons per year (tpy). The remaining life (as of December 15, 2022) of the facility not including the 2024 Horizontal Expansion Area is projected to be approximately 2 years based on an estimated average disposal rate of 500 tons per day. The site life estimate is based on average in-place waste and interim cover soil density of 1,606 lb/cy and 307 operational days per year. Based on these calculations, the MBLF closure date will be extended to 2034. The information above satisfies, in part, Rule 0400-11-01.02. For additional information on solid waste type and source, refer to Section 2.6 of this Plan.

1.4 DESIGNATION OF RESPONSIBILITY

The Loudon County Solid Waste Disposal Commission holds the solid waste permit and owns the facility. Santek, a subsidiary of Republic, is contracted to operate and maintain the site in accordance with the contract and permit terms. All inquiries and correspondence concerning the landfill's permits and operations should be submitted to his/her attention at the following address:

Chairman Adam Waller
Loudon County Solid Waste Disposal Commission
100 River Road, #106, Loudon, Tennessee 37774
Telephone No. (865) 591-4446

The facility name and address are:

Matlock Bend Landfill
21712 Highway 72 North
Loudon, Tennessee 37774

Daily operation and maintenance of the landfill will be conducted by Santek. Landfill operations shall be supervised by a qualified individual who shall be thoroughly familiar with proper landfill operating procedures and who is trained and certified in accordance with Rule 0400-11-01-.12.

Santek personnel will notify the Division of Solid Waste Management within fourteen (14) days upon identifying a significant issue or noncompliance item.

2.0 OPERATIONS PLAN – GENERAL CONSIDERATION

2.1 INTRODUCTION

This Plan is to set forth operating and maintenance procedures necessary to meet the rules of Chapter 0400-11-01 Solid Waste Processing and Disposal and effectively dispose of solid waste. Establishment and enforcement of the proposed procedures for operation and plans for future development will be the ultimate responsibility of landfill management.

The objectives of the Facility Operations Plan are to:

- Present operation details that are compatible with the site characteristics and are useful to, and understandable by, operating personnel;
- Protect the environment; and
- Provide an efficient and economical operation.

2.2 COMPLIANCE WITH BUFFER ZONE STANDARDS

The landfill is located, designed, constructed, operated, and maintained in general accordance with Rule 0400-1l-01-.04(3)(a). The waste limit fill area is surrounded by a 100-foot buffer zone from the facility property line and greater than 500 feet from the nearest resident. The nearest existing downgradient drinking water well is greater than 500 feet from the waste limit. No springs, streams, lakes, or other bodies of water are located within 200 feet of the waste limit.

Table 1 provides a description of the surrounding features and their approximate distance to the waste limit.

TABLE 1: BUFFER DISTANCES

Structure/ Feature	Requirement	Location and estimated distance relative to waste limit
Nearest Property Line	100 feet	A minimum 100-foot buffer will be in place between the property line and the placement of waste.
Nearest Residence	500 feet	Approximately 2,000 feet west of the proposed waste limit boundary.
Nearest Well	500 feet	A total of 55 potential residents may rely on domestic water sources (including 15 suspected private wells and 2 springs) located within a 1-mile radius of the MBLF as described in Section 4.9 of the Supplemental Hydrogeological Report, and all are greater than 500 feet from the waste limit.
Nearest Stream	200 feet	A preliminary jurisdictional determination (PJD) was completed and is included as Appendix F in the Supplemental Hydrogeologic Report. The PJD identified a total of five water features within the study area including: one (1) intermittent stream (INT-1), one (1) perennial stream (PER-1), one (1) wet weather conveyance (WWC-1), and two (2) Ephemeral Wet Weather Conveyances (EPH/WWC-1 and EPH/WWC-2). The five identified features consisted of approximately 783 linear feet of perennial/intermittent stream, 677 linear feet of ephemeral/wet weather conveyance, and 564 linear feet of wet weather conveyance within the proposed future expansion area. The impacted portions of these streams are 367 feet for INT-1 and 553 feet for EPH-1 and -2. In addition, no wetlands were identified during the PJD. Concurrences from TDEC and the US Corp of Engineers are provided in Appendix A.

2.3 FACILITY ACCESS CONTROLS

Entrance to the MBLF property is provided with a locking gate to allow public access to the Site during working hours only. This gate is kept locked when the landfill is closed. Signs erected at the entrance gate describe the following information:

1. Name of the facility
2. Emergency telephone numbers
3. Fees assessed
4. Restricted materials
5. Normal operating hours
6. Penalty for unlawful dumping

7. Tarp policy

Furthermore, signs are posted as needed to notify haulers of speed restrictions and to direct them to the proper disposal areas. Such signs are legible and placed conspicuously to encourage safe operation within the landfill.

A formal record of each authorized vehicle that enters MBLF is kept by the scale house attendant. The log may be in paper or electronic format. Preliminary load inspection occurs as the trucks are being weighed in at the MBLF facility. The scale house operator visually inspects open incoming trucks and randomly questions the drivers about the materials being transported, including the place of origin. If the scale house operator determines that unacceptable material is being conveyed, the driver will be directed to consult a hazardous materials waste contractor for guidance on proper off-site disposal. Trucks carrying acceptable waste are directed by the scale house operator to the proper location for on-site disposal. Signs along the road are placed as required to guide the transporters to the appropriate disposal area.

Random physical inspections of 5% of all incoming vehicles are conducted by MBLF personnel. Records of these inspections are kept including the time, date, type of waste, vehicle identification, driver signature, and name of waste transporter. If unacceptable materials are discovered during unloading of the trucks, the wastes are reloaded, and the driver is directed to consult a hazardous material contractor for guidance on proper off-site disposal. Suspicious loads are also inspected. For more information on the random inspection procedures, refer to Section 2.24, Random Inspection Program, of this Plan.

Review of the solid waste manifest and scale house records aid the landfill staff in tracing the origin of unacceptable loads that are placed and not discovered prior to the hauler leaving the Site. However, when the source is not discovered, it is the responsibility of the MBLF operator to dispose of the material.

The landfill's operations hours for receiving waste are Monday through Friday (7:30 am - 4:00 pm), Saturday (7:30 am - 12:00 pm) and closed on Sunday. However, operations at the facility may take place 24 hours per day, 7 days a week.

2.4 METHOD AND SEQUENCE OF OPERATION

MBLF anticipates the construction of Modules 1 and 2 as the initial phase of construction of this 2024 Horizontal Expansion. Module 3 will be constructed after Modules 1 and 2. Each of these 2024 Horizontal Expansion modules will require placement of waste over existing waste slopes that are covered with soil. In such a case, intermediate soil cover will be stripped, or windows excavated in the soil cover prior to waste placement to promote downward movement of leachate and bonding of the new waste to the existing waste.

- The top 12 inches of soil material in the landfill expansion area is to be considered topsoil and should be stripped and stockpiled separately. It is preferable for stockpiles to be located in areas that will not disrupt construction or traffic flow around the perimeter of the new cell or existing landfill operations.
- After stripping of topsoil, the remaining excavation is to be completed to the grades and elevations shown on the permit drawing package. The materials removed by excavation are to be tested per the quality assurance standards outlined in the Construction Specifications and the Construction Quality Assurance Plan (CQA Plan) provided in Section VII of the permit application. Material having soil properties to obtain a remolded permeability of 1 x 10^{-7} centimeters per second (cm/sec) or less is to be stockpiled separately for use in the construction of barrier soil layer ~~layers~~. Other material will be used as fill materials in the construction of roads and berms. Any excess excavation materials will be stockpiled for future use as operational cover materials.
- Prior to placement of the barrier compacted soil layer, the subgrade will be proof rolled with a loaded, tandem-axle, dump truck or approved, pneumatic-tired construction equipment. Areas that pump, rut, or behave in an unstable manner will be undercut and replaced with engineered fill.
- After inspection of the disposal area is complete, placement and compaction of the barrier soil layer with a maximum permeability of 1 x 10^{-7} cm/sec will begin. The material will be placed in loose lifts not to exceed 9 inches thick and each lift will be compacted to an approximate 6-inch thick lift and observed and tested in accordance with the CQA Plan.
- After the geomembrane liner is installed, approved, and accepted, construction of the leachate drainage system will begin. A geotextile will be placed directly over the geomembrane to provide a cushion for the leachate drainage media. The leachate drainage media will be 12 inches of #57 washed gravel as described in the CQA Plan placed over the geotextile cushion. The drainage media will be spread over the geotextile cushion by a tracked dozer. A low-ground pressure dozer will be used to spread a minimum 1-foot bed of drainage media beneath it at all times. A standard-track dozer will supply the small low-ground pressure dozer by pushing a minimum 3-feet bed of rock beneath it at all times. No equipment will be in direct contact with the geotextile.
- Three leachate collection sumps will be constructed in the 2024 Horizontal Expansion area. The first leachate collection sump (Sump 1) will be located within Module 1 and is designed to collect leachate from Modules 1, B, C, D, and G. The second leachate collection sump (Sump 2) will be located within Module 2 and is designed to collect leachate from Modules 2, A, E, and F. The third leachate collection sump (Sump 3)

will be located in Module 3 and will collect leachate from Module 3, H, IA, IB, and J. Leachate from the existing Modules A through I of the existing landfill will be routed and collected in the three new leachate collection sumps as indicated. The sumps have been designed to have up to 4 feet of hydraulic head. The remainder of the leachate collection system is designed for 12 inches of head maximum.

- Leachate collection pipes will be installed during placement of the 12-inch drainage layer. The leachate collection pipes will be placed directly on the geotextile cushion and backfilled with No. 57 washed gravel or equivalent to the specified depth of 12 inches. In addition, No. 57 washed gravel will be placed at the toe of slopes in the landfill modules.
- The initial lift of waste will be visually screened to eliminate large sharp objects that have the potential to damage the liner system, be at least 6 feet in depth, and will cover the entire lined portion of the disposal area to provide protection for the geomembrane liner.

To increase the overall efficiency and safety of waste placement operations, stormwater segregation berms may be installed. These physical divisions within a module reduce the volume of stormwater runoff that comes in contact with the waste and, consequently, reduces the volume of leachate to be processed. The actual time and location of construction of these berms is a function of the rate of waste placement and the volume of stormwater to be managed. Consequently, actual locations of these berms are not presented in the permit drawing package prior to construction. Stormwater control details are presented on Drawings P-231 through P-235 and P-650 and P-651 of the permit drawing package.

General fill progression is shown on Drawing P-200 of the permit drawing package. A representation of the 2024 Horizontal Expansion sequencing and module phasing is shown on Drawing Nos. P-204 through P-210. The following narrative provides a general description of the fill procedures:

- Following construction of the first stormwater diversion berm (rain flap), waste placement will begin in the active module. Initial lifts of select waste (minimum 6 feet thick) will be placed in the lower portion of the active area. Select waste excludes bulky wastes, rods, poles, fence posts, and other waste with higher potential for damaging the liner. Waste filling will typically progress from the low point of the module and isolation berms upward to the first stormwater diversion berm.
- A sufficient number of pumps of adequate capacity will be maintained and employed at the stormwater diversion berm and the isolation berm bordering the active portion of the module. These pumps will be utilized to remove stormwater that collects along the upstream toe of the berms to manage contact with in-place Class I waste. This will

allow non-contact water runoff to be discharged to the stormwater detention basins or other acceptable structures.

- When the active area reaches the toe of the stormwater diversion berm, the stormwater diversion berm will be removed, and the removed rock material will be stockpiled for later use or spread into the leachate collection layer. If needed, the next stormwater diversion berm will be in place above the active area. A lift of waste will then be placed to the next stormwater diversion berm or isolation berm.
- Once the waste placement progresses to the level where exterior final or temporary slopes are constructed above the perimeter isolation berm or intercell berm, intermediate cover soil will be placed on the slope. Precipitation and other surface water will be directed to flow over the perimeter berm to a perimeter ditch or temporary stormwater pond before being diverted to one of the three stormwater management ponds. Only surface water that has avoided contact with the waste will be treated in this manner. Surface water that contacts the waste will be directed into the cell where it will be collected and handled as leachate.
- When the bottom area from the toe berm (low end) to the isolation berm (high end) within the active module is covered with a lift of select waste, the fill sequence will then progress from the high end of the module back toward the low end.

2.5 SOLID WASTE TYPE, QUANTITY, AND SOURCE

The MBLF accepts Class I wastes for disposal. Class I wastes include: domestic wastes, commercial wastes, institutional wastes, industrial wastes, municipal wastes, demolition/ construction debris, sewage solids, farming wastes, shredded or chipped waste tires, and dead animals. Special waste shall be disposed of in the Class I landfill area only if special provisions are made for such disposal and only if it is approved by the TDEC, Division of Solid Waste Management.

Based on the quantity of solid waste currently accepted, it is estimated that approximately 500 to 700 tons per day of Class I waste will be disposed at MBLF. Waste accepted in 2022[1] was roughly 47% non-hazardous municipal solid waste, 36% construction and demolition debris, 16% special waste, and less than 2% yard, organic, and tires waste. The facility will typically operate a minimum of 307 days a year.

[1] Data from "Summary of Material Activity Report, January 01, 2022 to December 31, 2022, All Materials," provided by Santek.

2.6 LANDFILL ACREAGE

A 152-acre Site, including the required buffer zones, has been designated for the MBLF facility. The design of the 2024 Horizontal Expansion has designated a total of approximately 47.6 acres of this Site for the purpose of Class I waste disposal. The existing permitted modules (Modules A through J) comprise approximately 40.6 acres and the proposed 2024 Horizontal Expansion (Modules 1 through 3) comprises approximately 7 acres.

Presently permitted Modules A through J operational areas have been utilized in the development of this Plan. The operational boundary and phasing plan for the expansion is shown on Drawings P-100, P-200, P-201, and P-202 of the permit drawing package in accordance to Rule 0400-11-01-.02. Modules are anticipated to be constructed in accordance with the phasing plan; however, the phasing plan will be reassessed throughout the operational life of the facility. The module layout and sequence of module construction shown on Drawing P-200 is proposed at the time of this submittal. Modifications to the module layout and sequencing may be required to better facilitate operational and construction needs in the future.

The module limits provide approximate boundaries of the anticipated progression of the landfilling operations. It is possible that changes in the waste stream, schedule or other factors could necessitate variations in the location of these module limits. Consequently, the module locations and limits should be considered approximate, understanding that the minimum buffer requirements will be adhered to. The 2024 Horizontal Expansion perimeter waste boundary will not be extended beyond the limits shown on the permit drawing package.

Also, each module may be constructed in whole or in part as required by operational and construction needs. For example, a module may be constructed in two sections, with each half given a different designation, i.e., Module 3A and Module 3B.

2.7 WASTE HANDLING AND COVERING PROGRAM

The waste hauling vehicles will deposit their loads at the open working face, as directed by MBLF facility personnel. The facility personnel will be present to ensure safety and inspect the waste for acceptability. The solid waste will then be spread in lifts approximately 3 feet thick or less. The dimensions of the open working face, while minimized, will be a sufficient size for proper waste disposal and equipment maneuvering. The slope of the waste placement will be maintained at or less than three horizontal to one vertical (3:1), as shown on the permit drawing package. Lifts of waste will be sloped as required to promote drainage away from the lift. Benches or add on berms will be constructed to provide stormwater drainage and reduce erosion of cover soil.

At the end of each day, one or both of the following methods will be used as daily cover:

1. 6 inches of soil cover material placed on the compacted wastes of the working face
2. Synthetic daily cover material.

In the event that only synthetic daily cover is used, at least once a week a minimum of 6 inches of soil cover material will be placed on the waste.

Soil will be excavated from onsite sources and from a borrow area located adjacent to the site.

Intermediate cover soil consists of an additional 6 inches of compacted soil on top of the 6 inches of daily/weekly cover soil or other material approved by the TDEC. Intermediate cover soil will be utilized on all surfaces that will be exposed for a period of 30 days in accordance with Rule 0400-1l-01-.04(6)(a)3. The intermediate cover soil will be maintained on all surfaces until either additional waste is placed over the surfaces or final closure cover is applied. Stockpiled soil obtained from excavating the current module or future modules may be used for barrier soil layer construction, daily, weekly, and intermediate cover.

2.8 OPERATING EQUIPMENT

The following is a list of the major equipment available that may be used on the Site:

TABLE 2: SITE EQUIPMENT

Quantity	Description
2	730 CAT ART. Truck
1	Ford Tractor
1	Sterling Water Truck
1	International Service Truck
1	ELGIN Street Sweeper
1	826K CAT Compactor
2	Ford F-150 Pickup
1	D6N T4 LGP
1	D6T CAT Dozer
1	320C CAT Excavator
1	826H CAT Compactor
1	320F CAT Excavator
1	740 CAT Articulated Dump
1	Dodge 1500 Pickup

Back-up equipment is available and included in the list above. In the event that additional back-up equipment is required, it may be rented, leased, or obtained from other landfill operations managed by Santek. The equipment list provided above is proposed at the time of this submittal and may be modified during operations with alternate equipment of various makes and models. Maintenance shall be provided by in-house personnel or at a commercial location in the MBLF area. Tools and supplies necessary for the proper operation and maintenance of the equipment shall be provided as needed.

2.9 LITTER CONTROL

The MBLF shall be kept free of litter and unloading shall be performed to manage scattering of solid waste. Portable fencing may be located near the working face to capture windblown debris. One or more employees on staff shall have part in the responsibility of picking up any material that is windblown, including material caught in the permanent fencing around the perimeter of the property.

2.10 STORMWATER MANAGEMENT

Surface water run-on and run-off may be diverted around the operating area by means of interceptor ditches, sediment traps or diversions berms as needed. Permanent stormwater run-on and run-off structures (i.e., culverts, ditches, etc.) have been designed to manage peak discharge resulting from a 25-year, 24-hour design storm event. Isolation berms may be constructed between modules as required to contain leachate and to prevent stormwater from entering the active area.

Temporary stormwater basins may be constructed outside of the isolation berm to collect stormwater from adjacent cut slopes. Swales and diversion ditches may be used to divert stormwater run-on water and surface water on the slopes. Pumps may be used to remove the water from the temporary basins as needed. Culverts, drainage pipes and/or other controls may be employed as needed. Ponding water will not be allowed on the working face during or after the completion of operations in any area. Finished plateau areas will be graded to provide adequate drainage of the finished area to minimize erosion, decrease runoff velocities and increase filtration of water into the soil and supports vegetation. The final cover grades have been established to maintain positive drainage of surface water even as consolidation of the underlying waste occurs.

Stormwater management basins will be utilized on the Site to control stormwater run-off and migration of sediments. The stormwater management basins have been designed to pass the run-off from a 25-year, 24-hour storm event through a primary spillway and pass the run-off from a 100-year, 24-hour storm event through a primary and an emergency spillway. The basins will be inspected for structural and operational integrity after significant rainfall events.

The stormwater management basins are designed to accumulate naturally occurring sedimentation. A reference post, or equivalent, will be used to gauge sediment depth. Stormwater management basins will be managed to assure the design capacity is maintained by excavating excessive soil sediment that may collect in the pond(s) upon reaching the 35% capacity mark noted on the reference post, or sooner.

As shown on Drawings P-231, P-232. And P-233 of the permit drawing package, Sediment Basin 2 will be enlarged, Sediment Basin 3 will be altered and Sediment Basin 4 will be constructed to manage stormwater at the Site through the completion of the post closure period. During the active operation of MBLF, Basins 2, 3 and 4, as well as temporary structures, may be used to control stormwater. In general, Basins 3 and 4 will be modified (Basin 3) or constructed (Basin 4) as the modules approach final grade elevations. Basin 2 was resized to accommodate additional flows from the expansion area, and to meet TDEC design criteria for wet storage and forebay volume.

Basin 3 is anticipated to be altered as the proposed Modules fill above grade and approaches final grade. Similarly, Basin 4 is anticipated to be constructed as the proposed modules fill above grade. Please refer to Appendix D of this operations plan for correspondence from TVA allowing construction of Basin 4 in the TVA easement.

Silt fences, hay bales and/or other erosion control methods may be constructed at the toe of slopes greater than 100 feet in length. At periodic intervals, not to exceed 200 feet, erosion control methods may be provided in collection ditches until vegetation has been established. The actual spacing of the erosion control device will be adjusted for steepness of the ditch slope. Erosion control devices will be maintained to limit transportation of sediments. Trapped sediments will be removed as needed. Rock check dams may also be used to improve the movement of suspended solids by controlling water velocity in the ditches.

Surface water run-off from soil stockpile area(s) will be controlled using berms, ditches, and/or other erosion control methods to limit siltation of on-site ditches and stormwater management basins. Vegetation will be established as soon as practical on areas not part of daily operation. The vegetation shall be properly maintained (i.e., mowed, fertilized) to assure growth. The erosion control procedures used will be in conformance to the guidelines provided in the TDEC Erosion & Sediment Control Handbook.

2.11 LEACHATE MANAGEMENT

The MBLF landfill's leachate containment system will include a composite liner system consisting of, from top to bottom:

- 12-inch-thick (minimum) protective cover and leachate collection system layer;
- 16-ounce per square yard (oz/sy) non-woven geotextile cushion; and
- Double-sided textured 60-mil thick high-density polyethylene (HDPE) geomembrane liner.
- 2-feet-thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1×10^{-7} cm/sec obtained from on-site sources; alternatively, a reinforced geosynthetic clay liner (GCL) providing a maximum hydraulic conductivity of 5×10^{-9} cm/sec underlain by a 2 feet thick low permeability select fill barrier soil providing a maximum hydraulic conductivity of 1×10^{-6} cm/sec obtained from on-site sources.

In select areas of Modules 1, 2, and 3 the 16 oz/sy nonwoven geotextile and 60-mil textured HDPE geomembrane will be replaced with a layer of Super GripNet manufactured by Agru America. The use of this material in select Module 1, 2, and 3 areas in lieu of geotextile/geomembrane is due to the need to increase liner system shear strength to provide adequate slope stability. The approximate location where Super GripNet is to be installed is shown on Drawing P-201.

The containment system will be underlain by not less than 5 feet of geologic buffer material (a maximum permeability of 1 x 10^{-6} cm/sec) from the bottom of the composite liner system to the seasonal high-water table. For information and data on the determination of the seasonal high-water table, refer to the Part II A Permit Application Supplemental Hydrogeologic Report, dated February 2023, prepared by Civil & Environmental Consultants, Inc. and submitted to TDEC. This report is also provided as Section II of this Permit Application.

Leachate from the 2024 Horizontal Expansion Area will be pumped by side slope riser sump pumps, located in the leachate collection sumps, to the leachate storage tank. A 100,000-gallon leachate storage tank is currently in-place at the time of this submittal. Additional tank(s) will be added to facilitate operations within one (1) year of waste acceptance in Modules 1 and 2. The 30-day estimated leachate storage volume is included in Section VI Appendix B and is estimated to be 358,481 gallons. Accounting for the existing 100,000-gallon leachate storage tank, a minimum additional 258,481 gallons of leachate storage capacity will be added. The new leachate storage tanks will be glass lined leachate storage tank(s) manufactured by the Aquastore or engineer approved equivalent. Two existing 10,000-gallon interim leachate storage tanks are located within the proposed 2024 Horizontal Expansion area and will be moved prior to the construction of Modules 1 and 2.

The leachate collection sumps will be a minimum of 3 feet deep and will include 24-inch diameter, SDR 11 perforated HPDE pipes as indicated on Drawing P-613 of the permit drawing package. The leachate collection pipes will have cleanouts in the event the collection pipes become clogged, or inspection is required. The cleanout lines, which are attached to the end of each leachate collection pipe, parallel the pipes that house the pump(s) to the surface. Clean water can be flushed into the pipes using a jetting or other system appropriate for the purpose. Inspections and/or cleaning will be done annually until a steady state is reached within the area influencing the leachate collection pipes. Once steady state appears to be achieved (i.e., when siltation becomes minimal), cleaning will be done as needed, such as when leachate flow decreases unexpectedly, or leachate levels are inconsistent with the predicted flow volumes. The drainage layer consists of a minimum of 1 foot of washed No. #57 gravel ~~limestone~~ with a 16-oz/sy cushion geotextile on the bottom. The geotextile will aid in protection of the composite liner system. Module bottoms are sloped toward the collection pipes to promote leachate movement. Final proposed base contours are as illustrated on Drawing P-201 of the permit drawing package. The leachate will be disposed via an existing force main system that direct discharges to an existing Loudon Utilities sewer system.

A discussion of leachate management system compliance points and levels, data tables, sump details with elevations, and typical maintenance schedule is provided in the Leachate Management Plan (Appendix B).

Currently, Loudon County Solid Waste Disposal Commission has authorization from the Loudon Utilities Publicly Owned Treatment Works (POTW) to discharge wastewater (leachate) from the Matlock Bend Landfill to the Loudon Utilities POTW under Industrial User Permit Number 09F that expires on April 30, 2025. A 100,000-gallon aboveground leachate storage tank was certified in February 2012. Based on a 4-year historical monthly average for the Matlock Bend Landfill, this storage tank will provide up to 10 days of storage capacity in the event of repairs, maintenance, or other disruption of the force main or other appurtenances to the Loudon Utilities POTW. The design of the leachate storage tank provides the capability of loading tanker trucks. In the unlikely event of such disruption, leachate will be temporarily rerouted to the leachate storage tank and an immediate plan to pump and haul leachate to a secondary treatment facility will be implemented. When Loudon Utilities POTW becomes operational, the onsite leachate collection system will return to direct discharge. Information regarding the primary and secondary leachate treatment options is provided in the Leachate Management Plan (Appendix B).

As noted above, within one (1) year of Module 1 and 2 waste acceptance, MBLF will install a minimum 258,481 gallons of additional storage capacity. MBLF will contract with a leachate hauling company to provide on call truck and treat capabilities from initial waste acceptance in Modules 1 and 2 to when the new leachate storage capacity is brought online.

The facility Leachate Management Plan that includes effluent limits and other conditions is provided in Appendix B. Leachate will be sampled and analyzed annually for the constituents listed in Appendix B. The semi-annual ground water analysis report also includes leachate sampling and analysis for the constituents in Tables 3 and 4.

The Hydrologic Evaluation of Landfill Performance (HELP) model was used in the design of the leachate collection system. Additional information and HELP model calculations are provided in Section VI, Appendix B of this Permit Application.

2.12 DUST CONTROL METHOD

Dust control measures shall be taken at the MBLF to prevent dust from creating a nuisance or safety hazard to adjacent landowners or to people engaged in supervising, operating, and using the Site. The on-site haul roads and any off-site borrow area haul roads are expected to be the primary sources of dust. Construction equipment traveling on the haul roads can disturb soil particulate matter, causing them to become airborne, particularly during periods of dry weather. A water truck may be utilized to suppress dust and to mitigate fugitive dust particles from migrating across the landfill property boundary by lightly spraying access roads and haul roads. Existing trees within the buffer zone provide wind breaks and help reduce off-site dust migration. Prompt seeding operations to establish vegetative cover on non-active areas will further minimize the potential for dust problems.

2.13 FIRE PROTECTION

Fire protection at the working face will be prevented by maintaining stockpiled earth for any fires that may occur. Any fires that occur may be smothered by placing soil on the burning area and working it back and forth with a bulldozer or other appropriate equipment. In no case shall operating personnel cross the burning refuse. A water truck is also available as fire protection back-up, if necessary. Supplemental fire protection may also be provided by the Loudon County Fire Department. The Loudon County Fire Department will respond to onsite emergencies if needed. In the event of a fire or explosion on-site that could threaten the environment or human health outside the facility, within 24 hours the Tennessee Emergency Management Agency and the Tennessee Department of Environmental Compliance, Division of Solid Waste Management will be notified.

To avoid injury and damage caused by landfill equipment fires, each piece of heavy landfill equipment shall have a mounted fire extinguisher. Proper cleaning and maintenance of the equipment will also reduce the possibility of equipment fires.

Solid waste that is burning or smoldering will not be deposited into the active portion of the landfill. The solid waste will be directed to a designated area, safely away from the active portion, and extinguished prior to being deposited into the landfill. Open burning of solid waste will not be allowed.

2.14 PERSONNEL FACILITIES AND SERVICES

Three buildings are utilized currently for the landfill site: a combination scale house/manager's office, maintenance building, and a storage/break room.

The scale house/office is a permanent structure approximately 12 feet by 46 feet. It is located adjacent to the entrance road for the purpose of maintaining traffic control, charging for disposal, and landfill security. Sanitary facilities, electricity, and telephone services are provided in this building.

The maintenance building is located south of the active landfill. It is a permanent structure consisting of reinforced concrete for the floor slab and sheet metal for the walls and the roof structure. Plumbing, lighting, heat, and electrical connections are provided in this building. A storage/break room is located adjacent to the maintenance building. The scale house/office is equipped with two-way radios to monitor landfill personnel. The scale house operator will also be able to contact the local hospital and fire department by telephone in case of an emergency.

2.15 LANDFILL GAS CONTROL DEVICES

The migration of landfill gases generated by the decomposition of solid wastes at the MBLF may be controlled through a passive venting system. As described in the Title V Permit Renewal (2021) the facility is currently not subject to a State or federal requirement for landfill gas collection and control. Consequently, the facility does not operate a landfill gas collection and control system (GCCS) as provided in 40 CFR 62 Subpart OOO and 40 CFR 63 Subpart AAAA. The Municipal Solid Waste Landfill transitioned from the requirements of 40 CFR 60 Subpart WWW (New Source Performance Standards for Municipal Solid Waste Landfills) to the federal plan for existing Municipal Solid Waste Landfills as provided in 40 CFR 62 Subpart OOO (Federal Plan Requirements for Municipal Solid Waste Landfills that Commenced Construction on or Before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014). The final rule for 40 CFR 62 Subpart OOO became effective on June 21, 2021. Additionally, the landfill is subject to 40 CFR 61 Subpart M (National Emission Standard for Asbestos). The facility is not subject to 40 CFR 63 Subpart AAAA (National Emission Standards for Hazardous Air Pollutants: Municipal Solid Waste Landfills), because the NMOC emissions are below the 50 megagram threshold according to the most recent Tier 2 testing.

The gas venting system indicated in this Plan is for a passive gas system that meets the current regulatory requirements for this facility. The closure gas venting system will consist of a series of interconnected gas collection trenches. These trenches will be spaced at a maximum distance of 100 feet and will be 18 inches wide and 18 inches deep. A geotextile fabric will encapsulate the washed crushed gravel ~~stone~~ placed in the trenches. A 3-inch diameter perforated HDPE pipe will be placed in the trenches to convey the gas to the passive gas vents. An active gas system may be designed and installed at this facility in the future. Whether voluntary or required by regulations, a minor modification will be prepared prior to installation of an alternate active gas system.

2.15.1 Landfill Gas Monitoring Plan

To monitor off-site landfill gas migration, methane gas will be monitored at the following locations:

- Underneath or in the low area of each on-site building;
- At the compliance monitoring boundary shown in the permit;
- At any potential gas problem areas, as indicated by dead vegetation or other indicators; and
- At any other points required by the MBLF permit.

Monitoring procedures will be in accordance with Section 3.3, "Post-Closure Landfill Gas Monitoring," of the Closure/Post-Closure Plan. If necessary, gas migration control will be performed in accordance with Rule 0400-11-01-.04(5)(a).

If concentrations of explosive gases at the compliance monitoring boundary exceed the lower explosive limit (LEL), the following precautions shall be met:

- Immediate implementation of all necessary steps to ensure protection to human health;
- Within 48 hours, notification of the TDEC Division of Solid Waste Management;
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health;
- Within 60 days of detection, implement remediation plan for release of methane gas; and
- The TDEC Division of Solid Waste Management will be notified of remedial plan and implementation schedule.

If explosive gas concentrations in facility structures exceed 25% of LEL, the following precautions will be taken:

- Evacuate facility structures;

- Ventilate facility structures;
- Notify the Loudon County Fire Department; and
- Post notification on all facility entrances stating occupying building is prohibited.

2.15.2 Landfill Gas Sampling Protocol

Landfill gas monitoring is described in Appendix C, Landfill Gas Control and Monitoring Plan.

2.16 GROUNDWATER MONITORING PLAN

The proposed groundwater monitoring plan consists of eight monitoring wells. Well MW-4R is the upgradient (background) well and wells MW-1A, MW-01, MW-02, MW-03, MW-05, MW-6R, and MW-07 are the downgradient (compliance) wells. All wells are currently installed, including MW-07, which is being proposed to replace MW-5 that will be decommissioned as development proceeds in the 2024 Horizontal Expansion Area. The proposed locations of these monitoring wells are shown on Figure 2 of the Modified Groundwater Monitoring Plan provided in Section III of this Permit Application.

The groundwater sampling will be conducted on a semi-annual basis and will include analysis of the constituents listed in Tables 3 and 4 below. Groundwater monitoring data will be evaluated using statistical methods in accordance with Rule 0400-11-01-.04(7)(a)4(v). Revisions to the constituents listed in Tables 3 and 4 may be requested by the MBLF based upon statistics.

TABLE 3: INORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Antimony	0.006	Lead	0.015
Arsenic	0.01	Mercury	0.002
Barium	2.0	Nickel	0.1
Beryllium	0.004	Selenium	0.05
Cadmium	0.005	Silver	0.10
Chromium	0.1	Thallium	0.002
Cobalt		Vanadium	
Copper	1.3	Zinc	
Fluoride	4.0		

TABLE 4: ORGANIC CONSTITUENTS

Constituent	MCL (mg/L)	Constituent	MCL (mg/L)
Acetone		trans-1,3-Dichloropropene	
Acrylonitrile		Ethylbenzene	0.7
Benzene	0.005	2-Hexanone; Methyl butyl ketone	
Bromochloromethane		Methyl bromide; Bromomethane	
Bromodichloromethane	0.08	Methyl chloride; Chloromethane	
Bromoform; Tribromomethane	0.08	Methylene bromide; Dibromomethane	
Carbon disulfide		Methylene chloride; Dichloromethane	0.005
Carbon tetrachloride	0.005	Methyl ethyl ketone; MEK; 2-Butanone	
Chlorobenzene		Methyl iodide; Iodomethane	
Chloroethane; Ethyl chloride		4-Methyl-2-pentanone; Methyl isobutyl ketone	
Chloroform; Trichloromethane	0.08	Styrene	0.1
Dibromochloromethane; Chlorodibromomethane	0.08	1,1,1,2-Tetrachloroethane	
1,2-Dibromo-3-chloropropane; DBCP	0.0002	1,1,2,2-Tetrachloroethane	
1,2-Dibromoethane; Ethylene dibromide; EDB	0.00005	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	0.005
o-Dichlorobenzene; 1,2-Dichlorobenzene	0.6	Toluene	1.0
p-Dichlorobenzene; 1,4-Dichlorobenzene	0.075	1,1,1-Trichloroethane; Methyl chloroform	0.2
trans-1,4-Dichloro-2-butene		1,1,2-Trichloroethane	0.005
1,1-Dichloroethane; Ethylidene chloride		Trichloroethylene; Trichloroethene	0.005
1,2-Dichloroethane; Ethylene dichloride	0.005	Trichlorofluoromethane; CFC-11	
1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	0.007	1,2,3-Trichloropropane	
cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	0.07	Vinyl acetate	
trans-1,2-Dichloroethylene; trans-1,2- Dichloroethene	0.1	Vinyl chloride	0.002
1,2-Dichloropropane; Propylene dichloride	0.005	Xylenes	10.0
cis-1,3-Dichloropropene			

Samples referred to above will be obtained in accordance with the groundwater monitoring program. Bailers or pumps will be utilized for monitoring well purging and sampling. The groundwater surface elevation will be determined and recorded at each monitoring well before each sample extraction, prior to any pumping or bailing of the well.

Groundwater sample analysis results and the associated groundwater surface elevations will be submitted to the TDEC, in the manner specified in the permit, within 60 days after completing the analysis. Additionally, records of all groundwater monitoring activities will be kept throughout the active life and post closure period of the MBLF facility, as specified in Rule 0400-11-01-.04(4)(a)4(vii).

These monitoring records will include the following information:

- The date, exact place, and time of sampling;
- The individual(s) who performed the sampling;
- The date(s) analyses were performed;
- The techniques (including equipment utilized) used for the analyses; and
- The results of each analysis.

2.17 FLOOD FREQUENCY AND PROTECTION

The Matlock Bend Landfill is not located within a 100-year floodplain. Figure 2 depicts the location of the Site relative to the FEMA Flood Insurance Rate Map.

2.18 FACILITY IMPACTS ON ENDANGERED AND THREATENED SPECIES

The facility design and Operations Plan have been prepared to have no impact on endangered or threatened species of plants, fish, wildlife, and their habitat.

2.19 FAULT AREAS

Rule 0400-11-01-.04(9)(c)4

Describes its compliance with applicable siting requirements for fault areas.

Rule 0400-11-01-.04(2)(u)
Fault Areas - Class I and II disposal facilities shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates in the Narrative Description of the Facility and Operations Manual that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the SWLF unit and will be protective of human health and the environment.

As described in the Supplemental Hydrogeological Report, fault areas are not known to exist within the Matlock Bend Landfill property. A review of regional geology, described in the Hydrogeological Report, shows that the proposed landfill expansion is also not located within 200 feet of a fault that has experienced displacement in Holocene time.

2.20 SEISMIC IMPACT ZONES

Rule 0400-11-01-.04(9)(c)5

Describes its compliance with applicable siting requirements for seismic impact zones.

Rule 0400-11-01-.04(2)(v)

Seismic Impact Zones - Class I and II disposal facilities shall not be located in seismic impact zones unless the owner or operator demonstrates that all containment structures including liners, leachate collection systems and surface water control systems are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The owner or operator must place the demonstration in the Narrative Description of the Facility and Operations Manual.

Based on seismic hazard mapping developed by the USGS, the maximum horizontal acceleration of bedrock that has a 10 percent chance of occurring during a 250-year return period is approximately 0.35g at the Matlock Bend Landfill. A copy of this map is provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application.

The Expansion Area was evaluated with respect to stability under site specific spectral response accelerations as described in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The results from that analysis are also provided in Appendix A (Liner System Calculations) to Section VI (Design Calculations) of this application. The evaluation demonstrates that estimated deformations that could occur during an earthquake with the above noted maximum horizontal acceleration will be negligible and within referenced maximum acceptable limits for both the base liner system and final cover system. This indicates that Expansion Area will remain stable and protective of the environment under the maximum design seismic event.

2.21 UNSTABLE AREAS

No unstable areas exist on the landfill expansion Site per the 2023 Hydrogeologic Report. No geologic faults known to have exhibited movement since Holocene time have been identified within 200 feet of the proposed landfill extension. The nearest fault to the Matlock Bend facility is the Beaver Valley fault, which is located approximately 3,000 feet northwest of the facility boundary. The Beaver Valley fault is not known to have experienced any motion since the late Paleozoic Era, per the 1996 hydrogeologic investigation by Theta Engineering, Inc., which is included in the 2023 Supplemental Hydrogeologic Report by CEC.

2.22 FACILITY IMPACTS ON REGULATED WETLANDS

No regulated wetland exists on the landfill expansion Site.

2.23 SEALING OF BORE HOLES

Prior to excavation, all bore holes drilled or dug during subsurface investigation, piezometers, and abandoned wells which are either in or within 100 feet of the areas to be filled will be backfilled with a bentonite slurry or other approved method by the Commissioner to an elevation at least ten feet greater than the elevation of the lowest point of the landfill base, or to the ground surface if the Site will be excavated less than 10 feet.

2.24 RANDOM INSPECTION PROGRAM

A random inspection program will be used to screen for regulated hazardous waste, infectious waste, PCBs (concentration 50 ppm), whole tires, lead-acid batteries, liquid wastes, and unauthorized special waste. At a minimum, 5% of the daily incoming loads will be inspected by MBLF personnel for prohibited wastes. The procedures and guidelines for this inspection program are as follows and are part of Santek Standard Operating Procedures:

A. Complete Solid Waste Manifest on Every Facility User.

   Know your customers. Do not accept wastes from unknown, unlicensed, or otherwise questionable haulers. Manifests will contain, at a minimum, the following:

   - Inspection date;
   - Vehicle identification;
   - Driver signature;
   - Identification of any unauthorized waste;
   - Disposition of any unauthorized waste; and
   - Facility inspector signature.

B. Require Customer to Sign Affidavit on Weight Ticket.

   By signing the affidavit, haulers certify they are "not transporting any hazardous, infectious or regulated waste." This further enhances facility screening efforts and emphasizes to haulers the importance of closely monitoring customers' waste as well as increases awareness of shared liability.

C. Random Daily Inspections

A random selection procedure ensures anyone can be checked anytime.

- Complete the Random Inspection Manifest and return a copy to Santek's corporate office on a weekly basis. Landfill personnel shall retain a copy of the inspection manifest at the landfill in a bound notebook.
- Inspections should occur approximately once per day at different times during the day, but not less than 5% of daily incoming loads.

D. Upon Discovering Prohibited Waste

Use protective equipment (gloves, goggles, respirators) before proceeding if waste is potentially hazardous. The following steps should be taken:

- Segregate waste;
- Question hauler;
- Review Solid Waste Manifest for discrepancies;
- Identify and contact generator;
- Document findings in print and with camera;
- Contact proper authorities, including the TDEC field office;
- Contact laboratory support, if necessary;
- Notify response agency, if required; and
- Prepare for alternative disposal methods, if required.

E. Operator Training - Screening of Wastes

As part of routine safety meetings, the landfill operators are educated to recognize unacceptable wastes and special wastes, and to be aware of the approval conditions of special wastes. Training consists of:

- Reviewing TDEC's regulations and definitions of specific waste streams including solid wastes, bulky wastes, hazardous wastes, industrial wastes, liquid wastes, medical wastes, special wastes, and construction and demolition waste.

- Reviewing the approval process for special wastes which includes receiving the appropriate paperwork issued by the Division Field Office to the waste generator indicating the waste has been granted approval for disposal at the landfill.
- Reviewing operating procedures and restrictions for the disposal of special wastes which require transportation to the landfill separately and securely contained.
- Receiving advance notice from the waste generator and establishing a routine delivery schedule, if necessary, to prepare for the receiving of special wastes.
- Confining unloading and disposal operations to a specific area, if necessary, to assure proper disposal with minimum complications.
- Covering the waste with approved cover material at the end of the working day.
- Maintaining proper records on the receipt and management of certain special wastes and incorporating the records into the daily random inspection program.

F. Communications

Radio contact between the scale house attendant and equipment operator should always be accessible.

The following wastes will not be accepted for landfill disposal at the Matlock Bend Landfill:

- Biomedical wastes;
- Powders & dusts – unless accompanied by State approval;
- Lead acid or other batteries;
- Used oil & other liquids;
- Unapproved sludges;
- Unapproved ash; and
- Fluorescent bulbs – if more than 50 per load.

Other Questionable Materials:

- Barrels and drums – unless (a) rinsed, and (b) ends are removed;
- Refrigerators and air conditioners – unless generator can document that the Freon has been removed; and
- Asbestos – unless accompanied by 24-hour notification to the MBLF (accepted under blanket special waste approval).

Personnel working at the scale house and the active face will be trained to identify suspicious wastes based on inherent characteristics. Landfill personnel will be familiar with the specific and detailed procedures of the screening program if suspicious, hazardous, infectious, or unauthorized special waste is found.

2.25 INSPECTION OF LINERS AND COVERS

Rule 0400-11-01-.04(9)(c) 19

Describes in a construction quality assurance plan:

(i) How each new "as-built" solid waste landfill unit(s) liner(s) and/or lateral expansion liner(s) and cover system(s) will be inspected and/or tested by a registered engineer as required at subparagraph (1)(c) of this rule during construction or installation for uniformity, damage, and imperfections, and

(ii) How each constructed section of the liner system or final cover system will be certified by a registered engineer.

Rule 0400-11-01-.04(1)(c) Project Supervision - A registered engineer must plan, design, and inspect the construction of any Class I, II, III, or IV disposal facility; also, a registered engineer must assist in the start-up of and outline correct operating procedures for any new or altered facility. Any registered engineer herein required shall be governed by the terms of T.C.A. Title 62, Chapter 2.

A detailed Construction Quality Assurance and Quality Control (CQA/QC) Plan for the construction of new landfill cells, final cover, and other appurtenant structures is provided in Section VII of this permit application. The provisions included in the CQA/QC Plan will be followed during the construction sequence, and the construction activities regulated by the CQA/QC Plan will be certified by a professional engineer registered in Tennessee.

2.26 PERMANENT BENCHMARK

Rule 0400-11-01-.04(2)(o)

Permanent Benchmark - There must be installed on-site a permanent benchmark (e.g., a concrete marker) of known elevation.

There are three (3) existing permanent benchmarks on-site and two (2) will be added in the future as shown in Table 5.

TABLE 5: SITE BENCHMARKS

BM#	Northing	Easting	Elev. (MSL)	Comment
6	497448.00	2471943.27	997.46	Existing
21	497772.83	2471868.18	997.79	Existing
24	497314.07	2470296.78	880.93	Existing
22A	498983.01	2470583.01		Future Benchmark
25	499203.42	2471846.30		Future Benchmark

2.27 AIRPORT SAFETY

Rule 0400-11-01-.04(2)(r)

Airport Safety - The owners or operators of Class I disposal facilities located within 10,000 feet (3,048 meters) of any airport runway end used by turbojet aircraft or within 5,000 feet (1,524 meters) of any airport runway end used only by piston-type aircraft must include in the Narrative Description of the Facility and Operations Manual a demonstration that the unit does not pose a bird hazard to aircraft. The owners or operators proposing new Class I disposal facility within a five-mile radius of any airport runway end used by turbojet or piston-type aircraft must notify the affected airport and the appropriate Federal Aviation Administration (FAA) office.

There are no airports located within 10,000 feet of the disposal facility boundaries, nor is the facility located within 5,000 feet of an airport runway end used by turbojet or piston-type aircraft.

2.28 ANNUAL REPORTING

Rule 0400-11-01-.04(2)(t)

Future Planning – All operators of Class I disposal Facilities within the state of Tennessee shall file with the Department, by May 1st of every year, and estimate of the remaining life of their site. This report shall include the original usable acreage of the site and the remaining unused portion at the time of the report. Where measuring facilities are available, an average monthly weight (or volume) estimate of the incoming waste shall be supplied. The Department shall have final determination of the accuracy of the estimate. If the operator plans to operate a new landfill, a suitable site for the new facility shall be selected at least twelve months before the estimated date for expiration of the operating life of the existing facility, and as applicable, design and construction plans shall be submitted at least six months prior to the estimated date for expiration of the operating life of the existing facility or site.

Similar to existing operations, Matlock Bend will file an estimate of the remaining life of the disposal facility with the Division by May 1 of each year. The report will include the original permitted acreage of the site and the remaining unused portion of the facility at the time of the report. In addition, an average monthly volume (by weight) estimate of the incoming materials shall be provided.

At least 12 months prior to the estimated expiration of waste disposal capacity, Matlock Bend will notify the Division of their intentions concerning the continuation of disposal operations at the facility.

2.29 HOLDING AND PROCESSING TANKS

Rule 0400-11-01-.04(2)(x)

<u>*Holding and Processing Tanks*</u> - *Holding and processing tanks for any liquids brought to a landfill facility for waste processing shall not be located within the waste management boundary of the landfill.*

No holding and processing tanks are currently proposed for use at the site for liquids processing.

APPENDIX B
LEACHATE MANAGEMENT PLAN FOR LANDFILL OPERATIONS

LEACHATE MANAGEMENT PLAN FOR MATLOCK BEND LANDFILL OPERATIONS

Prepared for:
Santek Environmental, LLC
Matlock Bend Landfill
Loudon County, Tennessee

Prepared by:
Holly Van Kirk – Environmental Specialist
Luke Cunningham - Environmental Manager

Date:
December 19, 2022

Revision: 0
Rev. 4 April 2025

SIGNIFICANT REVISIONS TO THIS PLAN REQUIRE A MINOR PERMIT MODIFICATION
(See Introduction Section, Pg. 1)

Amendment Schedule

This Leachate Management Plan (LMP) requires periodic updates to address changes in site conditions, facility operations, and/or government regulations, and shall be reviewed for adequacy at a minimum frequency of once per year.

Amendments to the LMP shall be documented on the LMP amendment schedule, included below. Each LMP revision shall be approved by the authorized representative responsible for certifying the LMP. The signature of this representative in the appropriate space below attests that the LMP amendment information is true and accurate. Amendment to the LMP can be inserted into the appropriate section of the original LMP and properly identified as a revision, or the entire document may be revised for clarity.

Amendment	Date	Approved By
Rev. 2, March 2024 (Revised to Address TDEC February 9, 2024 NOD)	April 2024	
Rev. 3, August 2024 (Revised to Address TDEC July 5, 2024 NOD)	August 2024	
Rev. 4, April 2025 (Revised as part of April 2025 Minor Modification Submittal)	April 2025	

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ATTACHMENTS

Introduction

This Leachate Management Plan (LMP) for Santek Environmental, LLC, located at 21712 Highway 72 North, Loudon County, TN 37774, contains procedures for leachate minimization, removal, storage, disposal, and recordkeeping responsibilities at this Santek facility. Leachate will be managed and disposed of every working day in such a manner to maintain full compliance with all local, state, and federal operating permit conditions and regulations. Significant changes to this LMP will be discussed with TDEC and may require a minor permit modification. Minor updates to the LMP to include as-built information are excluded from this minor permit modification requirement. Following cell construction and TDEC approval, MBLF will meet with TDEC's local inspector to assess whether a minor permit modification is required for any changes.

It is important that everyone at the facility participate in leachate management. The LMP establishes responsibilities and procedures for collecting, recording and reporting information pertinent to leachate management, and it defines methods for maintaining ongoing compliance at the facility. All facility personnel shall understand the permit requirements and abide by those requirements. In the event that a conflict arises between the permit and LMP, the permit shall always govern the actions of the personnel at the facility.

The LMP should be reviewed annually (at a minimum) by facility personnel throughout the year and updated if site conditions change.

Attachment A drawing that shows the alignment of the leachate force main from the existing 100,000 gal. storage tank to the direct disposal point.

Attachment B includes leachate data tables to define compliance levels and leachate sump on/off setting information for leachate sump pumps. In addition, tables to record daily storage tank levels and volumes of liquid removed from facility storage vessels for disposal at the approved disposal location.

Attachment C includes the list of procedures and management routines outlining what tasks and the recommended frequency by which they should be completed, and the responsible person for each task.

Attachment D provides the Leachate Disposal Permits/Agreements.

Attachment E includes a Leachate Maintenance and Inspection Schedule.

Attachment F includes a narrative description of the transition from current leachate operations to the proposed leachate operations associated with the 2024 Horizontal Expansion at the site.

Attachment G consists of drawings and details associated with the leachate management system.

Attachment H includes an image of the placard from the existing 100,000 gallon onsite leachate storage tank.

Leachate Regulations and Minimum Compliance

Promulgated on October 9, 1991, Subtitle D of the Resource Conservation and Recovery Act (RCRA), (40 CFR Parts 257 and 258) Section 258.40(a) (2), specifies that new municipal solid waste landfill units and lateral expansions shall be constructed with a composite liner and a leachate collection system that is designed and constructed to maintain less than a 30-cm (1 foot) depth of leachate over the liner. The design must consider the volume as well as the physical and chemical characteristics of the leachate. Leachate shall be managed until it can be demonstrated that it no longer poses a threat to human health and the environment.

Presented below are minimal, general leachate collection design and management requirements. In order to determine if the applicable state or facility specific permit has more stringent requirements, a review of state (and local) regulations as well as the facility permit and/or permit application must be conducted.

- Subtitle D leachate systems shall be designed to maintain a maximum head of leachate of one (1) foot or less above the liner.
- The leachate drainage system shall be designed and constructed to operate for the entire design period (i.e. the operating life of the facility plus 30 or more years).
- The drainage layer shall be designed with a graded filter or geotextile as necessary to minimize clogging and to prevent intrusion of fine material.
- Materials used in the leachate collection system shall be chemically resistant to the wastes and to the leachate expected to be produced.
- Collection pipes shall be of a cross-sectional area that allows for cleaning.
- The system shall be equipped with a sufficient number of cleanout risers or other access points to allow cleaning and maintenance of all pipes throughout the design. Leachate force main should have easily accessible cleanouts at intervals of no more than 500 feet and should account for pipe deflection and bends that limit advancement of cleaning equipment.
- The leachate management system shall consist of any combination of storage, treatment, pretreatment, and disposal options designed and constructed to maintain compliance with the requirements of the site-specific permit and local regulations.
- Pumps, meters, valves, and monitoring stations which control and monitor the flow of

leachate from the unit, and which are under the control of the operator shall be considered part of the facility and shall be accessible to the operator at all times.

- Leachate storage capacities should be of sufficient volume to allow for consistent, safe management of liquids, considering potential interruptions in disposal due to weather, holidays, or other factors causing disposal to be interrupted.
- All leachate storage tanks shall be equipped with secondary containment systems.

Compliance Point Identification

In order to comply with applicable regulations and maintain operational excellence standards, facility personnel must have a complete understanding of the leachate collection system components and site-specific operational requirements, and have complete records of the following components:

- The compliance locations that exist (Reference plans in Attachment G),
- The type of equipment and associated components installed,
- How the equipment is installed, and at what elevations, and
- The location-specific, permitted elevation levels.

Facility points of compliance typically include the following:

- Leachate sump: Module H (until Cell 3 is constructed), and Sumps 1, 2, and 3, and
- Leachate Pump #1, and
- Leachate storage tank.

Compliance points are tabulated in Attachment B.1. Sump details and compliance elevations are provided in Attachment B.2.

Compliance Level Establishment

In order to establish confidence that compliance levels are being attained, a review of the facility engineering drawings and details, and/or discussion with the facility engineer of record, is necessary. These sources should provide sufficient information to complete the leachate data tables included in Attachment C. If specific record details are not available, a field inspection of each sump will be necessary to obtain information in order to properly document the elevations of the pumps and required on/off pump setting elevations for each pumping location. Figure 1 (see below) shows a typical leachate sump cross section.

Once the configuration of each sump at the facility is established, a regulatory review should be conducted to understand the site specific federal, state, and local regulatory requirements to operate the leachate collection sumps. The facility operating permit is the primary source that outlines these requirements. However, if the facility operating permit does not clearly define legal requirements, further reference to the state solid waste laws and regulations will be necessary. Collectively, this information is used to determine compliance requirements for leachate elevations.

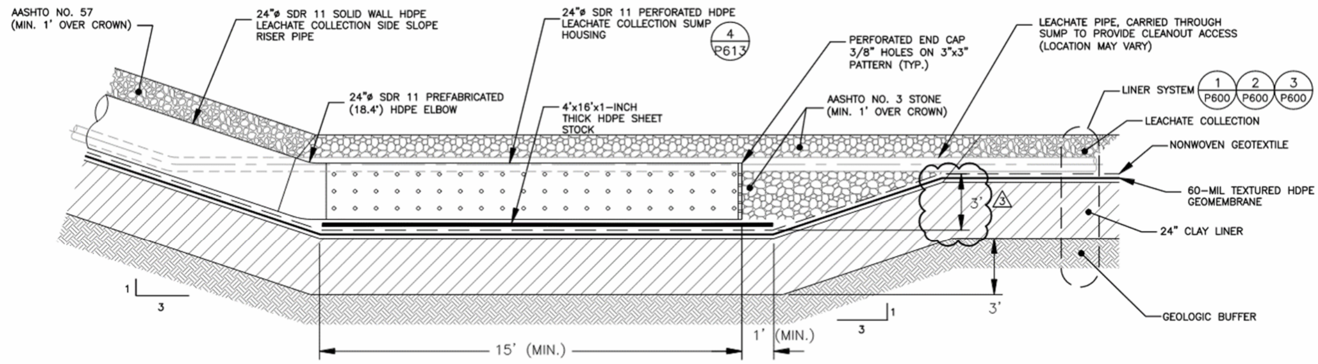
Example: A review of facility records indicates that the floor of the sump is situated 2 feet below the elevation of the base liner, and the pump and leachate level monitoring device are situated at the bottom of the sump. The facility's operating permit requires that leachate levels do not exceed 12 inches above the liner (not including leachate sump floor elevation). Thus, the compliance leachate level at the location of the leachate monitoring device would be less than 36 inches.

Once the compliance levels for each location have been documented, the appropriate information should be recorded on the appropriate form in Attachment C.

This information should be maintained in a binder at the facility to document all of the leachate sump elevations and settings of the leachate sump pump removal equipment. In addition, a laminated copy of the information for each leachate sump should be placed in each leachate control panel, providing the current elevation settings at each leachate removal location for facility personnel to reference during the course of their daily operations and maintenance of the leachate management system.

In addition to maintaining all of this elevation information in the facility operating file, the Environmental Manager should provide all of this information annually to the appropriate representative in the Corporate Engineering and Environmental Compliance group.

The data review and compilation for the leachate sumps elevations can also be used to verify compliance levels for other leachate conveyance devices, including, but not limited to, lift stations, storage tanks, or containment pond levels. The corresponding readings from other pumping locations at the facility shall be documented on the forms included in Attachment C and the schedule in Attachment E.

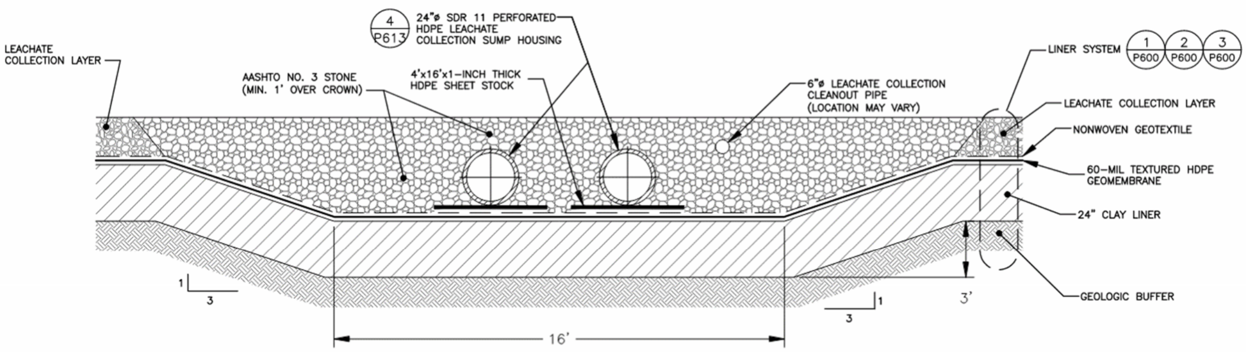


2 LEACHATE COLLECTION SUMP SECTION (TYPICAL)

NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.



3 LEACHATE COLLECTION SUMP SECTION (TYPICAL)

NOT TO SCALE

DETAIL NOTE:

1. ALL DIMENSIONS ARE APPROXIMATE AND MAY VARY TO SUIT FIELD CONDITIONS.

Figure 1 – Typical Leachate Sump Cross Section

Operations Inspection and Documentation

All leachate removal, conveyance, and storage systems shall be operable every day. While it is important to establish site-specific compliance levels for each leachate component, it is just as critical to maintain and confirm ongoing compliance with those established levels. Landfill environments are dynamic, and as such frequent observations are necessary to ensure consistent compliance.

On a daily basis (each working day), the Operations Manager (or their designee) should visit each compliance location and observe and document, at a minimum, the following operational conditions:

- On a daily (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each permit-defined leachate sump and leachate lift compliance locations. At a minimum, the following should be documented:
  - System operational status,
  - Compliance level at location,
  - Liquid level reading at time of inspection, and
  - Amount of liquid removed/pumped since last inspection (gallons or totalizer reading).
- On a daily, (working day) basis at active landfills and monthly at closed landfills, documented inspections should be completed at each leachate storage location. At a minimum, the following should be documented:
  - System operational status,
  - Storage level reading at time of inspection,
  - Comparison of storage level reading at time of inspection to maximum capacity, and
  - Amount of liquid pumped since last inspection (gallons or totalizer reading).

On a monthly basis, the Operations Manager (or their designee) should inspect each compliance location and observe and document the following maintenance conditions:

- Is the area clean, organized, and protected from siltation and standing rainwater?
- Is the area secured/locked/bolted at sump entry points?
- Are all confined space and other warning signs in place and legible?
- Is there evidence of leaks (staining, standing liquid)?
- Are the high/low level alarms properly set and functioning?
- Do all of the exposed piping and controls appear to be intact? Any obvious repairs needed (replacing sun damaged handles on valves, etc.)?
- Is piping permanent intact and protected, and the facility is not using temporary hoses or quick-connects?

- Is the specific compliance level labeled on the control panel?
- What is the condition of the pump control and level indicator system?
- Is the control box secure?
- Is there power to the control box? Is the box hooked to a timer or disconnect which would shut off power?
- Are there any exposed electrical components which should be contained/resealed?
- Does the system appear to be functioning properly?
- If controls are automated, what are the levels that pumps are currently set to come on and then turn off?
- Record the leachate level reading on the proper form and compare to the documented compliance level for that location.
- Is the pump running? If not, the pump must be cycled in manual operation and determination made of the following:
    - With pump running, observe discharge piping and verify that fluid is flowing to force main / discharge points.
- Is there a flow meter or cycle counter on the sump? Record any information.
- Is there an hour meter on the pump? Record any information.
- Describe the discharge pipe from the pump to the surface. Is the pipe hard-walled or flexible tubing? How is the pumps installation depth verified?
- Determine where the liquid collected by the pump is discharged.
- Is heat trace / freeze protection operational and in good working order (seasonal)?
- Repeat process for each compliance location.

If the monthly inspection described above is completed and a deficiency is noted, corrective actions should be scheduled immediately, especially in the event that liquid level readings suggest that the compliance level is exceeded. In the event that the liquid level does not indicate compliance and the system is not operating to lower the level, notification should be made to the General Manager and the facility Environmental Manager.

Additionally, the leachate management system at the Matlock Bend Landfill shall be maintained on a routine basis. Cleaning and inspection shall follow the schedule included in Attachment E of this Leachate Management Plan.

Environmental Compliance Evaluations

The Environmental Manager shall perform routine compliance evaluations of onsite data to confirm appropriate placement and operation of liquid removal equipment at all compliance points for the facility. These evaluations are meant to be a review of the daily observations and record-keeping by the Operations Manager (or their designee) described in the prior section.

A leachate compliance evaluation shall be performed annually at a minimum and any time that:

- System components are adjusted and / or changed,
- Site records are incomplete and do not contain specified information, or
- A greater than 50% change (up or down) in discharge quantity is recorded. This requires consistent review and trending of discharge quantity data.

Leachate compliance evaluations shall contain:

- Design review,
- Regulatory review, historical volume information review,
- Operating records review,
- Sump Location Inspection, and
- Inspection of Storage Tanks.

The results of these evaluations shall be presented to the General Manager for review. If any deficiencies are noted in the evaluation, the General Manager shall direct the appropriate responsible party (Operations Manager, Environmental Manager, or another designee of the General Manager) to correct the deficiency in a timely manner. The time to complete the corrective action shall be reasonable based on the specific item to be repaired, but by no means be delayed beyond the next scheduled environmental compliance evaluation.

Preventative Maintenance and System Verification Procedures

On a minimum annual basis, confirm equipment placement and operational compliance verification for all aspects of the leachate collection removal, conveyance, storage, and disposal systems. These procedures should include, but not be limited to:

- Removal, Cleaning, and Visual inspection of:
  - Leachate sump pump and liquid level control (transducer, float, etc.) for each leachate sump,
  - Lift station, manhole, storage tank/containment pond, cleaning (mechanical pump inspections, manhole/tank/pond integrity verification), and
  - Evaporation pond is clean and any accumulated sediment is removed so required storage capacity is maintained.
- Verification of integrity of piping:
  - Leachate collection and conveyance line jetting, and
  - Forcemain conveyance piping line jetting.
- Verification of pump and liquid level settings
  - Verify correct elevation settings are in place for every leachate sump pump and liquid level control,
  - Verify correct high/low elevations are in place for proper pump operations for every lift station and storage tank, and
  - Verify containment ponds or evaporation ponds are clean, and that any pumping equipment is properly calibrated with the required high/low elevation settings.

All preventative maintenance activities should be completed using leading industry practices.

Additionally, the leachate management system at Matlock Bend Landfill shall be maintained on a routine basis. Cleaning and inspection shall follow the schedule included in Attachment E of this Leachate Management Plan.

Annual Leachate Sampling Requirement

On an annual basis, a composite leachate sample shall be collected, which is representative of total landfill leachate. The Environmental Manager shall coordinate internal or external efforts to collect and analyze a representative sample of total landfill leachate.

The sample shall be analyzed (at a minimum) for ammonia, TKN, BOD, COD, metals, total sulfates, pH, TSS, TDS and other permit required parameters (if applicable) in order to confirm consistency with permit and regulatory requirements and internal guidance.

Leachate samples are taken by a qualified third-party vendor. The third-party vendor is escorted to both Leachate tanks where the sample is taken. One sample is taken at both tanks for a total of two samples. The third-party vendor completes a chain of custody, performs analytical testing, and provides results to the Environmental Manager.

Analytical Reports should be maintained in the facility operating file and shared with the appropriate representative in the Corporate Engineering and Environmental Compliance group.

Leachate Contingency Plan

Disposal methods may vary from facility to facility. Regardless of what onsite disposal options are used, the facility should have a primary offsite disposal. In the event that a primary location is unavailable, a secondary disposal location should be identified.

Primary Disposal Location Most Recent Verification Date: 12/19/22

Disposal Facility Name	Loudon Utilities
Facility Address	2360 TN-72, Loudon, TN. 37774
Facility Contact Name/Phone Number	Brianna Baxter; (423) 478-9337
Distance to Facility	3.3 miles
Active Permit or Agreement (Y/N) (if "Y", then provide permit or agreement number)	Yes
Volume/Flow Limitations (if any)	No limitations apply
Discharge Constituent Limits (if any)	Varies

Secondary Disposal Location Most Recent Verification Date: 07/31/2024

Disposal Facility Name:	Onsite Environmental
Facility Address	3900 N. Hawthorne Street, Chattanooga, TN 37406
Facility Contact Name/Phone Number	Valerie Fancher/ (423) 721-8836
Distance to Facility	78 miles
Active Permit or Agreement (Y/N) (if "Y", then provide permit or agreement number)	Y
Volume/Flow Limitations (if any)	132,360 gpd
Discharge Constituent Limitation (if any)	None

Note: Santek reserves the right to haul leachate to other secondary leachate disposal sites at their discretion, provided it is a licensed treatment facility.

Semi-annually, the Operations Manager and Environmental Manager or their designee will confirm the status of the primary and secondary disposal locations/options.

Leachate Disposal Agreements

The proper disposal of leachate from our post-collection facilities is a critical component for compliance and technical health of our landfills. As such, maintaining appropriate relationships, including compliance with permits and agreements, with our third-party disposal facilities is critical. Whether these relationships are directly with a municipal or privately owned treatment facility or a broker, it is important to maintain a professional working relationship and remain in good standing with those entities.

Third-party disposal entities may utilize a variety of mechanisms to establish an official relationship with users. These entities may require discharge permits, disposal agreements, contracts, or a combination thereof. State agency permits for discharge may also be required in conjunction with the specific agreement with the disposal entity. In rare circumstances, some small entities may not require any agreement whatsoever. It is Santek's policy that at a minimum, a disposal agreement or contract must be in place with all third-party disposal entities. This would include relationships with municipal treatment plants, privately owned treatment facilities, brokers, and leachate transporters. Service agreements from treatment facilities or brokers should be routed through normal contract review channels, beginning with a review from the Manager of Engineering and Environmental Management and assisted by our Legal Department. For contracting with transporters, the Corporate Procurement Department can assist with bidding and contracting.

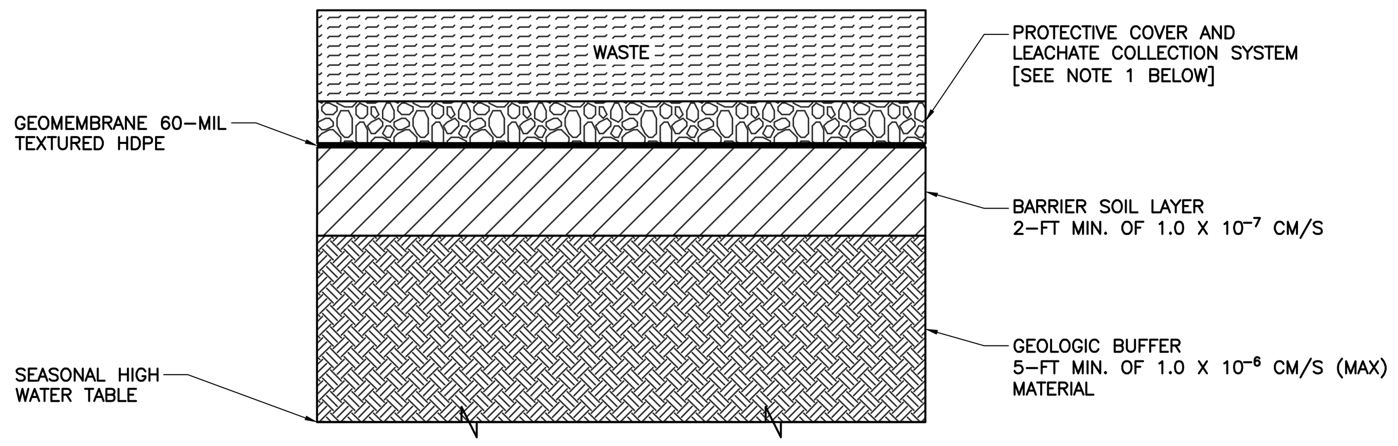
The relationship between third-party disposal entities and the local Santek facility is unique. Our facility is a customer of the third-party disposal outlet, but at the same time is regulated by that facility via a permit or disposal agreement. Because responsibility for and liability associated with our leachate goes beyond simply "getting it offsite," it is critical to maintain a close relationship with the disposal facility, much as one would with a regulator.

The most effective way to manage this relationship is through communication. Some suggestions for communication opportunities include:

- Invitations for tours, or touring the disposal facility,
- Communicating changes that may affect the quality or quantity of leachate (e.g. opening a new cell, installing additional pumps, change in waste stream), and
- Develop an understanding of changes the treatment facility may be planning in its processes.

ATTACHMENT G
DRAWINGS AND DETAILS ASSOCIATED WITH THE LEACHATE MANAGEMENT PLAN

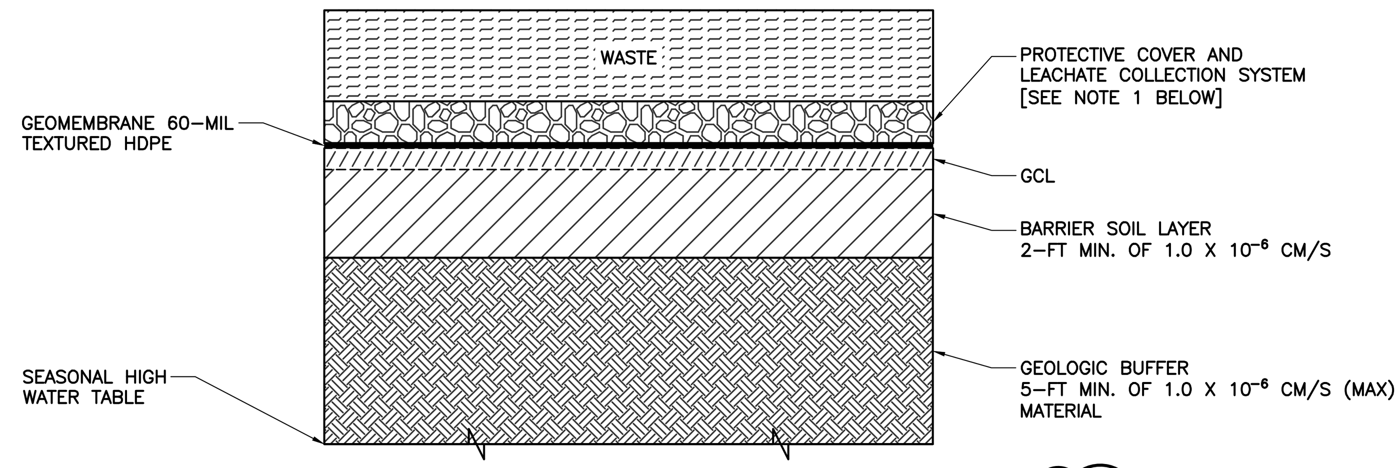
Note that the drawings and details shown in this section have been reproduced and are identical to the drawings included in the Part II – 2024 Horizontal Expansion Permit Plans, last revised April 2025. Drawings are included here for reference and completeness of the Leachate Management Plan. Refer to the Part II – 2024 Horizontal Expansion Permit Plans for additional information.



NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

1 OPTION 1 BASE LINER SYSTEM

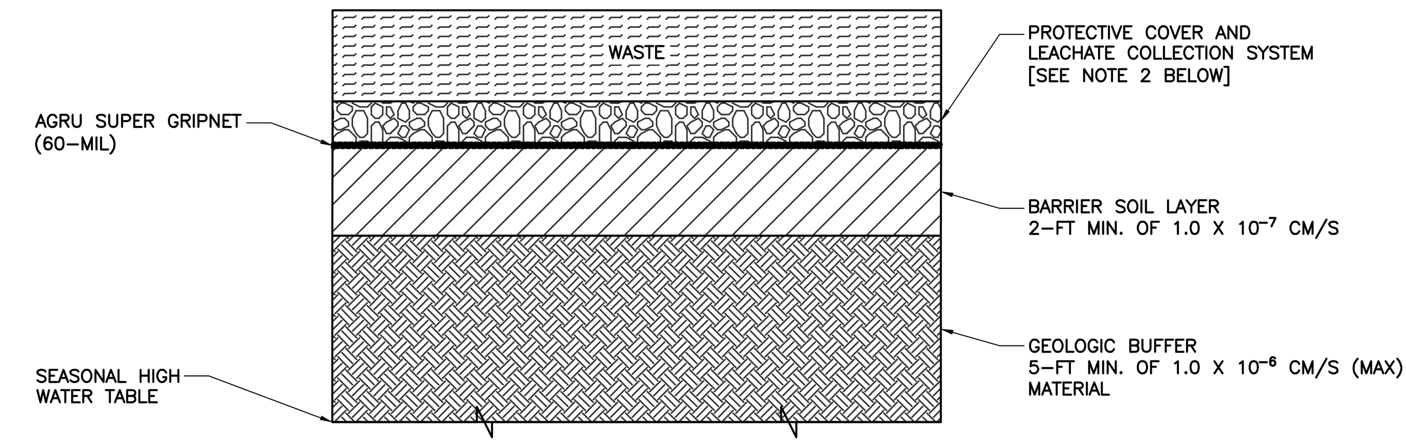
NOT TO SCALE



NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

2 OPTION 2 BASE LINER SYSTEM

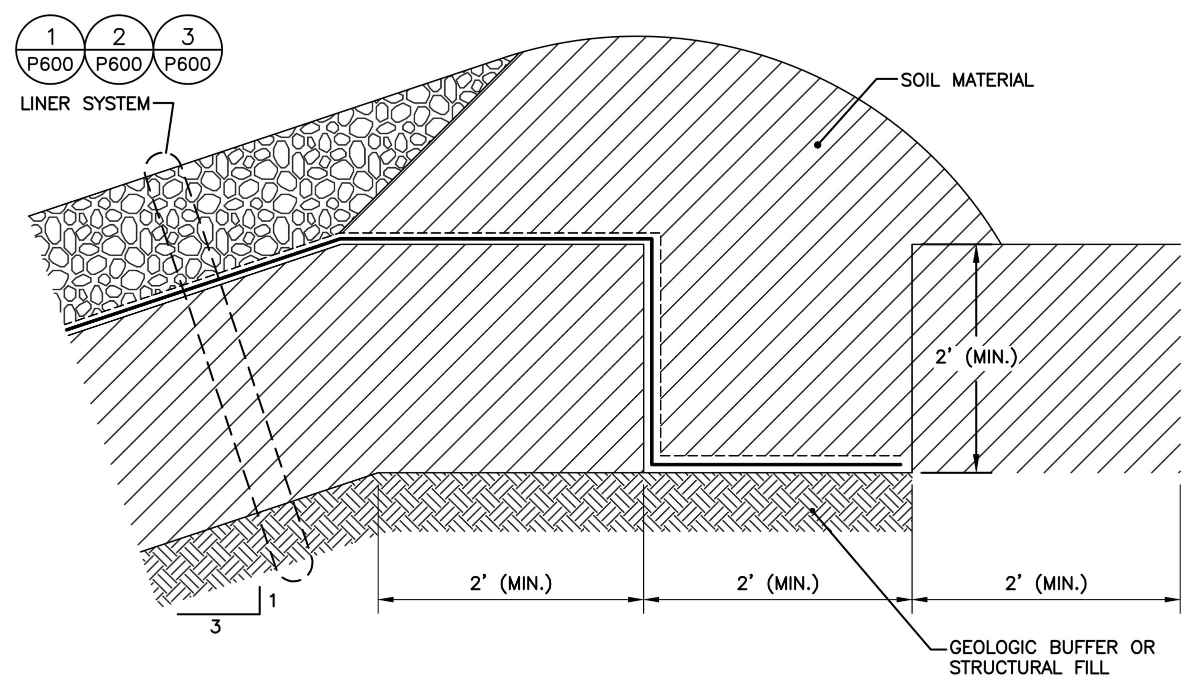
NOT TO SCALE



NOTE:
1. AGRU SUPER GRIPNET LINER SYSTEM SHALL BE INSTALLED IN MODULES 1, 2, AND 3 IN THE APPROXIMATE LOCATIONS SHOWN ON DRAWING P201.
2. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

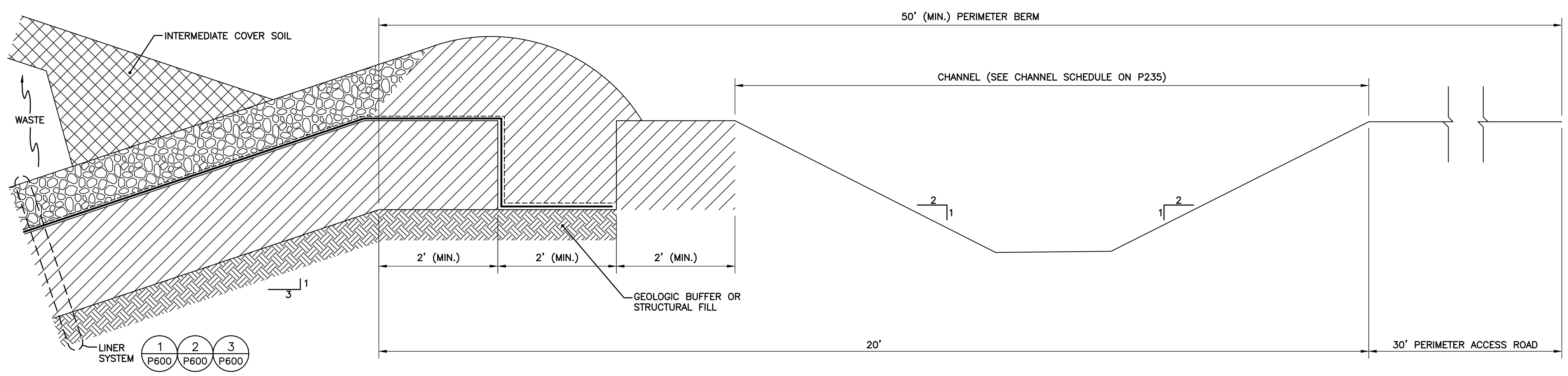
3 OPTION 3 BASE LINER SYSTEM

NOT TO SCALE



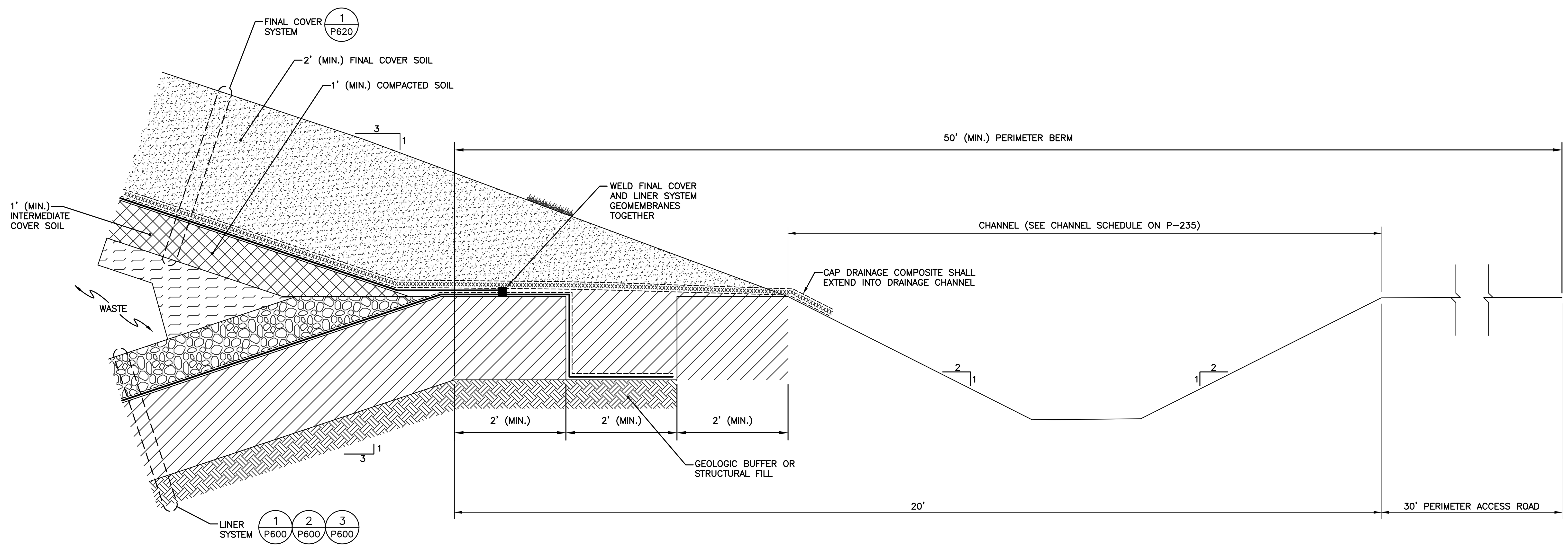
4 PERIMETER ANCHOR TRENCH

NOT TO SCALE



5 INTERIM PERIMETER BERM

NOT TO SCALE



6 PERIMETER BERM AT CLOSURE

NOT TO SCALE

LEGEND:

- 1 / P600 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINERSYSTEMDETAILS (SHEET 1 OF 3)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

ROBERT MICHAEL YACYSHYN · REGISTERED ENGINEER · AGRICULTURE · COMMERCE · No. 130544 · STATE OF TENNESSEE

4/4/2025

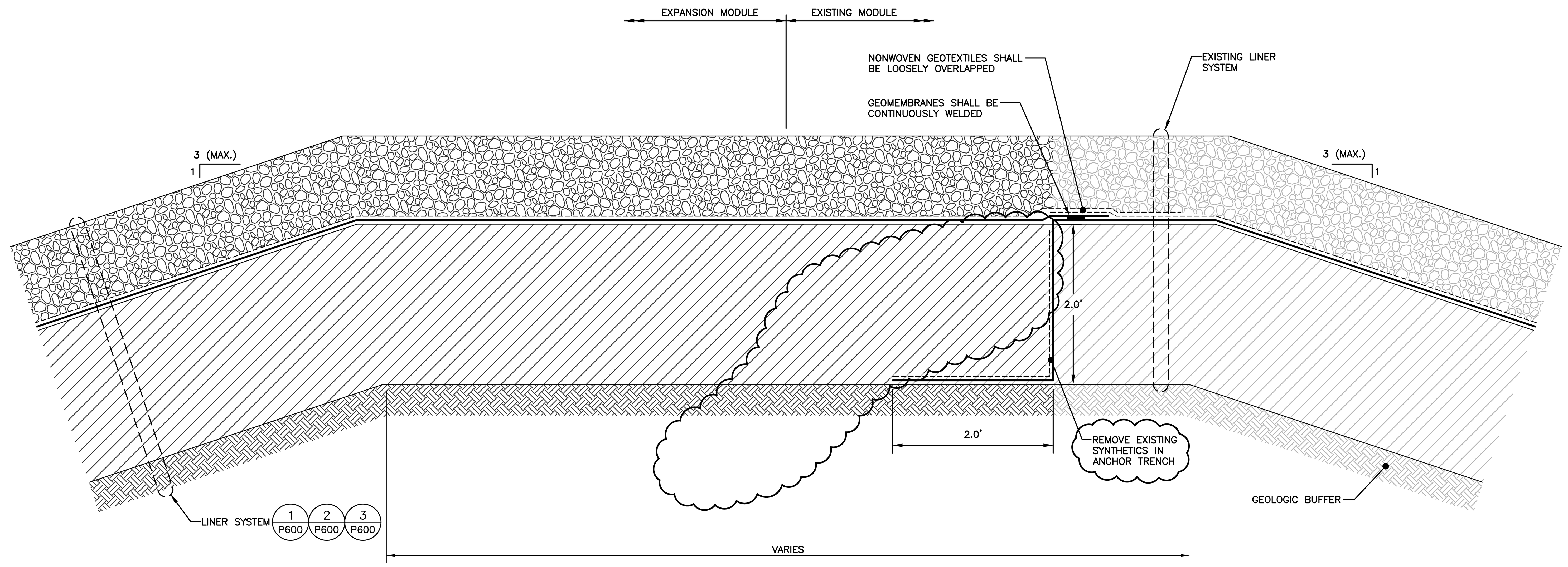
DRAWING NO.: P-600

*HAND SIGNATURE ON FILE

P:\310-000\317-474\-0400\Dwg\SWGP\317474-SWGP-P600-DETAILS.dwg[P-600] LS:(3/18/2025 - kunderwood) - LP: 4/3/2025 2:52 PM

DETAIL REMOVED

1 INTERCEPTOR DRAIN
NOT TO SCALE



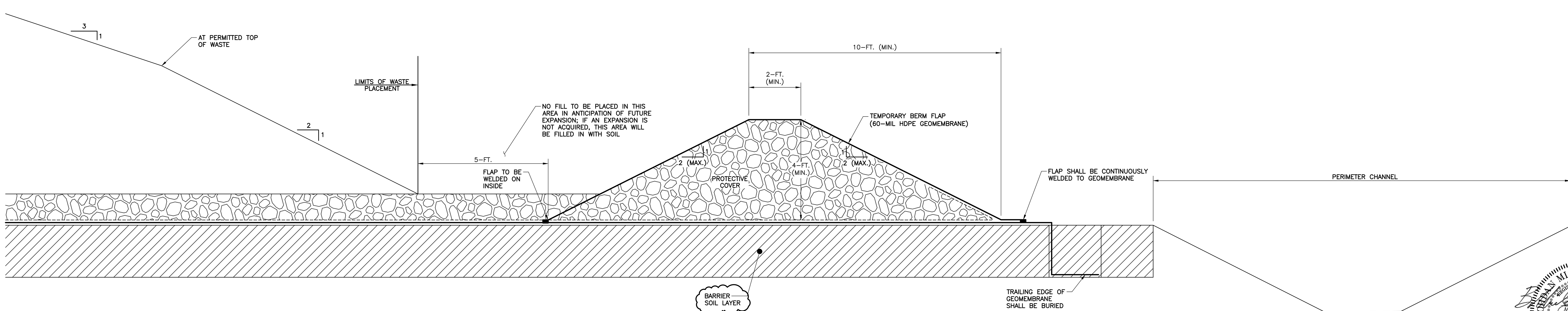
2 TIE-IN TO EXISTING LINER SYSTEM
NOT TO SCALE

LEGEND:

- 1 / P600 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



3 WESTERN AND NORTHERN PERIMETER BERM
NOT TO SCALE

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

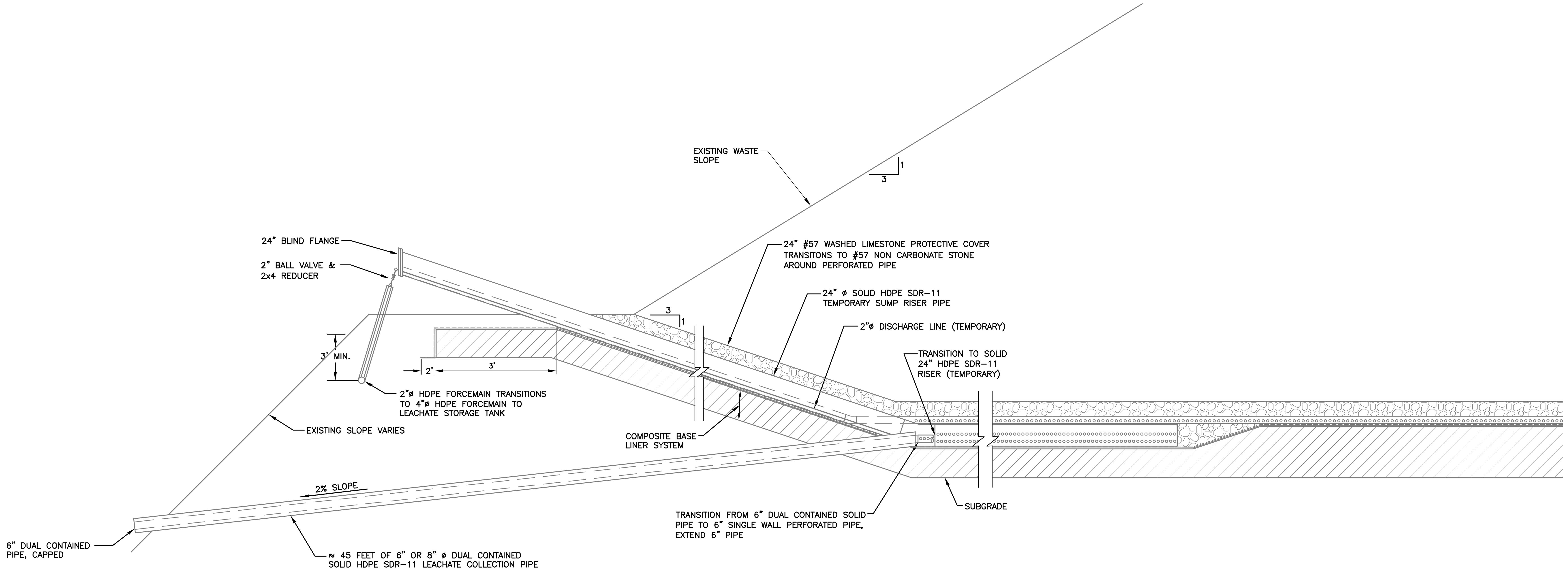
LINER SYSTEM DETAILS
(SHEET 2 OF 3)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025
*HAND SIGNATURE ON FILE

DRAWING NO.:
P-601

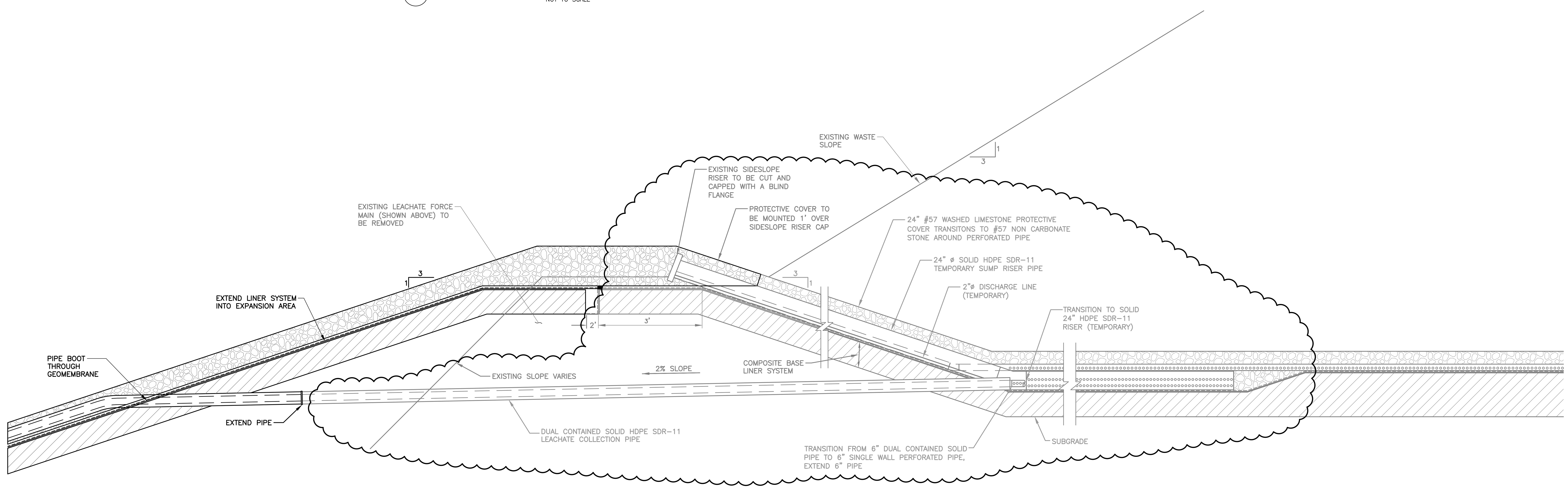
P:\310-000\317-474\-CADD\Dwg\SWGR\SWGR_317474-SWGR-P600-DETAILS.dwg[P-601] LS:(4/3/2025 - bunderwood) - LP: 4/4/2025 10:01 AM



NOTE:
THIS DETAIL SHOWS THE APPROXIMATE CONFIGURATION OF THE SUMP IN EXISTING MODULE H. THE EXISTING SUMPS IN MODULES A AND B ARE SIMILAR, EXCEPT THEY DO NOT HAVE THE 2 INCH FORCE MAIN CONNECTED THE THEIR SUMP PUMPS. REFER TO DETAIL 2 ON THIS SHEET FOR HOW THESE SUMPS WILL BE EXTENDED TO DRAIN BY GRAVITY INTO EXPANSION MODULES 1, 2, AND 3.

1 EXISTING TEMPORARY SUMP CROSS SECTION

NOT TO SCALE



2 EXISTING LEACHATE COLLECTION PIPE TIE-IN TO NEW MODULES

NOT TO SCALE

LEGEND:

- DETAIL DESIGNATION (1 / P601)
- SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
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2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

REVISION RECORD

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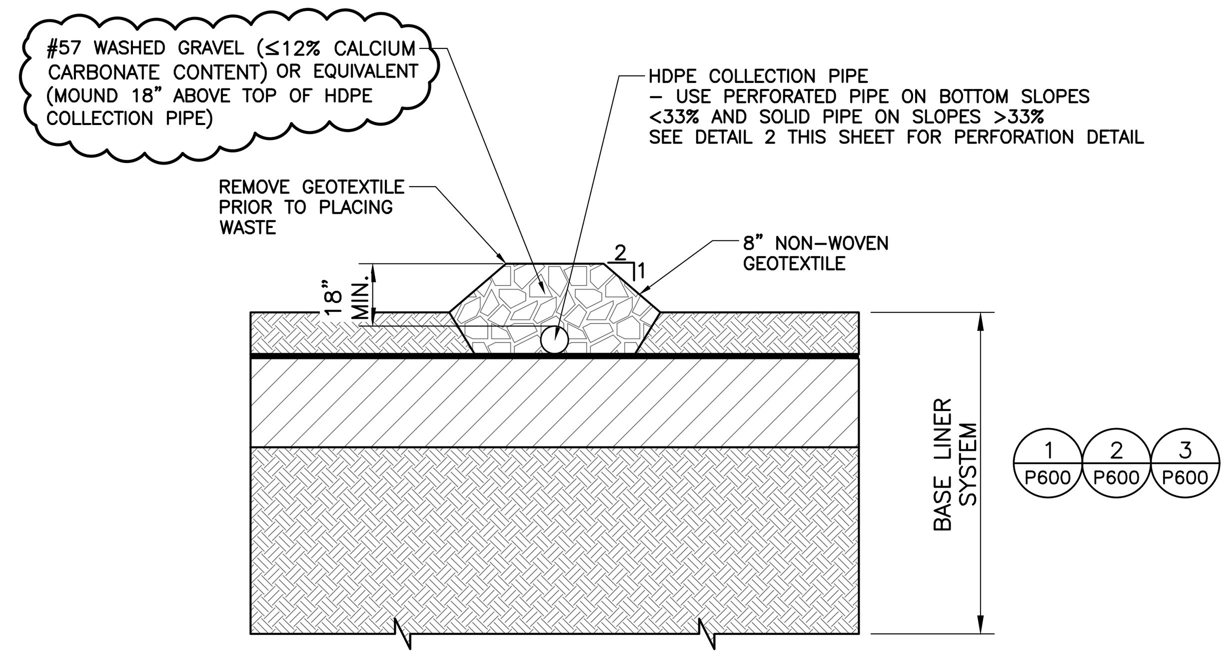
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474		
APPROVED BY:	EDC*		

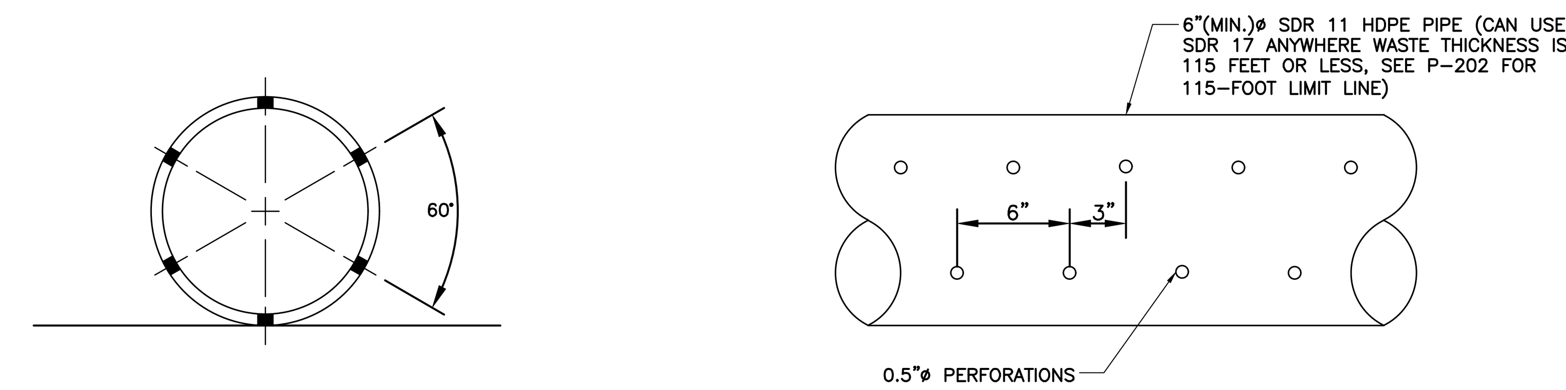
BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025
*ORIGINAL SIGNATURE ON FILE

DRAWING NO.: P-611



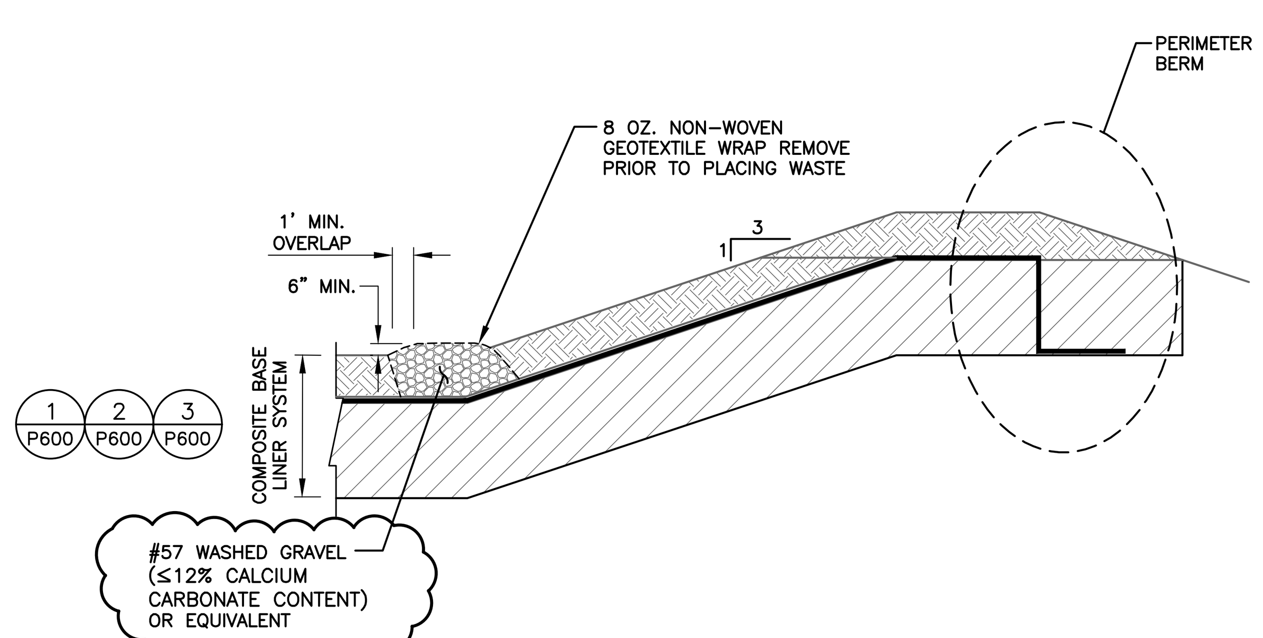
1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

NOT TO SCALE



2 PERFORATED PIPE DETAIL

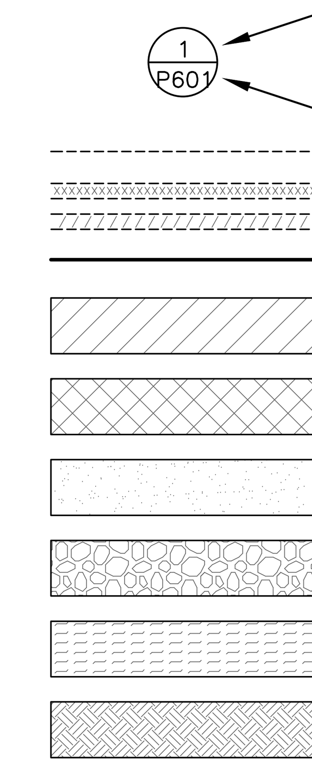
NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:



DETAIL DESIGNATION

SHEET WHERE DETAIL IS SHOWN

NONWOVEN GEOTEXTILE

DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)

GEOSYNTHETIC CLAY LINER

60-MIL TEXTURED HDPE GEOMEMBRANE

CLAY LINER

INTERMEDIATE COVER SOIL

FINAL COVER SOIL

PROTECTIVE COVER STONE

WASTE

STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

REVISION RECORD

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT
DETAILS (SHEET 3 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	*BMY

BOHDAN MICHAEL YACYNYCH
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025
SIGNATURE ON FILE

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APPENDIX C
LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND CLASS I LANDFILL 2024 HORIZONTAL EXPANSION MAJOR PERMIT MODIFICATION APPLICATION

LANDFILL GAS CONTROL AND MONITORING PLAN

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

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CEC PROJECT 317-474

AUGUST 2024
(REV. 1, APRIL 2025)

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INTRODUCTION

The following Landfill Gas Control and Monitoring Plan is designed to ensure compliance with applicable TDEC DSWM regulations. Generally, the most prevalent issues associated with landfill gas (LFG) are explosiveness, the asphyxiation hazard, and nuisance odors. As part of the 2024 Horizontal Expansion permit application, Matlock Bend Landfill (MBLF) is proposing to install a passive LFG venting system designed to control gas migration.

As described in the Narrative Description of the Facility and Operations, and as shown on the Engineering Plans, the proposed LFG management system will fulfill the following objectives:

- Allow LFG to vent at its point of generation, to reduce the potential for off-site migration;
- Control odor generation and surface emissions; and
- Avoid the build-up of pressure beneath closed and capped portions of the landfill.

The remainder of this attachment describes the proposed plan to control LFG and to evaluate the effectiveness of the control plan through the implementation of a monitoring plan.

LANDFILL GAS CONTROL PLAN

1.0 BACKGROUND

The following describes the design concepts and methods that will be used to construct the 2024 Horizontal Expansion gas control system to achieve the objectives stated above. Installation of the gas control system will occur in a phased manner that will follow the approximate phasing of cell and waste placement development shown on the phasing plans in the Engineering Plans. Specifically, as areas reach final grades, select gas venting features will be installed to control these areas. It is noted that the cell divisions and areas at final grade shown on the phasing plans are approximate and will depend in large part on the rate of waste deposition. Accordingly, phasing of the individual gas components may vary to meet field conditions.

Landfill gas will be vented from the waste to the atmosphere. The 2024 Horizontal Expansion LFG venting system will consist of the components listed below, which are discussed in depth in the following narrative.

- Passive Landfill Gas Venting Features;
- Landfill Gas Management System Installation;
- Landfill Gas Management System Operation;
- Maintenance; and
- Monitoring.

Refer to the figures included at the end of this Landfill Gas Control and Monitoring Plan for proposed locations of the gas vents and associated LFG details.

2.0 LANDFILL GAS GENERATION

The facility permit currently requires a passive landfill gas venting system to be installed at the time of final cover construction. Based on the current design capacity and site-specific Non-Methane Organic Compounds (NMOC) rate, the site is not required to submit an active Gas Collection and Control System (GCCS) Design Plan at this time for an active GCCS. An initial design capacity and NMOC emissions report was submitted to EPA on September 20, 2021, showing that the landfill will remain below 34 Mg/yr of NMOC through 2024 when the Tier II sampling results will need to be retested. This testing will reconfirm the site specific NMOC rate, but based on current rates, and it is not expected to require an active GCCS through the projected life of the site.

3.0 PASSIVE LANDFILL GAS VENTING SYSTEM CONSTRUCTION

The overall collection efficiency of the gas venting system depends largely upon the location and design of the 2024 Horizontal Expansion passive gas vents. Site-specific characteristics, such as existing and final topography, terrace/stormwater channel locations, limits and depths of waste, and cell development and sequencing are important factors in vent locations. Based on a consideration of these factors, the 2024 Horizontal Expansion passive gas vents were spaced on approximate 200-foot centers, which is similar to typical vertical landfill gas well spacing.

To allow LFG to vent, the passive vents will be installed over the disposal area in a phased manner throughout the life of the site. Due to variable field construction conditions, actual as-built locations may vary slightly from that shown on the Engineering Plans, but the approximate center-to-center spacing described above will be maintained.

Generally, passive gas vents will be installed after final waste elevations are achieved, but prior to installation of the final cover system. However, there may be instances (i.e., long periods when large intermediate slopes are exposed) when temporary gas vents may be installed. There may also be interim periods when temporary collection piping is necessary. Temporary vents and piping, if any, are not shown on the Engineering Plans, because they will be installed as needed. Additionally, if it is determined that the passive gas vent network is not effectively removing LFG from the waste mass (as indicated by odor or elevated methane concentrations), additional vents may be installed.

Passive gas vents will consist of several components including a 12” x 8’ x 8’ rock pocket installed in the intermediate cover layer, 4” diameter Schedule 40 PVC standpipes, LLDPE boot at the liner penetration, and a 24” diameter concrete standpipe.

After intermediate cover is placed, the rock pocket will be constructed in the intermediate cover layer. The rock pocket will be an 8’ x 8’ square filled with 12” of AASHTO #57 washed gravel or an equivalent aggregate. A 6’ x 6’ gas collection “H” will be constructed from perforated 4” diameter Schedule 40 PVC pipe and placed in the rock pocket. A tee in the center of the “H” will allow for a vertical standpipe to surface. Compacted soil will be mounded around the vertical standpipe to direct stormwater runoff away from the gas vents. Each vent will be protected by a 24” diameter reinforced concrete pipe. Details of the passive gas vents are provided in the Engineering Plans.

LANDFILL GAS MONITORING PLAN

The purpose of the landfill gas monitoring plan is to provide a process so that the MBLF operates in conformance with state and federal rules and regulations governing the management of landfill gases. The gas monitoring probe system will detect gas migration at the landfill boundary and around on-site structures. In addition, the LFG monitoring program will also monitor the effectiveness of the landfill gas passive venting system.

1.0 GAS MONITORING PROBE LOCATIONS

There is one gas monitoring probe currently installed at MBLF. Additionally, six temporary barhole probes are installed and sampled during quarterly events. The location of the LFG probe and approximate locations for the six barhole probes after the 2024 Horizontal Expansion are shown on Figure 1. In the event that LFG is detected in excess of specified maximum allowable levels, additional intermediate gas monitoring probes may be installed to enhance gas migration monitoring in that particular area.

2.0 STRUCTURE SAMPLING LOCATIONS

On-site buildings that have foundations and/or floor slabs constructed at or below grade have been and will continue to be monitored for combustible gas. These buildings include the scale house, office, and maintenance buildings. Tests should be performed along exterior walls at columns and/or construction joints. In addition, cracks or expansion joints of building slabs on grade are possible monitoring locations. In these structures, the air will be sampled with a calibrated gas detector, with samples obtained at floor level and in floor drains.

3.0 MONITORING FREQUENCY

During active landfill operations, the probes and structures will be monitored once per quarter, and following final closure, the probes will be monitored quarterly for percent combustible gas by volume. Gas monitoring will continue after closure until the end of the post-closure period.

Combustible gas levels will be measured to assess if these levels equal or exceed the following criteria:

- 25 percent of the lower explosive limit (LEL) in a structure within the landfill site; and
- The LEL at the boundaries of the landfill site.

The LEL is defined as the lowest percent by volume concentration at which an explosive gaseous mixture will propagate a flame in air at 25°C and atmospheric pressure. As methane is the main combustible constituent of LFG, the LEL for landfill gas is typically 5 percent methane in air.

4.0 MONITORING PROCEDURES

Monitoring will be accomplished using a portable combustible gas indicator (CGI) capable of registering 0 to 100 percent of the methane lower explosive limit and 0 to 100 percent combustible gas by volume. The CGI units will be appropriately calibrated and maintained.

Monitoring Methodology

- Always extinguish all smoking materials before testing for LFG;
- Monitor ambient air for landfill gas at one LFG probe, inside structures, and at six locations that have been historically monitored inside/along the compliance monitoring boundary;
- Methodology at location of LFG migration signs that are not in a final cover area:
    a. Punch a barhole approximately 12 inches deep.
    b. Take readings in the bottom of hole.
    c. Record readings after 120 seconds and location.
- Methodology at location of LFG migration signs that are in a final cover area:
    a. Inspect the area for cracks or signs of damage to the final cover.
    b. Take readings in areas of vegetative stress.
    c. Record readings and location.

5.0 REPORTING

All monitoring data will be recorded on an appropriate reporting form, and results kept on file at the landfill office. Results required for submission will be submitted to TDEC DSWM.

6.0 CONTINGENCY RESPONSE PLAN

During quarterly gas monitoring events, landfill personnel will note possible signs of LFG migration that may include:

- Stress in vegetation in or around site (stress could include stunted growth, wilting, color changes, etc.); and
- Inability to grow vegetation (bare spots) in or around Site.

Upon noting possible gas migration indicators noted above, the cause of the stress shall be verified. If the cause of the stress is determined to be gas migration, the area of stressed vegetation shall be monitored for the presences of landfill gas through bar hole methods as describe below under

Monitoring Methodology. If the cause of the stress is determined not to be from gas migration, gas monitoring will continue along the compliance monitoring boundary.

If concentrations in the monitoring probe and barhole probes equal or exceed the appropriate compliance level, the LEL (5 percent combustible gas by volume), The Tennessee Division of Solid Waste Management (TDSWM) will be notified within 24 hours. In such a situation, appropriate remedial action such as additional monitoring probe installations and/or installation/expansion of the gas venting/collection system may be required to return the site into compliance.

The following actions will be considered when gas concentrations in excess of the above levels are detected:

- Immediate implementation of all necessary steps to ensure protection to human health.
- Within 48 hours, notification of the TDSWM.
- Within 14 days, chronicle in the facility's operating records detectable gas levels and steps taken to protect human health.
- Within 90 days of detection, propose remediation plan for release of methane gas. The TDSWM will be notified of the remedial plan and implementation schedule.
- Monitoring frequencies may be increased. Samples may be collected for more precise laboratory analysis, and to determine if the source of gas is landfill related. Nested monitoring wells could also be installed to more precisely determine the depth of occurrence of the detected LFG.

If monitoring results indicate a safety concern for buildings or building occupants, appropriate measures to remedy the situation shall be immediately implemented.

FIGURES

Note that the drawings and details shown in this section have been reproduced and are identical to the drawings included in the Part II – 2024 Horizontal Expansion Permit Plans, last revised April 2025. Drawings are included here for reference and completeness of the Landfill Gas Control and Monitoring Plan. Refer to the Part II – 2024 Horizontal Expansion Permit Plans for additional information.

CONSTRUCTION QUALITY ASSURANCE/
QUALITY CONTROL PLAN
(CQA/QC PLAN)

MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

Prepared For:

SANTEK ENVIRONMENTAL, LLC
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APPENDICES

CONSTRUCTION QUALITY ASSURANCE /
QUALITY CONTROL PLAN

EXECUTIVE SUMMARY

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) addresses the construction of the liner system, leachate management system, landfill gas system, final cover system, sedimentation basins, and ancillary components. This CQA/QC Plan also addresses the inspection and documentation procedures that will be utilized before, during, and after construction.

The CQA/QC Plan describes the following:

- Field and laboratory sampling and testing procedures;
- Testing frequency;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to follow if a test fails;
- Management structure;
- Experience and training of the testing personnel; and
- Contingency plan for anticipated construction difficulties.

In the context of this CQA/QC Plan, the terms CQA and QC are defined as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to ascertain if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements.
- Quality Control (QC) refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements.

The principal parties involved in the CQA process include the Permitting Agency [Tennessee Department of Environment and Conservation (TDEC)], the Owner [Loudon County Solid Waste Disposal Commission, Matlock Bend Landfill], the operator, Santek Environmental, LLC (Santek), a subsidiary of Republic Services, Inc., the Construction Manager, the Area Environmental Manager (AEM), the Environmental Manager (EM), the Permit/Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer(s), the Geosynthetics Installer(s), and the Surveyor. Note that the EM and Construction Manager are representatives of the Operator and may be the same person. The Permit Engineer and the Design Engineer may also be the same person and/or engineering firm. The

CQA Consultant is responsible for observing and documenting activities related to the permit documents and the CQA/QC Plan. The CQA Consultant is also responsible for issuing documentation reports.

The CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for construction of base liner systems and final cover systems. These components will include:

- Excavation;
- Structural Fill;
- Liner System Barrier Soil Layer;
- Liner System Protective Cover/Leachate Collection System; and
- Final Cover Soil (compacted soil cover, final cover soil, and vegetative cover).

Tables A-1 and A-2 included in Appendix A present the laboratory and field test methods that will be used to characterize and evaluate the construction quality of soils and aggregates. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given. Table A-3 provides recommended minimum test frequencies to characterize and evaluate the quality of soils and aggregates, and to test the construction. Table A-3 also presents the sample size, acceptance criteria, and sample locations for soils and aggregate testing. Both field and laboratory tests will be performed prior to construction to confirm that the characteristics of the soil and aggregate from the proposed sources meet the material acceptance requirements.

The CQA Consultant shall document the inventory, testing, and placement of geosynthetics. Accordingly, this CQA/QC Plan presents information related to the manufacture, shipment, storage, testing, and installation of geosynthetic products (i.e., geomembranes, geosynthetic clay liners, geotextiles, geonets, and geocomposites) required for the construction of both liner systems and final cover systems. Each proposed geosynthetic test, along with its corresponding methodology and conformance testing frequency, are summarized in Tables A-4(a) through A-8.

Surveying shall be conducted at the site as part of the CQA/QC activities. Surveying of lines and grades shall be conducted on a continuous basis during the construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, to document quantities of soils and geosynthetics used in the construction, and to assist the Earthwork Contractor in complying with the required landfill grades. Survey results for record drawings shall be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

The CQA Consultant shall document that the quality assurance requirements presented in the CQA/QC Plan have been addressed and satisfied. Accordingly, the CQA Consultant shall provide the

Construction Manager with signed descriptive remarks, data sheets, logs, and reports to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain a file of design drawings, the CQA/QC Plan, checklists, test procedures, daily logs, and other relevant information at the project site.

At the completion of the work, the CQA Consultant shall prepare a final documentation report, which shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

1.0 USE AND APPLICATION OF CQA/QC PLAN

1.1 INTRODUCTION

This Construction Quality Assurance/Quality Control Plan (CQA/QC Plan) has been prepared for use at the Matlock Bend Landfill, owned by the Loudon County Solid Waste Disposal Commission and operated by Santek Environmental, LLC (Santek), a subsidiary of Republic Services.

1.2 SELECTION AND TESTING OF SOILS AND AGGREGATES

The CQA/QC Plan shall be used to confirm soil and aggregate material quality and installation. The selection of soils and aggregates shall be based on the permitted design for the facility. Given the selected soils and aggregates to be utilized for a project, this CQA/QC Plan shall be used to govern the material testing and installation. The CQA/QC Plan narrative and Table A-3 included in Appendix A have been prepared utilizing general terminology so that the CQA/QC Plan would be applicable to a range of soil and aggregate materials selected from the permitted design.

1.3 SELECTION AND TESTING OF GEOSYNTHETICS

The CQA/QC Plan shall be used to confirm geosynthetic material quality and installation. The geosynthetic materials shall be selected for a given project to satisfy applicable site-specific design requirements.

Following selection of suppliers or manufacturers for each geosynthetic component required for a given project, the applicable conformance testing tables provided in Appendix A shall be completed. The CQA Consultant or Operator's Representative shall insert the Manufacturer MARV values into the last column of each geosynthetic conformance testing table to be used for the project. Conformance testing shall be completed and reviewed with respect to the Manufacturer MARV values in each conformance test table. These completed conformance testing tables shall be provided to the Geosynthetic CQA Laboratory prior to the start of testing. These tables shall also be included with the certification report.

1.4 MINIMUM FIELD MONITORING FREQUENCY

This CQA/QC Plan addresses the selection, testing, and installation of materials needed for the construction of various landfill components. During the installation/construction phase of a project, field monitoring is necessary to ensure that the desired materials are utilized and installed in a proper fashion. Consistent with the personnel requirements specified in Section 3.3.1 of the CQA/QC Plan, the field personnel shall be trained and act under the control of a professional engineer registered in Tennessee. The scope of field monitoring activities may vary, depending on the type of construction being completed. During a given construction project, certain aspects may be monitored with part-time field visits, or on a full-time basis.

- Part-time monitoring is where a CQA/QC technician is not on-site full-time. Sufficient visits are made to the project to inspect each key item of construction prior to being covered by the next. During these visits to the project, the CQA/QC Technician will most likely be on-site for a limited time, less than the full workday.
- Full-time monitoring is where the CQA/QC technician is on-site for the full work period during each day when work is performed. The CQA/QC technical would typically be on-site and at the project area when key construction is taking place, or when monitoring the work prior to the covering with the next component.

During a typical disposal cell or closure construction project, the CQA/QC technician(s) shall provide full-time monitoring starting with preparation of the subgrade and/or buffer layer and continuing throughout installation of the protective cover layer. Generally, other construction monitoring activities may be performed on a part-time basis.

2.0 GENERAL

2.1 INTRODUCTION

This CQA/QC Plan addresses the construction of the base liner system, leachate management system, final cover system, sedimentation basins, and ancillary components.

Work shall be performed to the lines, grades, and dimensions indicated within the permit drawings. This CQA/QC Plan addresses the inspection and documentation procedures that shall be utilized before, during, and after construction to provide assurance, with a reasonable degree of certainty, that the facility meets the permitted design standards and specifications.

2.2 SCOPE OF THE CQA/QC PLAN

This CQA/QC Plan describes:

- Sampling and testing procedures to be used in the field and in the laboratory;
- Testing frequencies;
- Sampling parameters and sample locations;
- Material specifications;
- Procedures to be followed if a test fails;
- The management structure, experience, and training of testing personnel; and
- Contingency plan for anticipated construction difficulties.

2.3 DEFINITIONS AND USE OF TERMS

The following provides general information regarding specific terms, references, and units used within this CQA/QC Plan.

2.3.1 Use of Terms

In the context of this CQA/QC Plan, the terms CQA and QC are used as follows:

- CQA and Conformance Testing refers to measures taken by the Owner to determine if the Contractor's materials and workmanship are in compliance with the Contract Documents, Permit specifications, and design requirements;
- QC and Quality Control refers to measures taken by the supplier or Contractor to verify that the material has been prepared and the work has been performed in compliance with the requirements for materials and workmanship as stated in the Contract Documents, Permit specifications, and design requirements; and

- Manufacturer MARV values refer to the property or test values as published on the most recent manufacturer's standard specification sheet.

Note: For the purposes of this CQA/QC Plan, the term "geosynthetics" refers to geomembrane, geotextile, geonet, geocomposite, geosynthetic clay liner, or other manufactured component materials.

2.3.2 References to Standards

The CQA/QC Plan includes references to standard test procedures defined by the ASTM International (ASTM), and the Geosynthetic Institute.

2.3.3 Units

Properties and dimensions given in the CQA/QC Plan are expressed in U.S. units and may be followed by approximate equivalent values of International System of Units (SI) shown in parentheses. The values given in SI are typically accurate within ten percent of the governing U.S. units specification. In cases of conflict, the U.S. units govern.

3.0 RESPONSIBLE PARTIES AND LINES OF AUTHORITY GENERAL

3.1 RESPONSIBILITY AND AUTHORITY

The principal parties involved in the CQA process include the Permitting Agency, the Owner, the Construction Manager, the Environmental Manager, the Permit Engineer, the Design Engineer, the CQA Consultant, the Soils CQA Laboratory, the Geosynthetics CQA Laboratory, the Earthwork Contractor, the Geosynthetics Manufacturer, the Geosynthetics Installer, and the surveyor. The general responsibilities and authorities of each of these parties are described in the following paragraphs. The responsibility and/or authority of a given party may be modified or expanded as dictated by specific project needs during Pre-Construction Meetings.

3.1.1 Permitting Agency

The Permitting Agency (TDEC) is authorized to issue the permit for construction of the waste containment facility based on review and acceptance of the permit application. Additionally, the Permitting Agency provides formal acceptance of the Construction Certification Report prior to the use of the constructed item.

3.1.2 Owner

The Owner is the Loudon County Solid Waste Disposal Commission. The Owner contracts with the Operator, Santek, to operate the facility and to engage the various services needed to permit, design, and construct the facility.

3.1.3 Operator

The Operator, Santek, is responsible for coordinating the design and construction of the landfill. The Environmental Manager and Construction Manager are the two representatives of the Operator responsible for coordinating the design and construction of the landfill facility.

- Environmental Manager is responsible for the management of the Design Engineer, CQA Consultant, and other entities directly contracted to the Owner for engineering, surveying, laboratory testing, or other professional services. This responsibility includes compliance with the permit and review/submission of the CQA documentation demonstrating that the facility was constructed in general accordance with the approved permit and design specifications. The Environmental Manager is responsible for procuring a consultant to provide the surveying necessary for the certification documentation. The Environmental Manager has the authority to select and dismiss parties charged with design and CQA. The Environmental

Manager also has the authority to accept or reject design drawings and specifications, CQA/QC Plans, and CQA reports.

- Construction Manager, if used, is the official representative of the Owner responsible for coordinating schedules, meetings, and field activities. This responsibility includes communications to the Operator, CQA Consultant, Surveyor, Contractors, Manufacturers, and other involved parties. The Construction Manager has the authority to select and dismiss parties charged with construction activities. The Construction Manager also has the authority to direct contractors hired by the Owner and to accept or reject their materials and workmanship. Construction Manager responsibilities may be fulfilled by on-site facility employed personnel or a selected representative assigned by the Owner.

3.1.4 Permit/Design Engineer

The Permit/Design Engineer is a firm or person, retained by the Operator, to prepare documents for acceptance by the Permitting Agency and/or construction of the facility. The permit documents establish the limits, type, and details of the liner system, leachate management system, and other components of the site. The permit documents provide minimum specifications and are the governing document when a specification contradiction arises. Optional construction documents and drawings may be prepared in some cases to provide additional information for a specific construction project.

During construction, the Permit/Design Engineer may prepare applications to the Permitting Agency for approval of substantive changes to the design drawings or specifications of the facility. Substantive changes include changes that modify or impact the technical basis for engineered components of the facility design. Such changes will require the approval of the Permitting Agency.

3.1.5 CQA Consultant

The CQA Consultant is responsible for observing and documenting activities related to the permit documents and CQA/QC Plan. The CQA Consultant is represented on-site by the CQA Resident Engineer and supported on-site by CQA monitoring personnel, the specific number of which will be determined by workload.

In general, the responsibilities and authorities of the CQA Consultant include:

- Having a complete understanding of the permit documents, drawings, and specifications;
- Attending construction meetings and preparing meeting minutes;
- Scheduling, coordinating, and performing CQA activities;
- Verifying that the selected geosynthetic products meet or exceed the design;

- Performing independent on-site observation of the work in progress to assess compliance with the CQA/QC Plan, permit documents, drawings, and specifications (if applicable);
- Recognizing and reporting deviations from the CQA/QC Plan, permit documents, drawings, and/or specifications (if applicable) to the Environmental Manager and Construction Manager;
- Verifying that test equipment meets testing and calibration requirements, and that tests are conducted according to standardized procedures defined in the CQA/QC Plan;
- Recording and maintaining test data accurately;
- Identifying CQA tested work that should be accepted, rejected, or further evaluated;
- Verifying that corrective measures are implemented;
- Documenting and reporting CQA activities;
- Collecting data needed for record documentation; and
- Maintaining open lines of communication with other parties involved in the construction.

The CQA Consultant is also responsible for issuing certifications for major construction activities. Certifications shall bear the seal of a Professional Engineer registered in the state of Tennessee. Possible construction activities include:

- Structural Fill;
- Geologic Buffer Layer;
- Barrier Soil Layer;
- Geomembrane Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System Piping;
- Erosion and Sedimentation Control Structures;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Intermediate and Final Cover Soil;
- Gas Monitoring System; and
- Groundwater Monitoring System.

3.1.6 Soils CQA Laboratory

The Soils CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the soils and aggregates. The Soils CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work of the Soils CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.7 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory is responsible for performing the laboratory testing required by the CQA/QC Plan to determine specific characteristics of the geosynthetics. The Geosynthetics CQA Laboratory is also responsible for providing adequate documentation of analytical results, test methods followed, and testing equipment used. Work performed by the Geosynthetics CQA Laboratory shall be administered by, and reported to, the CQA Consultant.

3.1.8 Earthwork Contractor

The Earthwork Contractor is responsible for all activities assigned by the Operator, these may include such things as: moving earth to establish the liner grades, installing structural fill, installing the barrier soil layer, placing pipe and granular materials for construction of the leachate collection and management systems, preparing the intermediate cover surface, placing final cover soils, or other related work items. The Earthwork Contractor may also be responsible for construction of sedimentation and erosion control facilities, anchor trenches for liner installation, and other support activities outside the immediate project area.

It is the responsibility of the Earthwork Contractor to supply equipment and perform work that results in completed project components that are in conformance with the CQA/QC Plan.

3.1.9 Geosynthetics Manufacturer

The Geosynthetics Manufacturer is responsible for the production of geosynthetics that meet the requirements of the CQA/QC Plan. The Geosynthetics Manufacturer is also responsible for providing adequate documentation regarding the characteristics of the resin and the finished product, the testing performed to determine the characteristics, and the quality control measures taken during manufacturing.

The Geosynthetics Manufacturer is responsible for safe transportation of the geosynthetics between the manufacturing plant and the site. The Geosynthetics Manufacturer is responsible for carefully loading and transporting geosynthetics and accepts full responsibility for damage to the geosynthetics that may occur during these operations.

3.1.10 Geosynthetics Installer

The Geosynthetics Installer is responsible for unloading, field handling, storing, placing, seaming, temporarily anchoring against wind, and other aspects of geosynthetics installation in accordance with the CQA/QC Plan. The Geosynthetics Installer may also be responsible for the preparation and completion of anchor trenches.

Prior to installation, the Geosynthetics Installer is responsible for preparation of the panel layout drawing, which identifies fabricated and field seams including dimensions and details. Prior to site mobilization, the Geosynthetics Installer is responsible for providing the installation schedule and a list of proposed field personnel and their qualifications. The Geosynthetics Installer is responsible for providing quality control documentation and subgrade acceptance certificates. Upon completion of the installation, the Geosynthetics Installer shall provide the geomembrane installation certification, the Manufacturer's warranty, and the installation warranty.

3.1.11 Surveyor

The Surveyor is a firm or person, retained by the Operator or Construction Manager, responsible for delineating and documenting the lines and grades associated with construction of the landfill. Activities include surveying of construction grades, including original ground surface, excavation and placement of structural fill, barrier soil layer, and subsequent liner components. Additionally, the surveyor shall delineate the limits of the soils construction area and geosynthetic components, the location and elevation of pipes, and the limits and elevations of perimeter ditches, roads, and other relevant features. The Surveyor is also responsible for preparation of the construction Record Drawings which include plan views of constructed components or cross-sections necessary to estimate quantities of construction materials.

3.2 PROJECT MEETINGS

Clear, open channels of communication are essential to achieve a high degree of quality during installation. The following meetings should be held when appropriate to coordinate activities between the Operator, CQA Consultant, and Contractor, as well as set up proper lines of authority and reporting. The type and purpose of meetings to be held for this project are described in this section. The actual meeting discussion points and meeting timeframes should be agreed to by the affected parties at the beginning of each construction project. The Owner shall be kept informed in a timely manner by the Operator of all construction schedules, work interruptions and delays, developments that may produce a work delay of more than several days, all changes to the construction schedule, and receive advance notice of meetings and inspections with the State permitting authority related to the foregoing. Notice shall be provided in writing to the Loudon County Solid Waste Disposal Commission Chair, Vice Chair and the appointed engineer for the Commission.

3.2.1 Pre-Construction Meeting

A Pre-Construction Meeting may be held at the site prior to earthwork construction and prior to geosynthetics placement. At a minimum, the meeting shall be attended by the Environmental Manager, the Construction Manager, the CQA Consultant's Certifying Engineer (registered in Tennessee), the CQA Consultant's Lead Monitor(s), the Geosynthetics Installer's Superintendent, the Earthwork Contractor's Superintendent, and the Permit/Design Engineer and other involved parties. The Permit Agency (TDEC) shall be invited to attend all Pre-Construction Meetings. Possible topics to be discussed shall follow the Pre-Construction Meeting Agenda in Appendix B.

The purpose of this meeting is to begin planning for coordination of tasks, anticipate problems that might cause difficulties and delays in construction, and, above all, present the CQA/QC Plan to the parties involved. It is very important that the rules regarding testing, repair, etc., be known and accepted.

The meeting shall include the following activities:

- Distribute relevant documents;
- Review critical design details of the project;
- Review the CQA/QC Plan;
- Make appropriate modifications to the CQA/QC Plan to include CQA activities specific to the project;
- Select testing equipment and review protocols for the testing of materials;
- Confirm the methods for documenting and reporting, and for distributing documents and reports; and
- Confirm the lines of authority and communication.

A mandatory topic during the Pre-Construction Meeting will be the selection of geosynthetic materials. The CQA Consultant shall present a table for each geosynthetic material which lists the Manufacturer MARV values. This table will be reviewed and used to verify that the selected materials meet or exceed the design requirements.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted, within 24 hours, to the parties involved.

3.2.2 Daily Meetings

A daily meeting may be held between the CQA Consultant, the Geosynthetics Installer, the Earthwork Contractor, the Construction Manager, and other involved parties on an as-needed basis. Those attending will discuss, plan, and coordinate the work and CQA activities to be completed that day.

These meetings may be held informally, and meeting minutes summarizing these meetings are not necessary.

3.2.3 Progress Meetings

Progress meetings may be held between the Environmental Manager, the Construction Manager, the CQA Consultant, the Geosynthetic Installer, the Earthwork Contractor, and other involved parties, on an as-needed basis, approximately one per week. Those attending will discuss current progress, planned activities for the next week, and new business or revisions to the work. The CQA Consultant will log problems, decisions, or questions arising at this meeting. The meeting shall be documented by the CQA Consultant, and minutes shall be transmitted to involved parties within 48 hours of the meeting.

3.2.4 Problem or Work Deficiency Meetings

A special meeting shall be held when, and if, a problem or deficiency that would impact the construction schedule is present or likely to occur. At a minimum, the meeting shall be attended by the affected contractors, the Construction Manager, and the CQA Consultant. The purpose of the meeting is to define and resolve the problem or work deficiency as follows:

- Define and discuss the problem or deficiency;
- Review alternative solutions; and
- Implement an action plan to resolve the problem or deficiency.

The meeting shall be documented by the CQA Consultant and minutes shall be transmitted within 24 hours to the parties involved.

3.3 QUALIFICATIONS OF KEY PERSONNEL AND ORGANIZATIONS

The following qualifications shall be required of the key personnel and organizations involved in the construction of solid waste containment systems.

3.3.1 CQA Consultant

The CQA Consultant shall be pre-qualified and approved by the Operator. The CQA Consultant shall be a qualified firm with experience in construction quality assurance and quality control, particularly on projects involving similar facets as the project to be completed. The CQA Consultant shall designate a Certifying Engineer who is a Professional Engineer registered in Tennessee. The Certifying Engineer shall be responsible for the CQA personnel and their activities, as well as the preparation of a certification report to certify the project has been constructed in substantial compliance with the CQA/QC Plan, permit documents, drawings, and specifications (as applicable). The CQA Consultant shall be capable of assigning technically qualified personnel to the project, including an on-site Lead CQA Monitor and CQA Monitors, as needed. The CQA Consultant may utilize multiple Lead CQA Monitors, such that each Lead CQA Monitor may be brought on-site when project tasks for which the Lead CQA Monitor is experienced or specifically trained are being performed. The person designated as the Lead CQA Monitor shall possess a thorough knowledge of all aspects of earthwork and geosynthetic construction.

CQA Monitors shall be specifically trained in quality assurance of geosynthetics, earthwork, etc. Unless otherwise approved by the Operator, the Lead Geosynthetic CQA Monitor shall be experienced in supervising the installation of a minimum of 1,000,000 ft^2 (92,900 m^2) of various geosynthetic materials or otherwise approved by the Operator.

3.3.2 Soils CQA Laboratory

The Soils CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Soils CQA Laboratory shall be experienced in performing laboratory tests to determine soils characteristics as required by this CQA/QC Plan. The Soils CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate calibrated equipment to perform the tests.

3.3.3 Geosynthetics CQA Laboratory

The Geosynthetics CQA Laboratory shall be pre-qualified by the Operator or CQA Consultant. The Geosynthetics CQA Laboratory shall be experienced in performing laboratory tests to determine geosynthetics characteristics as required by this CQA/QC Plan. The Geosynthetics CQA Laboratory shall demonstrate that it follows the standard test methods listed in the CQA/QC Plan and maintains the appropriate, calibrated equipment to perform the tests.

3.3.4 Earthwork Contractor

The Earthwork Contractor shall be pre-qualified and approved by the Operator. The Earthwork Contractor shall be capable of assigning the personnel and equipment required to perform the work within the project schedule.

3.3.5 Geosynthetics Manufacturer

The Geosynthetics Manufacturer shall be able to provide sufficient production capacity and experience to meet the demands of the project. The Geomembrane Manufacturer shall be pre-qualified and approved by the Operator.

3.3.6 Geosynthetics Installer

The Geosynthetics Installer shall be trained and qualified to install geosynthetics. Prior to execution of contractual agreements with the Operator, the Geomembrane Installer shall provide the Construction Manager with information demonstrating qualifications as required by this CQA/QC Plan.

The Geomembrane Installer shall provide the Construction Manager with a list of proposed seaming personnel and their professional resumes. This certificate shall be reviewed by the Construction Manager and CQA Consultant. Proposed seaming personnel deemed inexperienced shall not be accepted by the Construction Manager.

The Geomembrane Installer shall designate one representative as a Superintendent, who will represent the Installer on-site and at site meetings. The Superintendent shall be qualified by experience. The Superintendent must have supervised the installation of a minimum of 2,000,000 ft^2 (185,800 m^2) of geomembrane, 500,000 ft^2 (46,450 m^2) of geotextile, 500,000 ft^2 (46,450 m^2) of geocomposite, and must also exhibit good management skills. The Superintendent shall be approved by the Construction Manager. The Superintendent or designee approved by the Environmental Manager shall be on-site at all times during geosynthetic deployment and seaming activities.

In addition, the Geomembrane Installer shall designate a Master Seamer, who shall not be the Superintendent. The Master Seamer shall be present during seaming operations and shall have a minimum of 5,000,000 ft^2 (464,500 m^2) of field seaming experience. The Master Seamer shall also be experienced with extrusion welding, fusion welding, and welding in both hot and cold weather.

4.0 SOILS AND AGGREGATES

4.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with construction involving the use of soils and aggregates for the construction of liner systems and final cover. These components include:

- Structural Fill;
- Excavation;
- Geologic Buffer Material (if native material requires processing);
- Barrier Soil Layer;
- Protective Cover; and
- Intermediate Cover, Compacted Soil Cover, and Final Cover Soils.

The above components shall meet requirements related to material characteristics and construction quality. The proposed soils shall undergo field and laboratory testing to evaluate that the proposed soils meet the specifications included in Appendix A. Throughout construction, field and laboratory testing shall be performed to ensure that the in-place soil material meets the requirements of this CQA/QC Plan with regard to material acceptance and construction quality.

4.2 TEST METHODS AND SAMPLING REQUIREMENTS

Tables A-1 and A-2 (Appendix A) present the laboratory and field test methods that shall be used to characterize and evaluate the construction quality of the installed foundation soils. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions. The tests shall be conducted in accordance with the current versions of the corresponding standard methods given.

Table A-3 (Appendix A) provides minimum test frequencies. The table presents the sample size, acceptance criteria, and general locations of where samples shall be collected. Four types of sampling location methods shall be used for the various soil and aggregate components, including:

- As required by the CQA Consultant to evaluate material characteristics prior to use of the material in construction. These samples may come from the source of a potential material such as an aggregate production plant or from a test pit/stockpile/ borrow area;
- For specific bulk volumes of material in stockpiles [e.g., 1 sample per 5,000 cy (3,800 m^3)]. These samples are usually taken from material which has been processed or segregated for a particular purpose;

- For materials placed over a long linear extent (such as roads and embankments), using stationing, offsets, and approximate elevation. Stationing should be designated as 1+00, 2+00, etc. and offsets should be designated as left or right of the stationing line based on view toward increased stations; and
- Grid pattern sampling methods shall be used on placed material. These samples are usually taken from within a liner/final cover construction area or other aerially extensive construction project. Grids and stations shall be clearly marked and the perimeter or station markers should be surveyed.

Tables A-1, A-2, and A-3 shall be used in conjunction with the text of this section of the CQA/QC Plan.

4.3 STRUCTURAL FILL

Structural fill is used within low areas to raise existing grades to design grades, construct perimeter berms, construct intercell berms, or other items. The areas where structural fill will be placed shall be stripped of topsoil and proof-rolled as an initial step. Deleterious materials such as soft soils or organics shall be removed and the resulting void shall be filled with structural fill. In areas that require structural fill to establish design grades, structural fill shall be placed on the proof-rolled surface. Structural fill shall be placed and the structural fill material selected to prevent voids or bridging within the fill.

Refer to Appendix A for the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for structural fill material and placement requirements. In addition to the testing and confirmation of placed structural fill lifts, the CQA Monitor shall periodically observe structural fill placement to confirm construction practices. The CQA Consultant shall prepare a certification report for the structural fill based on a review of the CQA information and CQA monitoring performed during installation of structural fill.

4.3.1 Structural Fill Repair

During placement of structural fill, the CQA Monitor shall monitor placement and compaction. Monitoring activities include both field and laboratory soils testing outlined in Appendix A, as well as visual observation of lift thickness and compaction. As structural fill is placed and compacted, pumping or rutting shall be noted. If pumping or rutting is determined to be excessive by either the CQA Monitor or the Operator, the material exhibiting pumping shall be removed and replaced with competent structural fill material, using the following general procedures:

- The deficient material shall be removed from the structural fill area;

- Efforts shall be made to remove all materials contributing to the pumping or rutting;
- Repairs may include (but not limited to):
    - The installation of drains and piping to de-water the area;
    - The installation of a re-enforcing geotextile or geogrid prior to backfilling the excavated area;
    - The first structural fill lift placed over the soft materials shall be one and a half (1.5) times the normal lift thickness. This initial structural fill lift, specifically containing a dry, higher rock content material than normal structural fill, shall act as a 'bridge'. The purpose of the initial lift is to provide a solid base for subsequent lifts of overlying structural fill and barrier soil layer soils;
  - Should pumping or rutting persist, excavation of deficient soils shall be performed again; and
  - If pumping is suspected to be a result of decaying trees and/or vegetation, efforts shall be made to remove the organic and deficient materials.

4.4 EXCAVATION GRADE

The excavation grade refers to the top of the natural soil layer functioning as the geologic buffer below the liner system. The geologic buffer provides an additional barrier to liquid migration. Field exploration and laboratory testing documented in the MBLF Supplemental Hydrogeologic Investigation Report demonstrate that a 5-feet thick geologic buffer with a maximum hydraulic conductivity of 1×10^{-6} cm/sec is provided by the native soils underlying the proposed cells at the site. Excavation grade refers to the bottom of the barrier soil layer, which also equals the upper surface of the geologic buffer.

Prior to placement of the barrier soil layer component of the liner system, the Earthwork Contractor shall excavate overburden materials to the excavation grade elevations shown on the Drawings. The prepared excavation grade should conform to the contours shown on the grading plan, as verified by the surveyor. The excavation of existing soils or placement of structural fill meeting the requirements of the geologic buffer specifications may be required to establish these grades.

Upon completion of the subgrade preparation and prior to placement of any of the barrier soil layer soils, the CQA Monitor shall visually observe the exposed subgrade materials for signs of unsuitable materials such as isolated lenses or pockets of sand, organic materials, or other unsuitable materials. If these materials are present, the unsuitable materials will be removed by undercutting the full 5 feet depth of the geologic buffer. Replace the material excavated with compacted geologic buffer soils per the Technical Specifications. Removal and replacement of unsuitable soils shall extend laterally as far as necessary to remove the unsuitable soils.

The excavation grade shall be proof rolled by the Earthwork Contractor with suitable compaction equipment. The excavation grade should be accepted by the CQA Consultant if it does not pump or rut excessively. If excessive pumping or rutting occurs, the area should be reworked or removed by excavating the deficient soil until competent soils are exposed. The procedure outlined within Section 4.3.1, Structural Fill Repair, shall be followed for excavation and reconstruction of the excavation grade due to pumping or rutting.

4.5 BARRIER SOIL LAYER

The barrier soil layer is a uniform, compacted 24-inch-thick soil layer placed over the subgrade (i.e. top of geologic buffer) surface for liner construction projects prior to the placement of the landfill liner geosynthetic components. The 24-inch thick barrier soil layer shall consist of relatively homogenous, fine-grained soils that are free of rock-sized particles or clods greater than 1-1/2 inches in any dimension, frozen material, organic material, and other foreign debris. The CQA Consultant shall obtain samples from within the identified borrow area and subject the soils to the testing indicated in Table A-3 of Appendix A. Table A-3 provides information regarding the minimum test frequencies associated with the barrier soil layer. The table presents the sample size, acceptance criteria, and locations of where the samples shall be collected.

Soil laboratory test results will identify borrow sources that are acceptable for potential use as barrier soil layer material, as determined by the Operator or CQA Consultant. The material will also be subjected to laboratory remolded permeability tests to develop a moisture/density relationship. Subsequently, a window of moisture/density values corresponding to the required permeability shall be delineated based upon the results of laboratory testing. This window will then be used as the acceptable range of moisture/density values for field compaction CQA testing.

4.5.1 Test Pad

After the barrier soil layer borrow source has been selected and preliminary testing has been performed, a test pad shall be constructed for each borrow source to establish construction details or verify or amend the construction details proposed in the approved permit. In addition, a test pad shall be constructed whenever there is a significant change in soil material properties. The test pad shall be used to evaluate the following:

- Material handling and placement requirements;
- Lift thickness;
- Water content necessary to achieve the desired compaction;
- Compaction equipment type, weight, and number of passes; and
- Field permeability.

The results of test pad construction may be used to verify or amend construction details proposed in the approved permit for the site. Test pads shall be constructed using the same material, equipment, and procedures to be used in construction of the barrier soil layer. The test pad will have a minimum width of three times the width of the compaction equipment and a length that is two times the length of the compaction equipment, including power equipment and attachments. The test pad will consist of at least four lifts with in-situ density and moisture testing performed at least three times per lift. The construction of the pad shall be closely monitored, and the following tests shall be performed at a frequency of at least twice per lift:

- Maximum dry density; and
- Optimum moisture content.

Following construction of the test pad, a determination of permeability through field testing shall be performed.

The test results shall be used to verify that the specified construction procedures yield recommendations that meet the design and performance criteria. Refer to Table A-3 for a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the test pad.

4.5.2 Construction Quality Assurance

Prior to placement of the barrier soil layer, the surface of the excavation grade shall consist of relatively homogenous, fine-grained soils that are free of debris, rocks greater than 1/2 inch in diameter, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft areas. The surface shall be non-yielding, uniform, and smooth.

Lifts of the barrier soil layer shall be placed in uniform layers not to exceed 8 inches in uncompacted thickness. The lift thickness shall be determined manually throughout construction. The finished thickness of the barrier soil layer shall be verified by the measurement of survey points before and after installation of the barrier soil layer is completed. The minimum total thickness of the barrier soil layer shall be 2 feet. Soil clods shall be broken down to 1-1/2 inches or half the lift thickness, whichever is less. Moisture conditioning shall be conducted to preserve the homogeneity of the soil and to obtain a relatively uniform moisture content throughout the soil mass. The moisture content of the barrier soil layer shall be field tested during placement and compaction. Each lift shall be scarified prior to placing the subsequent lift to sufficiently bond it to the previous lift. Each lift of the barrier soil layer shall be rolled and compacted to the moisture content and density as specified in Table A-3.

Visual monitoring of the barrier soil layer construction shall consist of observing and verifying:

- Identification of changes in material characteristics causing a change in construction specifications;
- Adequate spreading of barrier soil layer material to obtain complete coverage and loose lift thickness;
- Removal of debris, rocks, vegetation and organic materials, frozen materials, foreign objects, excess silt, and soft and/or wet areas;
- Adequate clod-size reduction of the barrier soil layer material;
- Spreading and incorporation of water to obtain full penetration through clods and uniform distribution of the specified water content;
- Proper adjustment of the water content of in-place material in the event of prolonged rain or drought during construction;
- Prevention of significant water loss and desiccation cracking before and after compaction;
- Use of compaction equipment of the proper type, configuration, and weight;
- Appropriate equipment speed and number of equipment passes used for compaction;
- Uniformity of coverage by compaction equipment, particularly at fill edges, in equipment turn-around areas, and on slopes;
- Use of sufficient methods to tie lifts together;
- Use of sufficient methods to blend new barrier layer soils into existing clay layer soils at tie-ins to existing cells;
- Proper repair of penetrations resulting from the use of density and moisture probes using bentonite or a soil-bentonite mixture;
- Sealing the working surface at the close of each day's work or when work is stopped for a period of time by compacting the surface and sloping it to allow run-off of precipitation;
- All loose or dry materials have been removed from the final surface prior to FML deployment;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface are removed;
- Depressions and holes in excess of ¾ inch deep shall be filled with a clean, uniform sand;
- The final surface is prepared such that the deployment of the final cover geomembrane would not dislodge large particles that would remain beneath the geomembrane;
- Timely placement of protective covers or the overlying FML to prevent desiccation of barrier soil layer material between the installation of lifts or after completion of the barrier soil layer;
- Prevention of accidental damage or weather-related degradation to installed portions of the barrier soil layer; and
- Observation and verification of activities to correct conditions not meeting specifications for the construction of the barrier soil layer.

Perforations in the barrier soil layer created by nuclear density gauge probes, sample retrieval, stakes, or other penetrating objects shall be filled with fine grained soil from the barrier soil layer stockpile, bentonite, a soil-bentonite mixture, or an approved equal. Test holes in the barrier soil layer that are filled with fine grained barrier soil layer material shall be backfilled with maximum 0.25-inch soil particles and compacted in three equal compacted lifts. The finished surface of the barrier soil layer shall be uniform, non-yielding, and smooth. Surveying shall be performed to document that the finished barrier soil layer thickness and dimensions are as specified in the design.

Refer to Table A-3 for sample locations, sample sizes, test frequencies, the specific test methods to be used, a summary of the field and laboratory testing to be performed, and acceptance criteria for the barrier soil layer.

The barrier soil layer shall be maintained and protected by the Earthwork Contractor until formal written acceptance of the barrier soil layer is given to the CQA Consultant by the Geosynthetics Installer. The Earthwork Contractor shall protect, maintain and repair (at no additional cost to the Operator), the barrier soil layer from excessive desiccation, cracking, water, or wind erosion and damage during construction.

4.6 PROTECTIVE COVER LAYER

The protective cover layer shall be composed of aggregate meeting the gradation and general requirements of protective cover as specified within Table A-3 in Appendix A. Soil may also be used for the protective cover layer as long as aggregate is still used above leachate collections pipes as indicated on the drawings. The aggregate and soil shall be substantially free of organics, frozen material, deleterious materials, and other foreign objects.

Table A-3 presents the specific test methods to be used, a summary of the field and laboratory testing to be performed, sample locations, sample sizes, test frequencies, and acceptance criteria for the protective cover material.

Low ground-pressure equipment shall be used to grade and smooth the protective cover layer aggregate. The low-ground pressure equipment shall only be allowed to move across the protective cover over the full protective cover placement thickness. Equipment utilized to haul the protective cover material shall only be allowed to travel over 3-foot-thick roadway areas. These roadway areas shall be reduced in thickness by the low-ground pressure equipment once the road is no longer needed.

4.7 COVER SOILS

Soils for the operation and closure of the landfill include daily covers, intermediate cover soil, compacted soil cover, and the final cover soil. This CQA Plan addresses the field and laboratory tests to be performed, prior to and during construction, to evaluate the suitability of the proposed soils. Table A-3, within Appendix A, provides a summary of the necessary tests and minimum testing frequency for the final cover soils. This table includes a summary of the sample size and acceptance criteria.

4.7.1 Intermediate Cover Soils

Intermediate cover shall meet the gradation and requirements described in Table A-3 in Appendix A. Intermediate cover soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Intermediate cover soil shall be placed in one loose lift resulting in a final layer thickness of at least 12 inches. After spreading, the soil shall be tracked-in and densified with at least four passes using a Cat D6 bulldozer or similar. The CQA technician shall observe the densification process and verify the layer is firm. This material should meet the gradation requirements for intermediate cover described in Table A-3.

4.7.1.1 Intermediate Cover Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing intermediate cover soil layer shall be verified by the CQA Consultant. The intermediate cover soil layer shall be a minimum 12 inches thick and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the intermediate cover shall be verified by field test pits, dug with a hand shovel or power equipment. The frequency of this testing is one test per acre, as noted in Table A-3.

Following installation of the densified12-inch-thick intermediate cover, the thickness of the intermediate cover shall be verified through field survey, excavation of test pits, or use of depth gauges during placement. The frequency of this testing is provided in Table A-3.

4.7.2 Compacted Soil Layer Soils

Compacted soil layer soils shall meet the gradation and other requirements described in Table A-3 in Appendix A. Compacted soil layer soil shall be substantially free of organics, frozen material, foreign objects, or other deleterious materials.

Compacted soil layer soil shall be placed in loose lifts with a maximum compacted thickness of 6 inches. After spreading, the soil shall be moisture conditioned and compacted using appropriate equipment.

4.7.2.1 Compacted Soil Layer Thickness Verification

Prior to the installation of final cover geosynthetics, the thickness of the existing Compacted Soil Layer shall be verified by the CQA Consultant. The Compacted Soil Layer shall be a minimum 12 inches thick, and provide a suitable surface for the installation of the final cover geosynthetics. The thickness of the Compacted Soil Layer shall be verified by field test pits, dug with a hand shovel or power equipment, or use of depth gauges during placement. The frequency of this testing is one test per 10,000 square feet, as noted in_Table A-3. Testing, as outlined in Table A-3, shall be performed as close as practical to the day the geomembrane is to be installed for the final cover.

4.7.2.2 Compacted Soil Layer Surface Inspection

Prior to the installation of final cover geosynthetics, the CQA Consultant and Geosynthetics Installer shall inspect the exposed compacted soil layer area for wet areas, large or non-round rocks, or other items which could compromise the integrity of the final cover system. This inspection should occur as close as practical to the day the geomembrane installation is planned. All degraded areas as described below will be restored prior to geomembrane deployment.

Excessively dry desiccated, wet, frozen, and soft areas identified with during surface inspection shall be repaired. The full extent of the unacceptable area shall be excavated and repaired. Excavated waste and leachate-impacted soil must be re-disposed within active portions of the landfill. Any excavation into the waste shall be backfilled with tire chips, sand, drainage aggregate, or other high permeability material to allow wet areas to drain back into the waste mass. The excavation shall be backfilled to within 1-foot of the top of the intermediate cover, then 1-foot-thick intermediate cover soil and the 1-foot-thick compacted soil layer shall then be replaced over the repaired area returning the area to surrounding grade.

Before the installation of final cover components, the surface of the compacted soil cover soil shall be graded smooth and rolled with a smooth drum roller. Depressions in excess of ¾ inch deep shall be filled with a clean, uniform sand.
. For the direct deployment of the final cover flexible membrane liner (FML) on to the compacted soil layer, the prepared surface:

- Shall not contain loose or dry materials;
- Shall not contain sharp objects;
- All protrusions or stones capable of damaging the overlying FML by protruding ¾ inch or more above the prepared surface shall be removed;
- Not be excessively wet, or contain ponded water;
- Not contain fragments greater than ¾ inch on the surface;

- Be prepared such that the deployment of the final cover FML would not dislodge large particles which would remain beneath the FML; and
- Shall not contain localized significant grade changes (holes).

4.7.3 Final Cover Soil

Following the installation of the final cover geosynthetics, the contractor shall place the final cover soil. The final cover soil shall be 24 inches thick and the upper 12 inches of the soil must be capable of supporting and sustaining vegetative growth and satisfy the requirements of Table A-3 in Appendix A.

The 24-inch-thick final cover soil shall be spread by a low ground pressure dozer in one lift to its full depth. The contractor shall place the soil by working across final cover benches with the soil then proceeding uphill from each bench. The only compactive effort to be exerted to the final cover soil shall be that applied by the bulldozer spreading the soil. Haul equipment shall travel to the placement area over roadways of thickened final cover soil with a minimum thickness of 3 feet. During the hauling and placement of final cover soil, the dozer operator shall grade and shape the placed final cover soil and final cover soil roadways to prevent excessive pumping or rutting by the equipment. Maintenance of roadway or other areas of thickened final cover soil placement may be performed by non-low ground pressure equipment. At no time shall final cover soil be placed where the soil is inadequate to provide support for the haul or placement equipment.

The thickness of the final cover soil shall be verified following placement through field survey or excavation of test pits or use of depth gauges during placement. If test pits are to be used for the verification of thickness, care must be taken to not damage the underlying geosynthetics. Depth gauges may be utilized to aid in placement of the soil and provide quality assurance of thickness of placed material during construction. Depth gauges shall be collapsible materials such as Styrofoam, non-rigid plastic, cardboard, or other material which would not result in damage to the final cover geosynthetics if the gauges were hit by construction equipment. If the depth gauge is of a known height or a marker line is added to the gauge prior to placement of the soil, visual confirmation of the soil height relative to the marker is sufficient confirmation of final cover soil thickness.

Independent of the method utilized to confirm the thickness of the final cover soil, a field survey of the bench area shall be completed. The field survey shall be oriented along the benches to ensure that the benches have the appropriate drainage features, i.e., slope and width.

4.8 CONTINGENCY PLAN FOR ANTICIPATED CONSTRUCTION DIFFICULTIES

During construction, the frequency of testing may be increased at the discretion of either the CQA Consultant or the Owner when visual observations of construction performance indicate a potential problem. Additional testing for suspected areas will be considered when the following conditions are observed:

- Excessive pumping or cracking of material;
- Adverse weather conditions;
- Work conducted in difficult areas; and
- High frequency of failing tests.

If a defect is discovered in the earthwork construction, the CQA Consultant shall determine the extent and nature of the defect. If the defect is indicated by an unsatisfactory test result, the CQA Consultant shall determine the extent of the deficient area by additional tests, observations, a review of records, or other means that the CQA Consultant deems appropriate. All deficiencies shall be corrected by the Earthwork Contractor to the satisfaction of the CQA Consultant and the Owner.

4.8.1 Notification

The CQA Consultant shall notify the Earthwork Contractor immediately upon discovering the defect. After determining the extent and nature of the defect, the CQA Consultant shall notify the Construction Manager as necessary.

4.8.2 Repairs and Retesting

The Earthwork Contractor shall correct the deficiency to the satisfaction of the CQA Consultant and Owner. If a design specification criterion cannot be met, or unusual weather conditions hinder the work, the CQA Consultant shall develop and present to the Owner suggested solutions for approval.

The CQA Consultant shall schedule appropriate retests after the work deficiency has been corrected. Retests recommended by the CQA Consultant must document that the defect has been corrected before any additional work is performed by the Earthwork Contractor in the area of the deficiency.

5.0 GEOMEMBRANE

5.1 INTRODUCTION

This section of the CQA/QC Plan presents information related to geomembrane products for use in both liner system and final cover construction.

Following selection of the geomembrane manufacturer, as described in Section 1.3, the manufacture, shipment, and installation of geomembrane shall be conducted in accordance with the conformance test tables included in Appendix A. Throughout this section, laboratory and field tests will be referred to by name. Appendix A outlines each proposed geomembrane test and corresponding methodology and also lists the corresponding required testing values for each test. The CQA Consultant shall document the inventory, testing, and placement of geosynthetics.

5.2 MANUFACTURE, SHIPMENT, AND STORAGE

The following text addresses the activities associated with the manufacture of the geomembrane; the shipment, handling, and delivery of geomembrane to the site; conformance testing of delivered geomembrane; and the storage of the geomembrane prior to installation.

5.2.1 Manufacture of Geomembrane

The Geomembrane Manufacturer shall provide documentation that the material meets the requirements of the design specifications and that adequate quality control measures have been implemented during the manufacturing process.

5.2.1.1 Resin Quality

The raw material composing the geomembrane shall be first quality resin containing no more than 2 percent clean recycled polymer by weight. Prior to the shipment of geomembrane material, the Geomembrane Manufacturer shall provide the Construction Manager and CQA Consultant with the following information:

- The origin (Resin Supplier's name and resin production plant), identification (brand name, and number), and production date of the resin;
- A copy of the quality control certificates issued by the Resin Supplier;
- Reports of the tests conducted by the Manufacturer that document the quality of the resin meets the requirements indicated above; and
- A statement that reclaimed polymer is not added to the resin (however, the use of polymer recycled during the manufacturing process may be permitted if done correctly with

appropriate cleanliness and if recycled polymer does not exceed 2 percent of the total resin by weight).

At the Owner's discretion and cost, testing may be carried out on the resin by the Geosynthetics CQA Laboratory for purposes of documenting conformance. If the results of the Manufacturer and the Geosynthetics CQA Laboratory testing differ, the testing shall be repeated by the Geosynthetics CQA Laboratory. The Geomembrane Manufacturer will be permitted to monitor the retesting. The results of this latter series of tests will prevail, provided that the applicable test methods have been followed.

5.2.1.2 Certification of Property Values

In addition to information regarding the raw material, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with the following prior to shipment of the geomembrane:

- Manufacturer certification values for all test properties presented in Table A-4(a) for 60-mil High Density Polyethylene (HDPE) Geomembrane, and Table A-5(a), Final Cover Geomembrane; and
- Manufacturer typical content range (expressed as percent of total resin) of polyethylene, carbon black, and additive package. The additive package may be described in general terms for major constituents if valid copyrights/trademarks are held by the manufacturer or manufacturer's supplier.

The CQA Consultant shall utilize the property values certified by the Geomembrane Manufacturer to complete the Manufacturer's MARV information for the conformance testing tables.

5.2.1.3 Quality Control Certificates

Prior to shipment, the Geomembrane Manufacturer shall provide the Construction Manager and the CQA Consultant with quality control certificates for the geomembrane. The quality control certificates will be signed by a responsible party employed by the Geomembrane Manufacturer. The quality control certificate will include:

- Roll numbers and identification; and
- Sampling procedures and results of quality control tests.

The Manufacturer shall be required to perform, at a minimum, the testing scope and frequency presented in Tables A-4(a) and A-5(a) included in Appendix A.

The CQA Consultant shall:

- Verify that quality control certificates have been provided at the frequency defined by the Manufacturer QC Test Frequency specified within the conformance tables included in Appendix A;
- Review the quality control certificates to document that the testing methodology and resulting values comply with the requirements specified within the conformance tables included in Appendix A; and
- Verify that the quality control results meet or exceed the Manufacturer MARV values.

5.2.2 Shipment and Handling

Shipment of the geomembrane to the site is the responsibility of the Geomembrane Manufacturer. Handling the geomembrane on-site is the responsibility of the Installer.

The CQA Consultant shall observe that:

- Handling equipment used on-site pose minimal risk of damage to the geomembrane; and
- The Geomembrane Installers personnel handle the geomembrane with care.

Upon delivery to the site, the Installer and the CQA Consultant shall conduct a surface inspection of the exposed geomembrane rolls for defects, damage, and labeling. This examination shall be conducted without unrolling rolls unless defects or damages, are found or suspected. All labels identifying rolls shall be weatherproof. The CQA Consultant will indicate to the Construction Manager:

- Rolls, or portions thereof, that should be rejected and removed from the site because they have severe flaws;
- Rolls that have minor repairable flaws; and
- Rolls that do not have proper identification.

Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

5.2.3 Conformance Testing of Geomembrane

Upon, or if possible prior to, delivery of geomembrane rolls, the CQA Consultant shall document that samples are removed and forwarded to the Geosynthetics CQA Laboratory for testing to document conformance with the test methods and values presented within Tables A-4(a) and A-5(a). Samples shall be taken and tested at the minimum frequency specified by the tables included in Appendix A.

Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

5.2.3.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at a minimum frequency specified in Tables A-4(a) and A-5(a). If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted to assure that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one test sample.

Samples will be recovered from a geomembrane roll by removing a 3-foot (1-m) length of geomembrane across the entire width of a roll. The CQA Consultant shall mark the machine direction on the samples with an arrow.

5.2.3.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample meet the requirements presented in Tables A-4(a) and A-5(a) included in Appendix A, as well as the Design Requirement values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Extra tests required by an additional evaluation shall be at no expense to the Owner.
    a. In the case of failing parameter(s), two additional tests for the failing parameter shall be performed on sub-samples taken from the failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet conformance testing requirements, the roll will be rejected and samples will be collected from the closest numerical roll on both sides of the failed roll and tested again for the failed parameter(s). If one or both of these tests do not meet requirements, those roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

5.2.4 Storage

The Installer shall be responsible for the storage of the geomembrane on-site. Storage space should protect the geomembrane from theft, vandalism, passage of vehicles, water, and weather.
The CQA Consultant shall document that storage of the geomembrane provides adequate protection against dirt, shock, and other sources of damage.

5.3 GEOMEMBRANE INSTALLATION

The installation of the geomembrane involves three primary tasks; earthwork, placement of geomembrane field panels, and seaming of the field panels.

5.3.1 Earthwork

The earthwork immediately beneath the geomembrane and the anchoring of the geomembrane are crucial to the performance of the material. Earthwork construction activities shall be closely monitored by the CQA Consultant.

The CQA Consultant shall document that:

- A qualified Surveyor has verified lines and grades; and
- The requirements of the CQA/QC Plan are satisfied.

The Installer shall certify in writing that the surface on which the geomembrane will be installed is acceptable. This subgrade acceptance certificate shall be given by the Installer to the CQA Consultant prior to commencement of geomembrane installation in the area under consideration. The Construction Manager will be given a copy of this certificate by the CQA Consultant.

It is the Installer's responsibility to protect the contacting soil beneath the geomembrane after it has been accepted. After the soil has been accepted by the Installer, it shall be the responsibility of the Installer and the CQA Consultant to indicate to the Construction Manager changes in the soil condition that may require repair work.

5.3.2 Geomembrane Placement

The placement of geomembrane field panels is the responsibility of the Installer and shall be performed in accordance with the approved panel layout drawing and the following specifications.

5.3.2.1 Panel Layout

On or before a Pre-Construction Meeting, the Geomembrane Installer shall provide the Construction Manager and the CQA Consultant with a drawing of the facility to be lined showing expected seams (panel layout drawing). The CQA Consultant shall review the panel layout drawing and document it as consistent with the accepted state of practice and the CQA/QC Plan. The panel layout drawing shall be approved by the CQA Consultant's Certifying Engineer (registered in Tennessee) or Environmental Manager (EM) or Area EM. The Geosynthetics Installer is responsible, at no cost to Owner, for the repair or re-installation of any materials installed prior to the verbal or written approval of the panel layout drawing by the Certifying Engineer (registered in Tennessee) or EM or AEM.

Geomembrane panel seams should be oriented parallel to the line of maximum slope, i.e., placed along the length of the slope, not perpendicular to it. In corners and odd-shaped geometric locations, the number of seams should be minimized. Horizontal seams should be avoided on slope areas 3H:1V or steeper, and within 5 feet (1.5 m) from the toe of a 3H:1V or steeper slope, or areas of potential stress concentration, unless otherwise authorized.

5.3.2.2 Field Panel Identification

The CQA Consultant shall document that the Installer labels each field panel with an "identification code" (number and/or letter) consistent with the layout plan. This identification code shall be agreed upon by the Construction Manager, Installer, and CQA Consultant. It is the responsibility of the Installer and the CQA Consultant to document that each installed field panel can be traced back to the original roll number. The identification code will be marked at a location agreed upon by the Geosynthetics Installer, and CQA Consultant at the Pre-Construction Meeting.

The CQA Consultant shall establish a table or chart showing correspondence between geomembrane roll numbers and installed field panel identification codes. The field panel identification code will be used for quality assurance records.

5.3.2.3 Location

The CQA Consultant shall document that field panels are installed at the location indicated on the Installer's panel layout drawing, as approved or modified.

5.3.2.4 Installation Schedule

Field panels shall be placed one at a time unless otherwise approved by the CQA Consultant and the Construction Manager. Each field panel shall be seamed after its installation in order to minimize the number of unseamed field panels exposed to weather.

It is beneficial to "shingle" panel overlaps in the downward direction to facilitate drainage in the event of precipitation. It is also beneficial to proceed in the direction of prevailing winds. Scheduling decisions shall be made during installation, depending upon varying weather and other construction conditions. The Installer shall be fully responsible for the decision made regarding placement procedures.

The CQA Consultant shall record the identification code, location, date of installation, time of installation, and ambient temperature of each field panel. The CQA Consultant shall also evaluate field changes by the Installer which may affect the original schedule proposed by the Installer and advise the Construction Manager on the acceptability of that change.

5.3.2.5 Weather Conditions

Geomembrane panel installation shall not proceed when measured sheet temperature exceeds the constraints as specified in Section 5.3.3.4. Deviations from this temperature criteria shall only occur when authorized by the Construction Manager and with concurrence of the CQA Consultant based on passing trial welds at sheet temperatures identical or in excess of the anticipated liner temperature. Geomembrane placement shall not be performed during precipitation, fog, snow, in an area of ponded water, or in the presence of excessive winds.

The CQA Consultant shall document that the above conditions are fulfilled and shall inform the Construction Manager of deviations from the accepted installation procedures.

5.3.2.6 Geomembrane Anchor Trench

Anchor trenches shall be excavated by the Earthwork Contractor (unless otherwise specified) to the lines and widths shown on the drawings prior to geomembrane installation. The CQA Consultant shall document that anchor trenches have been constructed according to the design drawings.

Slightly rounded corners shall be provided along the trench length where the geomembrane enters the trench to avoid sharp bends that could increase geomembrane stress concentrations and potentially damage the geomembrane. Loose soil shall not underlie the geomembrane within the trench. Panel seaming shall continue through the anchor trench. Following the placement of each geosynthetic layer within the trench, the geosynthetics installer is responsible for temporary anchorage within the anchor trench. Temporary anchorage shall be achieved with sandbags, rolls of geosynthetic material, or other material which allows for removal from the trench for the placement of additional geosynthetic layers. The Earthwork Contractor is responsible for the placement and compaction of soil within the anchor trench as permanent anchorage, following notice of backfill request by the Construction Manager. Backfilling of anchor trenches shall be performed in accordance with this CQA/QC Plan and Table A-3.

5.3.2.7 Method of Placement

The following is the responsibility of the Geomembrane Installer, and the CQA Consultant shall document that these conditions are satisfied:

- The geomembrane is not damaged by equipment through handling, traffic, excessive heat, leakage of liquids, or other means;
- The prepared soil surface underlying the geomembrane has not deteriorated since previous acceptance and is still acceptable immediately prior to geomembrane installation;
- Geosynthetic materials immediately underlying a proposed geomembrane layer to be installed are clean and free of debris;
- Personnel working on the geomembrane do not smoke, wear damaging shoes, or engage in other activities that could damage the geomembrane;
- The method and equipment utilized to deploy panels does not cause scratches or crimps in the geomembrane and does not damage the barrier soil layer;
- The method used to place the panels minimizes wrinkles (especially differential wrinkles between adjacent panels);
- Adequate temporary loading and/or anchoring (e.g., sandbags, geosynthetic rolls), not likely to damage the geomembrane, has been placed to prevent uplift by wind (in case of high winds, continuous loading, e.g., by adjacent sand bags, is recommended along the edges of panels to minimize the risk of wind flow under the panels); and
- Direct contact with the geomembrane is minimized; i.e., the geomembrane is protected by a sacrificial layer of geomembrane, or other suitable materials, in areas where excessive traffic may be expected.

The CQA Consultant shall inform the Construction Manager if the above conditions are not fulfilled.

5.3.2.8 Damage

The CQA Consultant shall visually inspect each panel after placement and prior to, during, or following seaming for damage. The CQA Consultant shall advise the Construction Manager if any panels, or portions of panels, should be rejected, repaired, or accepted. Damaged panels or portions of damaged panels which have been rejected shall be marked and their removal from the work area recorded by the CQA Consultant. Repairs shall be made according to procedures described in Section 5.3.4.

As a minimum, the CQA Consultant shall document:

- The panel is placed in such a manner that is unlikely to be further damaged; and
- Tears, punctures, holes, thin spots, etc. are either marked for repair or the panel is rejected.

5.3.3 Field Seaming

Field seaming is the responsibility of the Installer and shall be performed in accordance with the following.

5.3.3.1 Requirements of Personnel

At the Pre-Construction Meeting, the Geomembrane Installer will provide the CQA Consultant with a list of proposed seaming personnel and their professional resumes. This documentation will be reviewed and approved by the Construction Manager and the CQA Consultant.

5.3.3.2 Seaming Equipment and Products

HDPE Geomembrane shall be used for all FML components within the baseliner. Approved processes for HDPE Geomembrane field seaming are extrusion seaming and fusion seaming. Proposed alternate HDPE Geomembrane field seaming processes shall be documented and submitted to the Owner and TDEC for approval. Only alternate seaming equipment which has been specifically approved by make and model shall be used. The Installer shall submit seaming equipment documentation to the Construction Manager and the CQA Consultant for approval.

Non-HDPE Geomembrane products may be used as the FML within the final cover system; however, the specific type of FML and the method proposed to seam the FML are subject to the Construction Manager and the CQA Consultant for approval.

The following is the responsibility of the Installer, and the CQA Consultant shall document these conditions are met:

- The Installer maintains on-site a number of spare operable seaming devices that were approved for seaming at the Pre-Construction Meeting;
- Equipment used for seaming is not likely to damage the geomembrane;
- The extruder is purged prior to beginning a seam until heat-degraded extrudate has been removed from the barrel;
- For cross seams, the edge of the cross seam is ground to a smooth incline (top and bottom) prior to seaming;
- The electric generator is placed upon a flat smooth base and a rub sheet such that no damage occurs to the geomembrane; and
- A smooth insulating plate or fabric is placed beneath the hot seaming apparatus after usage.

- **Extrusion Process**
  - The extrusion seaming apparatus shall be equipped with gauges that show extrudate, nozzle, and preheat temperatures of the apparatus.
  - The Installer shall provide documentation on the extrudate to the Construction Manager and the CQA Consultant and shall certify that the extrudate is compatible with the design specifications and is comprised of the same resin as the geomembrane sheeting.
  - The CQA Consultant shall log apparatus temperatures, ambient temperatures, extrudate temperatures, and sheet temperatures at appropriate intervals.

- **Fusion Process**
  - The fusion seaming apparatus must be an automated mechanical device, equipped with gauges giving the applicable temperatures. Pressure settings shall be verified by the Installer prior to each seaming period. The CQA Consultant shall log ambient temperatures, sheet temperatures, and seaming apparatus temperatures, speeds, and pressures. The Geosynthetic Installer shall maintain at least one spare, operable seaming unit on-site at all times.
  - The single-track fusion seaming method shall be allowed only with prior approval of the Owner. Any alternative seaming methods proposed by the Geosynthetic Installer must be approved by the Owner and TDEC prior to use on the project.

5.3.3.3 Seam Preparation

The following is the responsibility of the Installer; the CQA Consultant shall document these conditions are met:

- Prior to seaming, the area to be seamed shall be clean and free of moisture, dust, dirt, oils, greases, foreign material, and debris. The geomembrane panels to be welded together shall be wiped with a clean cloth, brush or other cleaning equipment just prior to seaming;
- A rub sheet shall be used to protect the liner while cutting materials;
- If seam overlap grinding is required, the process will be completed within 1 hour of the seaming operation, adhering to the Geomembrane Manufacturer's instructions, and performed in a way that does not damage the geomembrane;
- No abrasions are visible when welding is complete;
- Seams are aligned with the fewest possible number of wrinkles and "fishmouths"; and
- No metal objects that could potentially damage the liner are permitted to be used within the lined area.

5.3.3.4 Weather Conditions for Seaming

The required weather conditions for seaming are as follows:

- The sheet temperatures shall be measured on the surface of the geomembrane sheet with a thermometer;
- Unless authorized in writing by the Construction Manager, no seaming shall be attempted at a sheet temperature above 120°F for extrusion welding and 140°F for fusion welding; in both fusion and extrusion welding, no seaming shall be attempted at a sheet temperature below 32°F; and
- The geomembrane shall be dry and protected from wind.

If the Installer wishes to use methods which allow seaming at ambient temperatures above 120°F for extrusion welding, and above 140°F for fusion welding or below 32°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are equivalent to seams produced at ambient temperatures above 32°F and below 120°F for extrusion welding and 140°F for fusion welding. The Installer shall also demonstrate that the overall quality of the geomembrane is not adversely affected and the Construction Manager and CQA Consultant shall concur with the installer.

The above specified temperature constraints apply to general construction for disposal areas and final cover projects. However, if repair activities are necessary for previously constructed areas and the repairs cannot await improved weather due to construction considerations, scheduling, or importance of the repair, these repairs may be completed at a wider range of ambient temperatures. For these repair situations, welding may be performed at ambient temperatures between 120°F and 20°F for both types of welding, the Installer shall demonstrate through trial welds that such methods produce seams which are acceptable when compared to the seam requirements of Tables 4(b) and 5(b) in Appendix A. When these repairs are performed outside of normal ambient welding temperatures, trial welds shall be performed once per four hours. The CQA Consultant shall document that these weather conditions are complied with and will advise the Construction Manager accordingly.

5.3.3.5 Overlapping and Temporary Bonding

The following shall be the responsibility of the Installer and shall be verified by the CQA Consultant:

- In general, geomembrane panels shall have a finished overlap of a minimum of 3 inches (75-mm) for extrusion seaming and 4 inches (100 mm) for fusion seaming (or otherwise specified by the manufacturer), but in any event, sufficient overlap will be provided to allow peel tests to be performed on the seam; and
- The procedure used to temporarily bond adjacent panels together does not damage the geomembrane (in particular, the temperature of hot air at the nozzle of a spot seaming apparatus will be controlled such that the geomembrane is not damaged).

The CQA Consultant shall log appropriate temperatures and conditions and shall log and report deviations to the Construction Manager.

5.3.3.6 Trial Seam, Geomembrane Seaming

Trial seams shall be made on scrap pieces of geomembrane liner under the same weather and field conditions to be encountered during the seaming period to document that seaming conditions and procedures are adequate and in accordance with Appendix A. Such trial seams shall be made at the beginning of each seaming period, and at least once every 5 hours, whichever time period is less. A passing trial seam shall be made for each seaming device and technician.

For fusion welding with a self-propelled machine, re-trial welding shall be required if any setting on the machine is altered from those used for the preparation of the previous passing trial seam. With fusion welding, once a machine has passed trial weld testing, any qualified welding technician may utilize that machine. For extrusion or other manually advanced welding equipment, a change in technician, machine, or machine settings from that used for the preparation of the previous passing trial weld shall warrant completion of a new passing trial weld. With extrusion or other manually advanced welding equipment, only a qualified technician who utilized that machine shall be allowed to use that machine without the preparation of a new trial weld.

A trial seam shall also be made in the event that the sheet temperature varies more than 20°F since the last passing trial seam. Trial seams shall be made under the same conditions as actual seams. If the seaming apparatus is turned off for any reason, a new passing trial seam must be completed for that specific seaming apparatus.

The Installer shall provide the tensiometer required for field trial seam shear and peel testing. The tensiometer shall be automatic and have a direct digital readout. The tensiometer shall be calibrated at the site prior to use. The Installer shall provide the CQA Consultant with the calibration certification.

The trial seam sample shall be at least 5 feet (1.5 m) long by 1-foot (0.3 m) wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as indicated in Section 5.2.3.5. Six specimens, 1 inch (25-mm) wide each, shall be cut from the trial seam sample by the Installer. Three specimens shall be tested in shear and three in peel (each track for a double track fusion welder) using a field tensiometer. A passing welded seam is achieved in peel and shear when the specimen meets the criteria presented in Tables A-4(b) and A-5(b).

If a specimen fails, the trial seam operation shall be repeated. If the additional specimen fails, the seaming apparatus and seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive, successful, trial seams are achieved.

The CQA Consultant shall observe trial seam procedures. The remainder of the successful trial seam sample shall be assigned a number and marked accordingly by the CQA Consultant, who will also log the date, hour, ambient temperature, number of seaming unit, name of seamer, and pass or fail description. The remainder of the successful trial seam sample shall be archived at the site until the Permitting Agency has approved the final documentation.

5.3.3.7 General Seaming Procedure

Unless otherwise specified, the general seaming procedure used by the Installer shall be as follows:

- While fusion seaming, a movable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be seamed. This is to help prevent moisture build-up between the panels to be seamed;
- If required, a firm substrate will be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support;
- Wrinkles at the seam overlaps will be cut along the ridge of the wrinkle in order to achieve a flat overlap. Cut wrinkles will be seamed and portions where the overlap is inadequate will then be patched with an oval or round patch of the same geomembrane extending a minimum of 6-inches (150 mm) beyond the cut in all directions;
- With respect to the anchor trench, seaming will extend to the outside edge of panels installed within the anchor trench; and
- No field seaming shall take place without the on-site presence of the Geosynthetic Installer’s Master Seamer.

The CQA Consultant shall document that the above seaming procedures are followed and shall inform the Construction Manager of deviations.

5.3.3.8 Non-Destructive Seam Continuity Testing

The Installer shall non-destructively test field seams over their full length using a vacuum test unit (for extrusion seams only), air pressure test, or other Owner approved method. The testing shall be carried out to the accepted standards of the industry. The purpose of non-destructive testing is to inspect the continuity of geomembrane panels seams. Continuity testing shall be carried out simultaneously, as the seaming work progresses (maximum of 3,000 lineal feet (1,000 m) of seam), not at the completion of all field seaming, unless otherwise approved by the Construction Manager. The Installer shall complete required repairs in accordance with Section 5.3.4. Non-destructive testing shall not be permitted to occur before sunrise or after sunset unless the Installer demonstrates the capabilities to do so.

Air Pressure Testing

Unless otherwise specified, the general air pressure testing procedure used by the Installer shall be as follows:

- Inflate the test channel to a range of 30 to 35 pounds per square inch (psi). Close valve;
- Provide an Initial 2-minute relaxation period after pressurization prior to start of test;
- Observe and record the air pressure 5 minutes after start of test, record ending and initial pressures. If loss of pressure exceeds 3 psi, or if the pressure does not stabilize, locate the faulty area and repair;
- At the conclusion of the pressure test, the end of the seam opposite the pressure gauge shall be cut. A decrease in a gauge pressure must be observed or the air channel will be considered "blocked" and the test will have to be repeated after the blockage is corrected;
- Remove needle or other approved pressure feed device and seal the resulting hole by extrusion welding; and
- Testing will be recorded by the CQA Consultant.

Non-Complying Air Pressure Test

In the event of a non-complying air pressure test, the following procedure shall be followed:

- Check the seals at the end of the seam and retest the seam;
- If deviation with specified maximum pressure differential reoccurs, cut 1-inch (25 mm) samples from each end of the suspect area; and
- Perform destructive peel tests on the samples using the field tensiometer.

If all samples pass destructive testing, the Installer may:

- Cap-strip the suspect area;
- When sufficient overlap exists [2-inch (50 mm)], heat tack the overlap and extrusion weld the entire seam. Test the entire length of the repaired seam by vacuum testing; or
- Further isolate the air pressure failure as agreed upon by the CQA Consultant and Construction Manager;
- If one or more samples fail the peel tests, additional samples will be taken. When two passing samples are located, the suspect area between the passing tests will be considered geomembrane material that is in non-compliance. This section of failing seam shall be cap stripped, or the overlap created by the wedge welder will be heat tacked in place along the entire length of the seam and the entire length of the seam will be extrusion welded. Subsequently, the entire length of the repaired seam will be inspected by vacuum testing;

- If the seam is in non-compliance due to air channel blockage, the blockage shall be isolated, as agreed upon by the CQA Consultant and the Construction Manager; and
- All sections shall be retested and repaired in accordance with Section 5.3.4.2.

Vacuum Testing

Unless otherwise specified, the general vacuum testing procedure used by the Installer shall be as follows:

- Turn on vacuum pump to reduce pressure within the vacuum box to approximately 5 psi (0.35 kg/cm^3);
- Apply a generous amount of a solution composed of liquid soap and water to the area to be tested;
- Place the vacuum box over the area to be tested and apply sufficient downward pressure to "seat" the seal strip against the liner;
- Close the bleed valve and open the vacuum valve;
- Ensure that a leak tight seal is created;
- For a period of not less than 10 seconds, examine the geomembrane through the viewing window for the presence of soap bubbles; and
- If no bubbles appear after 10 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3-inch (75 mm) overlap and repeat the process.

Non-Complying Vacuum Test

In the event of a non-complying vacuum test, the following procedure shall be followed:

- Mark all areas where soap bubbles appear and repair the marked areas, as specified in Section 5.3.4.2; and
- Retest repaired areas.

CQA Responsibilities

The CQA Consultant shall:

- Document all continuity testing;
- Record location, date, test unit number, name of tester, and outcome of testing; and
- Inform the Installer and Construction Manager of required repairs.

When defects are located, the CQA Consultant shall:

- Observe the repair and retesting of the repairs;
- Mark on the geomembrane that the repair has been made; and
- Document the results.

Non-Testable Areas

The Installer shall use the following procedures at locations where seams cannot be non-destructively tested.

- Spark testing or other method approved by the CQA Consultant and Owner shall be employed, if possible;
- All such seams shall be cap-stripped with the same geomembrane material;
- If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation; and
- If the seam cannot be tested prior to final installation, the seaming and cap-stripping operations shall be observed by the CQA Consultant and Installer for uniformity and completeness.

The seam number, date of observation, name of tester, and outcome of the test or observation shall be recorded by the CQA Consultant.

5.3.3.9 Destructive Testing, Geomembrane Seaming

Destructive seam tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming work progresses [maximum of 3,000 lineal feet (1,000 m) of seam], not at the completion of all field seaming, unless otherwise approved by the Construction Manager or CQA Consultant. Seam lengths shall be tracked separately for each type of welding.

Location and Frequency

The CQA Consultant shall select locations where geomembrane panel seam samples will be cut out for laboratory testing. Those locations shall be established as follows:

- A minimum frequency specified in Tables A-4(b) and A-5(b). This minimum frequency is to be determined as an average taken throughout the entire facility;
- The minimum frequency specified in Table A-4(b) and A-5(b) shall be satisfied for each type of welding (i.e., extrusion and fusion); and

- Test locations will be determined during seaming at the CQA Consultant's discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset seams, or other potential cause of defective seaming.

The Installer shall not be informed in advance of destructive seam tests locations.

Sampling Procedure

Samples shall be cut by the Installer as the seaming progresses in order to have passing laboratory test results before the geomembrane is covered by another liner material. The CQA Consultant shall:

- Observe sample cutting;
- Assign a number to each sample and mark it accordingly;
- Record the destructive sample location on the appropriate geomembrane panel layout drawing; and
- Record the reason for taking the sample at this location (e.g., statistical routine or suspicious feature of the geomembrane).

Holes in the geomembrane resulting from destructive seam sampling shall be repaired in accordance with repair procedures described in Section 5.3.4.2 of the CQA/QC Plan. The continuity of the new seams in the repaired area will be tested according to Section 5.3.3.8.

Size of Samples

At a given sampling location, two types of samples shall be taken by the Installer. Initially, two specimens for field testing shall be taken. Each of these specimens will be 1-inch (25 mm) wide by 12 inches (300 mm) long, with the seam centered parallel to the width. The distance between these two specimens will be 42 inches (106 cm) (or 30 inches (76 cm).

The sample for laboratory testing shall be located between the two specimens for field testing. The destructive sample will be 12 inches (30 cm) wide by 42 inches (106 cm) long, if the Geomembrane Installer requests a sample; otherwise, the destructive samples will be 12 inches (30 cm) wide and 30 inches long (76 cm) with the seam centered lengthwise. The sample shall be cut into three parts and distributed as follows:

- One portion to the Installer for laboratory testing, 12 inches x 12 inches (30 cm x 30 cm);
- One portion to the Owner for archive storage, 12 inches x 12 inches (30 cm x 30 cm); and
- One portion for Geosynthetics CQA Laboratory testing, 12 inches x 18 inches (30 cm x 45 cm).

Final determination of the sample sizes shall be made at the Pre-Construction Meeting. The CQA Consultant shall witness destructive sample collection and label samples and portions with their number. The CQA Consultant shall also log the date and time, seam identification, and sample location.

Field Testing

The two 1-inch (25 mm) wide specimens described in the previous section may be tested in the field with a tensiometer, for peel and shear respectively, and shall meet the minimum requirements presented in Tables A-4(b) and A-5(b), included in Appendix A. If any field test sample fails to pass, the procedures outlined in the Destructive Test Failure section will be followed. The CQA Consultant shall observe and document the results of the field tests.

Geosynthetics CQA Laboratory Testing

Destructive test samples shall be packaged and shipped, if necessary, by the CQA Consultant in a manner that will not damage the test sample. The Construction Manager shall be responsible for storing the archive samples. Test samples shall be tested by the Geosynthetics CQA Laboratory.

At least five specimens will be tested, each for shear and peel as shown in Tables A-4(b) and A-5(b). A maximum of one non-Film Tear Bond (FTB) failure is acceptable for each method provided the strength requirements are met on that sample.

The Geosynthetics CQA Laboratory shall provide test results, in writing, no more than 24 hours after they receive the samples. The CQA Consultant shall review laboratory test results as soon as they become available and make appropriate recommendations to the Construction Manager. If a sample fails, the procedures given in the Destructive Test Failure section shall be followed.

Installer's Laboratory Testing

The Installer's laboratory test results shall be presented to the Construction Manager and the CQA Consultant for review within 24 hours of sample collection.

Destructive Test Failure

The following procedures shall apply whenever a sample fails a destructive test, whether that test is conducted by the Geosynthetics CQA Laboratory, the Installer's laboratory, or by the field tensiometer.

- The Installer can reconstruct the seam between any two passed destructive seam test locations; or
- The Installer can trace the seaming path to an intermediate location [at least 10 feet (3 m) from the point of the failed test in each direction] and take a small sample for an additional field test at each location. If these additional samples pass field tensiometer testing, then full destructive laboratory samples are taken. If these destructive laboratory samples pass the tests, then the seam is reconstructed between these locations by capping via extrusion or fusion welds. If either the field tensiometer or the laboratory test sample fails, then the process is repeated to establish the zone in which the seam should be reconstructed.

If a fusion type seam fails destructive testing and the Installer chooses to cap the seam, the only acceptable capping method is as described in Section 5.3.4.2.

All acceptable seams must be bounded by two locations from which destructive samples passing laboratory tests have been taken. In cases exceeding 150 feet (45 m) of reconstructed seam, a sample shall be taken from the zone in which the seam has been reconstructed. This sample must pass destructive testing or the procedure outlined here must be repeated.

The CQA Consultant shall document all actions taken in conjunction with destructive test failures.

5.3.4 Defects and Repairs

All seams and non-seam areas of the geomembrane shall be examined by the CQA Consultant for identification of defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. Because light reflected by the geomembrane helps to detect defects, the surface of the geomembrane will be clean at the time of examination. The geomembrane surface shall be swept or washed by the Installer if the amount of dust or mud inhibits examination.

5.3.4.1 Evaluation

Each suspected defect location, both in seam and non-seam areas, shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.9. Each location which fails the non-destructive testing shall be marked with an identification code by the CQA Consultant and repaired by the Installer. Work shall not proceed with any subsequent materials which will cover locations which have been repaired until field or laboratory test results with passing values are available.

5.3.4.2 Repair Procedures

Any portion of the geomembrane exhibiting a flaw, failing a destructive test, or failing a non-destructive test, shall be repaired. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be approved by the Construction Manager and the CQA Consultant. The procedures available include:

- Patching - Apply a new piece of geomembrane sheet over, and at least 6 inches (150 mm) beyond the limits of a defect. The patch shall be extrusion seamed to the underlying geomembrane. This method should be used to repair holes, tears, destructive test locations, undispersed raw materials, contamination by foreign matter, dents, pinholes, and pressure test holes;
- Capping - Apply a new strip of geomembrane along the length of a delineated faulty seam. The cap strip shall extend at least 6 inches (150 mm) beyond the limit of the seam and the edges will be extrusion seamed to the underlying geomembrane. This method should be used to repair lengths of extrusion or fusion seams; and
- Replacement - The faulty seam is removed and replaced.

In addition, the following provisions shall be satisfied:

- Surfaces of the geomembrane which are to be repaired will be abraded no more than one hour prior to the repair;
- All surfaces must be clean and dry at the time of the repair;
- All seaming equipment used in repairing procedures must be approved;
- The repair procedures, materials, and techniques will be approved in advance of the specific repair by the CQA Consultant and Installer;
- Patches or caps will extend at least 6 inches (150 mm) beyond the edge of the defect and all patch corners will be rounded; and
- Seam repairs over 150 feet (45 m) long will require a destructive test to be taken from the repair.

5.3.4.3 Verification of Repairs

Each repair shall be numbered and logged by the CQA Consultant and the Installer. Each repair shall be non-destructively tested, as necessary, using the methods described in Section 5.3.3.8. Repairs which pass the non-destructive test will be taken as an indication of an adequate repair. However, if the CQA Consultant suspects a repair to be questionable, although it passes non-destructive testing, a destructive test can be requested. Failed tests will require the repair to be redone and retested until a passing test result is achieved. The CQA Consultant shall observe non-destructive testing of repairs and shall record the repair test date, location, and test outcome.

5.3.4.4 Large Wrinkles

When seaming of the geomembrane panels is completed (or when seaming of a large area of the geomembrane is completed) and prior to placing overlying liner materials, the CQA Consultant shall inspect the geomembrane for the presence of wrinkles. The CQA Consultant will indicate to the Construction Manager which wrinkles should be cut and re-seamed by the Installer. The resulting seam produced by removing the wrinkle will be tested like any other repair.

5.3.5 Backfilling of Anchor Trench

Anchor trenches will be adequately drained to prevent ponding or otherwise softening of the adjacent soils while the trench is open. Anchor trenches shall be backfilled and compacted as soon as possible. Care shall be taken when backfilling the trenches to prevent any damage to the geosynthetics.

The CQA Consultant shall observe the backfilling operation and advise the Construction Manager of any problems. Testing of the anchor trench backfill shall be completed and monitored consistent with the requirements of Table A-3.

5.3.6 Installed Geomembrane Certification/Acceptance

The Installer and the Manufacturer shall retain ownership and responsibility for the geosynthetics installed within the facility until acceptance by the Owner.

The liner system shall be accepted by the Owner when:

- The installation is finished;
- Verification of the adequacy of seams and repairs, including associated testing, is complete;
- Installer’s representative furnishes the Construction Manager with certification that the geomembrane was installed in accordance with the Manufacturer's recommendations as well as the design drawings and specifications;
- All documentation of installation is completed including the CQA Consultant’s final report; and
- Certification, including record drawings, sealed by a Professional Engineer registered in Tennessee has been received by the EM or AEM.

The CQA Consultant shall provide certification that installation has proceeded in accordance with this CQA/QC Plan for the project except as noted to the EM or AEM or Construction Manager.

5.3.7 Materials in Contact with the Geomembranes

The quality assurance procedures indicated in this subsection are only intended to document that the installation of these materials does not damage the geomembrane. Additional quality assurance procedures provided in subsequent sections of this CQA/QC Plan are necessary to document that the systems built with these materials are constructed to perform as designed.

5.3.7.1 Appurtenances

The Design Engineer shall provide design specifications for appurtenances to the Construction Manager and the CQA Consultant.

The CQA Consultant shall document that:

- Installation of the geomembrane in appurtenance areas and connection of geomembrane to appurtenances have been made according to the design specifications;
- Extreme care is taken while seaming around appurtenances since neither non-destructive nor destructive testing may be feasible in these areas; and
- The geomembrane has not been visibly damaged while making connections to appurtenances.

The CQA Consultant will inform the Construction Manager if the above conditions are not fulfilled.

5.3.8 Geomembrane Rain Flaps

Geomembrane rainflaps may be installed to subdivide lined areas for leachate quantity management. The purpose of the flap is to prevent stormwater from entering the leachate collection system. The CQA Consultant shall document the material, configuration, and installation of the rainflap. Additionally, the CQA Consultant shall confirm that the berm installation does not harm the liner system.

5.4 TESTING OF SUMP AREAS

Liner construction projects which include the installation of a leachate sump area shall include additional inspection in these areas. Additional inspection shall be performed to verify that the liner material and installation has been completed with no identifiable defects. This inspection may be achieved through complete vacuum box testing, spark testing or a hydrostatic test. Inspection of the sump area shall be performed following the installation and detailing of the liner installation throughout the sump area. The inspection of the sump area shall be clearly noted and discussed in the field reports prepared by the CQA Consultant.

5.4.1 Vacuum Box Testing of Sump Areas

Following installation of the liner throughout the sump area, complete vacuum box testing can be performed to provide adequate testing of the sump area. Standard vacuum box testing procedures, as outlined in Section 5.3.3.8 shall be followed for the inspection of all seams and sheet material within the limits of the depressed portion of the sump. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.2 Spark Testing of Sump Areas

Following installation of the liner throughout the sump area, complete spark testing can be performed to provide adequate testing of the sump area. With the testing equipment and liner properly powered, the spark testing wand shall be moved slowly over all seam and sheet area within the limits of the depressed portion of the sump. The geosynthetic installer technician performing the spark testing shall be properly trained and demonstrate this training with written certification or resume experience. The speed and distance above the liner which the wand is moved shall be initially confirmed with the testing of a trial seam or liner material with a known defect to ensure that the sparking can be seen. The CQA Consultant shall provide a field monitor to accompany the geosynthetic installer throughout the vacuum box testing of the sump area. Defects identified during this testing shall be marked, repaired, and re-tested.

5.4.3 Hydrostatic Testing of Sump Areas

Following installation of the liner throughout the sump area, a hydrostatic test of the sump area can be performed to document its integrity. The sump shall be tested by filling the sump with clean water to a minimum of 2 inches (51 mm) above the crest of the depressed portion of the sump, unless otherwise specified by Owner and CQA Consultant. The horizontal limits of the water surface shall be delineated on the primary liner at the start of the testing period with markers or paints. The water shall remain in the sump for a minimum of 8 continuous hours. Loss of test water may be determined by comparing horizontal limits of the water surface with the interim limits. At a minimum of once every 1 hour (more frequently as possible), the test water level in the sump interim water loss amounts and time shall be noted as part of the test.

At the end of the testing period, the level of liquid in the sump shall be evaluated. If no liquid loss is noted, the hydrostatic test is deemed to pass. If appreciable liquid decrease is noted, the test is deemed as non-passing and the sump shall be emptied and inspected for leaks or hydrostatic testing may be run at various liquid depths within the sump to locate possible leaks. If no possible leaks are located, other possible avenues of infiltration through the sump shall be investigated and the test shall be re-run.

6.0 GEOSYNTHETIC CLAY LINER (GCL)

6.1 INTRODUCTION

The manufacture, shipment, and installation of a Geosynthetic Clay Liner (GCL) shall be in accordance with this section of the CQA/QC Plan. GCLs shall be utilized in accordance with the permitted design for the facility, as an alternative to the upper 1-foot of the 2-foot-thick barrier soil layer. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-8. These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of all GCLs.

6.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the GCL Manufacturer shall provide documentation which demonstrates that the GCL property values of the material adheres to project specifications. Site delivered rolls of GCL shall be appropriately labeled.

6.2.1 Certification of Property Values

The GCL Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for the specific type of GCL to be supplied. The GCL Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate GCL Manufacturer representative. The certification shall state that the site delivered GCLs have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

6.2.2 Labeling

The GCL Manufacturer shall identify all rolls of GCL. Each GCL roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;
- Roll weight; and
- Roll dimensions.

In addition, if any special handling of the GCL is required, it shall be marked on the top surface of the GCL, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

6.3 SHIPMENT AND STORAGE

During shipment and storage, the GCL shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. GCL rolls shall be wrapped in plastic sheets or otherwise protected. In addition to maintaining in-tact wrappings for the GCLs, the rolls shall be stored off of the ground and covered with an additional tarp, stored in a truck, van, building or other area that would provide protection against damage and exposure. Wrappings protecting the GCL rolls should not be removed more than one hour prior to unrolling the GCL.

GCLs shall not be exposed to precipitation prior to being installed. Wet GCLs are heavy which makes them difficult to deploy, can degrade the desired performance of the material and can also affect liner welding when the geomembrane is adjacent to the GCL.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviation from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

6.4 CONFORMANCE TESTING OF GCL

Upon or prior to delivery of GCL rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

6.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-8 in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA

Consultant shall inform the Construction Manager. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The sample shall be marked with the machine direction on the samples with an arrow.

6.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values (as listed in Table A-8), the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
   a. For the failing parameter(s), perform two additional tests on the sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
   b. If the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
   c. If one or more of the average test values do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and the samples shall be tested for the failed parameter(s). If one or both of these samples do not meet requirements, the failing roll(s) shall be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

6.5 HANDLING AND PLACEMENT

The Installer shall handle GCLs in such a manner as to minimize damage and shall comply with the following:

- GCL shall not be deployed by allowing the roll to freely unroll down a slope;
- GCLs shall be cut using an approved cutter only. If the GCL is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the GCLs;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the GCLs;

- During placement of GCLs, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the GCL, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the GCL shall be examined and harmful foreign objects, such as needles, shall be removed;
- Geomembrane installation shall immediately follow the GCL installation. In-place GCL shall be covered with geomembrane before the Contractor leaves the site at the end of the day that the GCL was placed. Geomembrane seams shall be welded after each geomembrane panel is placed;
- Geomembrane shall not be placed on a GCL which has sufficiently hydrated. Degree of hydration shall be determined by visual inspection by the CQA Consultant;
- Geomembrane defects and destructive sample locations shall be immediately repaired; and
- The CQA Consultant shall be present during cutting of the material overlaying the GCL to ensure that no incisions have been made into the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.6 SEAMS AND OVERLAPS

GCLs shall be overlapped a minimum of 6 inches on the edges of the panels and 12 to 18 inches between roll ends. Manufacturer's recommendations shall be consulted with respect to the need for loose bentonite on the seam overlaps. Horizontal seams on side slopes steeper than 25 percent (3H:1V) shall be made with a 3-foot overlap. Horizontal seams on side slopes steeper than 25 percent (4H:1V) shall also be offset by a minimum of 10 feet. The Installer shall pay particular attention that no material is inadvertently inserted beneath the GCL.

The CQA Consultant shall note deviations and report them to the Construction Manager.

6.7 REPAIRS

Holes or tears in the GCL shall be repaired by the Installer as follows:

- A patch made from the same GCL shall be placed and anchored over the defect or other method to "tack" it in place and lie no closer than 12 inches from any edge. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced.

Care shall be taken to remove soil or other material which may have penetrated the torn GCL. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

6.8 PLACEMENT OF MATERIALS ON GCLS

The Installer shall place materials on the GCL in the following manner:

- In a way that causes no damage to the GCL and underlying geosynthetics;
- Allows minimal slippage of the GCL on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the GCL, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

7.0 GEOTEXTILE

7.1 INTRODUCTION

The manufacture, shipment, and installation of geotextiles shall be in accordance with this section of the CQA/QC Plan. Geotextiles shall be utilized in accordance with the permitted design for the facility. Laboratory and field tests will be referred to by name throughout this section. For the specific test method corresponding to the named tests, see Table A-6(a) through A-6(c). These tables specify the test parameters and frequencies of the Manufacturer quality control testing as well as the conformance testing. The CQA Consultant shall document inventory, testing, and placement of geotextiles.

7.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the Geotextile Manufacturer shall provide documentation which demonstrates that the geotextile property values of the material adhere to project specifications. Site delivered rolls of geotextile shall be appropriately labeled.

7.2.1 Certification of Property Values

The Geotextile Manufacturer shall provide the Construction Manager with a list of guaranteed "minimum average roll value" properties (as defined by the Design Engineer) for each specific type of geotextile to be supplied. The Geotextile Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Geotextile Manufacturer representative. The certification shall state that the site delivered geotextiles have properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

7.2.2 Labeling

The Geotextile Manufacturer shall identify the rolls of geotextile. Each geotextile roll shall have a weatherproof label containing the following:

- Manufacturer's name;
- Product identification;
- Lot number;
- Roll number;

- Roll weight; and
- Roll dimensions.

In addition, if special handling of the geotextile is required, it shall be marked on the top surface of the geotextile, e.g., "This Side Up". Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

7.3 SHIPMENT AND STORAGE

During shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, snow, inundation, mud, dirt, dust, puncture, cutting, or other damaging or deleterious conditions. Geotextile rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the geotextile rolls should not be removed less than one hour prior to unrolling the geotextile.

Geotextiles shall not be exposed to precipitation prior to being installed. Wet geotextiles are heavy, which makes them difficult to deploy and can also affect liner welding when the geomembrane is adjacent to the geotextile. During cold weather, geotextiles must be protected from freezing.

The CQA Consultant shall observe rolls upon delivery and prior to installation, deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner.

7.4 CONFORMANCE TESTING OF GEOTEXTILE

Upon or prior to delivery of geotextile rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for conformance testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

7.4.1 Sample Collection

Using the packing list provided by the manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency shown in Table A-6(a) through A-6(c), in Appendix A. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample. If a roll is not identifiable by roll number, the CQA Consultant shall inform the Construction Manager immediately. If the roll cannot be tracked, the Construction Manager shall reject the roll.

Samples will be recovered across the entire width of the roll and will not include the first 3 lineal feet (1 m). Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

7.4.2 Test Results

The results of the conformance testing shall be evaluated in accordance to the following procedure:

1. If the average test values for the sample comply with all of the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed sample is not performed or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

7.5 HANDLING AND PLACEMENT

The Installer shall handle geotextiles in such a manner as to minimize damage and shall comply with the following:

- After the wrapping has been removed, a geotextile shall not be exposed to sunlight for more than the time specified by the Geotextile Manufacturer;
- On slopes, the geotextiles shall be securely anchored and then rolled down the slope in such a manner as to continually keep the geotextile panel in tension;

- In the presence of wind, geotextiles shall be weighted with sandbags or the equivalent. Sandbags shall be installed during the placement and shall remain until replaced with the appropriate overlying liner material;
- Sandbags shall be filled with fine grained material and must be handled with care to avoid rupture;
- Geotextiles shall be kept continually under tension to minimize the presence of wrinkles forming within the geotextile;
- Geotextiles shall be cut using an approved cutter (hook blade only if within a cell project area). If the geotextile is in-place, special care must be taken to protect underlying materials from damage which could be caused by the cutting of the geotextiles;
- The Installer shall take necessary precautions to prevent damage to the underlying geosynthetic or granular layers during placement of the geotextiles;
- During placement of geotextiles, care shall be taken not to entrap stones, excessive dust, or moisture that could damage the geotextile, generate clogging of drains or filters, or hamper subsequent seaming;
- During and after installation, the surface of the geotextile shall be examined and harmful foreign objects, such as needles, shall be removed; and
- If white geotextile is used, precautions will be taken against "snow blindness" of personnel.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.6 SEAMS AND OVERLAPS

Geotextiles shall be continuously joined. Geotextiles shall be sewn using thread, which is as chemically and UV resistant as the geotextile itself. Thread shall be approved by the CQA Consultant and Owner.

Geotextiles shall be overlapped a minimum of 6 inches (150 mm) prior to seaming. The Installer shall pay particular attention that no material is inadvertently inserted beneath the geotextile.

The CQA Consultant shall note deviations and report them to the Construction Manager.

7.7 REPAIR

Holes or tears in the geotextile shall be repaired by the Installer as follows:

- On slopes steeper than 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and lie no closer than 12 inches from the edge of the defect. Should a horizontal tear exceed 10 percent of the width of the roll, that roll shall be removed from the slope and replaced; and

- On slopes less than or equal to 20 percent (5H:1V): A patch made from the same geotextile shall be sewn or thermally bonded over the defect and have a minimum of 24 inches (600 mm) of overlap in all directions.

Care shall be taken to remove soil or other materials which may have penetrated the torn geotextile. The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

7.8 PLACEMENT OF MATERIALS ON GEOTEXTILES

The Installer shall place materials on the geotextile in the following manner:

- In a way that causes no damage to the geotextile and underlying geosynthetics;
- Allows minimal slippage of the geotextile on underlying layers; and
- Equipment used for placing the overlying material shall not be driven directly on the geotextile, unless approved by the CQA Consultant and Construction Manager.

Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

8.0 GEOCOMPOSITE

8.1 INTRODUCTION

The manufacture, shipment and installation of geocomposites shall be in accordance with this section of the CQA/QC Plan. A geocomposite consists of a HDPE geonet core, heat-bonded on both sides to a nonwoven geotextile. Table A-7 has been included in Appendix A to address the geonet component and finished geocomposite to be utilized as a final cover drainage layer. The geotextile component of geocomposites shall be tested separately for all parameters at the prescribed testing frequencies required for geotextiles, as presented in Section 7 of this CQA/QC plan.

The CQA Consultant shall document the inventory, testing, and placement of geocomposites.

8.2 MANUFACTURER'S DOCUMENTATION

Prior to delivery, the manufacturer shall provide documentation which demonstrates that the property values of the material adhere to the design specifications. Delivered rolls of geocomposite shall be appropriately labeled.

8.2.1 Certification of Property Values

The geocomposite Manufacturer (Manufacturer) shall provide the Construction Manager with a list of guaranteed “minimum average roll value" properties (as defined by the Design Engineer) for the type of geocomposite to be supplied. The Manufacturer shall provide the Construction Manager with a written certification, signed by the appropriate Manufacturer representative. The certification shall state that the site delivered geocomposite has properties which meet or exceed the guaranteed "minimum average roll values".

The CQA Consultant shall examine the Manufacturer's certifications to document that the property values listed on the certifications meet or exceed the Manufacturer's MARV values. Deviations shall be reported to the Construction Manager.

8.2.2 Labeling

The Manufacturer shall identify geocomposite rolls. Each roll shall have a weatherproof label which contains the following:

- Manufacturer's name;
- Product identification;
- Lot number;

- Roll number; and
- Roll dimensions.

The CQA Consultant shall examine rolls upon delivery and deviations from the above requirements shall be reported to the Construction Manager.

8.3 SHIPMENT AND STORAGE

Geocomposite cleanliness is essential to performance, therefore, measures must be taken during shipment and storage to protect them from dust and dirt. Geocomposite rolls shall be wrapped in plastic sheets or otherwise protected. Wrappings protecting the rolls should be removed less than one hour prior to unrolling the geocomposite.

The CQA Consultant shall document that the geocomposites are free of dirt and dust prior to being installed. If the roll is dirty or dusty, it shall be washed by the Installer prior to installation. Washing operations shall be observed and approved by the CQA Consultant.

The CQA Consultant shall examine rolls upon delivery and prior to installation. Deviations from the above requirements shall be reported to the Construction Manager. Damaged rolls shall be rejected and replaced at no cost to the Owner. Rolls without proper identification shall be identified by the CQA Consultant for rejection by the Owner.

8.4 CONFORMANCE TESTING OF GEOCOMPOSITE

Upon or prior to delivery of geocomposite rolls, samples shall be forwarded to the Geosynthetics CQA Laboratory for testing. Direct shear testing and interface shear testing shall be completed by the CQA Consultant before construction commences. Refer to Table A-9 (Appendix A) for testing conditions.

Sample Collection

Using the packing list provided by the Manufacturer or a sequential inventory list made by the CQA Consultant, rolls shall be selected for sampling at the minimum frequency specified in Table A-7. If the material is shipped in identifiable lots or manufacturing runs, sample selection should be adjusted so that the minimum frequency is met and that each different lot or manufacturing run is represented by at least one sample.

Samples will be taken across the entire width of the roll and will not include the first 3 lineal feet (1 m) of the roll. Unless otherwise specified, sample dimensions will be 3 feet (1 m) long by the roll width. The CQA Consultant will mark the machine direction on the samples with an arrow.

Test Results

The results of the conformance testing shall be evaluated in accordance with the following procedure:

1. If the average test values for the sample comply with the values given in the Manufacturer's MARV values, the sample passes.
2. If the average test value for the sample does not meet one or more of the required values, additional evaluation procedures will be implemented by the CQA Consultant. Additional tests required for further evaluation shall be done at no expense to the Owner.
    a. For the failing parameter(s), perform two additional tests on sub-samples taken from the previously failing sample. These tests may be performed by another CQA Geosynthetics Laboratory at the discretion of the CQA Consultant and the Construction Manager.
    b. If additional testing is done on the failed sample, and the average test values for each of the two additional tests meet the required values, the roll and adjacent rolls pass and are acceptable.
    c. If additional testing of the failed samples is not performed, or the average test values from the additional testing do not meet requirements, the roll shall be rejected. Samples shall be collected from the closest numerical roll on both sides of the failed roll and shall be tested for the failed parameter(s). If one or both of these adjoining rolls do not meet requirements, the failing roll(s) will be rejected and the CQA Consultant and Construction Manager shall determine further testing protocol and criteria for identifying the limits of rejected rolls.

8.5 HANDLING AND PLACEMENT

The Installer shall handle geocomposites in such a manner as to minimize damage and comply with the following:

- On slopes, the roll shall be secured in the anchor trench and then rolled in a parallel direction down the slope while maintaining a constant tension on the sheet. If necessary, the material shall be positioned by hand after being unrolled to minimize wrinkles. Efforts shall be made to place geocomposites parallel to the slope. However, in some landfill locations and/or some instances (e.g., at the toe of the slope, or if an extra geocomposite layer is required) the layer may be placed in the horizontal direction (i.e., across the slope). Such locations and cases shall be identified by the Design Engineer in the drawings;
- In the presence of wind, geocomposites shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and remain until replaced with overlying material;

- Sandbags shall be filled with fine grained material and must be handled with care to prevent rupture;
- Unless otherwise specified, geocomposites shall not be welded or attached to geomembranes;
- Geocomposites shall only be cut using appropriate equipment after deployment;
- The Installer shall take necessary precautions to prevent damage to underlying geosynthetic or granular layers during installation. Care should be taken not to leave tools on or beneath the geocomposite; and
- During placement, care shall be taken not to entrap dirt or excessive dust that could cause clogging of the drainage system, and/or stones that could damage the adjacent geosynthetics. If dirt, excessive dust, and/or stones are entrapped in or below the geocomposite it shall be washed or swept prior to placement of material over it.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.6 JOINING

Adjacent geocomposites shall be joined according to the drawings and design specifications. As a minimum, the following requirements shall be met:

- Adjacent rolls shall be overlapped by at least 4 inches (100 mm);
- These overlaps shall be secured by tying;
- Tying shall be achieved with net ties. Tying devices may be white or yellow for easy observation. Metallic devices are not permitted;
- Tying devices shall be placed every 5 feet (1.5 m) down the slope, every 2 feet (0.6 m) across the slope, every 6-inches (150 mm) in the anchor trench, and every 6 feet (2 m) on horizontal surfaces; and
- In the corners of the side slopes of rectangular landfills, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled from top to bottom of the slope and placed upon the top of the previously installed geocomposites.

The CQA Consultant shall note deviations and report them to the Construction Manager.

8.7 REPAIR

Holes or tears shall be repaired by placing a geocomposite patch extending 2 feet (0.6 m) beyond the edges of the hole or tear. The patch shall be secured to the original geocomposite by tying placed at a frequency of every 6 inches (150 mm). Tying devices shall be as indicated in Subsection 8.6. If the hole or tear width across the roll is more than one-half the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Subsection 8.6.

The CQA Consultant shall observe repairs, note deviations with the above requirements, and report them to the Construction Manager.

8.8 PLACEMENT OF MATERIALS ON GEOCOMPOSITE

The placement of materials on geocomposite shall be as soon as possible, such that:

- The geocomposite and underlying geomembrane are not damaged;
- Minimal slippage of the geocomposite on the underlying geomembrane occurs;
- No excess tensile stresses occur in the geocomposite;
- A minimum thickness of 1 foot (30 cm) of soil must be maintained between light, low ground pressure equipment and the geocomposite; and
- Equipment used for placing overlying material shall not be driven directly on the geocomposite unless approved by the CQA Consultant and Construction Manager.

If portions of the geocomposite are exposed, the CQA Consultant shall periodically place marks on the geocomposite and the underlying geomembrane and measure the elongation of the geocomposite during the subsequent construction activities. Before a subsequent layer of material is placed on the geocomposite, the CQA Consultant should observe the geocomposite and underlying liner to determine if dirt, excessive dust, or stones are entrapped in or beneath the liner. If so, the geocomposite and geomembrane must be washed or the geocomposite removed so that the liner can be cleaned. Deviations shall be noted by the CQA Consultant and reported to the Construction Manager.

9.0 LEACHATE MANAGEMENT SYSTEM

9.1 INTRODUCTION

This section of the CQA/QC Plan addresses the CQA activities associated with the Leachate Management System (LMS). These components include:

- Protective Cover Layer (See Section 4.6); and
- Polyethylene Pipes and Fittings.

The above components shall meet requirements related to material characteristics and construction quality. Both field and laboratory tests shall be performed prior to construction to evaluate if the characteristics of soil and aggregate from proposed sources and the quality of pipes meet the material acceptance requirements of the permit and design specifications. Throughout construction, additional field and laboratory testing shall be performed to evaluate if the placed material meets the requirements of the permit and construction documents with regard to material acceptance and construction quality.

9.2 PROTECTIVE COVER LAYER

See Section 4.6 of this CQA/QC Plan for information related to the Protective Cover Layer.

9.3 POLYETHYLENE PIPE AND FITTINGS

9.3.1 Material Requirements

HDPE pipe and its associated fittings and joints shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.3.1.1 Pipe

HDPE pipe shall consist of Standard Dimension Ratio (SDR) pipe, as specified in the design specifications, and must conform to the requirements of ASTM D2837, Class PE3408 for a pressure rating of 160 psi at 73.4 F. HDPE pipe shall comply with the following standards:

- ASTM F714 - pipe S.T.D;
- ASTM D1248 - Type III, Class C, Category 5 - Grade P34; and
- PPI - PE3408.

9.3.1.2 Fittings

HDPE pipe fittings shall be furnished by the Manufacturer of the pipe with which they are used and shall conform to the requirements of ASTM D3261 for standard fittings.

9.3.1.3 Joints

Pipe joints shall be fusion welded, using only Manufacturer-approved methods and equipment. Unless otherwise approved, joints inside manholes shall be joined with mechanical transition couplings.

9.3.2 Fusion Process for Joints

HDPE pipes and fittings shall be joined by the Pipe Installer using the procedures outlined below, unless otherwise specified.

9.3.2.1 Preparation

Delivered pipes and fittings shall be examined by the Pipe Installer. The Installer shall document that pipes and fittings are not broken, cracked, or contain otherwise damaged or unsatisfactory material. Prior to fusing, the Installer shall document that the fusion surface area is clean and free of moisture, dust, dirt, debris, and foreign material.

The CQA Consultant shall notify the Construction Manager of deviations.

9.3.2.2 Weather Conditions for Butt-Fusion

Butt-fusion of HDPE pipe joints is normally performed in uncontrolled atmospheres. Fusion of the HDPE joints shall be performed at temperatures above 20°F, unless otherwise authorized by the Construction Manager.

9.3.3 Pressure Testing of Joints

The joints of non-perforated HDPE pipes shall be tested by the Pipe Installer using the pressure test procedures outlined below. The CQA consultant shall report nonconformance of testing methods or test results to the Project Manager.

9.3.3.1 Segment Testing: Pre-Installation

- Similar sizes of polyethylene piping shall be butt-fused 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;
- 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 10 psi for gravity leachate piping and 40-psi for other piping with working pressure/static head up to 90 psi. For those cases with high pressure systems over 90 psi, the testing pressure shall be established as the working pressure/static head by estimating the minimum test pressure as [Head in feet / 2.3 = Test Pressure in psi];
- Contractor shall submit verification and results of gauge calibration prior to (no later than 60 days) and after completion of project;
- The allowable pressure drop observed during the test shall not exceed one percent of the test pressure over 30 minutes. Pressure drop shall be corrected for temperature changes before determining pass or failure;
- The Owner shall be notified before the testing procedure and shall have the option of being present during the test; and
- Equipment for this testing procedure will be furnished by the contractor. This shall consist of a polyethylene flange adapter 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 212°F (0° to 100°C), a pressure gauge 0 to 75-psi, a valve to facilitate an air compressor hose, and a ball valve to release pipe pressure at completion of the test. Polyethylene reducers shall be utilized to adapt the flange to the size of pipe being tested.

9.3.3.2 Test Failure

The following steps shall be performed when a pipe segment fails the 1 percent pressure drop per 30-minute test.

- The pipe and welds shall be inspected for cracks, pinholes, or perforations;
- 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;
- Pipe and fused joint leaks shall be repaired by cutting out the leaking area and refusing the pipe; and
- After leaks are repaired, a retest shall be performed in accordance with Section 9.5.3.1.

9.3.3.3 Final Test

- When the total length of the conveyance pipeline exceeds 2,000 feet, a final test shall be made on the completed conveyance pipeline in accordance with Section 9.3.3.1 and 9.3.3.2; and
- The completed system when tested should be in its proper trench location and allowed time to reach constant and/or ambient temperature before initiating the test.

9.3.3.4 Test Reporting

Testing shall be reported in writing to the Owner and shall include the following information:

- Date and time;
- Person performing test;
- Name of CQA Consultant;
- Pipe length, size(s), and location;
- Test pressure at 10-minute intervals; and
- Ambient temperature at 10-minute intervals measured in trench for final test.

The following information shall be reported in writing if a failure occurs:

- Nature of leaks found; and
- Details of repair.

The CQA Consultant shall report deviations of testing methods or test results to the Construction Manager.

9.3.4 Cleaning of Pipes

All pipe installed as part of new cell construction shall be cleaned out to remove trimmings, dirt and other deleterious materials prior to placing waste in the new cell.

9.4 HDPE MANHOLES

Manholes constructed from HDPE materials shall meet material acceptance and construction quality requirements as stated in this section of the CQA/QC Plan and in the design specifications.

9.4.1 Manholes

The acceptability of manholes which routinely hold leachate shall be evaluated using a hydrostatic test evaluation. This test will consist of filling the manhole to the design level with water and taking water level measurements over a 30-minute period. The manhole will be acceptable if the water level does not change more than 1-inch.

10.0 FINAL COVER

10.1 INTRODUCTION

This section of the CQA/QC Plan addresses the activities related to construction of the final cover system. The final cover system shall be installed over areas that have received waste and have reached final grades. The final cover system shall consist of the following components (from bottom to top):

- Intermediate Cover (See Section 4.7);
- Final Cover Textured Flexible Membrane Liner (See Section 5.3);
- Geocomposite Drainage Layer (See Section 7 and 8); and
- Final Cover Soil Layer (See Section 4.7).

Each of these components will be discussed in this section of the CQA Plan.

During construction of the final cover system, care will be taken to ensure that existing landfill structures such as gas wells, gas trenches, and bench drains are not damaged or their performance compromised by moving equipment, laborers, or the placement of final cover components. Prefabricated boots or fittings shall be placed around gas wells or other landfill structures that penetrate the landfill final cover to ensure a complete seal. Throughout construction near final cover structures, CQA/QC inspectors, laborers, and equipment operators shall look for possible damage or unusual conditions to structures.

10.2 FINAL COVER GEOSYNTHETICS

Geosynthetics within the final cover system consist of a textured flexible membrane liner (FML) and a geocomposite drainage layer. The geocomposite drainage layer will be placed upon the FML and collect and drain infiltration from the final cover to designated surface water collection points.

This CQA Plan addresses the field and laboratory tests needed to be performed, prior to and during construction, to evaluate the suitability of the proposed geosynthetics to be used within the final cover system. The sections presented below reference the specific sections that outline the CQA requirements for each geosynthetic within the final cover system.

10.2.1 Final Cover Geocomposite Drainage Layer

Section 8.0, Geocomposite, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for proposed geocomposite to be installed with the final cover system.

10.2.2 Final Cover FML

Section 5.0, Geomembrane, within this CQA Plan specifies the material characteristics, construction quality, acceptance requirements, and testing frequency necessary for the proposed FML to be installed with the final cover system.

11.0 SURVEYING

11.1 INTRODUCTION

Surveying of lines and grades shall be conducted during construction of soil and geosynthetic components. Surveying shall be performed to provide documentation for record drawings, document quantities of soils and geosynthetics, and to assist the Earthwork Contractor in complying with the required grades. Surveying conducted at the site shall be part of the construction quality assurance program.

11.2 SURVEY CONTROL

Benchmarks have previously been established for the sites. The vertical and horizontal controls for each site benchmark have been established within normal land surveying standards.

11.3 SURVEYING PERSONNEL

Surveying will be performed under the direct supervision of a qualified Land Surveyor or Professional Engineer licensed in the State of Tennessee. The survey crew will consist of the Senior Surveyor and as many Surveying Assistants as are required to satisfactorily undertake the work. Surveying personnel will be experienced in the provision of these services, in addition to preparing detailed and accurate documentation.

11.4 PRECISION AND ACCURACY

The survey instruments used for this work shall be precise and accurate to meet the needs of the project. Survey instruments shall be capable of reading to a precision of 0.01 foot (3.1 mm) with a setting accuracy of 10 seconds. Calibration certificates for survey instruments shall be submitted to the CQA Consultant prior to initiation of surveying activities.

11.5 LINES AND GRADES

When required, the following surfaces shall be surveyed to determine the lines and grades achieved during construction:

- Original ground surface;
- Surface of excavation/structural fill;
- Surface of the barrier soil layer (for disposal area construction, including edges, bottom, and limits of anchor trenches and sumps);
- Surface of the protective cover layer (including edges, bottom, and limits of pipes and sump);

- Surface of the intermediate soil cover and bench locations following placement of final cover soil layer, see Section 4.7;
- Surface and limits of geosynthetics;
- Anchor trench;
- Alignment and inverts of piping and tanks (both inside and outside the landfill); and
- Profiles, cross sections, ditch inverts, roads, and sedimentation basins.

11.6 FREQUENCY AND SPACING

Surveying shall be performed as soon as possible after completion of a given component installation to facilitate progress and avoid delaying the installation of subsequent components. When survey is utilized to confirm grades and thickness of various liner components, sufficient density of survey points shall be provided to determine that the constructed configuration is consistent with the permitted design. This density shall consist of spot elevations on a frequency of a 100-ft grid in base areas with additional shots at grade breaks, the limit of the area, trenches and other breaks in grade or configuration of the cell.

11.7 TOLERANCES

Acceptable tolerances on survey coordinates, within the waste containment areas, shall be ±0.20 feet (60 mm) on elevations and ±0.20 feet (60 mm) on coordinates, provided minimum permit conditions and state regulations are adhered to (i.e., thickness, grades, etc.). Surveying tolerances may need to be more stringent in the sump area to ensure accurate construction of this component.

11.8 DOCUMENTATION

Original field survey notes shall be retained by the Surveyor. A copy of these notes will be given to the CQA Consultant prior to the covering of the surveyed component. The results from the field surveys will be used as the basis for preparation of record drawings. At a minimum, these drawings shall show the final elevations of the surfaces listed in this section of the CQA/QC Plan at a scale of 1-inch (25 mm) equals 100 feet (30 m) with contour intervals no greater than 2 feet (0.6 m).

11.9 CERTIFICATION

Survey results will be certified by a land surveyor or professional engineer registered in Tennessee and submitted to the CQA Consultant for review.

12.0 DOCUMENTATION

12.1 INTRODUCTION

An effective CQA/QC Plan depends largely on recognition of construction activities that should be monitored and also upon assigning responsibilities for the monitoring of each construction activity. This is most effectively accomplished by the documenting of quality assurance activities. The CQA Consultant shall document that quality assurance requirements have been addressed and satisfied.

The CQA Consultant shall provide the Construction Manager with signed descriptive remarks, data sheets, and logs to document that monitoring activities have been accomplished. The CQA Consultant shall also maintain at the job site a complete file of design drawings, design specifications, the CQA/QC Plan, checklists, test procedures, daily logs, and other pertinent documents.

Appendix C contains some example field forms. Additional forms may be necessary for documentation of a specific project. The CQA Consultant may use different forms, but the level of information shall be equal or greater than the forms presented in Appendix C. Additional geosynthetic and soil testing forms will be required to be prepared by the CQA Consultant.

12.2 DAILY RECORDKEEPING

Standard reporting procedures shall include preparation of a daily report which, at a minimum, shall consist of a daily summary report including memoranda of meetings and/or discussions with the Owner and/or site contractors, observation logs, and test data sheets. Other forms of daily record keeping being used, as needed, include construction problem and solution data sheets and photographic reporting data sheets. This information shall be regularly submitted to and reviewed by the Construction Manager.

12.2.1 Daily Summary Report

The CQA Consultant shall prepare a daily summary report which shall include the following information:

- An identifying sheet number for cross referencing and document control;
- Date, project name, location, and other identification;
- Data on weather conditions;
- Information on meetings held or discussions which took place:
  - Names of parties to discussion;
  - Relevant subject matter or issues;
  - Decisions reached; and

- Activities planned and their schedule.

- A reduced-scale site drawing showing proposed work areas and test locations;
- Descriptions and locations of ongoing construction;
- Descriptions and specific locations of areas, or units, of work being tested and/or observed and documented;
- Locations where tests and samples were taken or reference to specific observation logs and/or test data sheets where such information can be found;
- A summary of field/laboratory test results or reference to specific observation logs and/or test data sheets;
- Calibrations or recalibrations of test equipment and actions taken as a result of recalibration, or reference to specific observation logs and/or test data sheets;
- Off-site materials received, including quality verification documentation;
- Decisions made regarding acceptance of units of work, and/or corrective actions to be taken in instances of substandard quality; and
- The CQA Consultant's signature.

12.2.2 Observation Logs and Test Data Sheets

The CQA Consultant's monitoring staff shall record observations of construction and CQA-related activities on project-specific logs and data sheets. At a minimum, the logs and data sheets shall include the following information:

- An identifying sheet numbered for cross referencing and document control;
- Date, project name, location and other identification;
- Description or title of activity monitored;
- Location of activity and locations of samples collected;
- Locations of field tests performed and their results;
- Results of laboratory tests received;
- Results of monitoring activity in comparison to specifications; and
- The CQA Monitor's signature.

12.2.3 Construction Problem and Solution Report

Reports describing special construction situations, as required by the Owner, shall be prepared by the CQA Consultant and cross-referenced to specific observation logs and test data sheets.

These reports shall include the following information:

- An identifying sheet number for cross-referencing and document control;

- A detailed description of the situation or deficiency;
- The location and probable cause of the situation or deficiency;
- How and when the situation or deficiency was found or located;
- Documentation of the corrective action taken to address the situation or deficiency;
- Final results of responses;
- Measures taken to prevent a similar situation from occurring in the future; and
- The signature of the Lead CQA Monitor, EM or AEM, and the Construction Manager indicating concurrence.

The Construction Manager shall be made aware of significant recurring non-conformances with the design specifications. The Construction Manager shall then determine the cause of the non-conformance and recommend appropriate changes in procedures or specifications to the EM or AEM. These changes will be submitted to the Design Engineer for Approval. When this type of evaluation is made, the results shall be documented and revisions to procedures, design specifications, or permit specifications will be approved by the EM or AEM, Design Engineer, and if necessary, TDEC DSWM.

12.2.4 Photographic Reporting

Photographic reporting, where used, shall be cross-referenced with observation logs and test data sheets and/or construction problem and solution reports.

These photographs will serve as a pictorial record of work progress, problems, and mitigation activities. The basic file shall contain color prints; negatives shall be stored in chronological order. In lieu of photographic documentation, videotaping may be used to record work progress, problems, and mitigation activities.

12.2.5 Design and/or Specification Changes

Design and/or permit specifications changes may be required during construction. In such cases, the CQA Consultant shall notify the EM or AEM and Construction Manager. The EM or AEM shall seek the approval of TDEC DSWM prior to the implementation of substantive changes.

Design and/or permit specification changes shall be made only with the written agreement of the EM or AEM and the Design Engineer and shall take the form of an addendum to the specifications.

12.3 REPORTS

The CQA Consultant shall prepare periodic reports that summarize construction activities and the results of observations and tests. Progress reports shall be prepared at regular time intervals to document the status of the work. Certifications shall be prepared at the completion of major construction activities.

At the completion of the work, final documentation shall be prepared and shall include a professional engineer's seal (registered in Tennessee) and supporting field and laboratory test results.

12.3.1 Progress Reports

The CQA Consultant shall prepare a progress report at regular time intervals established at the Pre-Construction Meeting and submit it to the Construction Manager and EM or AEM. At a minimum, this report shall include the following information:

- A unique identifying sheet number for cross-referencing and document control;
- The date, project name, location, and other information;
- A summary of work activities performed during the reporting period;
- A summary of construction situations, deficiencies, and/or defects occurring during the reporting period;
- A summary of test results, failures, and retests; and
- The signature of the CQA Consultant's representative.

The Construction Manager shall distribute copies of the Progress Reports as decided at the Pre-Construction Meeting.

12.3.2 Certification of Major Construction Activities

The CQA Consultant shall prepare a certification for the following items:

- Structural Fill;
- Geologic Buffer Material;
- Barrier Soil Layer;
- Geosynthetic Liner;
- Protective Cover;
- Leachate Collection System;
- Leachate Management System;
- Erosion and Sedimentation Control Structures;
- Intermediate Cover Soil;
- Final Cover Geomembrane;
- Final Cover Drainage Layer;
- Final Cover Soil;

- Gas Monitoring System;
- Gas Extraction System; and
- Groundwater Monitoring System.

At the time of the Pre-Construction meeting, the landfill construction certification issue will be resolved as to either present certification documentation of each constructed landfill component separately or present the entire completed landfill construction documentation package at the end of construction to satisfy the permitting agency. The certification shall describe activities associated with the construction of the item including construction procedures, observations, and tests performed by CQA personnel. Each certification shall be signed and sealed by a professional engineer registered in Tennessee and submitted to the EM.

12.3.3 Certification Documentation

At the completion of the work, the CQA Consultant shall submit to the EM or AEM the signed Final Certification Documentation. At a minimum, the Final Report shall include:

- Summaries of construction activities;
- Tables demonstrating that the Manufacturer’s MARV values for each geosynthetic material meet or exceed the design requirements for the site;
- Observation logs and test data sheets including sample location drawings, supporting field test results, and laboratory test results;
- Construction problem and solution reports;
- Changes from design and material specifications;
- Record drawings; and
- Completed, signed, and sealed TDEC Certification Statement.

The record drawings shall include scaled drawings depicting the location of the construction and details pertaining to the extent of construction (e.g., depths, drawing dimensions, elevations, soil component thicknesses, etc.). Surveying and base maps required for development of the record drawings shall be prepared by a qualified land surveyor.

12.4 STORAGE OF RECORDS

Handwritten data sheet originals, especially those containing signatures, shall be stored by the CQA Consultant in a safe repository on-site. Other reports may be stored by standard methods which will allow for easy access.

APPENDIX A

CQA/QC PLAN TESTING SUMMARIES

TABLE A-1
LABORATORY TEST METHODS
FOR THE EVALUATION OF SOIL AND AGGREGATES

COMMON TEST NAME	PARAMETER DETERMINED	STANDARD
Grain Size Distribution and Hydrometer Analysis	Particle Size Distribution of Coarse- and Fine-Grained Soils. USDA Classification	ASTM D6913/D7928
Grain Size Distribution for Aggregates	Particle Size Distribution for Aggregates	ASTM C136
Atterberg Limits	Liquid and Plastic Limits, Plasticity Index	ASTM D4318
Standard Proctor	Moisture / Density Relationship, 5.5 lb. hammer and 12-inch drop	ASTM D698
Flexible Wall Permeability	Permeability of Undisturbed or Remolded Samples	ASTM D5084
Constant Head Permeability	Permeability of Aggregates	ASTM D2434
Carbonate Content	Carbonate Content of Aggregates	ASTM D3042[1]

(1) Testing shall be performed at a pH equal to 4.0. See additional requirements in Table A-3.

TABLE A-3
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
EXISTING GRADE & PREPARED EXCAVATION GRADE – GEOLOGIC BUFFER	Visual Inspection	As Required	NA	No Excessive Pumping or Rutting are evident from Proof Rolling (1) If rock pinnacle is present, identify lateral extent of rock, and isolate the pinnacle to sufficient depth (2 to 3 feet) by overexcavation, and backfill with soil.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$ cm/sec max. for fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	8-inch Max. Compacted, No Bridging
STRUCTURAL FILL (See Note 3)	Grain Size (ASTM D6913)	Borrow Areas or Stockpiles: One test per soil type	75 lbs.	100% ≤ 12 inch 80-100% ≤ 6 inch 50-100% ≤ 2- inch 20-100% ≤ No. 10 sieve 40-100%≤ No. 200 sieve
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement (2)	NA	12-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area/stockpile
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One per soil type	(taken from grain size sample)	None – This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One per construction event	(taken from Proctor samples)	$k \leq 1x10^{-6}$ cm/sec max. for structural fill placed within5 feet below the bottom of the barrier soil layer (i.e. geologic buffer).
	Field Density (ASTM D6938)	Placed: One test per acre per lift	NA	95% of MDD Min. and ± 4% of OMC as determined by the Standard Proctor test
	Lift Thickness Verification	Visual inspection of each Lift, During or Following Placement (2)	NA	12-inch Max. Uncompacted, No Bridging

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
BARRIER SOIL LINER	Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 24-inch thickness	50 lbs.	No protrusions > 3/4 inch on Surface 100% ≤ 1-1/2 inches 90-100% ≤ ¾-inch sieve 25-90 % ≤ No. 200 sieve 18-90% ≤ 0.002 mm PI ≥ 10
	Standard Proctor (ASTM D698)	Borrow Area or Stockpiles: One test per 5,000 cubic yards for each soil type	50 lbs.	None. This test is used to establish the Maximum Dry Density (MDD) and Optimum Moisture Content (OMC) for field testing.
	Flexible Wall Permeability (Remolded) (ASTM D5084)	Borrow Areas or Stockpiles: One test per 10,000 cubic yards for each soil type	(taken from Proctor samples)	k ≤ $1x10^{-7}$ cm/sec max. Used to establish moisture-density/permeability window.
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content as determined by remolded samples with permeabilities less than or equal to $1x10^{-7}$ cm/sec
	Flexible Wall Permeability (Undisturbed) (ASTM D5084)	Placed: One Shelby tube per lift per 3 acres	Shelby Tube	k ≤ $1x10^{-7}$ cm/sec max.
	In-Place Moisture Confirmation	Visual inspection of each lift, during or following placement	N/A	Visually confirm that moisture of recompacted soil liner is uniform and that test location is representative of area to be covered by test. (Utilize Field Form for Documentation of Visual Inspection)
	Lift Thickness Verification	Placed: 4 per acre per lift	NA	Individual lifts ≤ 8 inches compacted thickness Completed barrier soil layer 24 inches min. (surveyed)

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
ANCHOR TRENCH BACKFILL	Grain Size	Placed: Visual during or following placement of each lift	NA	Utilize Barrier Soil Liner material or similar fine-grained material
	Field Density (ASTM D6938)	Placed: One test per 200-lf per lift, starting with second lift of backfill	N/A	Equal to or greater than 90% of the MDD and ±4% the OMC
	Lift Thickness Verification	Placed: Visual, as required	NA	18-inch compacted, maximum

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM PASSIVE LFG VENTING SYSTEM (AGGREGATE)	Grain Size Distribution (ASTM C136)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs.	Washed AASHTO No. 57 100% ≤1½-inch sieve 95-100% ≤1-inch sieve 25-60% ≤½-inch sieve 0-10% ≤ No 4 sieve 0-5% ≤ No 8 sieve 0-5% ≤ No 200 sieve (In-Place) 0-2% ≤ No. 200 sieve (Stockpile) Washed AASHTO No. 3 100% ≤ 2½-inch sieve 90-100% ≤ 2-inch sieve 35-70% ≤ 1-½-inch sieve 0-15% ≤ 1-inch sieve 0-5% ≤ ½-inch sieve
	Constant Head Permeability (ASTM D2434)	Stockpile: One per 20,000 tons, Minimum one test per source	(taken from grain size sample)	1×10^{-2} cm/sec Minimum
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.
	Carbonate Content (ASTM D3042) (Test solution pH equal to 4.0) [5]	Stockpile: One per 10,000 tons, Minimum one test per source	(taken from grain size sample)	12% Max., by weight

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
PROTECTIVE COVER/LEACHATE COLLECTION SYSTEM (SOIL)	Grain Size Distribution (ASTM D6913/D7928)	Stockpile: One per 10,000 tons, Minimum one test per source Placed: One per acre	75 lbs.	100% ≤1-1/2-inch sieve 75-100% ≤3/4- inch sieve 55-90% ≤1/2-inch sieve 35-90% ≤ No 4 sieve 35-80% ≤ No 8 sieve 0-70% ≤ No 200 sieve (In-Place)
	Thickness	Placed: One per acre	NA	Survey or field test pits of placed material, 12-inches Min.
SUMP AGGREGATE	Grain Size (ASTM C136)	Stockpile: One per source	100 lbs.	Washed AASHTO No. 3 100% ≤ 2½-inch sieve 90-100% ≤ 2-inch sieve 35-70% ≤ 1-½-inch sieve 0-15% ≤ 1-inch sieve 0-5% ≤ ½-inch sieve
	Carbonate Content (ASTM D3042) (Test solution pH to be equal to 4.0.) [5]	Stockpile: One per source	(taken from grain size sample)	12% Max., by weight

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
INTERMEDIATE COVER AND COMPACTED SOIL COVER	Composition/Performance	Placed: Intermediate Cover - Visual Observation by Landfill Personnel	N/A	Intermediate Cover shall be: (1) Prevent odors, blowing litter and other nuisances. (2) Cover solid waste after it is placed without change in its properties and without regard to weather. (3) Allow loaded vehicles to maneuver over it after placement. (4) Capable of controlling flies and other vectors. (5) Control infiltration of precipitation and erosion & sedimentation.
		Place: Compacted Soil Cover – Observation and Testing by CQA Consultant	N/A	Compacted Soil Cover shall: (1) Provide uniform support for the overlying FML. (2) Be firm and non-yielding. (3) Not have rocks, debris, or protrusions greater than 3/4 inch size on the top surface.
	Compacted Soil Cover – Surface Preparation	Placed: Visual Inspection Following Placement, prior to installation of final cover geosynthetics, rework/restore as necessary	N/A	Upper surface shall be smooth and not contain deleterious materials. See CQA/QC Plan Text Section 4.7.2.2.
	Compacted Soil Grain Size (ASTM D6913/D7928) and Atterberg Limits (ASTM D4318)	Borrow Areas or Stockpiles: One test per 5,000 cubic yards for each soil type Placed Fill: One test per acre per completed 12-inch thickness	50 lbs.	No protrusions > 3/4 inch on Surface 100% $\leq$ 1-1/2 inches 90-100% $\leq$ ¾-inch sieve 25-90 % $\leq$ No. 200 sieve 18-90% $\leq$ 0.002 mm PI $\geq$ 10
	Field Density (ASTM D6938)	Placed: Four tests per acre per 6-inch lift.	N/A	95% of the MDD Min. and moisture content within 0 to 4% of Optimum per ASTM D698
	Lift Depth Check	Placed: Test pit as needed during placement, 1 per acre for Intermediate Cover and 1 per 10,000 square feet for Compacted Soil Cover prior to FML deployment.	NA	Soil or Soil-like: the layer shall be 12-inch thick for both intermediate cover and 8 compacted soil cover.

TABLE A-3 - Continued
TEST SUMMARY FOR SOIL AND AGGREGATE COMPONENTS

ITEM	TEST	FREQUENCY	SAMPLE SIZE	ACCEPTANCE CRITERIA
FINAL COVER SOIL	Grain Size (ASTM D6913/D7928) and USDA Classification	Borrow Area or Stockpile: One test on a composite sample per soil type Placed: One Test per acre	25 lbs.	6-inch Max., 40% Min. Passing No. 10 sieve
	Fertilizer and Lime Requirements	NA	NA	Testing and acceptance per Project Technical Specifications
	Material Classification (Max Particle Size)	Visual inspection of each Lift, During or Following Placement	NA	3-inch Max., Visual inspection of each finished lift, confirm consistency with borrow area
	Thickness	Placed: One test per acre	NA	2-feet Min. (test pits or survey following installation of final cover soil)

(1) If firm strata cannot be established utilizing excavation and replacement of suspect soils, a layer of geotextile overlain by structural fill, or other prudent repair activities may be utilized.
(2) In addition to the inspection of completed structural fill lifts, the CQA Technician shall monitor placement of structural fill to confirm construction materials and practices.
(3) Santek/Republic shall use a modified structural fill material on the approximate interior half of the perimeter berms. More specifically, for portions of the perimeter berm which require fill to meet design grades, the interior slope of the perimeter berm shall be constructed using a modified structural fill material. The modified structural fill material shall be capable of providing a hydraulic conductivity of 1×10^{-5} cm/s or less. Modified structural fill material shall consist of soils with Unified Soils Classification System (USCS) soil designations of CH, GC, CL, or SC. The top size of the material shall be 6 inches. Santek/Republic shall perform sampling and laboratory testing for a proposed modified structural fill material source one time per construction event to demonstrate it is capable of achieving the parameters identified here. Also, with the exception of the parameters identified here, all other structural fill test, frequency, sample size, and acceptance criteria apply to the modified structural fill material.
(4) Testing of the compacted soil cover soil should occur as close as practical to the day the FML installation is planned. All degraded areas as described in Section 4.7.2.2 will be restored prior to FML deployment.
(5) Leachate pH testing to be completed by an independent certified laboratory selected by the CQA Consultant. Information about the material supplier and quarry location will be provided. Written test results signed by the CQA Consultant shall be provided to the Owner prior to purchasing the material. It is the Operator's responsibility to manage and adhere to this process.

REVISED PERMIT DRAWINGS

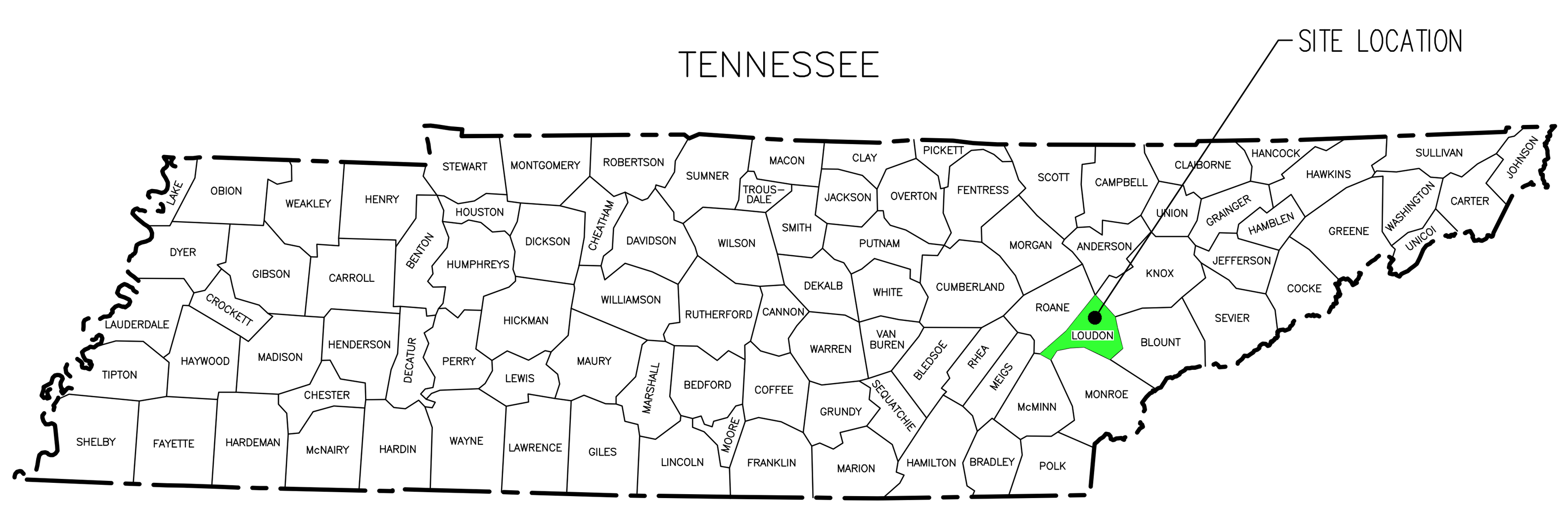
MATLOCK BEND LANDFILL
LOUDON COUNTY, TENNESSEE

PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
PERMIT NO. SNL #530000203

SEPTEMBER 2023
REVISED AUGUST 2024
REVISED APRIL 2025

PREPARED FOR:

REPUBLIC SERVICES



VICINITY MAP
NOT TO SCALE

Civil & Environmental Consultants, Inc.
117 Seaboard Ln; Suite E-100
Franklin, Tennessee 37067
(615) 333-7797 (800) 763-2326

SHEET LIST TABLE		
DRAWING NUMBER	SHEET TITLE	REV. NUMBER
P-000	COVER SHEET	3
P-100	OVERALL EXISTING SITE CONDITIONS	3
P-101	PHASE 1 EXPANSION EXISTING CONDITIONS	2
P-200	PROPOSED FILL PROGRESSION	3
P-201	TOP OF PROTECTIVE COVER GRADING PLAN	3
P-202	LEACHATE MANAGEMENT PLAN	3
P-204	PHASING DRAWING - MODULES 1 AND 2 DEVELOPMENT	2
P-205	PHASING DRAWINGS - MODS 1 AND 2 INTERIM GRADING AND CA-1 FINAL	2
P-206	PHASING DRAWINGS - MOD 3 DEVELOPMENT F	2
P-207	PHASING DRAWINGS - MOD 3 FILLING AND CLOSURE AREA CA-2	2
P-208	PHASING DRAWINGS - CLOSURE AREA CA-3	2
P-209	PHASING DRAWINGS - CLOSURE AREA CA-4	2
P-210	PHASING DRAWINGS - CLOSURE AREA CA-5	3
P-215	TOP OF INTERMEDIATE GRADES	3
P-220	FINAL GRADING PLAN	3
P-230	STORMWATER MANAGEMENT PLAN	3
P-231	SEDIMENT BASIN 2 PLAN AND DETAILS	
P-232	SEDIMENT BASIN 3 PLAN AND DETAILS	
P-233	SEDIMENT BASIN 4 PLAN AND DETAILS	3
P-234	SEDIMENT BASIN DETAILS	
P-235	SEDIMENT BASIN DETAILS AND STORMWATER MANAGEMENT TABLE	
P-250	LANDFILL GAS VENTING PLAN	3
P-301	CROSS-SECTION A-A'	2
P-302	CROSS-SECTION B-B'	2
P-303	CROSS-SECTION C-C'	2
P-600	LINER SYSTEM DETAIL (SHEET 1 OF 3)	2
P-601	LINER SYSTEM DETAIL (SHEET 2 OF 3)	2
P-602	LINER SYSTEM DETAIL (SHEET 3 OF 3)	
P-610	LEACHATE MANAGEMENT DETAILS (SHEET 1 OF 5)	2
P-611	LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)	
P-612	LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)	2
P-613	LEACHATE MANAGEMENT DETAILS (SHEET 4 OF 5)	
P-614	LEACHATE MANAGEMENT DETAILS (SHEET 5 OF 5)	2
P-615	PIPE PENETRATION DETAILS (SHEET 1 OF 4)	2
P-616	PIPE PENETRATION DETAILS (SHEET 2 OF 4)	2
P-617	PIPE PENETRATION DETAILS (SHEET 3 OF 4)	2
P-618	PIPE PENETRATION DETAILS (SHEET 4 OF 4)	3
P-620	FINAL COVER DETAILS (SHEET 1 OF 1)	3
P-630	LANDFILL GAS AND GROUNDWATER MONITORING DETAILS (SHEET 1 OF 1)	
P-640	EROSION AND SEDIMENT CONTROL DETAILS (SHEET 1 OF 1)	
P-650	STORMWATER MANAGEMENT DETAILS (SHEET 1 OF 1)	2
P-651	MISCELLANEOUS DETAILS (SHEET 1 OF 1)	2

NOTE:
ALL DRAWINGS IN THIS SET ARE PERMIT-LEVEL AND ARE NOT FOR CONSTRUCTION

BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025
*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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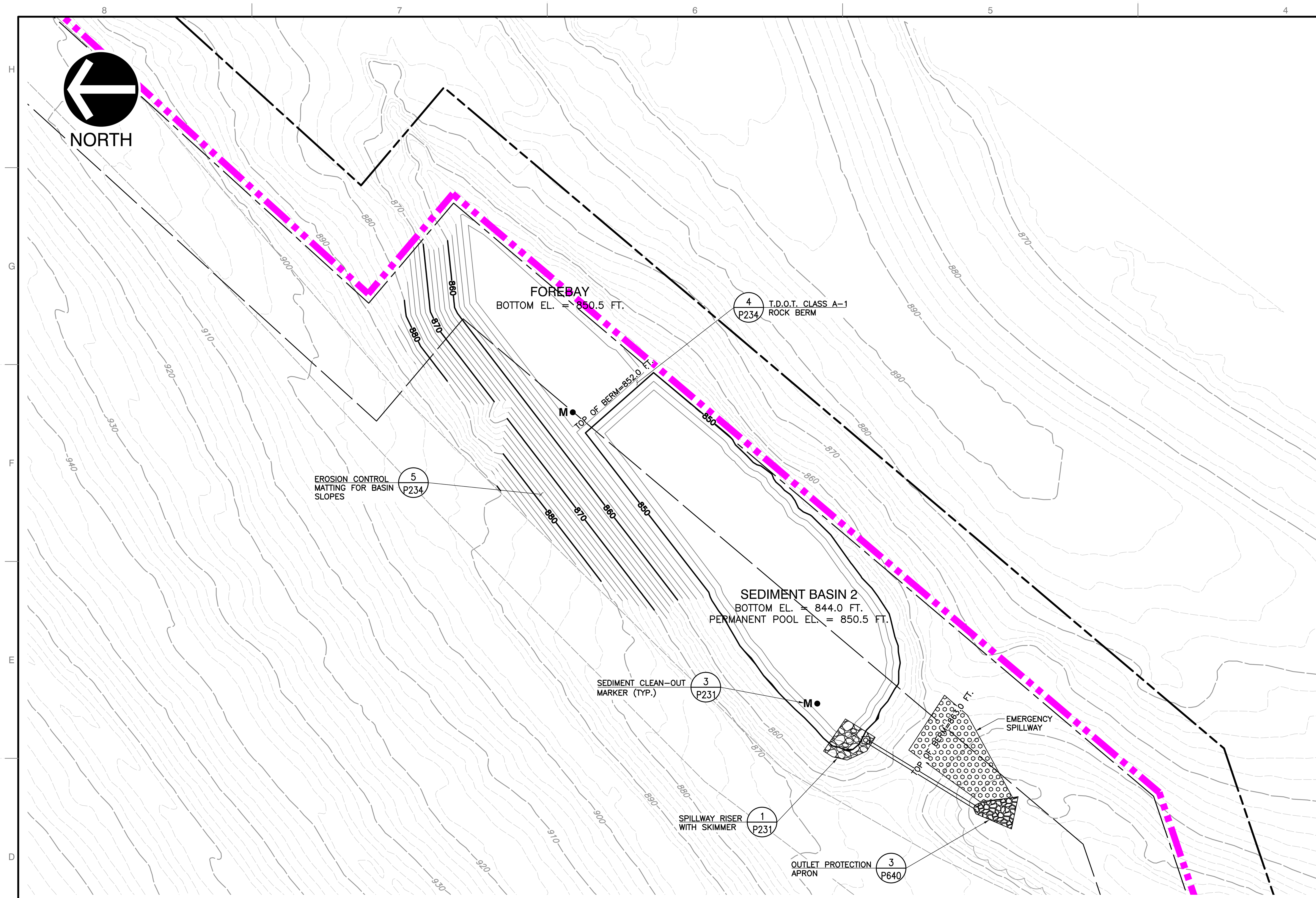
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

COVER SHEET

DATE: APRIL 2025
DWG SCALE: AS SHOWN
PROJECT NO: 317-474
DRAWN BY: BPR
CHECKED BY: TDM
APPROVED BY: EDC*

DRAWING NO.: P-000



PLAN VIEW - SEDIMENT BASIN 2

SCALE: 1"=40'

STAGE STORAGE TABLE

Elevation	Surface area (sf)
844	11313
845	12118
846	13219
847	14356
848	15528
849	16735
850	21699
851	23608
852	25667
853	27764
854	30454
855	32019
856	33640
857	35261
858	36929
859	38530
860	40156
861	42192
862	44096
863	46021

Existing Peak Outflows

25-YR	12.15
100-YR	66.35

Proposed Peak Inflows

Event	Flow (cfs)
5-YR	72.28
25-YR	119.30
100-YR	162.59

Proposed Peak Outflows (Req. skimmer only)

Event	Flow (cfs)
25-YR	36.52
100-YR	53.80

Proposed Peak Outflows (All Skimmers)

Event	Flow (cfs)
25-YR	35.24
100-YR	53.28

Proposed Peak Outflows (Worst Case)

Event	Flow (cfs)
25-YR	21.99
100-YR	51.19

BASIN SUMMARY TABLE

BASIN DESIGN DETAILS

Total Watershed Area for Proposed Basin		50.448	acres
Number of SubWatersheds		20	
TDEC EPSC Handbook Required Volume for Wet Storage (67 cy/acre drainage area)		3,380	cy
Actual Wet Storage Volume		3,693	cy
TDEC EPSC Handbook Required Volume for Dry Storage (67 cy/acre drainage area)		3,380	cy
Actual Dry Storage Volume from Top of Rock Pad for Skimmer to Top of Riser		9,501	cy
Required Minimum Surface Area (0.01 x 5-Year 24-Hour Peak Inflow)		0.72	acres
Actual Basin Surface Area at Top of Riser		0.86	acres
Approximate Length:Width Ratio		3:1	
Required Forebay Storage (Minimum of 25% of Required Dry Storage Volume)		2375	cy
Actual Forebay Volume		2,377	cy
Forebay Spillway Elevation		852.00	ft
Maximum Water Storage Volume for Basin from Bottom to Top Crest of Dam		12.22	ac-ft
Maximum Height of Dam from Top of Dam to Downstream Toe		13	ft
Does Basin Fall Under TN Safe Dams Regulation?		No	
Principal Spillway Riser Type and Diameter		48" CMP	
Barrel Type and Diameter		36" CMP	
Barrel Slope and Length		80 ft. at 4.37%	
Base Elevation of Riser (Top Elevation of Riser Concrete Base)		850.50	ft
Elevation of Top of Riser Pipe		858.80	ft
Number of Skimmers Required		1	
Size of Each Skimmer	Marlee	6.5	in. or equal
Maximum Discharge Rate of Skimmer		1.17	cfs
Length of Skimmer Arm		12.0	ft
Inter-Storm Event Drain Rate for Basin for 25 yr/24 hr event		2.90	days
*Allowable Basin Maximum Flux Rate for 5 Micron Capture (90% reduction of Fine Silt to Course Clay)		1.3E-04	cfs/ft^2
Actual Basin Maximum Flux rate		7.5E-05	cfs/ft^2
Peak Elevation in Basin During 25/yr Storm		859.70	ft
Combined Peak Discharge for Riser and Skimmer System During 25 yr/24-hr Storm		36.00	cfs
Barrel Peak Velocity During 25/yr/24-hr Storm		3.18	fps
Required Erosion Protection at Barrel Outlet Based on Peak Shear and Velocity		TDOT Class A1 Stone (D_{50} = 9 inches)	
Peak Elevation in Basin During 100/yr Storm		859.98	ft
Type of Emergency Spillway Weir		Broadcrested / V-Shaped Opening	
Emergency Spillway Crest Elevation		861.14	ft
Emergency Spillway Crest Width		0	ft
Barrel Peak Velocity During 100/yr/24-hr Storm		3.59	fps
Required Erosion Protection at Barrel Outlet Based on Peak Shear and Velocity		TDOT Class A1 Stone (D_{50} = 9 inches)	
Peak Elev. for 100/yr Storm with W.S.E starting at Em. Spillway Crest and Riser/Skimmers Plugged		861.41	ft
Peak Flow through Spillway (Plugged Scenario)		51.19	cfs
Peak Velocity through Weir Section (Plugged Scenario)		1.63	fps
Maximum Shear Within Weir Section (Plugged Scenario)		0.79	psf
Required Erosion Protection at for Weir Section Based on Peak Shear and Velocity (Plugged Scenario)		Flexamat (NAG C350, or equiv.may be substiuted within weir)	
Peak Velocity through Down-Chute of Spillway (Plugged Scenario)		12.79	fps
Maximum Shear on the Down-Chute Section (Plugged Scenario)		17.09	psf
Required Erosion Protection for Down-Chute Based on Peak Shear and Velocity (Plugged Scenario)		Flexamat	

LEGEND

- EXISTING CONTOUR (10' INTERVAL)
- EXISTING CONTOUR (2' INTERVAL)
- PROPOSED CONTOUR (10' INTERVAL)
- PROPOSED CONTOUR (2' INTERVAL)
- FLEXAMAT
- RIP-RAP (T.D.O.T. CLASS A-1 (D_{50} = 9 INCHES) @ 1.5 ft. DEEP WITH $8oz/yd^2$ NON-WOVEN NEEDLE-PUNCHED GEOTEXTILE UNDERLAY)
- RIP-RAP (T.D.O.T. CLASS B (D_{50} = 15 INCHES) @ 1.5 ft. DEEP WITH $8oz/yd^2$ NON-WOVEN NEEDLE-PUNCHED GEOTEXTILE UNDERLAY)
- NAG C350 TURF REINFORCEMENT MAT (OR EQUAL) 6 P234 8 P234
- M● SEDIMENT CLEAN-OUT MARKER 3 P231
- T▫ 1.25 lb/ft., 60-INCH LENGTH METAL T-POST WITH ANCHOR PLATE WITH MIN. 14 sq. INCHES.
- POLYESTER ROPE FOR SKIMMER STABILITY

OPERATIONS NOTE:

1. AN INSPECTION OF THE PRINCIPAL SPILLWAYS AND SKIMMERS MUST BE PERFORMED PRIOR TO ANY FORECASTED STORM EVENTS TO ENSURE THERE ARE NO OBSTRUCTIONS. THE INSPECTION SHOULD ALSO INCLUDE VISUAL CONFIRMATION THAT THE WATER LEVEL INSIDE THE BASIN IS AT THE SAME ELEVATION AS THE INVERT OF THE PVC ARM OF THE SKIMMER ASSEMBLIES AT THE INTERSECTION WITH THE RISER (I.E., THE SKIMMER IS RESTING ON TOP OF THE GRAVEL BASE).

GENERAL NOTES

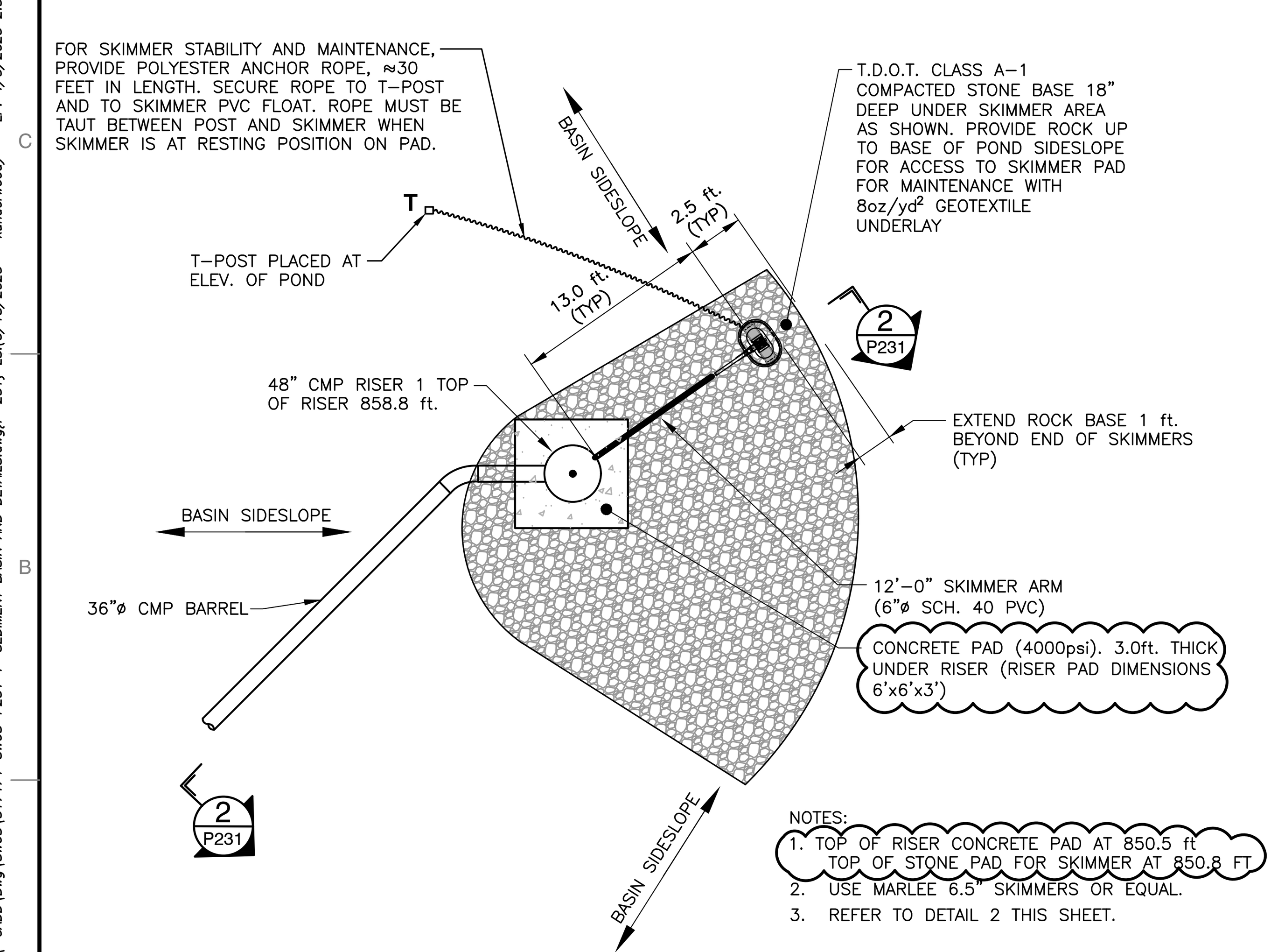
1. THE DESIGN OF THIS BASIN IS INTENDED TO MEET THE REQUIREMENTS FOR BASINS IN THE TENNESSEE DIVISION OF SOLID WASTE MANAGEMENT REGULATIONS, RULE 0400-11-01-04(2)(i).
2. SEED, FERTILIZE AND COVER WITH EROSION-CONTROL MATTING ON THE INTERIOR AND EXTERIOR SIDE SLOPE SURFACE AREA OF PROPOSED BASIN.
3. PROVIDE ANTI-VORTEX PLATE AND TRASH RACKS ON THE RISER ASSEMBLY.
4. PROVIDE ONE 6.5 INCH MARLEE SKIMMERS FOR RISERS.
5. PROVIDE OUTLET PROTECTION (HARD ARMORING) BELOW BARREL OUTLETS.
6. CLEAN-OUT ELEVATION IN BASIN IS TO BE ESTABLISHED AT 847.0 FT. WITHIN BASIN AND 851.0 FT. IN FOREBAY.
7. CLEAR PROPOSED POND LOCATION OF ALL TOPSOIL, VEGETATION INCLUDING TREES AND STUMPS. FILL ALL STUMP HOLES AND CREVICES WITH LOW-PERMEABILITY SOILS.
8. SCARIFY POND BASE SOILS TO A DEPTH OF 8-10 INCHES WITH A DISK, ROTO-TILLER OR OTHER SIMILAR EQUIPMENT. REMOVE ALL ROCKS AND TREE ROOTS.
9. COMPACT THE SOIL SUB-GRADE MAKING 4-6 PASSES WITH A SHEEPSFOOT ROLLER OVER THE SCARIFIED LAYER, ADDING MOISTURE AS NEEDED TO MAXIMIZE COMPACTION.

REFERENCES:

1. AERIAL TOPOGRAPHY PROVIDED BY OPERATOR, BY FIRMATEK, DATED DECEMBER 15, 2022.
2. PROPERTY LINE, ADJACENT PROPERTY LINES, MONITORING WELLS, AND BUFFER ZONES FROM SOUTHERN RESOURCES MAPPING CORPORATION PLAN, DATED FEBRUARY 2016.

PRINCIPAL SPILLWAY TABLE

PIPE	RISER DIA. (in)	BARREL DIA. (in)	BARREL LENGTH (ft)	BARREL SLOPE (%)	BARREL OUTLET I.E. (ft)	TOP OF RISER (ft)	BARREL INLET (ft)
CMP	48	36	80	4.37	847	858.8	850.5



1 SPILLWAY RISER WITH SKIMMER DETAIL

NOT TO SCALE

DETAIL 2 NOTES:

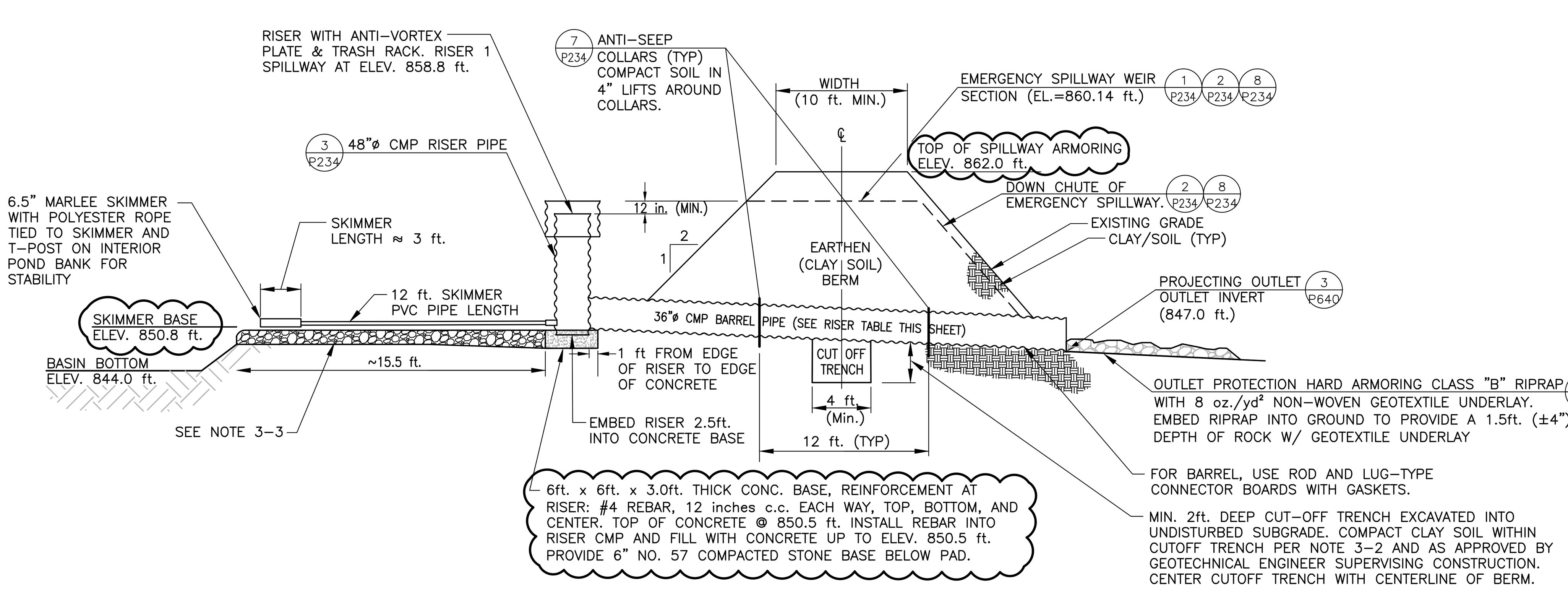
3-1. PROVIDE PERMANENT STAKE OR POST MONUMENT IN WET POOL AREA THAT SHALL BE MARKED AT THE CLEAN-OUT ELEVATION. POND SHALL BE CLEANED AS DEEMED NECESSARY BY ON-SITE INSPECTIONS.

3-2. BERM SOIL MATERIAL SHALL BE PLACED UNDER THE SUPERVISION OF A TN REGISTERED PROFESSIONAL GEOTECHNICAL ENGINEER. MINIMUM REQUIREMENTS FOR PLACEMENT OF SOIL FOR BERM CONSTRUCTION IS TO REMOVE ALL ORGANICS (TOP SOIL), VEGETATION, TREES, STUMPS, ETC. AND SCARIFY SURFACE 8-10 INCHES. PLACE BERM SOIL IN 8" LOOSE LIFTS, COMPACTED TO 95% STANDARD PROCTOR DENSITY, ± 3% OF OPTIMUM. SOIL USED FOR BERM CONSTRUCTION SHALL BE CLASSIFIED AS CLAY SOILS AND APPROVED BY THE GEOTECHNICAL ENGINEER SUPERVISING CONSTRUCTION.

3-3. USE T.D.O.T. CLASS A-1 STONE (COMPACTED) FOR SKIMMER PAD BEDDING WITH $8oz/yd^2$ GEOTEXTILE UNDERLAY. (18" THICK).

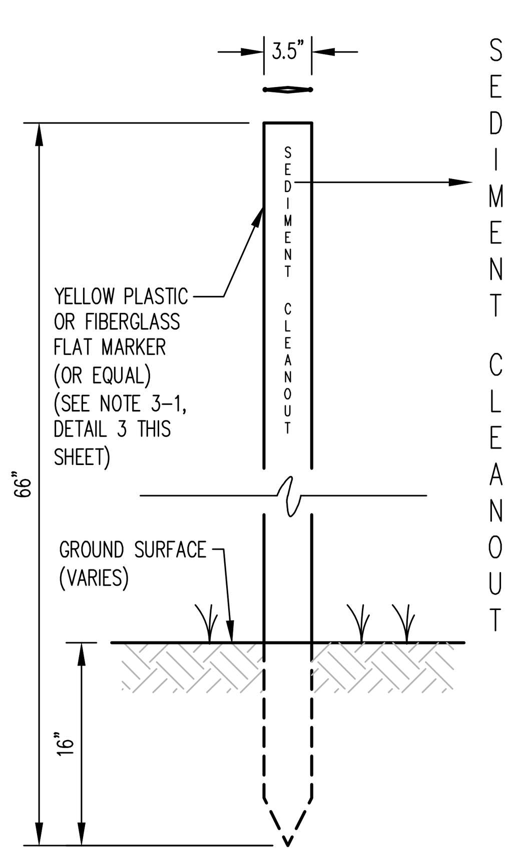
3-4. BOTH RISER AND BARREL OF PRINCIPAL SPILLWAY SHALL BE POLYMER-COATED CORRUGATED METAL PIPE.

3-5. SEED, FERTILIZE AND MULCH BERM TOP AND SIDE SLOPES TO PROMOTE VEGETATIVE STABILIZATION. COVER SIDE SLOPES WITH NORTH AMERICAN GREEN (NAG) OR EQUAL MATTING.



2 CROSS-SECTION: SPILLWAY RISER WITH SKIMMER

NOT TO SCALE



3 SEDIMENT CLEAN-OUT MARKER

NOT TO SCALE

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

SEDIMENT BASIN 2 PLAN AND DETAILS

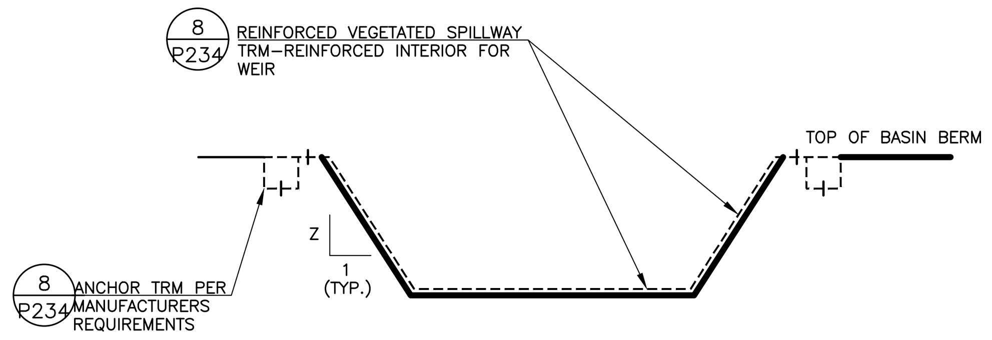
DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

JORDAN MICHAEL YACHNYAK
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130044
STATE OF TENNESSEE
4/4/2025

DRAWING NO.:
P-231

*HAND SIGNATURE ON FILE

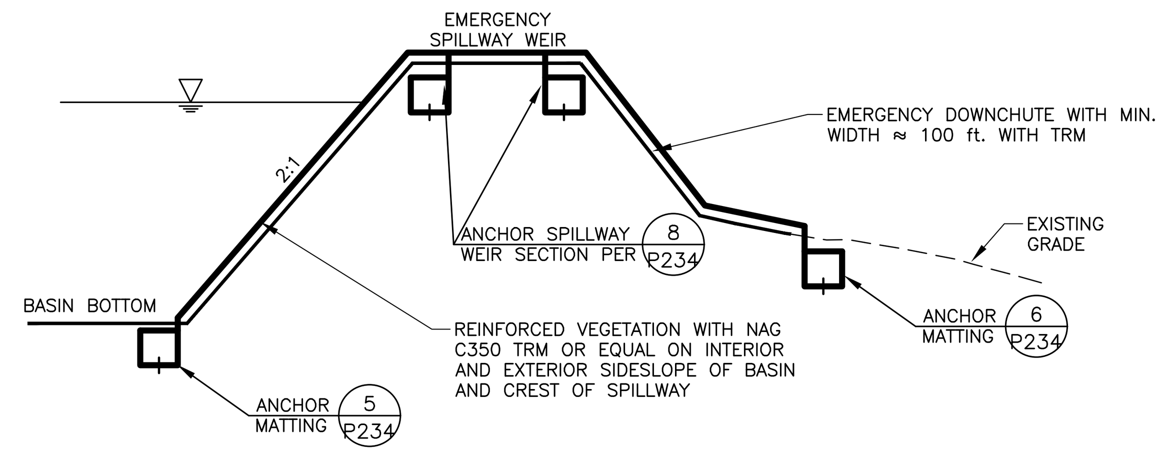
P:\310-000\317-474\-CADD\Dwg\SWOR\317474-SWOR-P231-P-SEDIMENT BASIN AND DETAILS.dwg{P-231} LS:3/18/2025 - lsundermann) - LP: 4/3/2025 2:54 PM



Emergency Spillway Weir				
Basin	Elevation (FT)	Bottom Width (FT)	Depth (FT)	Z
Sediment Basin 2	861.14	0	1.86	9.6
Sediment Basin 3	872	65	1.86	3
Sediment Basin 4	909	19.3	1.86	3

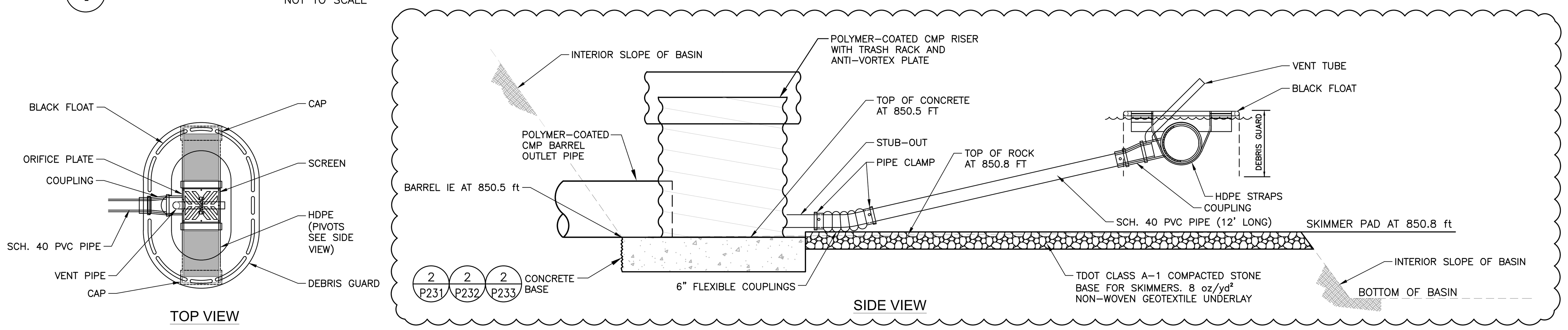
1 EMERGENCY SPILLWAY WEIR SECTION (TYP.)

NOT TO SCALE



2 EMERGENCY DOWNCHUTE SECTION (TYP.)

NOT TO SCALE



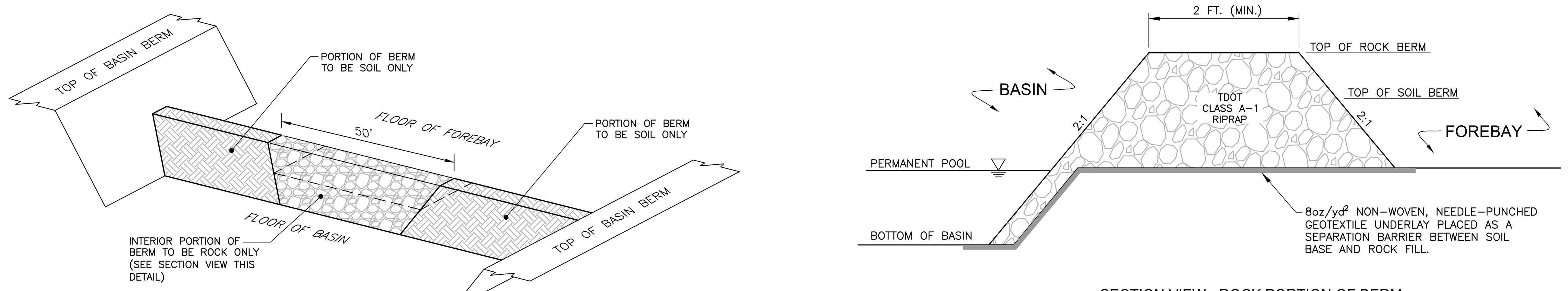
SKIMMER NOTES:

1. SCH. 40 PIPE SHOULD BE 1.4 TIMES THE HEIGHT OF OUTLET STRUCTURE (MIN. 8').
2. SEE SHEETS P–231–233 FOR SKIMMER SIZES.
3. CONTRACTOR PROVIDES SCH. 40 PVC PIPE. ALL OTHER SKIMMER MATERIALS AND PARTS PROVIDED BY VENDOR.
4. WEIGHT PROVIDED BY 40 LBS. OF STONE BALLAST ON EACH SIDE OF SCREEN/ORIFICE. TOTAL OF 80 LBS.

Marlee Float Skimmers				
Basin	Number of Skimmers	Bottom of Basin (FT)	Skimmer Pad Elevation (FT)	Skimmer Size (IN)
Sediment Basin 2	1	844.0	850.8	6.5
Sediment Basin 3	2	861.0	865.0	4.5
Sediment Basin 4	2	900.0	903.0	4.0

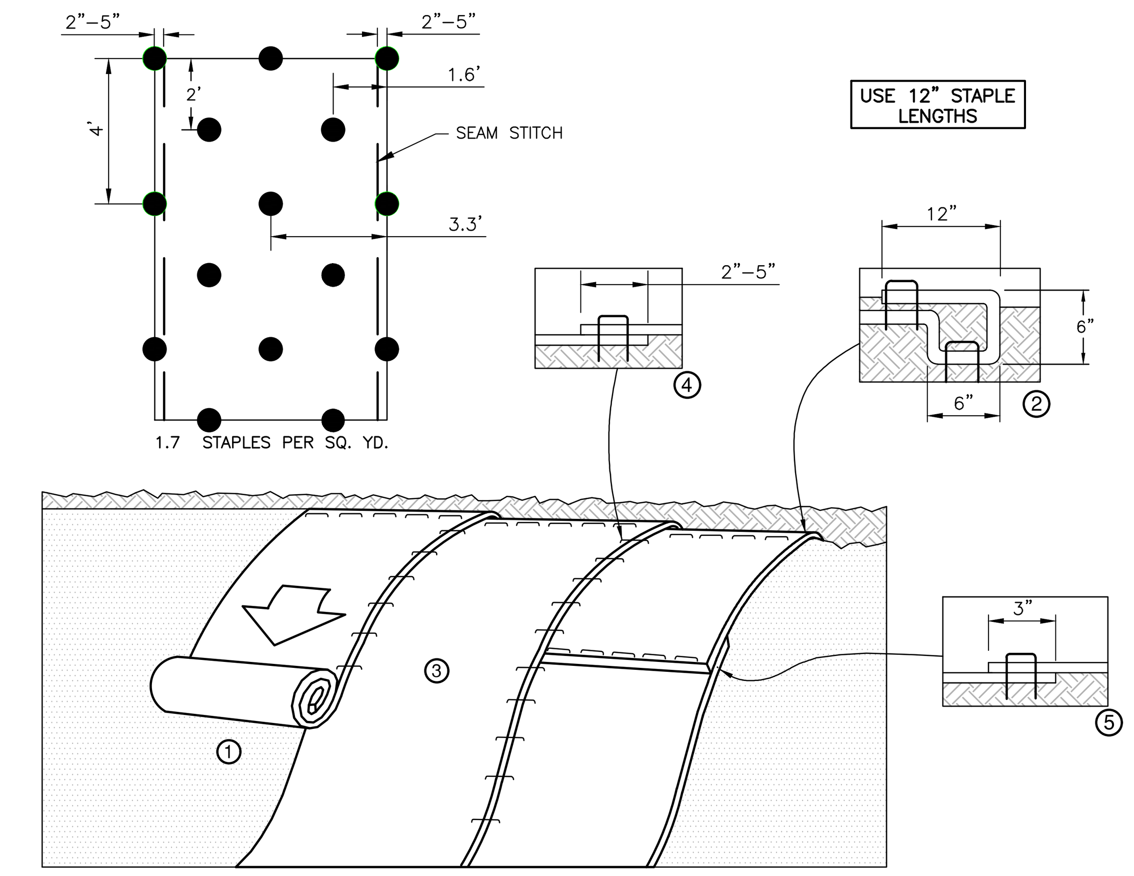
3 MARLEE SKIMMER® DISCHARGE SYSTEM WITH OUTLET STRUCTURE (TYP.)

NOT TO SCALE



4 T.D.O.T. CLASS A-1 ROCK BERM

NOT TO SCALE

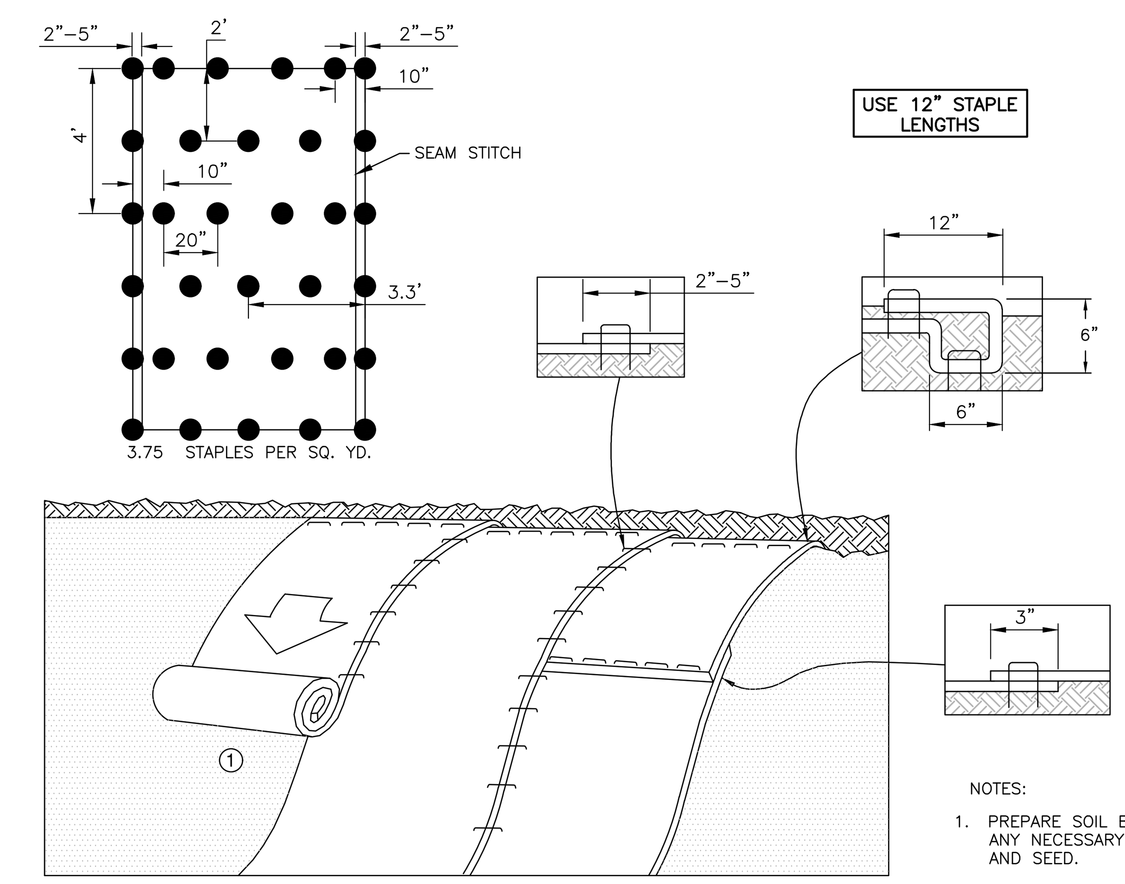


NOTES:

1. PREPARE SOIL BEFORE INSTALLING RECPs, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL EROSION CONTROL MATTING PER MANUFACTURER RECOMMENDATIONS.

5 EROSION CONTROL MATTING FOR BASIN SLOPES (TYP.)

NOT TO SCALE

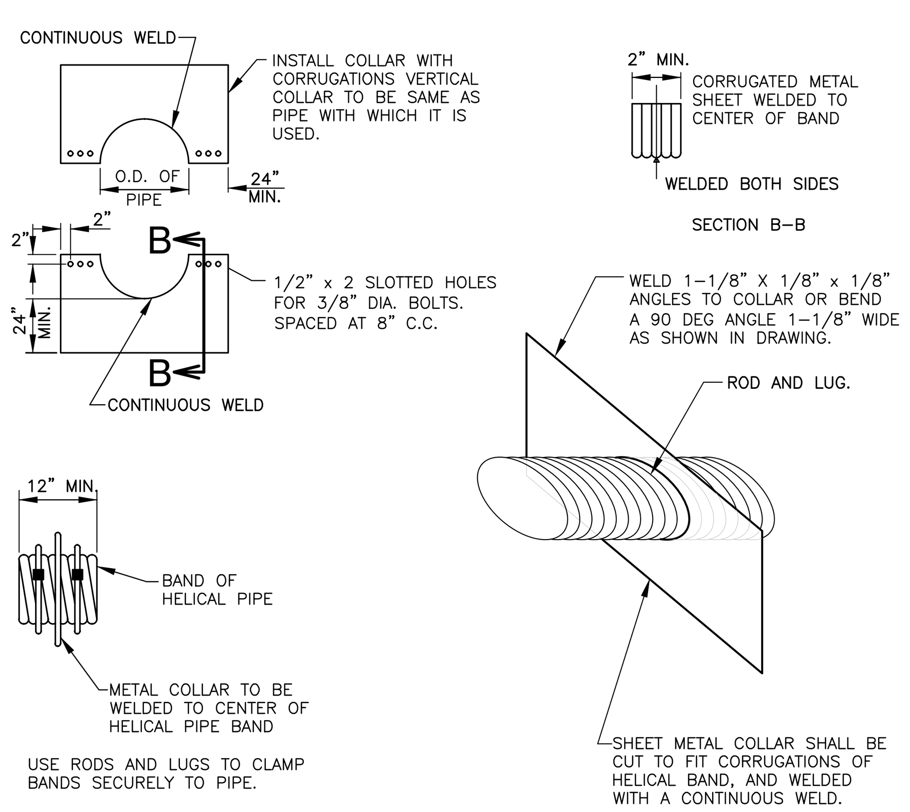


NOTES:

1. PREPARE SOIL BEFORE INSTALLING TRM, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL TURF REINFORCEMENT MATTING PER MANUFACTURER RECOMMENDATIONS.

6 TURF-REINFORCEMENT FOR BASIN SLOPES (TYP.)

NOT TO SCALE



NOTES FOR COLLARS:

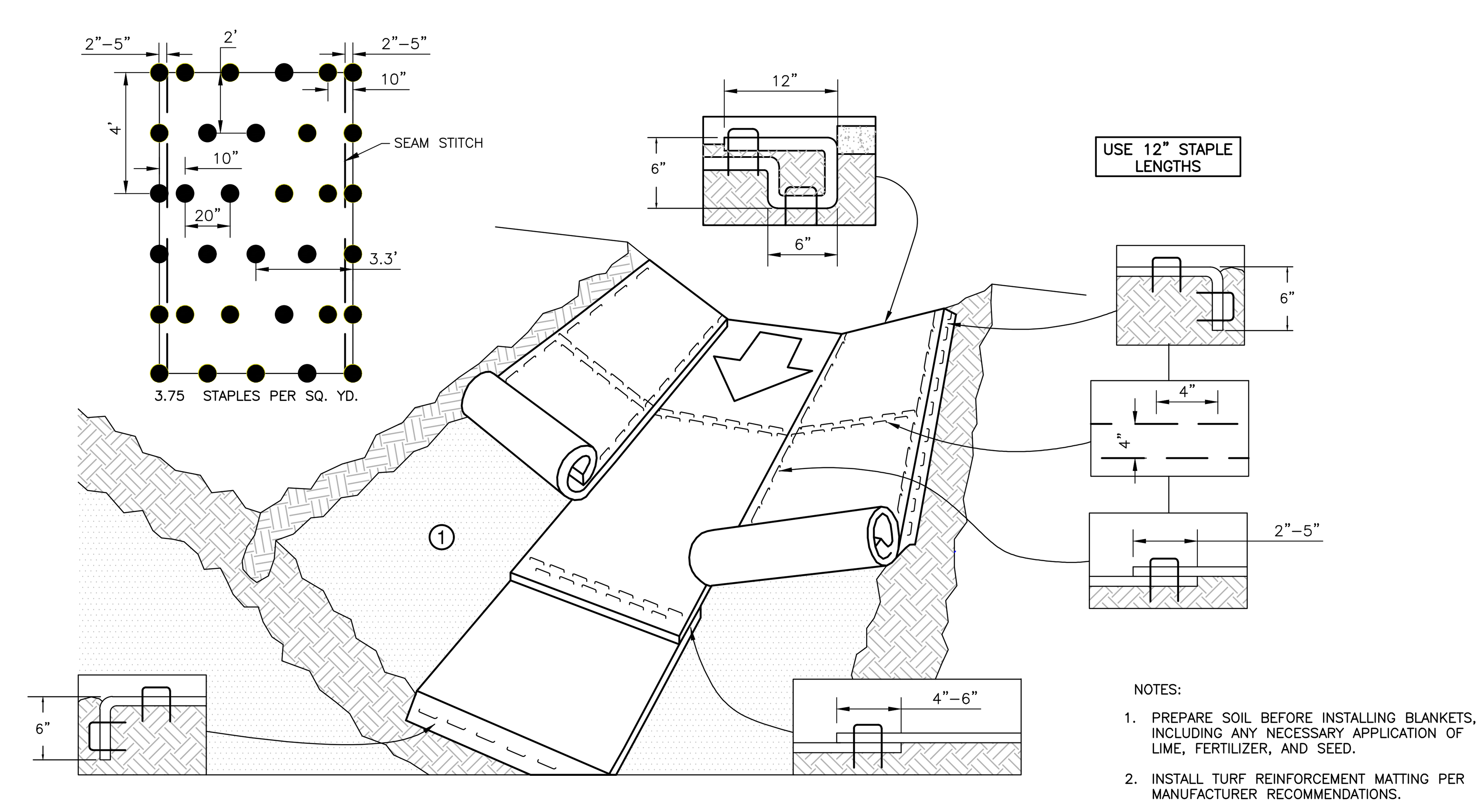
1. UNASSEMBLED COLLARS SHALL BE MARKED BY PAINTING OR TAGGING TO IDENTIFY MATCHING PAIRS
2. THE LAP BETWEEN THE HALF SECTIONS AND BETWEEN THE PIPE AND CONNECTING BAND ASPHALT MASTIC AT INSTALLATION.
3. EACH COLLAR SHALL BE FURNISHED WITH TWO 1/2" DIAMETER RODS WITH STANDARD TANK LUGS FOR CONNECTING COLLARS TO PIPE.

NOTE:
FOR BANDS AND COLLARS: MODIFICATIONS OF THE DETAILS SHOWN MAY BE USED PROVIDING EQUAL WATERTIGHTNESS IS MAINTAINED AND DETAILED DRAWINGS ARE SUBMITTED AND APPROVED BY THE ENGINEER PRIOR TO DELIVERY.

NOTE:
COLLARS SHALL BE POLYMER–COATED CORRUGATED METAL.

7 ANTI SEEP COLLARS (TYP)

NOT TO SCALE



NOTES:

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED.
2. INSTALL TURF REINFORCEMENT MATTING PER MANUFACTURER RECOMMENDATIONS.

8 TURF-REINFORCEMENT FOR EMERGENCY SPILLWAY WEIR SECTION (TYP.)

NOT TO SCALE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

SEDIMENT BASIN DETAILS

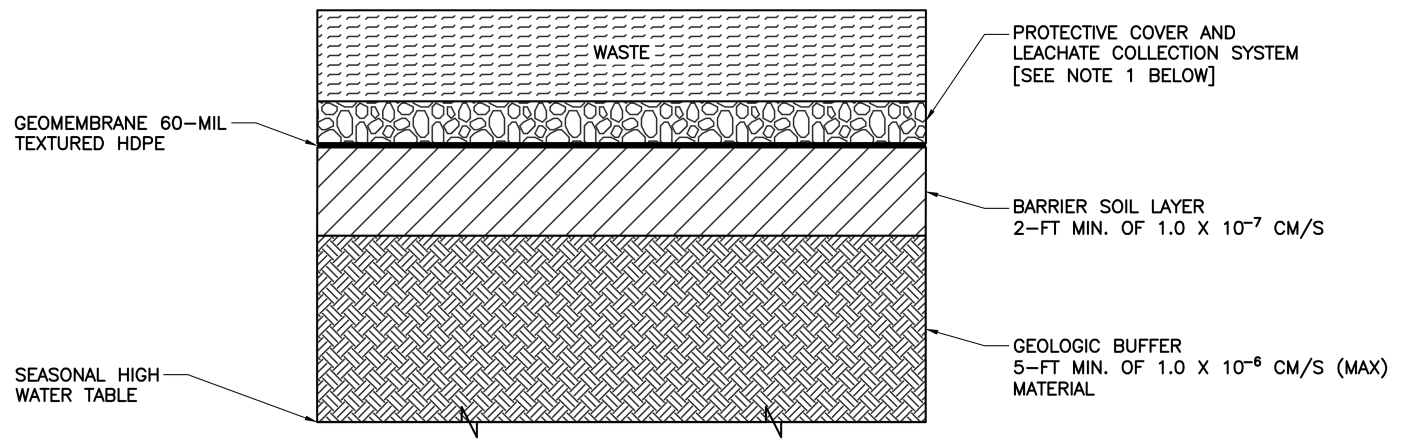
DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			EDC*

DRAWING NO.:
P-234

*HAND SIGNATURE ON FILE

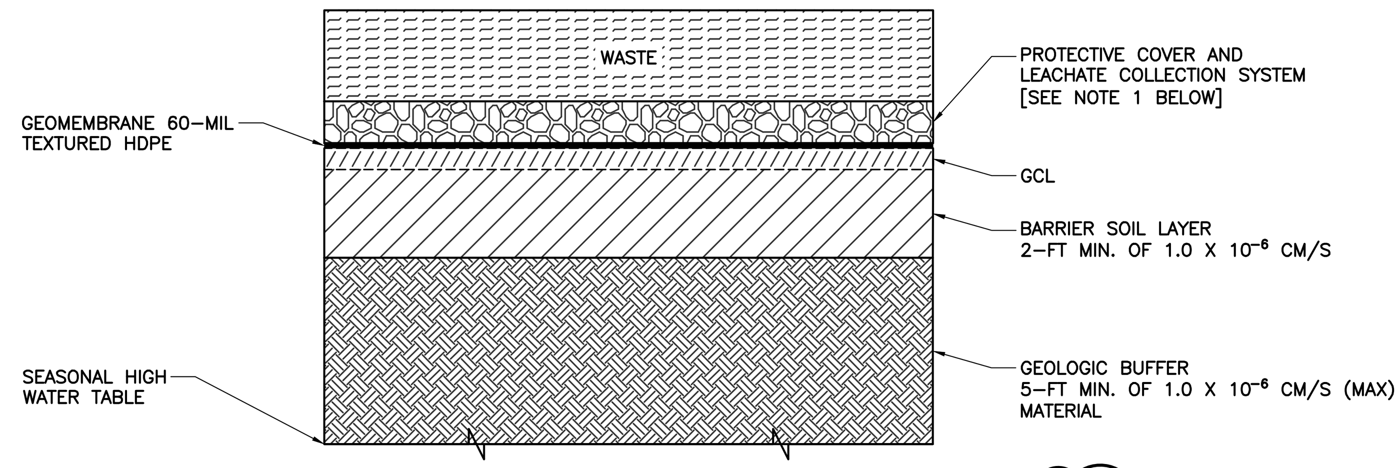
BRANDON MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025

P:\310-0001\317-474\-CADD\Dwg\SWDR\317474-SWDR-P231-P-SEDIMENT BASIN AND DETAILS.dwg{P-234} LS:(3/18/2025 - kunderwood) - LP: 4/3/2025 2:53 PM



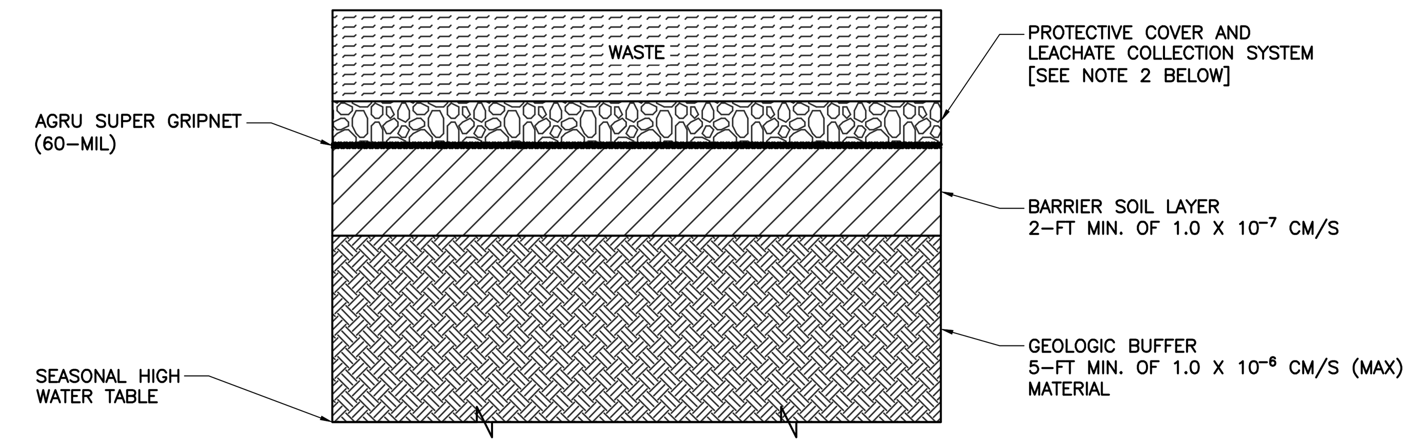
NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

1 OPTION 1 BASE LINER SYSTEM
NOT TO SCALE



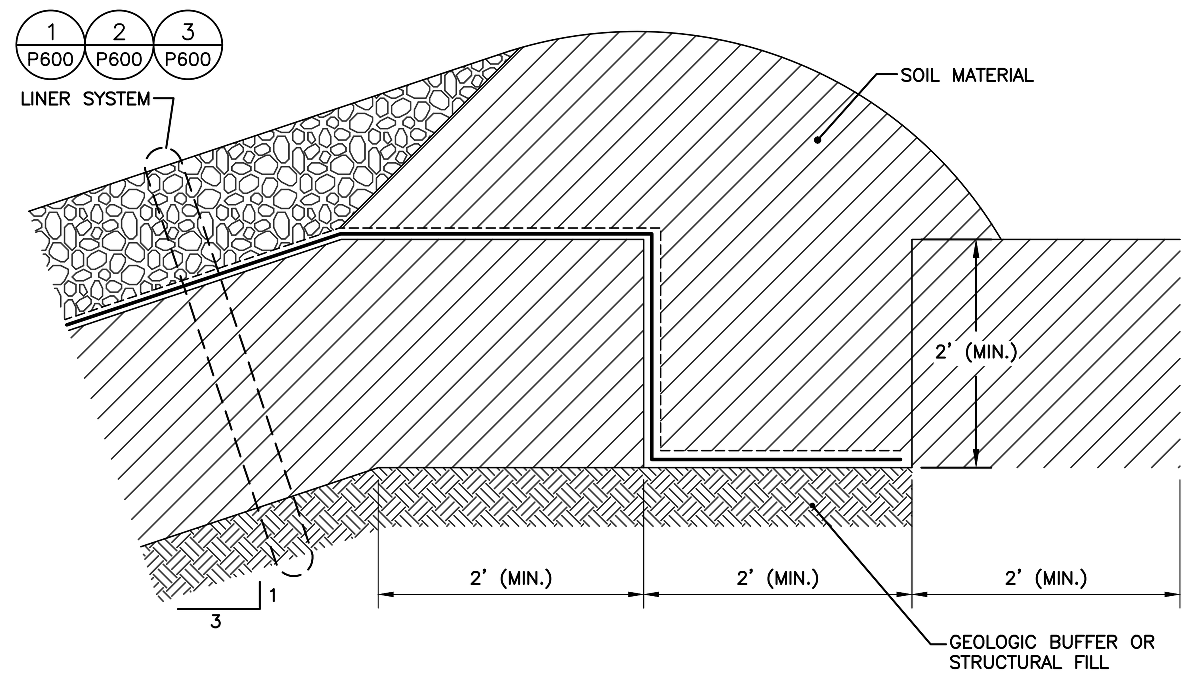
NOTE:
1. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

2 OPTION 2 BASE LINER SYSTEM
NOT TO SCALE

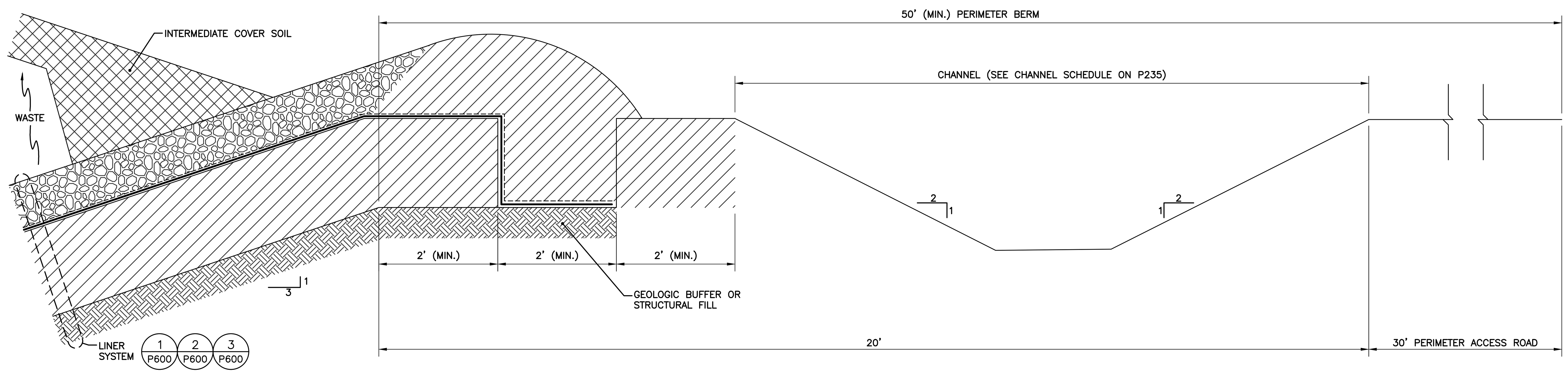


NOTE:
1. AGRU SUPER GRIPNET LINER SYSTEM SHALL BE INSTALLED IN MODULES 1, 2, AND 3 IN THE APPROXIMATE LOCATIONS SHOWN ON DRAWING P201.
2. 1-FT MIN. DRAINAGE LAYER – AASHTO #57 (1"ø) WASHED GRAVEL (≤12% CALCIUM CARBONATE CONTENT) OR ON-SITE SOILS (ON SIDE SLOPES ONLY) WITH 16 OZ/SY NON-WOVEN GEOTEXTILE FABRIC ON BOTTOM. SIDE SLOPES ARE DEFINED AS SLOPES WITH A 3H:1V GRADIENT OR GREATER.

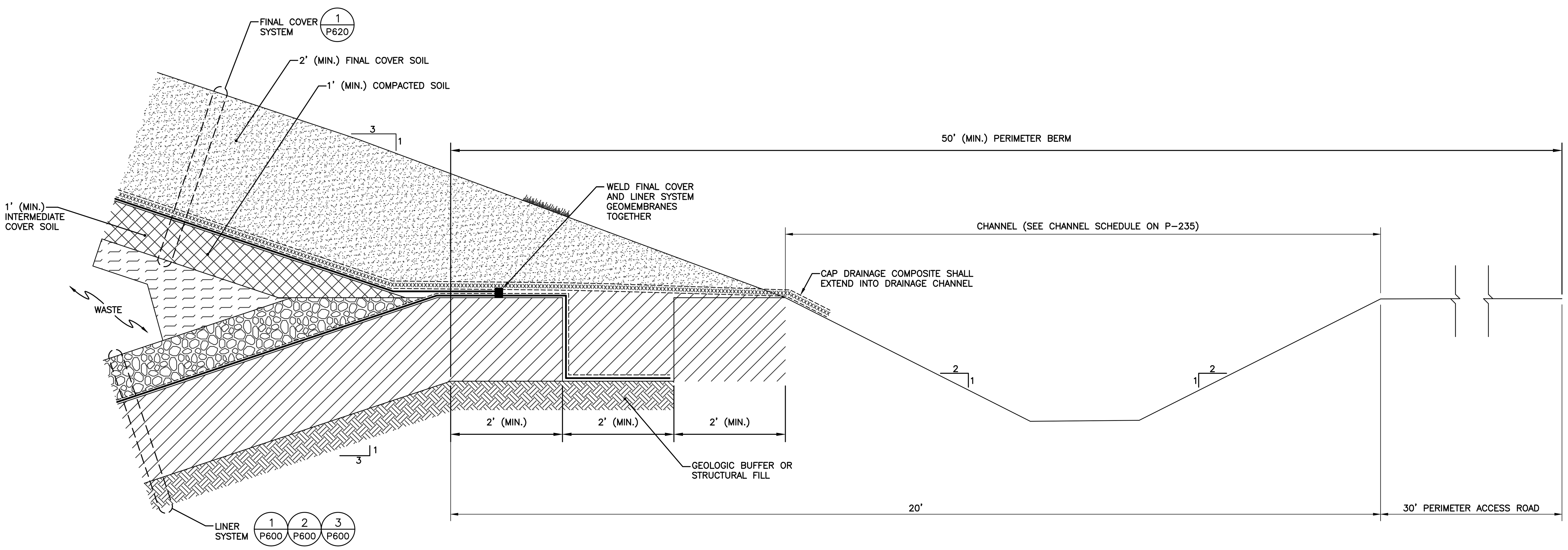
3 OPTION 3 BASE LINER SYSTEM
NOT TO SCALE



4 PERIMETER ANCHOR TRENCH
NOT TO SCALE



5 INTERIM PERIMETER BERM
NOT TO SCALE



6 PERIMETER BERM AT CLOSURE
NOT TO SCALE

LEGEND:
- 1 / P600 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

BRYAN MICHAEL YACHYN — STATE OF TENNESSEE — No. 130544
4/4/2025
*HAND SIGNATURE ON FILE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LINERSYSTEMDETAILS (SHEET 1 OF 3)

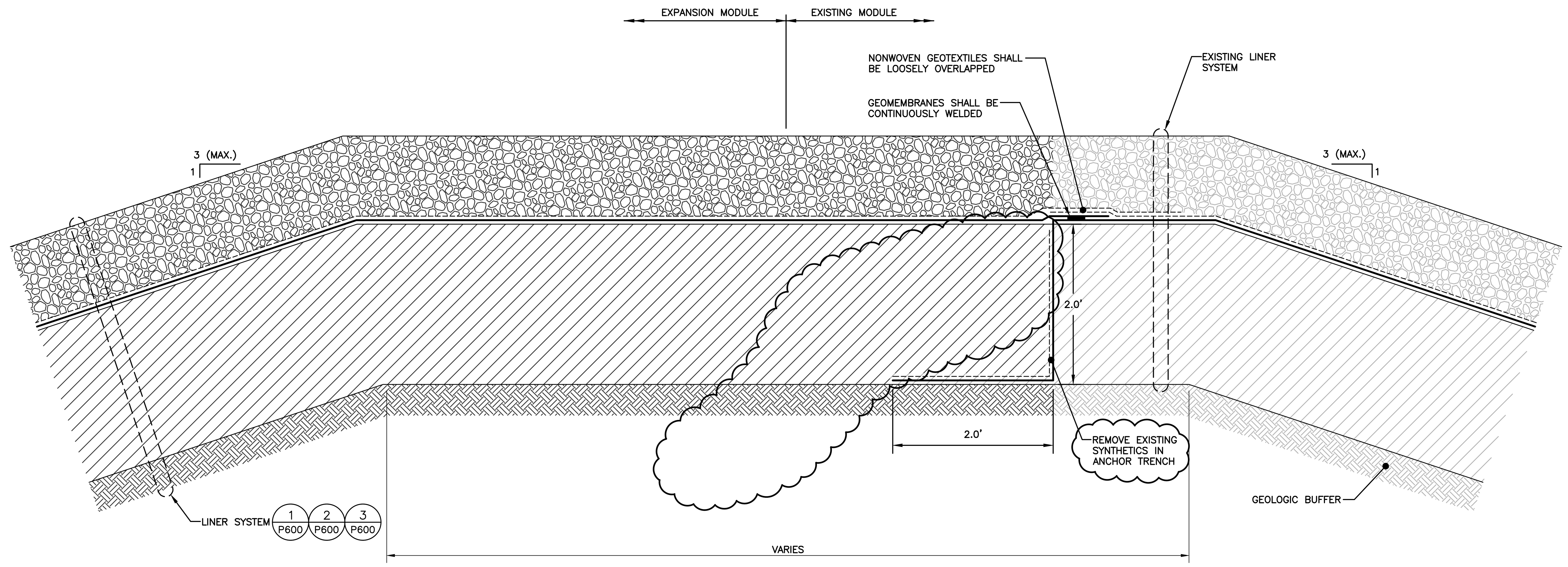
DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:			317-474
APPROVED BY:			*BMY

DRAWING NO.: P-600

P:\370-000\317-474\-0400\Dwg\SWDR\317474-SWDR-P600-DETAILS.dwg[P-600] LS:(3/18/2025 - kvanderwood) - LP: 4/3/2025 2:52 PM

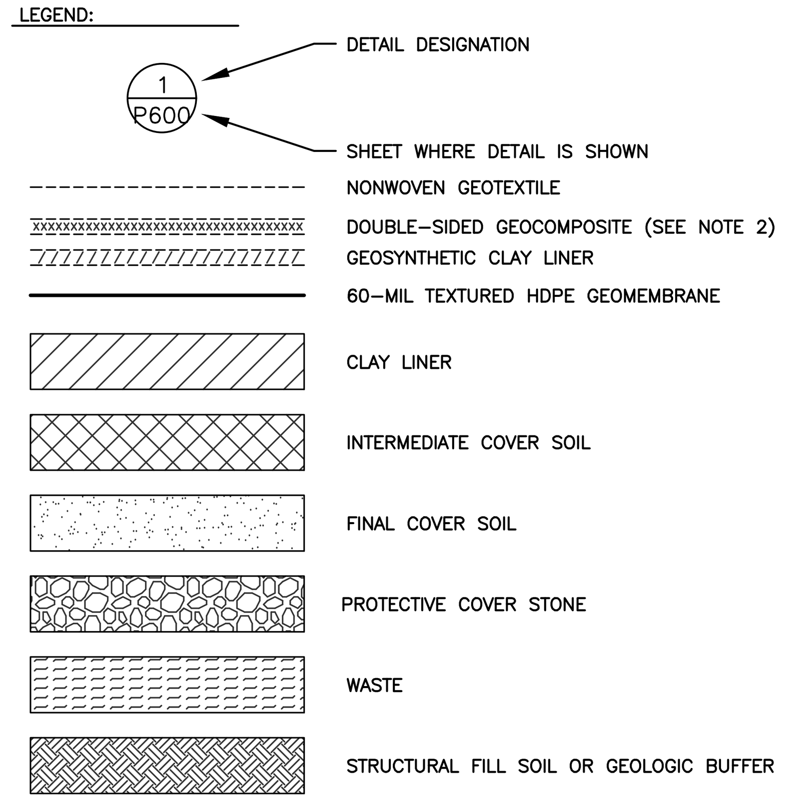
DETAIL REMOVED

1 INTERCEPTOR DRAIN
NOT TO SCALE

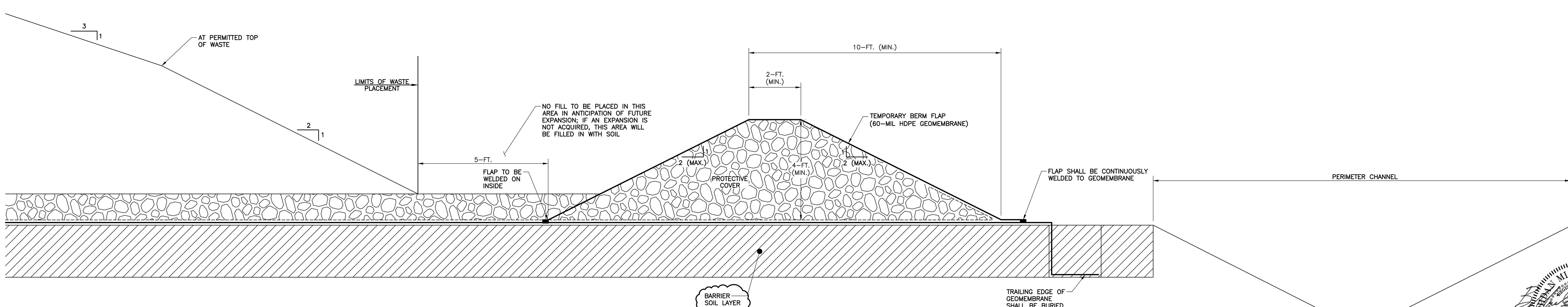


2 TIE-IN TO EXISTING LINER SYSTEM
NOT TO SCALE

LEGEND:



NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.



3 WESTERN AND NORTHERN PERIMETER BERM
NOT TO SCALE

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

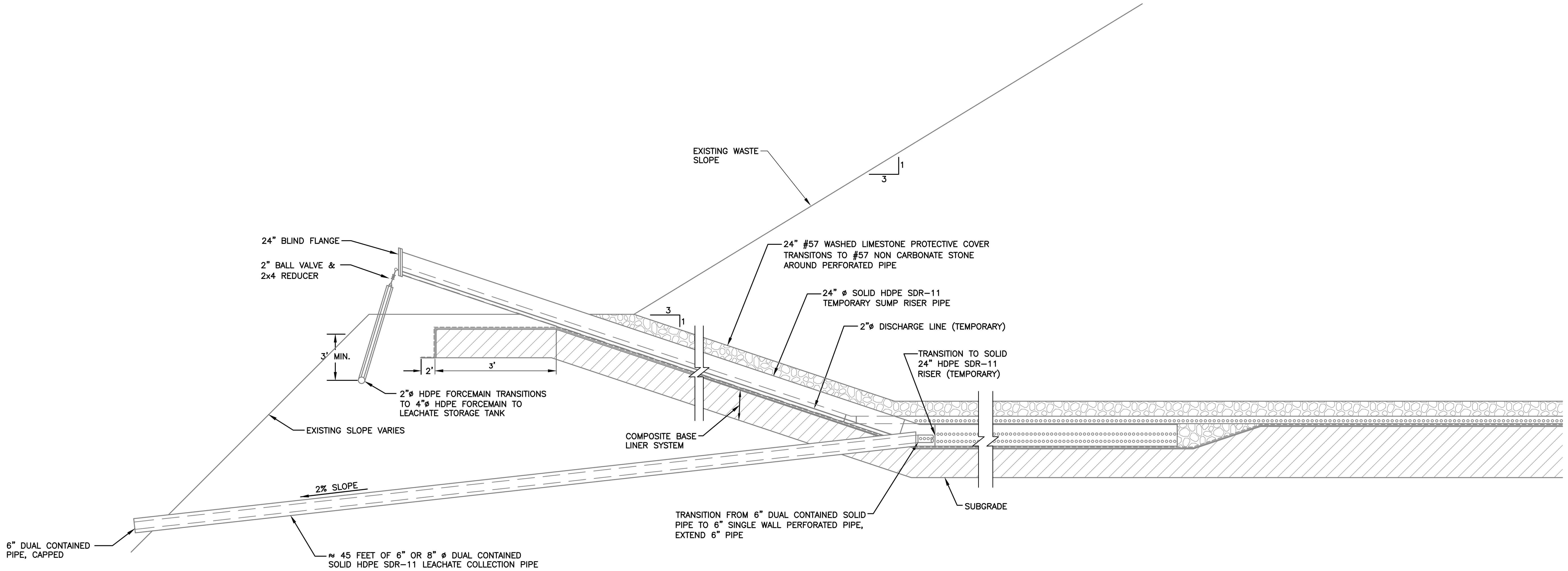
LINER SYSTEM DETAILS (SHEET 2 OF 3)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	*BMY

BOGDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 130544
STATE OF TENNESSEE
4/4/2025

*HAND SIGNATURE ON FILE

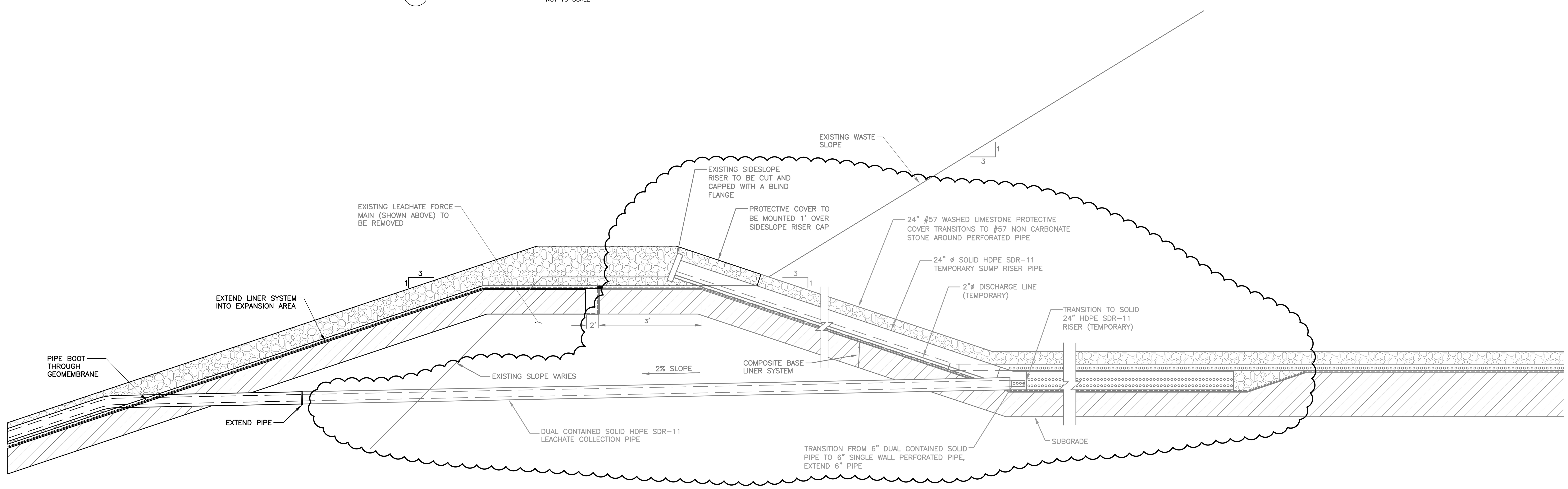
DRAWING NO.:
P-601



NOTE:
THIS DETAIL SHOWS THE APPROXIMATE CONFIGURATION OF THE SUMP IN EXISTING MODULE H. THE EXISTING SUMPS IN MODULES A AND B ARE SIMILAR, EXCEPT THEY DO NOT HAVE THE 2 INCH FORCE MAIN CONNECTED THE THEIR SUMP PUMPS. REFER TO DETAIL 2 ON THIS SHEET FOR HOW THESE SUMPS WILL BE EXTENDED TO DRAIN BY GRAVITY INTO EXPANSION MODULES 1, 2, AND 3.

1 EXISTING TEMPORARY SUMP CROSS SECTION

NOT TO SCALE



2 EXISTING LEACHATE COLLECTION PIPE TIE-IN TO NEW MODULES

NOT TO SCALE

LEGEND:

- 1 / P601 — DETAIL DESIGNATION; SHEET WHERE DETAIL IS SHOWN
- NONWOVEN GEOTEXTILE
- DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)
- GEOSYNTHETIC CLAY LINER
- 60-MIL TEXTURED HDPE GEOMEMBRANE
- CLAY LINER
- INTERMEDIATE COVER SOIL
- FINAL COVER SOIL
- PROTECTIVE COVER STONE
- WASTE
- STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:
1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

REVISION RECORD

NO	DATE	DESCRIPTION

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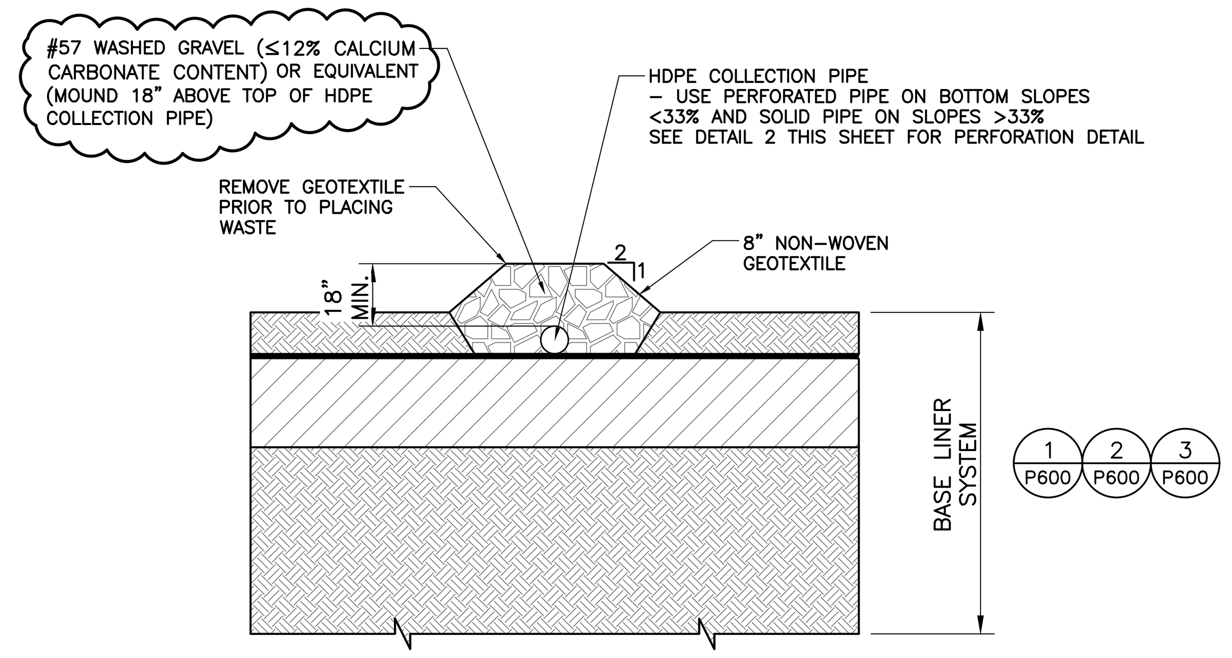
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 2 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474		
APPROVED BY:	EDC*		

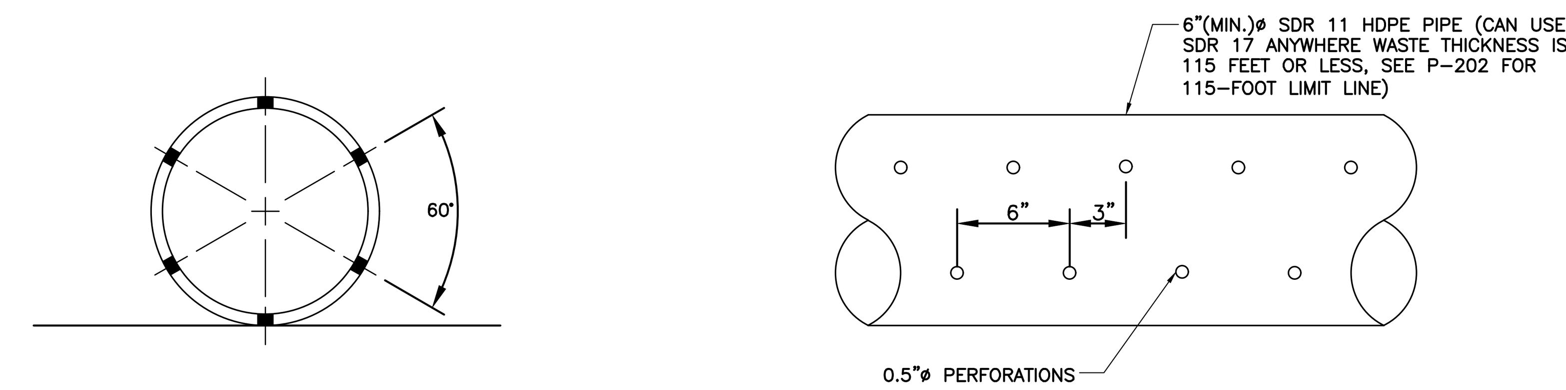
BOHDAN MICHAEL YACYSHYN
REGISTERED ENGINEER
AGRICULTURE
COMMERCE
No. 120544
STATE OF TENNESSEE
4/4/2025
*ORIGINAL SIGNATURE ON FILE

DRAWING NO.:
P-611



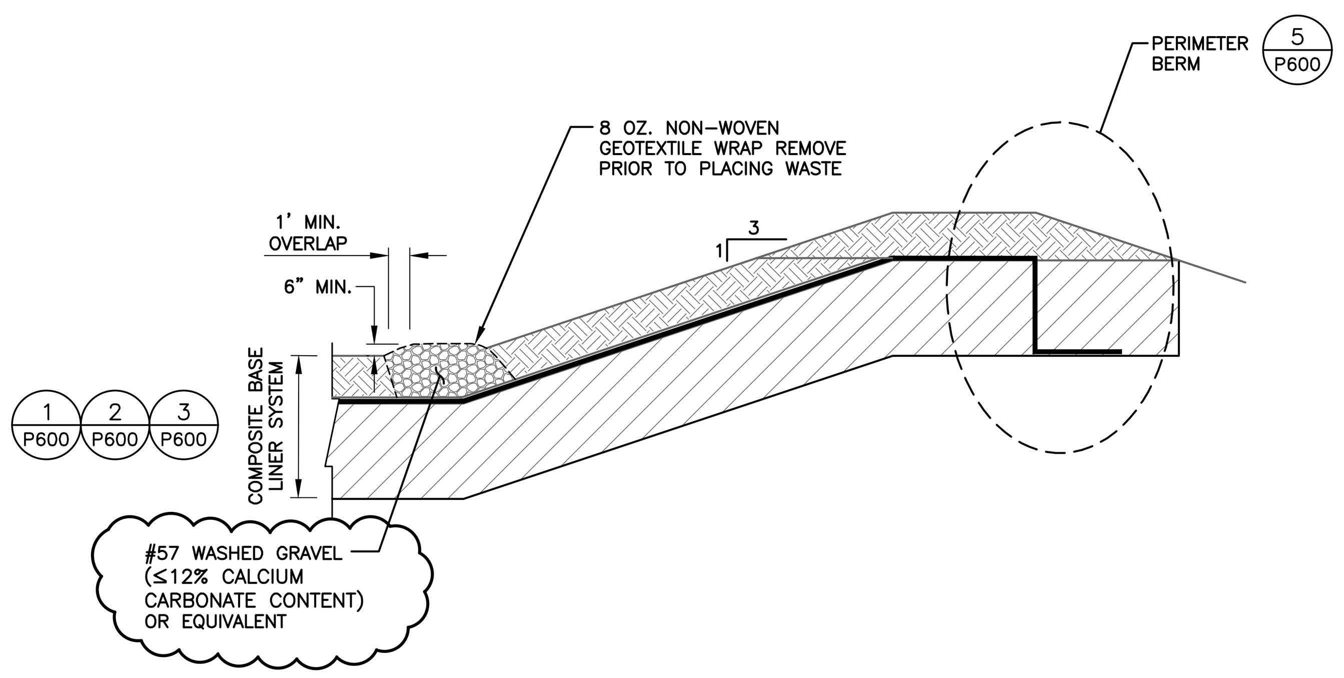
1 LEACHATE COLLECTION/PIPING SYSTEM AND BEDDING DETAIL

NOT TO SCALE



2 PERFORATED PIPE DETAIL

NOT TO SCALE



3 TOE OF SLOPE LEACHATE COLLECTOR

NOT TO SCALE

LEGEND:

1 / P601 — DETAIL DESIGNATION / SHEET WHERE DETAIL IS SHOWN

NONWOVEN GEOTEXTILE

DOUBLE-SIDED GEOCOMPOSITE (SEE NOTE 2)

GEOSYNTHETIC CLAY LINER

60-MIL TEXTURED HDPE GEOMEMBRANE

CLAY LINER

INTERMEDIATE COVER SOIL

FINAL COVER SOIL

PROTECTIVE COVER STONE

WASTE

STRUCTURAL FILL SOIL OR GEOLOGIC BUFFER

NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.

REVISION RECORD

NO	DATE	DESCRIPTION

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MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

LEACHATE MANAGEMENT DETAILS (SHEET 3 OF 5)

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	*BMY

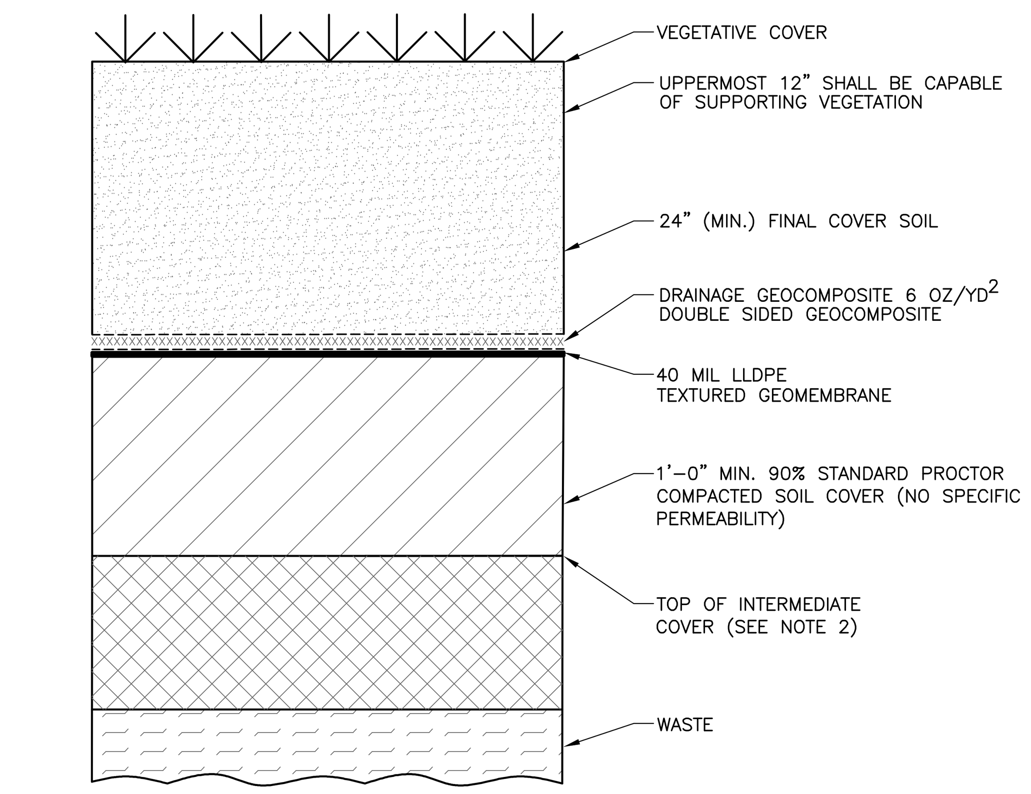
BOHDAN MICHAEL YACYSHYN, REGISTERED ENGINEER, AGRICULTURE, COMMERCE, No. 130544, STATE OF TENNESSEE

4/4/2025

SIGNATURE ON FILE

DRAWING NO.:

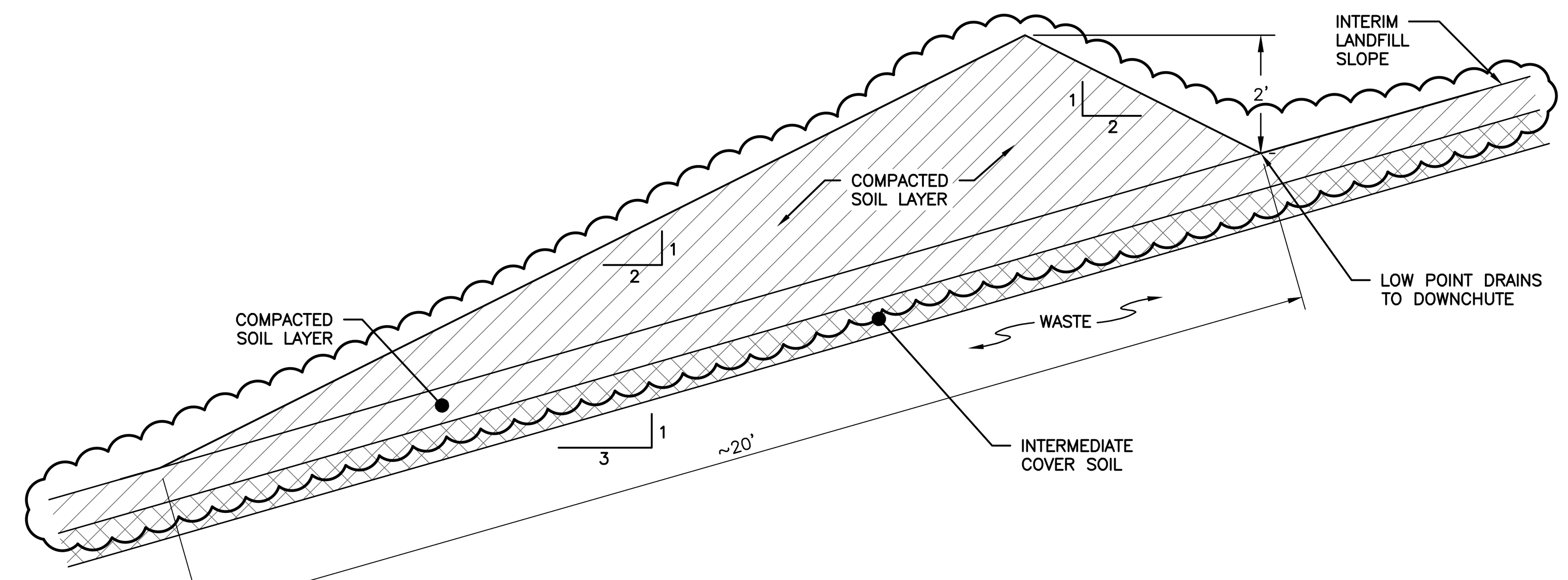
P-612



NOTES:

1. GAS COLLECTION TRENCHES TO BE INSTALLED IN WASTE. SEE THE GAS COLLECTION TRENCH DETAILS ON DRAWING P-630.
2. INTERMEDIATE COVER SHALL BE SOIL OR SOIL-LIKE. INTERMEDIATE COVER SHALL BE 12 INCH THICK.

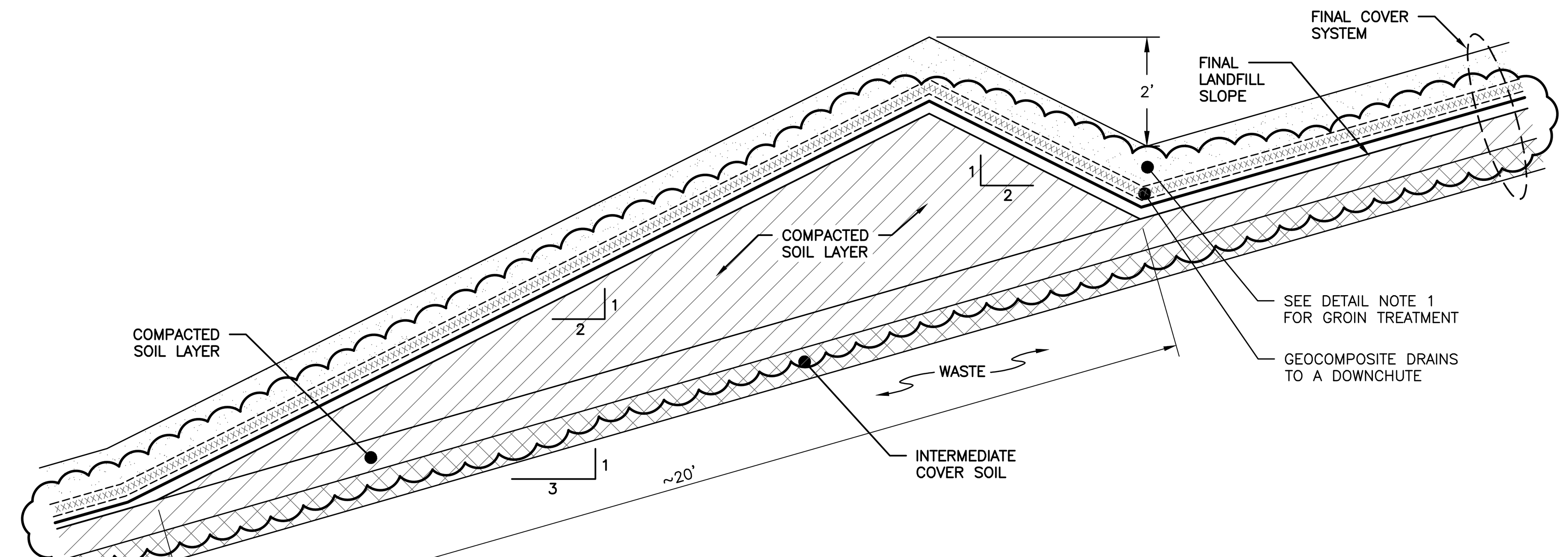
1 FINAL COVER SYSTEM
NOT TO SCALE



2 INTERIM TACK-ON BENCH - TYPICAL
NOT TO SCALE

NOTES:

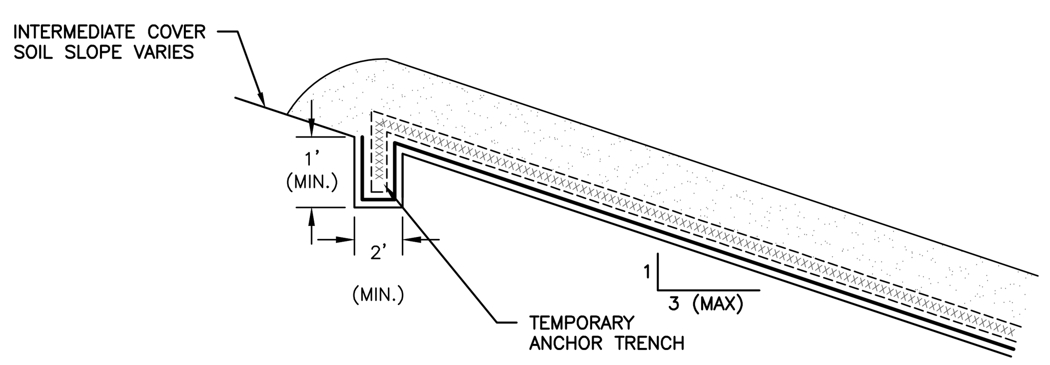
1. TOP SURFACE OF COMPACTED SOIL LAYER SHALL BE INSPECTED AND RESTORED AS NEEDED PRIOR TO FML DEPLOYMENT PER THE CQA PLAN.



3 FINAL TACK-ON BENCH - TYPICAL
NOT TO SCALE

NOTES:

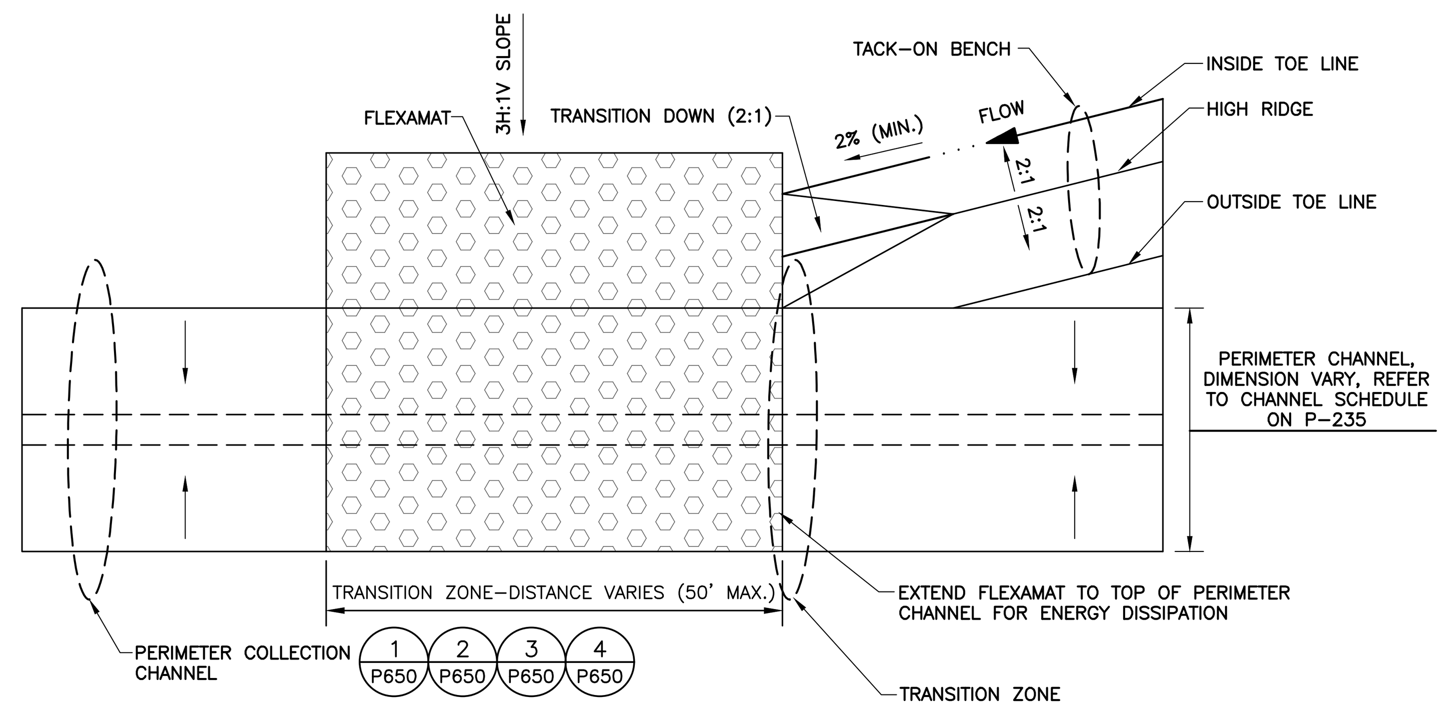
1. ADS 12-INCH ADVANEDGE HDPE PIPE WITH GEOTEXTILE WRAP SHALL BE INSTALLED ALONG THE GROIN OF TACK-ON BENCHES. ALTERNATIVELY, AN ADDITIONAL 3-FOOT WIDE STRIP OF 6 OZ/SY (MIN.) DOUBLE-SIDED DRAINAGE COMPOSITE MAY BE INSTALLED IN THIS LOCATION.
2. TOP SURFACE OF COMPACTED SOIL LAYER SHALL BE INSPECTED AND RESTORED AS NEEDED PRIOR TO FML DEPLOYMENT PER THE CQA PLAN.



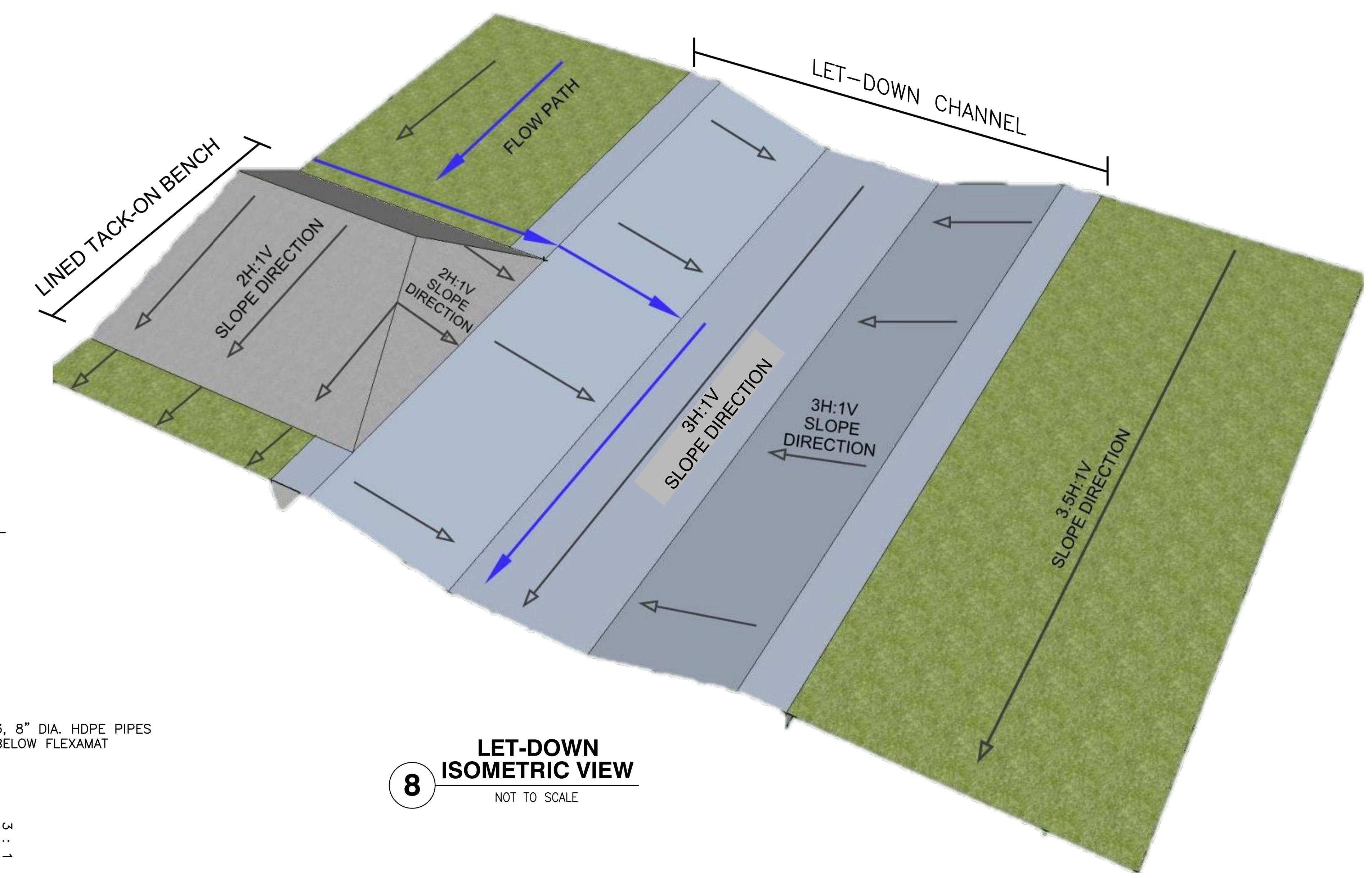
4 INCREMENTAL CAPPING DETAIL
NOT TO SCALE

NOTES:

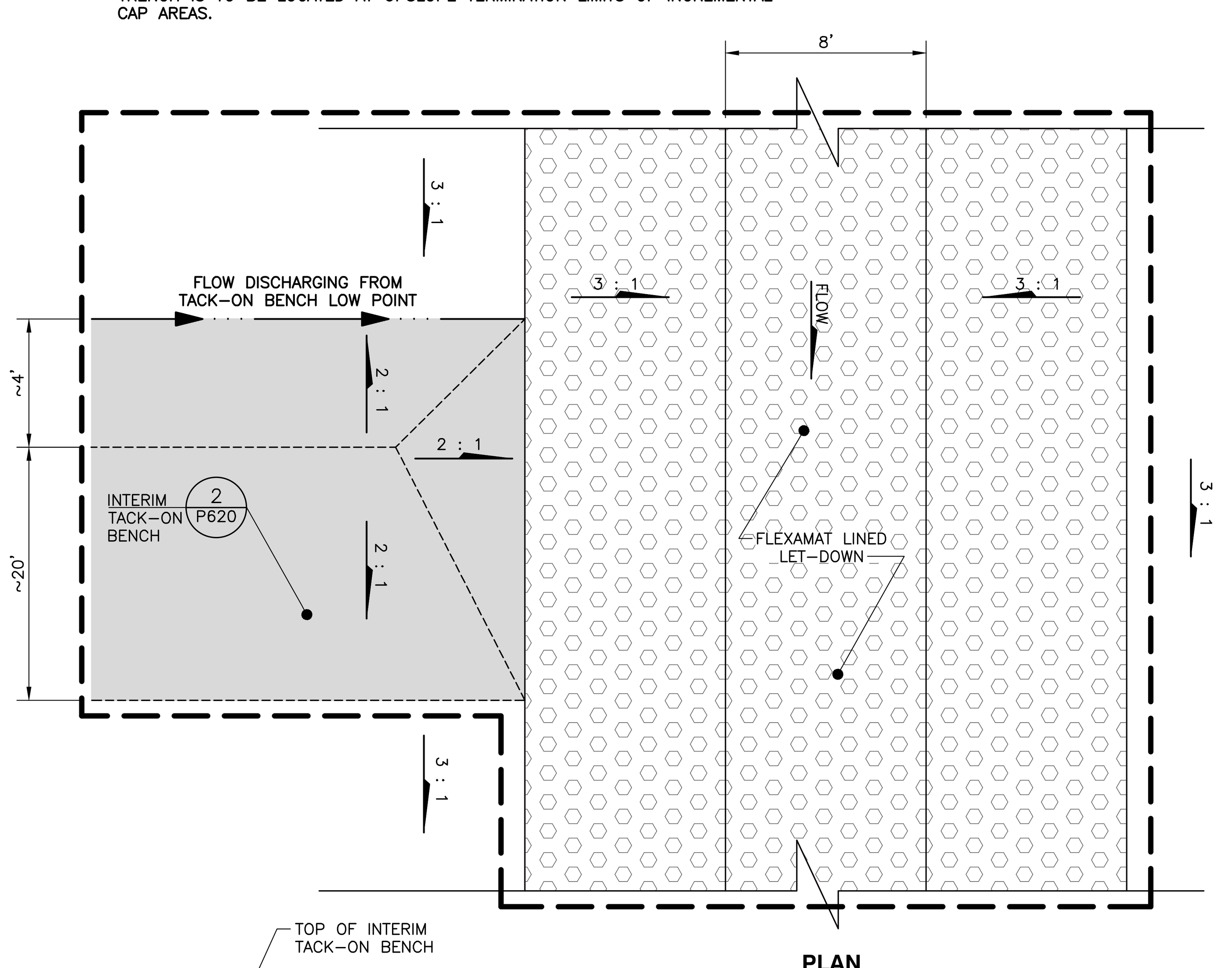
1. THIS INCREMENTAL CAPPING DETAIL IS TO BE USED TO TEMPORARILY ANCHOR FINAL COVER SYSTEM GEOSYNTHETIC COMPONENTS. THE TEMPORARY ANCHOR TRENCH IS TO BE LOCATED AT UPSLOPE TERMINATION LIMITS OF INCREMENTAL CAP AREAS.



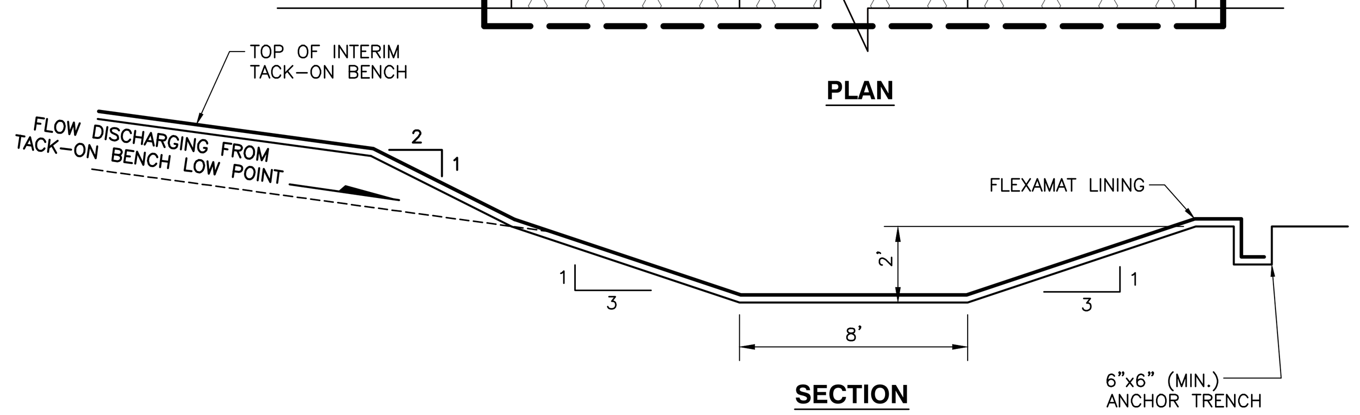
5 TACK-ON BERM CONNECTION TO PERIMETER CHANNEL
NOT TO SCALE



8 LET-DOWN ISOMETRIC VIEW
NOT TO SCALE

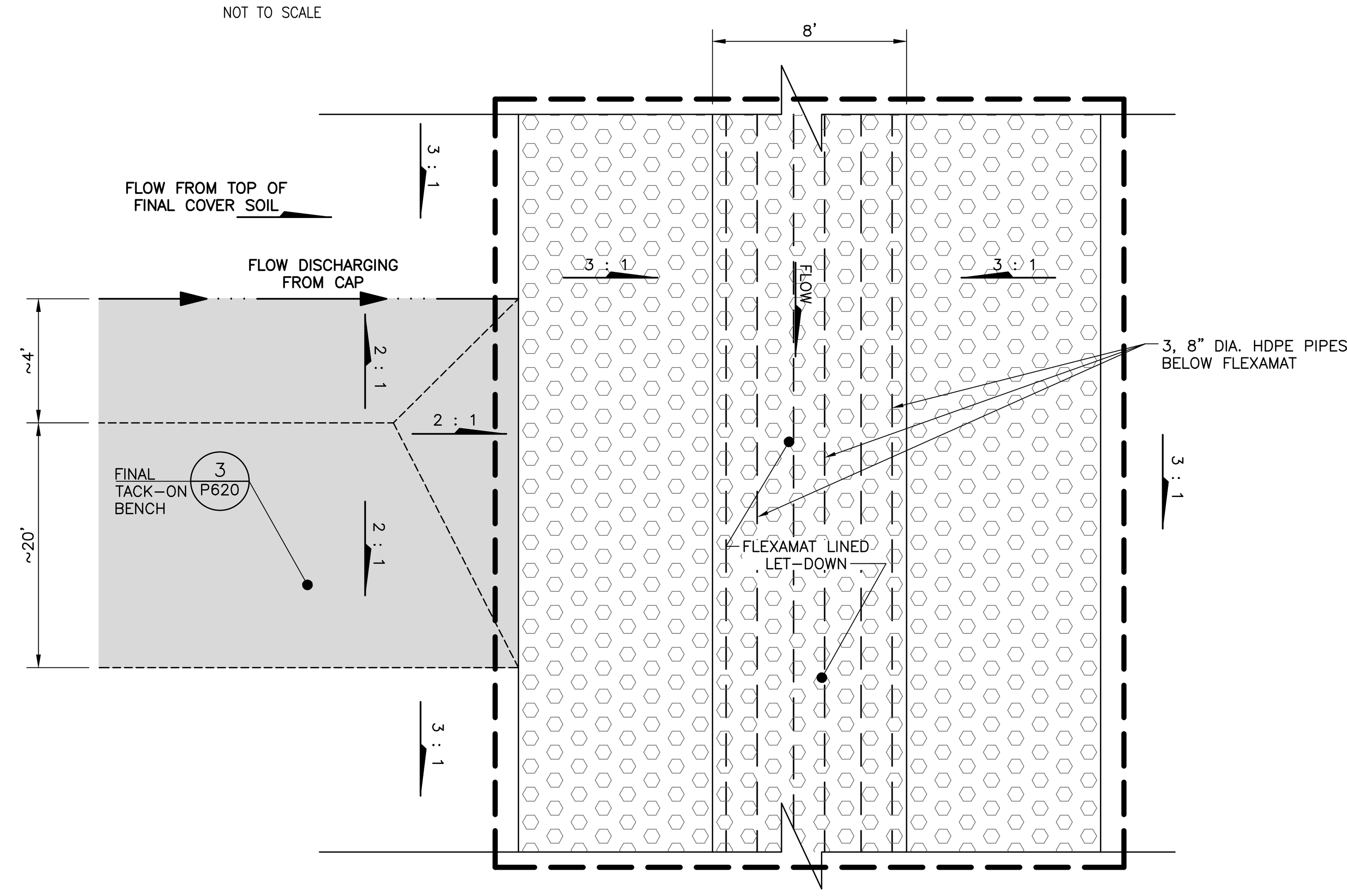


PLAN

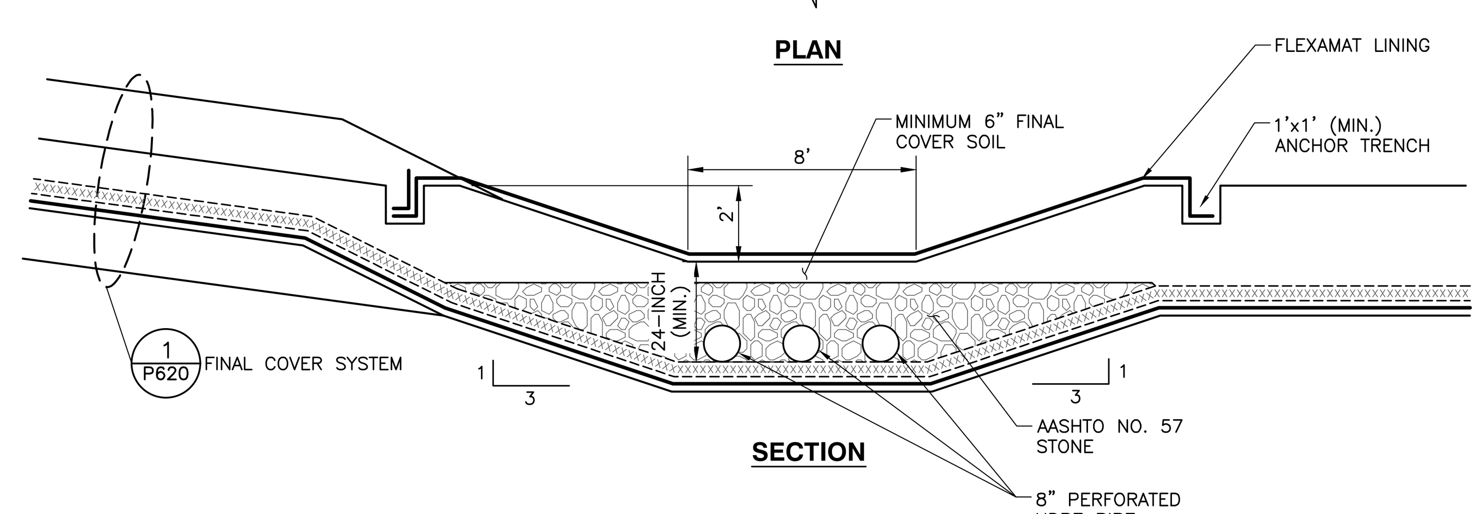


SECTION

6 LET-DOWN - INTERIM
NOT TO SCALE



PLAN



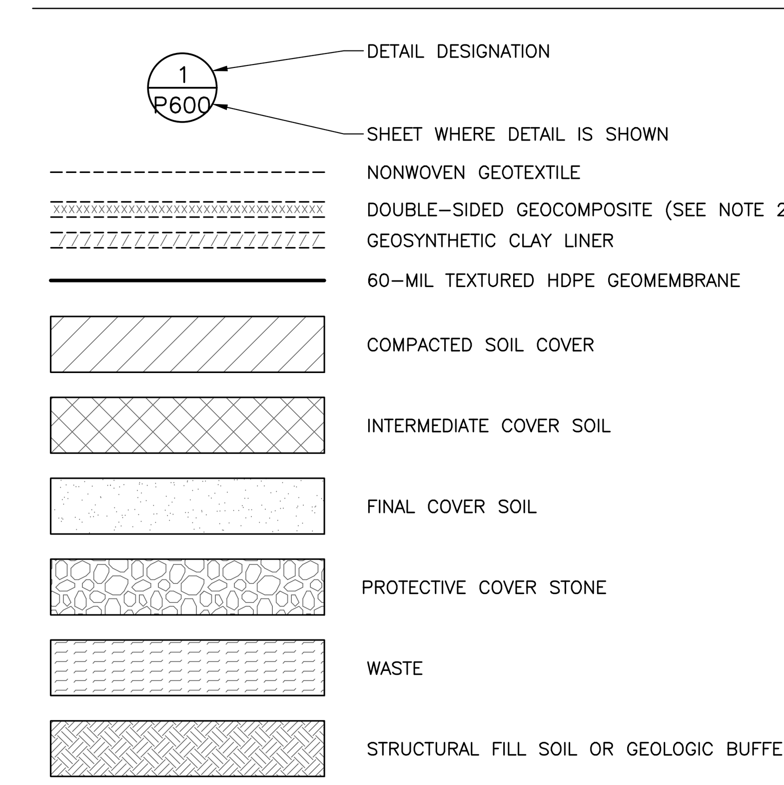
SECTION

7 LET-DOWN - FINAL
NOT TO SCALE

NOTE:

UNDER FINAL SLOPE CONDITIONS, THE TACK-ON BENCHES WILL BE VEGETATED AND THE DOWNCHUTES WILL BE LINED WITH FLEXAMAT.

LEGEND:



NOTES:

1. THE VERTICAL DIMENSIONS OF GEOSYNTHETIC LINER SYSTEM COMPONENTS HAVE BEEN EXAGGERATED FOR CLARITY.
2. DOUBLE-SIDED DRAINAGE COMPOSITE USED IN THE FINAL COVER SYSTEM SHALL CONSIST OF 6 OZ/SY NONWOVEN GEOTEXTILES HEAT-BONDED TO AN INNER CORE OF HDPE GEONET.
3. INSTALL FLEXAMAT PER MANUFACTURER INSTRUCTIONS

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
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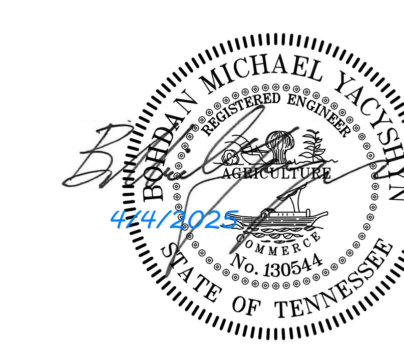
MATLOCK BEND LANDFILL
PART II - 2024 HORIZONTAL
EXPANSION PERMIT PLANS
LOUDON COUNTY, TENNESSEE

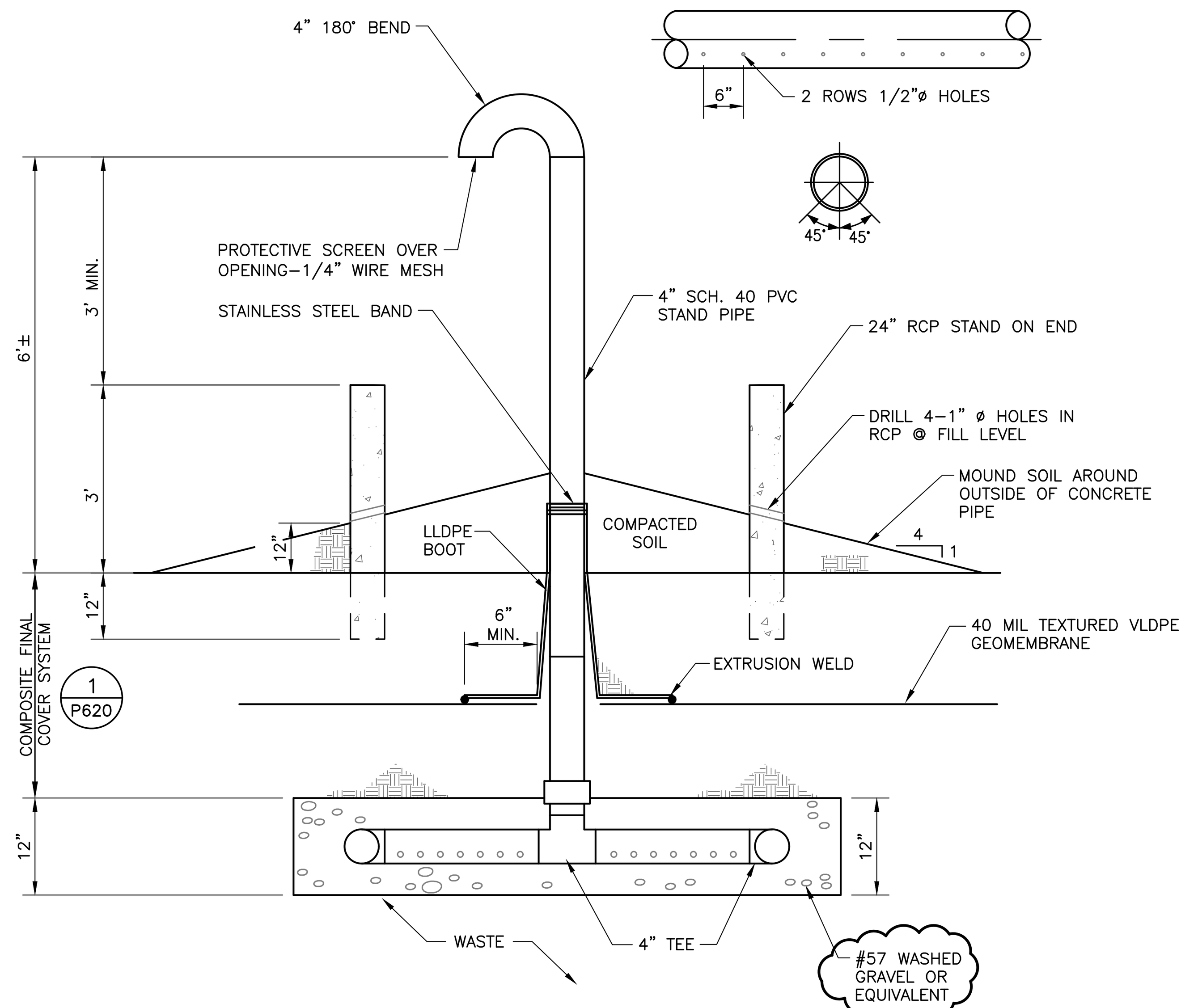
FINAL COVER DETAILS

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:		PROJECT NO:	317-474
APPROVED BY:			*BMY



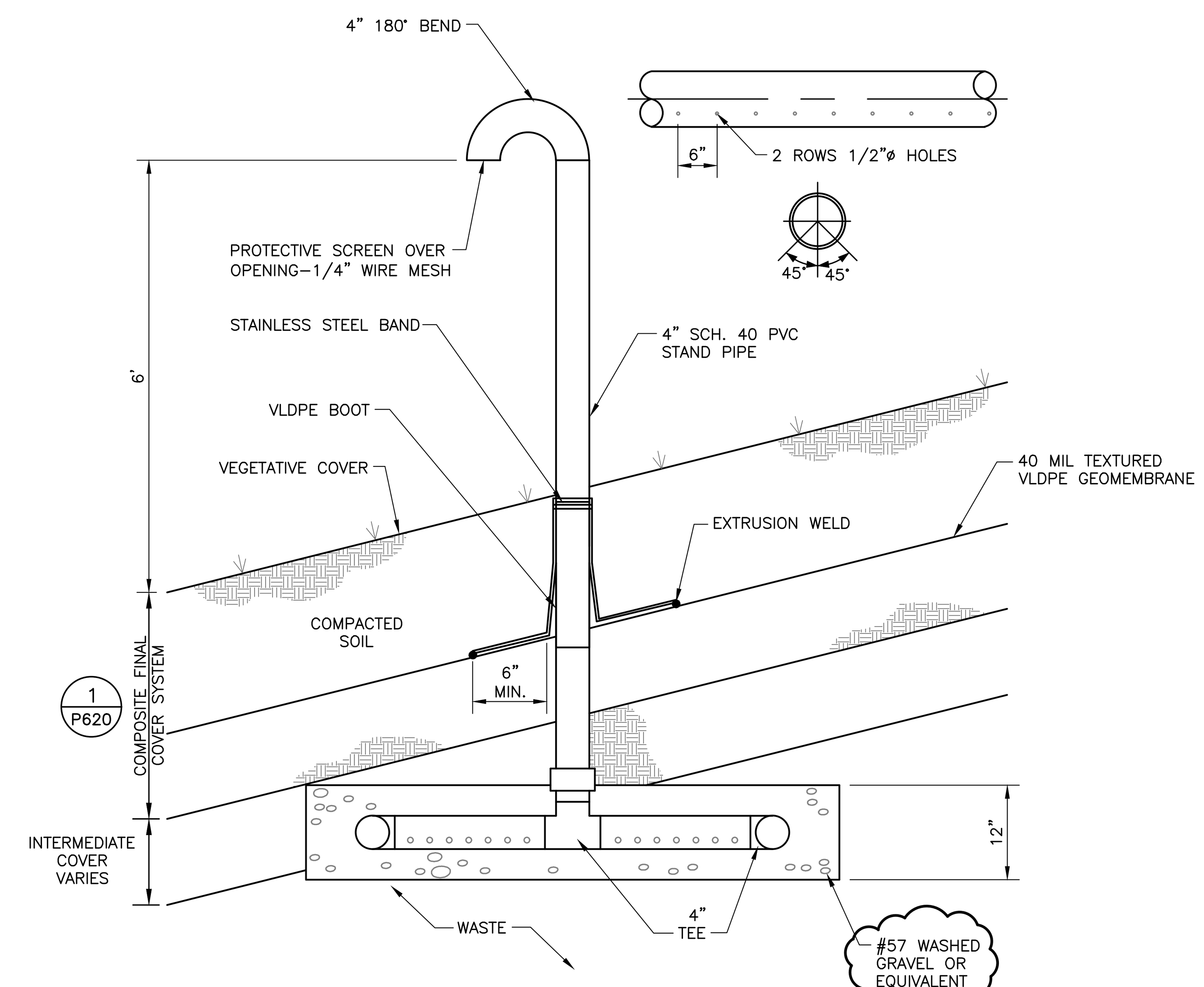
*HAND SIGNATURE ON FILE

DRAWING NO.:
P-620



CASE 1

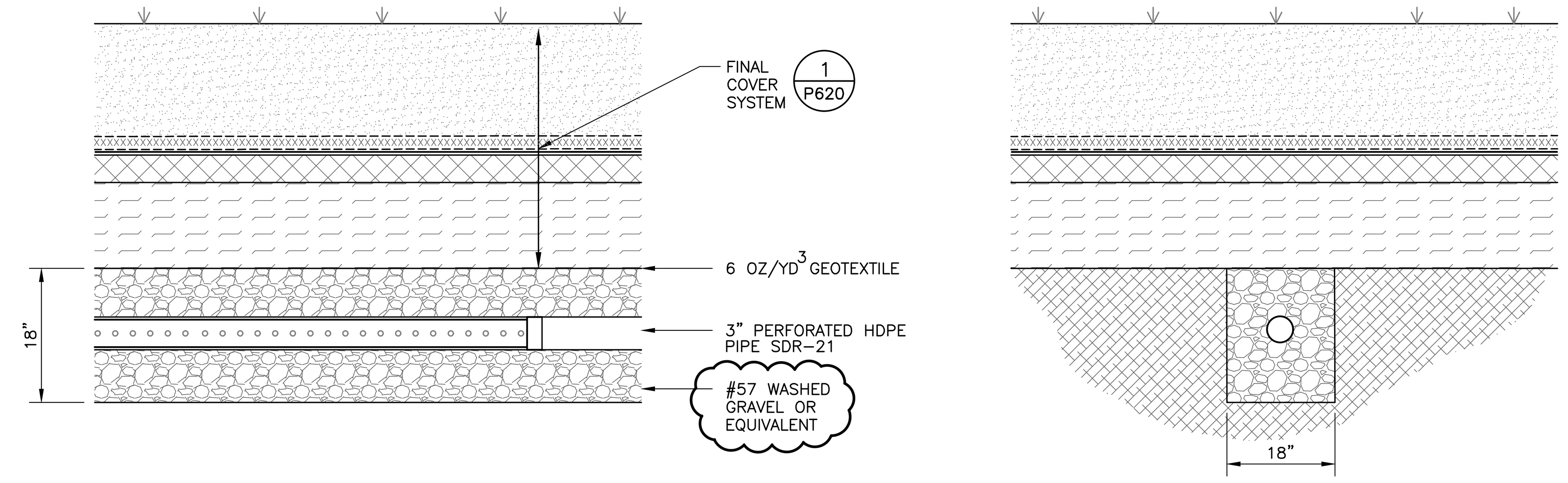
NOTE:
1) THIS DETAIL FOR GAS VENTS ON SLOPES <10% & ALONG ACCESS ROADS.
2) 12" X 8' X 8' ROCK POCKET TO BE INSTALLED IN INTERMEDIATE COVER LAYER.
3) GAS VENTS SHALL BE INSTALLED ON AN APPROXIMATE 200' X 200' (MAX.) GRID SPACING.



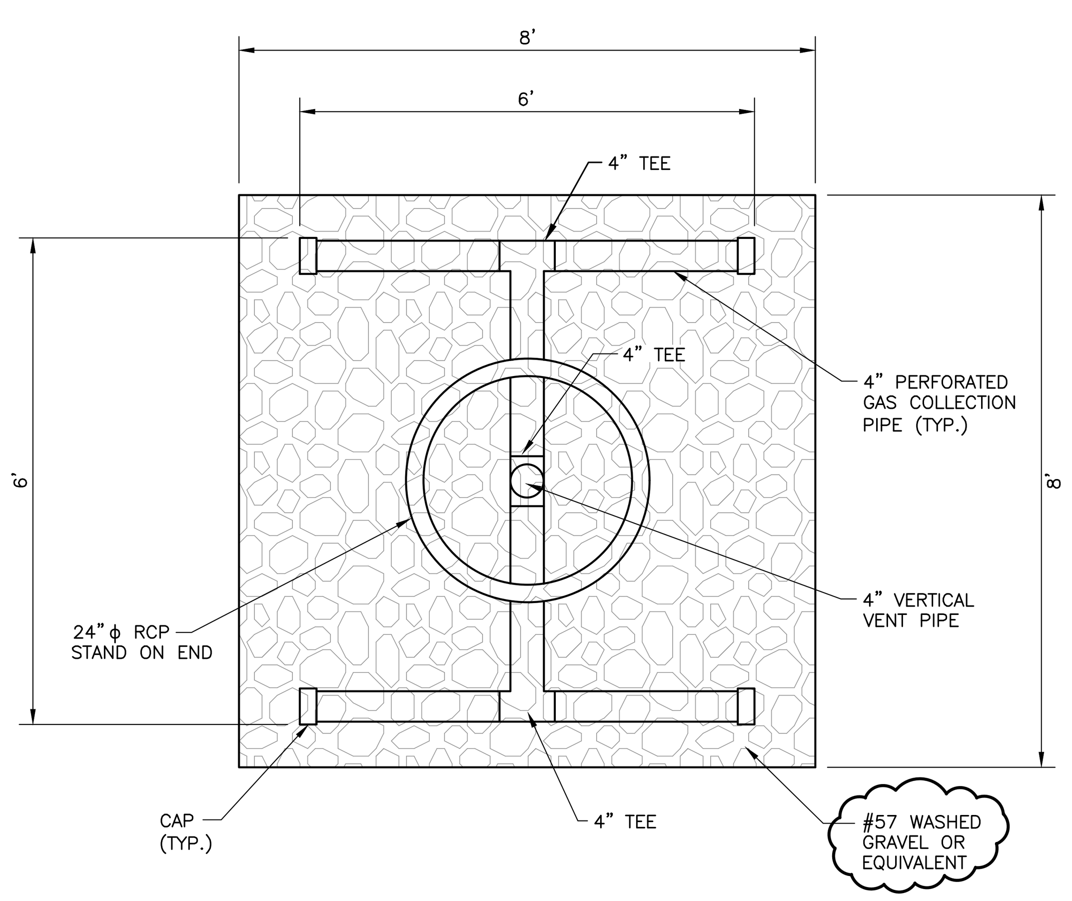
CASE 2

NOTE:
1) THIS DETAIL FOR GAS VENTS ON SLOPES ≥10%.
2) 12" X 8' X 8' ROCK POCKET TO BE INSTALLED IN INTERMEDIATE COVER LAYER.
3) GAS VENTS SHALL BE INSTALLED ON AN APPROXIMATE 200' X 200' (MAX.) GRID SPACING.

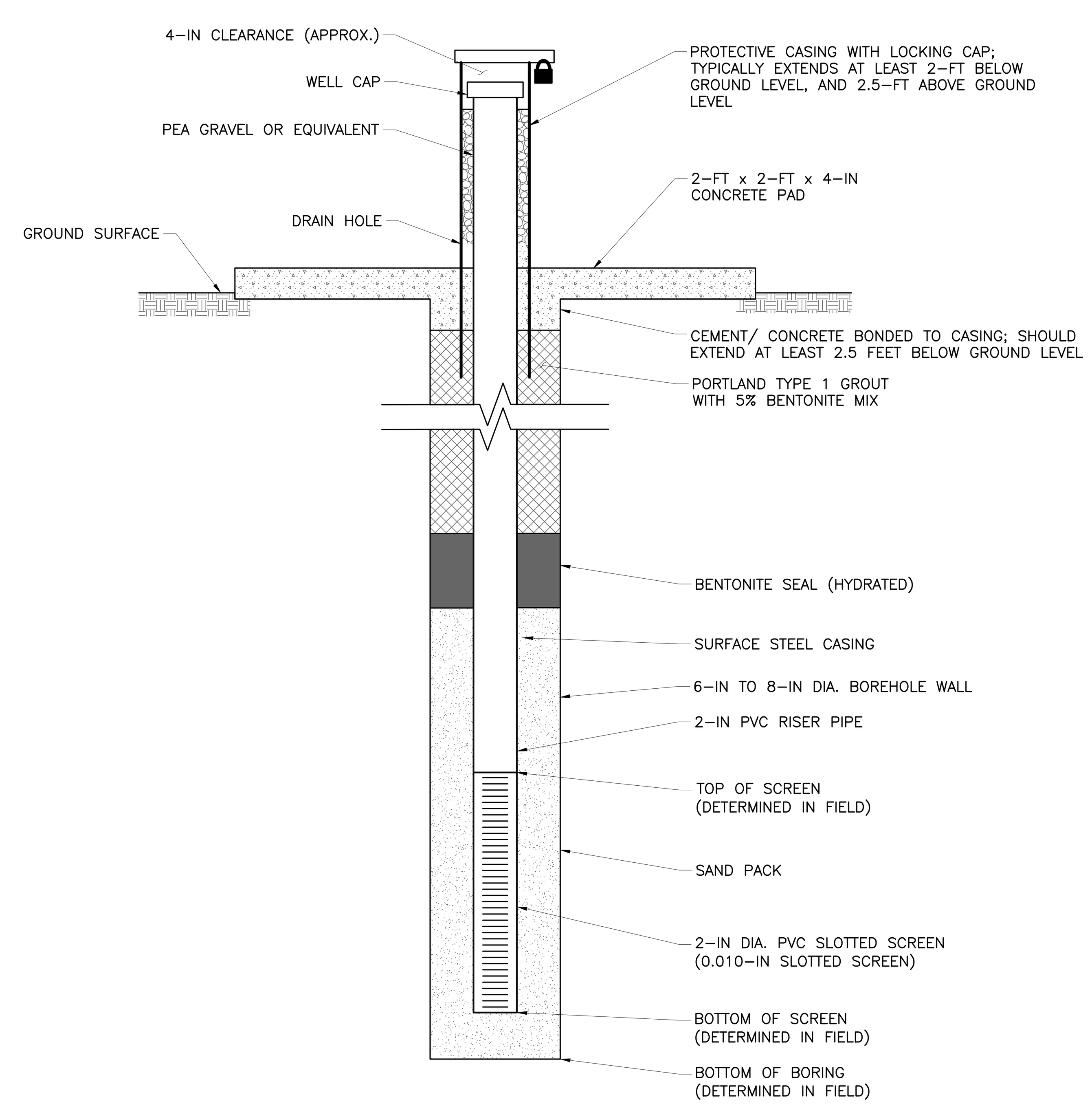
1 PASSIVE GAS VENT
NOT TO SCALE



2 PASSIVE GAS COLLECTION TRENCHES FOR CLOSURE PROFILE
NOT TO SCALE



3 PASSIVE GAS VENT PLAN
NOT TO SCALE



4 TYPICAL GROUNDWATER MONITORING WELL DETAIL
NOT TO SCALE

GAS MONITORING NOTES

1) TRENCHES TO BE SPACED NOT MORE THAN 200 FT. ON CENTERS AND WILL GENERALLY BE ORIENTED PERPENDICULAR TO THE CONTOURS
2) GAS COLLECTION PIPING WILL BE CONNECTED TO THE PASSIVE GAS VENTS AT REGULAR INTERVALS.
3) THE LOCATION OF THE PASSIVE GAS VENTS MAY VARY TO COORDINATE WITH THE TRENCH TIE–INS. SUCH VARIATION WILL NOT RESULT IN INCREASED SPACING NOR COVERAGE AREA THAN WHAT IS SHOWN.
4) THE GAS VENTING SYSTEM INDICATED IN THIS PERMIT DRAWING PACKAGE IS FOR A PASSIVE GAS SYSTEM WHICH MEETS THE CURRENT REGULATORY REQUIREMENTS FOR THIS FACILITY.
5) AN ACTIVE GAS SYSTEM MAY BE DESIGNED AND INSTALLED AT THIS FACILITY IN THE FUTURE. WHETHER VOLUNTARILY OR REQUIRED BY REGULATIONS.

REVISION RECORD

NO	DATE	DESCRIPTION

Civil & Environmental Consultants, Inc.
117 Seaboard Lane · Suite E-100 · Franklin, TN 37067
615-333-7797 · 800-763-2326
www.cecinc.com

MATLOCK BEND LANDFILL PART II - 2024 HORIZONTAL EXPANSION PERMIT PLANS LOUDON COUNTY, TENNESSEE

LANDFILL GAS AND GROUNDWATER MONITORING WELL DETAILS

DATE:	APRIL 2025	DRAWN BY:	BPR
DWG SCALE:	AS SHOWN	CHECKED BY:	TDM
PROJECT NO:	317-474	APPROVED BY:	EDC*

DRAWING NO.: **P-630**

BOGDAN MICHAEL YACISIN · REGISTERED ENGINEER · AGRICULTURE · COMMERCE · No. 130544 · STATE OF TENNESSEE

4/24/2025

*HAND SIGNATURE ON FILE

P:\310-000\317-474\-CADD\Dwg\SWDR\317474-SWDR-P620- DETAILS.dwg{P-630} LS:(3/18/2025 - kunderwood) - LP: 4/3/2025 2:51 PM

Monthly Operations Report
Matlock Bend Landfill
May 15, 2025

Presented by:
Republic Services, Inc.

I. OPERATIONS
   A. Tonnage Report
   B. Customer Activity Report
   C. Materials Classification Report
   D. Waste Characterization Report
   E. Tire Report
   F. Landfill Comments

II. Host & Security Fees Letter

III. Airspace Utilization Report

IV. TDEC Inspection – April 2025

V. Loudon Financial Information

Loudon Landfill Monthly Tonnages
Month Ending April 2025

Matlock Bend Landfill

Month	2024	2025	2024 to 2025
Jan	11,601	**14,498**	2,897
Feb	14,407	**14,212**	(195)
Mar	14,328	**17,577**	3,248
Apr	15,194	**17,012**	1,818
May	14,517	**0**	0
Jun	14,735	**0**	0
Jul	15,766	**0**	0
Aug	16,204	**0**	0
Sep	13,937	**0**	0
Oct	16,577	**0**	0
Nov	13,794	**0**	0
Dec	15,052	**0**	0
Total	176,112	**63,299**	7,769
% of Total Tonnage		**100%**	

Daily Avg. for any Running 30 Day Period 567

Loudon County

Month	2024	2025	2024 to 2025
Jan	529	**477**	(51)
Feb	541	**478**	(64)
Mar	574	**603**	29
Apr	607	**562**	(44)
May	596	**0**	0
Jun	613	**0**	0
Jul	615	**0**	0
Aug	599	**0**	0
Sep	486	**0**	0
Oct	572	**0**	0
Nov	516	**0**	0
Dec	554	**0**	0
Total	6,804	**2,120**	(131)
% of Total Tonnage		**3%**	

Daily Avg. for any Running 22.5 Day Period 756

Lenoir City

Month	2024	2025	2024 to 2025
Jan	434	**395**	(39)
Feb	478	**408**	(71)
Mar	529	**483**	(46)
Apr	524	**517**	(7)
May	565	**0**	0
Jun	455	**0**	0
Jul	484	**0**	0
Aug	485	**0**	0
Sep	424	**0**	0
Oct	494	**0**	0
Nov	399	**0**	0
Dec	403	**0**	0
Total	5,675	**1,802**	(164)
% of Total Tonnage		**3%**	

Loudon, City of

Month	2024	2025	2024 to 2025
Jan	452	**502**	50
Feb	467	**433**	(34)
Mar	521	**523**	2
Apr	572	**579**	7
May	572	**0**	0
Jun	538	**0**	0
Jul	573	**0**	0
Aug	557	**0**	0
Sep	498	**0**	0
Oct	526	**0**	0
Nov	444	**0**	0
Dec	517	**0**	0
Total	6,237	**2,037**	24
% of Total Tonnage		**3%**	

Republic Services, Inc.

Month	2024	2025	2024 to 2025
Jan	2,653	**2,501**	(152)
Feb	3,063	**2,499**	(565)
Mar	2,917	**2,584**	(334)
Apr	3,197	**2,695**	(502)
May	3,226	**0**	0
Jun	2,812	**0**	0
Jul	3,169	**0**	0
Aug	3,259	**0**	0
Sep	2,904	**0**	0
Oct	3,056	**0**	0
Nov	2,558	**0**	0
Dec	2,539	**0**	0
Total	35,353	**10,278**	(1,552)
% of Total Tonnage		**16%**	

Waste Management

Month	2024	2025	2024 to 2025
Jan	1,385	**1,401**	16
Feb	1,680	**1,546**	(134)
Mar	1,679	**1,604**	(75)
Apr	1,727	**1,690**	(37)
May	1,629	**0**	0
Jun	1,492	**0**	0
Jul	1,504	**0**	0
Aug	1,505	**0**	0
Sep	1,400	**0**	0
Oct	1,526	**0**	0
Nov	1,311	**0**	0
Dec	1,293	**0**	0
Total	18,132	**6,240**	(230)
% of Total Tonnage		**10%**	

Five Star Waste

Month	2024	2025	2024 to 2025
Jan	493	**932**	440
Feb	547	**1,155**	608
Mar	534	**1,463**	930
Apr	677	**1,566**	888
May	716	**0**	0
Jun	1,097	**0**	0
Jul	1,292	**0**	0
Aug	1,219	**0**	0
Sep	1,328	**0**	0
Oct	1,680	**0**	0
Nov	1,104	**0**	0
Dec	1,380	**0**	0
Total	12,067	**5,117**	2,866
% of Total Tonnage		**8%**	

Ward Waste

Month	2024	2025	2024 to 2025
Jan	0	**526**	526
Feb	0	**506**	506
Mar	0	**583**	583
Apr	0	**641**	641
May	0	**0**	0
Jun	0	**0**	0
Jul	0	**0**	0
Aug	0	**0**	0
Sep	0	**0**	0
Oct	0	**0**	0
Nov	287	**0**	0
Dec	605	**0**	0
Total	892	**2,257**	2,257
% of Total Tonnage		**4%**	

KCC ADC Material

Month	2024	2025	2024 to 2025
Jan	1,361	**3,503**	2,142
Feb	1,925	**3,012**	1,087
Mar	2,577	**4,440**	1,863
Apr	2,561	**3,643**	1,082
May	1,783	**0**	0
Jun	3,095	**0**	0
Jul	3,057	**0**	0
Aug	3,498	**0**	0
Sep	2,560	**0**	0
Oct	3,630	**0**	0
Nov	3,716	**0**	0
Dec	3,808	**0**	0
Total	33,571	**14,598**	6,174
% of Total Tonnage		**23%**	

All Other Tons

Month	2024	2025	2024 to 2025
Jan	4,036	**4,260**	224
Feb	6,039	**4,176**	(1,863)
Mar	5,530	**5,294**	(236)
Apr	6,005	**5,118**	(887)
May	6,146	**0**	0
Jun	5,730	**0**	0
Jul	6,363	**0**	0
Aug	6,301	**0**	0
Sep	5,664	**0**	0
Oct	6,773	**0**	0
Nov	4,850	**0**	0
Dec	5,939	**0**	0
Total	69,376	**18,848**	(2,762)
% of Total Tonnage		**30%**	

Materials Classification Report

Matlock Bend Landfill

Monthly Tonnage Summary April 2025

Material	Tonnage
MSW	
MSW	**10,153**
Special Waste	
Other	5,956
Ash	0
Sludge	903
Total Special Waste	**6,859**
Total MSW & SW	**17,012**
Tires	0
Total Material	**17,012**
% MSW	60%
% Special Waste	40%
% Sludge *	5%

2022 Sludge %		2023 Sludge %	
January	7%	January	6%
February	6%	February	9%
March	6%	March	7%
April	5%	April	7%
May	5%	May	4%
June	2%	June	6%
July	10%	July	4%
August	4%	August	6%
September	7%	September	6%
October	5%	October	5%
November	5%	November	8%
December	7%	December	7%

2024 Sludge %		2025 Sludge %	
January	4%	January	5%
February	7%	February	7%
March	8%	March	7%
April	7%	April	5%
May	5%	May	0%
June	6%	June	0%
July	4%	July	0%
August	6%	August	0%
September	5%	September	0%
October	5%	October	0%
November	6%	November	0%
December	6%	December	0%

* Sludge % is stand alone,
% Special Waste includes "Sludge"

2025 Loudon MSW and Special Waste Analysis

Material	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
MSW	7,862	8,286	9,661	10,153	0	0	0	0	0	0	0	0	**35,962**
Special Waste	6,635	5,926	7,916	6,859	0	0	0	0	0	0	0	0	**27,336**
Tires	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Total	14,497	14,212	17,577	17,012	0	0	0	0	0	0	0	0	**63,298**
%													
MSW	54%	58%	55%	60%	0%	0%	0%	0%	0%	0%	0%	0%	**57%**
Special Waste	46%	42%	45%	40%	0%	0%	0%	0%	0%	0%	0%	0%	**43%**
Total	100%	100%	100%	100%	0%	0%	0%	0%	0%	0%	0%	0%	**100%**

2024-2025 Matlock Bend Landfill Tire Report

Month	Tons (OB)	Each (IB)
Jul-24	35.45	2,222
Aug-24	16.56	2,162
Sep-24	35.50	2,085
Oct-24	50.75	2,340
Nov-24	31.37	1,399
Dec-24	23.08	1,017
Jan-25	19.46	1,311
Feb-25	29.19	1,578
Mar-25	26.62	2,179
Apr-25	60.80	2,091
May-25	0.00	0
Jun-25	0.00	0
Total	**328.78**	**18,384**

Loudon Landfill Comments Log April 2024

Calendar Day	Day of Week	Time of Day	Complainant Name	Complainant Number	Complaint	Resolution	Res Time
1	T			( ) -			
2	W						
3	TH						
4	F						
5	S						
6	SU						
7	M						
8	T						
9	W						
10	TH						
11	F						
12	S						
13	SU						
14	M	9:57AM	Brian Viars through TDEC		Mud on road	Swept the road	Immediately
15	T						
16	W						
17	TH						
18	F						
19	S						
20	SU						
21	M						
22	T						
23	W						
24	TH	12:49PM	Brian Viars through TDEC		Mud on road	Swept the road	Immediately
25	F						
26	S						
27	SU						
28	M						
29	T						
30	W						

May 2, 2025

Loudon County Solid Waste Disposal Commission
Attn: Chief Deputy Clerk
101 Mulberry Street Suite 203
Loudon, TN 37774

Dear Trustee:

Pursuant to Section 10.6 and 10.7 of the Sanitary Landfill Operation Agreement between Loudon and Santek as of July 1, 2007, Second Amendment Section 10.6 dated July 12, 2022, Santek agreed to pay the Commission a host fee and security fee as defined in the agreement. The following recap reflects the calculation for the period of April 2025:

Host Fees (Greater of below)

Total Tip Fees Billed	$500,630.06	Total Tonnage Received	17,012.00
Host Fee Percentage	5.5%	Rate per Ton	$1.00
	$27,534.65		$17,012.00
Minimum Fee	$10,750.00		
	==========		

Security Fees

Total Tip Fees Billed	$500,630.06
Security Fee Percentage	5%
	$25,031.50
	=========

Minutes Payment

Loudon County Minutes	$100.00
	=========
Total amount to be received	**$52,666.16**
	=========

Our checks in payment of the above fees have been remitted to the above address for the Commission. Should you have any questions or need additional information, please let me know.

Sincerely,

David L. Hollinshead
Manager Municipal Sales
Republic Services

LE03-AWIN MANAGEMENT INC
REPUBLIC SERVICES

No **20085172**
Check Date: 05/07/2025

LOUDON COUNTY SOLID WASTE DISPOSAL COMMISSION PO BOX 351 LOUDON, TN 37774-0351

Vendor Number: 10014896

INVOICE	DATE	DESCRIPTION	GROSS AMOUNT	DISCOUNT	NET AMOUNT
LC 043025	05/01/2025 URG RTD 5106		$52,666.15	$0.00	$52,666.15
Detach at perforation Before Depositing Check		**TOTALS:**	**$52,666.15**	**$0.00**	**$52,666.15**

THIS IS A WATERMARKED PAPER - DO NOT ACCEPT WITHOUT NOTING WATERMARK - HOLD TO LIGHT TO VERIFY WATERMARK

REPUBLIC SERVICES
LE03-AWIN MANAGEMENT INC
18500 NORTH ALLIED WAY
PHOENIX ARIZONA 85054

Bank of America
52-153/112 ME

Check Date
05/07/2025

Number
20085172

Amount

PAY FIFTY-TWO THOUSAND SIX HUNDRED SIXTY-SIX AND 15/100 DOLLARS*****

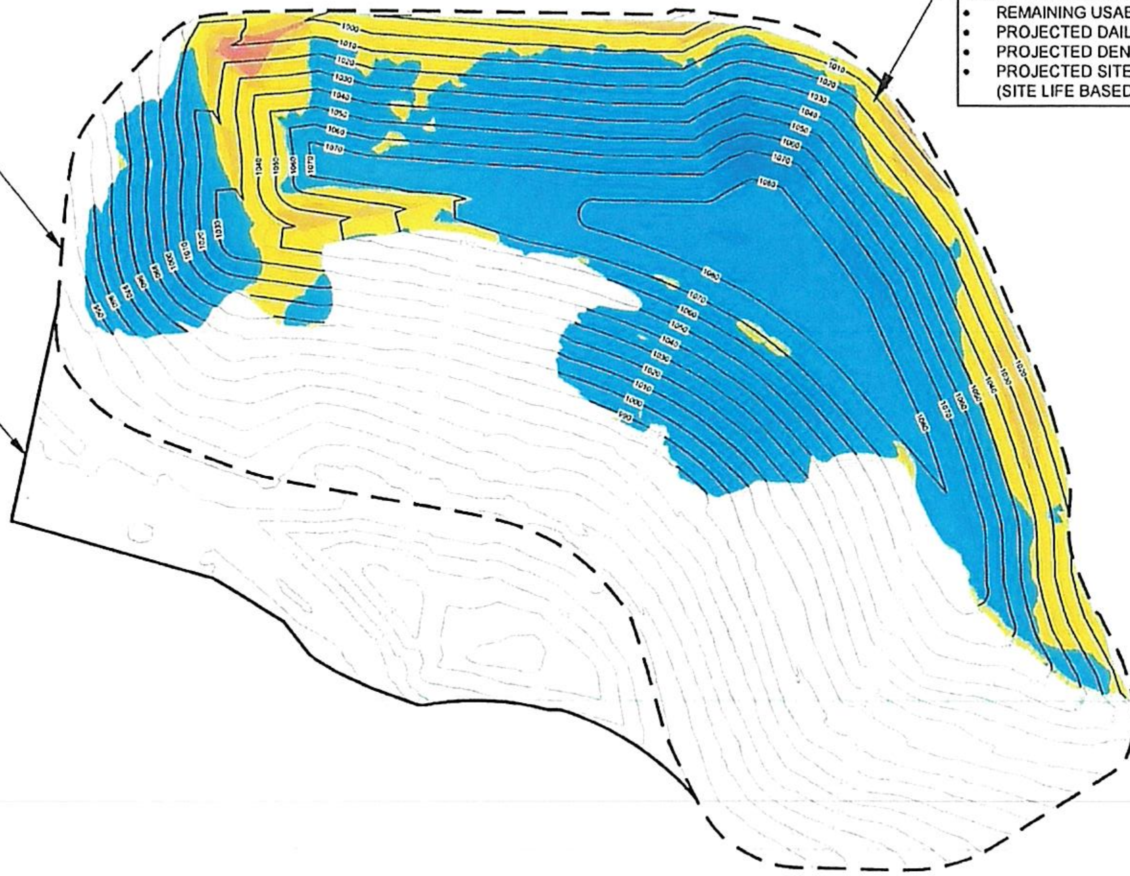
$***52,666.15

Void after 180 Days

PAY TO THE ORDER OF
LOUDON COUNTY SOLID WASTE
DISPOSAL COMMISSION
PO BOX 351
LOUDON, TN 37774-0351

Authorized Signature

⑈0020085172⑈ ⑆011201539⑆ 000080231000⑈



WASTE PLACEMENT AREA:

- REMAINING USABLE AIRSPACE: ±78,418 CY
- PROJECTED DAILY TONNAGE RECEIVED: 600 TONS/DAY
- PROJECTED DENSITY: 1,271 LBS/CY
- PROJECTED SITE LIFE REMAINING AS OF MARCH 10, 2025: ±3.5 MONTHS (SITE LIFE BASED ON 286 OPERATIONAL DAYS/YEAR)

NOTES:

1. PROJECTED DAILY TONNAGE AND PROJECTED DENSITY PROVIDED BY REPUBLIC SERVICES, INC.

2. THE STOCKPILE VOLUME ISOPACH WAS DEVELOPED FROM THE FOLLOWING SURFACES:

BOTTOM SURFACE
AERIAL TOPOGRAPHIC SURVEY BY FIRMATEK, LLC., DATED MARCH 10, 2025.

TOP SURFACE
OPERATIONAL CONSTRUCTED GRADING PLAN DEVELOPED BY HHNT AT THE DIRECTION AND APPROVAL OF REPUBLIC SERVICES, INC. CONTOURS REPRESENT TOP OF INTERMEDIATE COVER.

ELEVATIONS TABLE

NUMBER	MINIMUM ELEVATION	MAXIMUM ELEVATION	COLOR
1	-20.00	-15.00	
2	-15.00	-10.00	
3	-10.00	-5.00	
4	-5.00	0.00	
5	0.00	5.00	
6	5.00	10.00	
7	10.00	15.00	
8	15.00	20.00	

HHNT
ENVIRONMENTAL CONSULTANTS

CONSTRUCTED REMAINING CAPACITY
MATLOCK BEND LANDFILL
REPUBLIC SERVICES, INC.
LOUDON COUNTY, TENNESSEE

0 200 400
GRAPHIC SCALE IN FEET

DATE: 04-03-2025

Loudon County Department of Accounts and Budgets
Solid Waste Disposal Fund 207
Monthly Financial Report
April 2025

March 2025 Combined Ending Cash Balance per Monthly Report		6,378,925.41	
Adjustments:			
Trustee's Commission	(399.47)		
Total Adjustments		(399.47)	
Adjusted March 2025 Combined Ending Balance			**6,378,525.94**

Solid Waste Disposal Commission Operating Fund			
Operating Fund Ending Balance March 2025		**6,349,690.01**	
Cash Receipts:			
Trustee's Collections - Prior Year			
Surcharge - Host Fees	28,508.41		
Surcharge - Security Fees	25,825.83		
Investment Income - Proration based on % of balance	17,443.17		
Total Monthly Revenue		71,777.41	
Cash Disbursements:			
Board & Committee Members Fees	(400.00)		
Social Security			
Employer Medicare			
Audit Services			
Legal Services			
Legal Notices			
Engineering Services	(16,540.00)		
Materials			
Building & Content Insurance			
Trustee's Commission			
Total Cash Disbursements		(16,940.00)	
Expenditure Credit:			
Trustee Commission Adjustment		7.21	
Operating Fund Ending Balance April 2025			**6,404,534.63**
Poplar Springs Subfund			
Poplar Springs Subfund Balance March 2025		**28,835.93**	
Cash Receipts:			
Investment Income - Proration based on % of balance			
Total Monthly Revenue		0.00	
Cash Disbursements:			
Trustee's Commission	(7.21)		
Total Cash Disbursements		(7.21)	
Poplar Springs Subfund Balance April 2025			**28,828.72**
TOTAL COMBINED OPERATING AND POPLAR SPRINGS APRIL 2025 BALANCE			**6,433,363.35**

Combined Summary - April 2025	
Beginning Balance	**6,378,525.94**
Plus Operating Revenue	**71,777.41**
Less Operating and Poplar Springs Disbursements	**(16,940.00)**
TOTAL COMBINED BALANCE - APRIL 2025	**6,433,363.35**

NOTE: April report from Trustee was not available when this report was prepared.

STATE OF TENNESSEE
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF SOLID WASTE MANAGEMENT
DAVY CROCKETT TOWER, 7TH FLOOR
500 JAMES ROBERTSON PARKWAY
NASHVILLE, TN 37243

Initial Inspection

RESET

CHECK IF UNDER ENFORCEMENT ACTION ☐

CLASS I FACILITY INSPECTION CHECKLIST

DATE	TIME	WEATHER
5/7/2025	11:53	7oF Raining

	EFO
Loudon County Landfill SNL530000203 21712 Highway 72 North Loudon	KNOX

*SEE DISCLAIMER ON LAST PAGE

VIOLATION	REGULATION	OBSERVATION NVO	AOC	V1	V2
RECORDS AND REPORTS					
CERTIFIED PERSONNEL NOT PRESENT DURING OPERATING HOURS	0400-11-01-.04(2)(b)5.	■	NA	☐	☐
COMMENTS					
TRAINED PERSONNEL NOT PRESENT DURING OPERATING HOURS	0400-11-01-.04(2)(b)5. 0400-11-01-.04(2)(b)4.	■	NA	☐	☐
COMMENTS					
PERMITS, PLANS, OPERATING MANUAL NOT AVAILABLE	0400-11-01-.02(5)(a)(7).	■	NA	☐	☐
COMMENTS					
INADEQUATE RANDOM INSPECTION PROGRAM	0400-11-01-.04(2)(s)	■	☐	☐	☐
COMMENTS	Random inspection program provided via email, see below.				
NO OPERATING SCALES AND/OR FAILURE TO MAINTAIN WASTE RECORDS	T.C.A. 68-211-862(a)(b)(1)(2)	■	NA	☐	☐
COMMENTS					
OPERATION DOES NOT CORRESPOND WITH ENGINEERING PLANS	T.C.A. 68-211-104(3) T.C.A. 68-211-105(b)	■	☐	☐	☐
COMMENTS					
OPERATION DOES NOT CORRESPOND WITH PERMIT CONDITIONS	T.C.A. 68-211-104(3) 0400-11-01-.02(5)(a)1.	■	NA	☐	☐
COMMENTS					

*SEE DISCLAIMER ON LAST PAGE

VIOLATION	REGULATION	OBSERVATION NVO	AOC	V1	V2
GENERAL FACILITY STANDARDS					
ACCESS NOT LIMITED TO OPERATING HOURS	0400-11-01-.04(2)(a)4.	☒	☐	☐	☐
COMMENTS					
INADEQUATE INFORMATION SIGNS	0400-11-01-.04(2)(b)2	☒	☐	☐	☐
COMMENTS					
INADEQUATE ARTIFICIAL OR NATURAL BARRIER	0400-11-01-.04(2)(b)1.	☒	☐	☐	☐
COMMENTS					
INADEQUATE EMPLOYEE FACILITIES	0400-11-01-.04(2)(e)	☒	☐	☐	☐
COMMENTS					
UNSATISFACTORY ACCESS ROAD(S)/ PARKING AREA(S)	0400-11-01-.04(2)(b)3.	☒	☐	☐	☐
COMMENTS					
NO COMMUNICATION DEVICES	0400-11-01-.04(2)(f)	☒	☐	☐	☐
COMMENTS					
INADEQUATE FIRE PROTECTION	0400-11-01-.04(2)(c)2.	☒	☐	☐	☐
COMMENTS					
NO PERMANENT BENCHMARK	0400-11-01-.04(2)(o)	☒	☐	☐	☐
COMMENTS					
BUFFER ZONE STANDARD VIOLATED	0400-11-01-.04(3)(a)	☒	☐	☐	☐
COMMENTS					

VIOLATION	REGULATION	OBSERVATION NVO	AOC	V1	V2
OVERALL PERFORMANCE STANDARDS					
UNSATISFACTORY LITTER CONTROL	0400-11-01-.04(2)(d)	X			
COMMENTS					
INADEQUATE DUST CONTROL	0400-11-01-.04(2)(j)	X			
COMMENTS					
INADEQUATE VECTOR CONTROL	0400-11-01-.04(2)(a)1.	X			
COMMENTS					
POTENTIAL FOR EXPLOSIONS OR UNCONTROLLED FIRES	0400-11-01-.04(2)(a)2. 0400-11-01-.04(5)(a)	X			
COMMENTS					
UNAPPROVED SALVAGING OF WASTE	0400-11-01-.04(2)(b)6.	X			
COMMENTS					
LEACHATE MANAGEMENT					
LEACHATE OBSERVED AT THE SITE	0400-11-01-.04(2)(a)(3).				
*LEACHATE ON EXTERNAL SLOPE			X		
*LEACHATE ENTERING RUN-OFF			X		
*LEACHATE ENTERING A WATER COURSE		X	NA	NA	
COMMENTS	Ponds three and two have been tested and proven to be impacted, see April 02,2025 inspection record. Pond 2 was being aerated at time of inspection to return to compliance, while Pond 3 is being disposed off in leachate collection system. Minor leachate issue found on eastern slope near sump, the area was isolated and soft spot repaired same day (see pictures).				
INADEQUATE MAINTENANCE OF LEACHATE MANAGEMENT SYSTEM (Inspector check and record (i) Sump Levels (ii) Interception surfaces and piping (iii) Tanks. “Sumps: <12” NVO, 12”<36” V1, >36” V2”)	0400-11-01-.04(2)(a)(3). 0400-11-01-.04(4)(a)7.	X			
COMMENTS	10.6"				
Leachate Improperly Managed	0400-11-01-.04(4)(a)8.(i-iii)			X	
COMMENTS	On April 29, 2025 damage to leachate storage tank was reported and a small amount of leachate was found to have escaped containment. Leak to tanks secondary containment was. The leak causing containment failure was repaired, and the liquids from secondary secondary containment were removed by truck. Damage evaluation and plan to return to compliance should turned in ASAP to remove violation.				

*SEE DISCLAIMER ON LAST PAGE

VIOLATION	REGULATION	OBSERVATION NVO	AOC	V1	V2
LEACHATE MANAGEMENT					
INADEQUATE LEACHATE COLLECTION SYSTEM	0400-11-01-.04(4)(a)7.	■	☐	☐	☐
COMMENTS					
EROSION CONTROL					
INADEQUATE EROSION CONTROL	0400-11-01-.04(2)(i)6. & 0400-11-01-.04(8)(c)4(ii)	■	☐	☐	☐
COMMENTS					
INADEQUATE MAINTENANCE OF RUN-ON/RUN-OFF SYSTEM(S)	0400-11-01-.04(2)(i)1-5 0400-11-01-.04(8)(c)4(i)	■	☐	☐	☐
COMMENTS					
EXPOSED SOLID WASTE	0400-11-01-.04(2)(a)(3).	☐	☐	☐	☐
COMMENTS					
GAS AND GROUNDWATER MIGRATION					
INADEQUATE GAS MIGRATION CONTROL SYSTEM	0400-11-01-.04(5)(a)	■	☐	☐	☐
COMMENTS					
INADEQUATE MAINTENANCE OF GAS MIGRATION CONTROL SYSTEM	0400-11-01-.04(5)(a)	■	☐	☐	☐
COMMENTS					
GROUNDWATER MONITORING SYSTEM IMPROPERLY MAINTAINED	0400-11-01-.02(5)(a)4.	■	☐	☐	☐
COMMENTS					
COVER REQUIREMENTS					
UNAVAILABILITY OF COVER MATERIAL	0400-11-01-.04(2)(h)	■	☐	☐	☐
COMMENTS					
UNSATISFACTORY INITIAL COVER	0400-11-01-.04(6)(a)3. 0400-11-01-.04(6)(a)5.	■	☐	☐	☐
COMMENTS					

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VIOLATION	REGULATION	OBSERVATION NVO	AOC	V1	V2
COVER REQUIREMENTS					
UNSATISFACTORY INTERMEDIATE COVER	0400-11-01-.04(6)(a)4. 0400-11-01-.04(6)(a)5.	☒	☐	☐	☐
COMMENTS					
UNSATISFACTORY FINAL COVER	0400-11-01-.04(6)(a)6. 0400-11-01-.04(8(c)3(i)	☒	☐	☐	☐
COMMENTS					
UNSATISFACTORY STABILIZATION OF COVER	0400-11-01-.04(6)(a)5	☒	☐	☐	☐
COMMENTS					
OPERATIONS AND WASTE HANDLING					
INADEQUATE OPERATING EQUIPMENT	0400-11-01-.04(2)(g)	☒	☐	☐	☐
COMMENTS					
UNAVAILABILITY OF BACKUP EQUIPMENT	0400-11-01-.04(2)(g)	☒	☐	☐	☐
COMMENTS					
WASTE NOT CONFINED TO A MANAGEABLE AREA	0400-11-01-.04(6)(a)1.	☒	☐	☐	☐
COMMENTS					
IMPROPER SPREADING OF WASTE	0400-11-01-.04(6)(a)2.	☒	☐	☐	☐
COMMENTS					
IMPROPER COMPACTING OF WASTE	0400-11-01-.04(6)(a)2.	☒	☐	☐	☐
COMMENTS					

*SEE DISCLAIMER ON LAST PAGE

VIOLATION	REGULATION	OBSERVATION NVO	AOC	V1	V2
OPERATIONS AND WASTE HANDLING					
MISHANDLING OF SPECIAL WASTE	0400-11-01-.01(4)(d)1.	■	NA	☐	☐
COMMENTS					
EVIDENCE OF OPEN BURNING	0400-11-01-.04(2)(c)1.	■	NA	☐	☐
COMMENTS					
DUMPING OF WASTE INTO WATER	0400-11-01-.04 (2)(a)3.	■	☐	☐	☐
COMMENTS					
WASTE RESTRICTIONS					
UNAUTHORIZED WASTE ACCEPTED	0400-11-01-.04(2)(k)1.	■	NA	☐	☐
COMMENTS					
UNAPPROVED SPECIAL WASTE ACCEPTED	0400-11-01-.01(4)(b) 0400-11-01-.01(4)(c)5	■	NA	☐	☐
COMMENTS					
DEAD ANIMALS IMPROPERLY HANDLED	0400-11-01-.04(2)(k)5.(ii) (I-III)	■	NA	☐	☐
COMMENTS					
TIRES IMPROPERLY HANDLED	0400-11-01-.04(2)(k)3.	■	☐	☐	☐
COMMENTS					
MEDICAL WASTE IMPROPERLY HANDLED	0400-11-01-.04(2)(k)4.	■	☐	☐	☐
COMMENTS					

LEACHATE LEVELS

**Disclaimer:*
The information contained in the checklists is not intended to be all inclusive and is subject to change, and are intended solely for use by Division of Solid Waste Management. These checklists are not a substitute for evaluation of compliance in accordance with applicable laws and regulations, and are not intended for, nor can they be relied upon, to create any rights, substantive or procedural, enforceable or usable by any party in litigation with the State of Tennessee or its employees.

SAVE FORM

Follow-Up Inspection Date

Inspector Name ____

ADDITIONAL COMMENTS

The field office was contacted on 4/29/25 about damage to the leachate storage tank on-site. the breach for secondary containment of repaired and liquids drained from outer tank, a grab sample was taken of soil near tank, results should be submitted when available.

The return of the tank to full functionality and a timeline for this requirement is requested in writing by May 13, 20025.

Continued work to return ponds 2 and 3 will be required until features return to levels below discharge permit requirements. the request to put ponds back into working function and discharge are required to be submitted to TDEC DSWM in writing.

Inspection photo-log:

Random inspection and Special waste documentation:

Photos submitted 5/8/2025 showing repairs done to eastern slope for leachate mitigation: