BID DOCUMENTS

For

DICKINSON COUNTY LANDFILL

2575 190th St,

Spirit Lake, IA 51360

PHASE D1 COMPOSITE LINER

FEBURARY 2026

WASTE MANAGEMENT

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SUMMARY OF WORK

PART 1 - GENERAL

1.1 Section Includes

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1.2 PROJECT DESCRIPTION

A. Construction of the Phase D1 Liner, an approximately 4 acre composite liner system including but not necessarily limited to; subbase preparation, underdrain construction, clay hauling from borrow site, clay placement and compaction, geomembrane preparation, drainage layer stone and piping installation, side slope riser vault and piping, leachate and LFG piping, and site erosion/run-on control and restoration.

B. Repair and replacement of stormwater conveyance management features

1.3 Work Covered by Contract Documents

A. Base Bid: Work of this Contract under the Base Bid includes, but is not necessarily limited to, the following major elements:

1. Bid Item 101: Mobilization and General Conditions

Mobilization of all labor, equipment and materials necessary for the CONTRACTOR to perform the work in accordance with the Specifications and Construction Drawings, preparing a suitable staging pad for geosynthetics material, unloading all Owner provided material delivered to site for installation by others, all incidental work such as submittals, quality control, temporary construction facilities, protection of materials, etc. necessary to complete the project.

Additionally, Bid Item 101 shall include supervision and management expenses such as:

a. The salaries of Project Manager, Engineer, Superintendent, QA/QC Specialist, etc.

b. Management travel, etc.

c. Ongoing project related expenses such as:

d. Transportation or delivery of all parts, material, and equipment necessary for the work to and/or from the site.

e. Dust control.

f. Master mechanic services.

g. CONTRACTOR's facilities, office trailers, and their related expenses.

h. Vehicles and related maintenance including supplies such as fuel.

i. Sanitary facilities and related maintenance.

j. CONTRACTOR provided utilities.

k. Unloading and proper storage of Owner provided materials including Geosynthetics.

l. Construction of a suitable Geosynthetics Roll Staging area.

m. Preparation and submission of submittals, shop drawings, Operations and Maintenance Manual, etc.

n. Landfill gas control measures during construction, if necessary.

o. Protection of existing facilities to remain and protection of completed work including but not limited to the protection of work from stormwater, debris and sediment run-on.

p. All other related costs to complete the Project not specifically referenced in the bid tabulation.

q. Executing any and all the requirements of utility companies and regulatory agencies as pertaining to the Work.

r. Carrying out the work in compliance with the requirements set forth in the General Conditions, Supplementary Conditions, and Division 1 General Requirements.

2. Bid Item 201: Site Preparation, Erosion Control & Surface Water Drainage Features

Installation and maintenance of all necessary erosion control structures, installation and maintenance of temporary storm water control systems, construction and maintenance of haul roads to and from areas under construction including watering for dust control and means and methods to prevent track-out to and from areas under construction, clearing & grubbing, and maintenance and grading of borrow areas and stockpiles. Site grading including but not limited to construction of ditches or cleaning of permanent ditches and sedimentation basins that become silted in due to construction activities, roadway subgrades, stormwater sump and any disturbed areas caused by construction activities to drain. Also included in this bid item is dredging of sedimentation basin SWNE04. This includes dredging of sediment from construction activities as well as sediment that exists prior to construction. CONTRACTOR is responsible for managing stormwater run-on from the adjacent landfill slopes. This may include installation of diversion berms or other erosion control measures. All materials that wash onto the project area shall be cleaned at the CONTRACTOR's expense, this includes removal of drainage layer aggregate if it should be negatively impacted by siltation or other debris from stormwater run-on.

3. Bid Item 202: Dewatering

All labor, materials, and equipment to dewater construction area including but not necessarily limited to construction of temporary sump, installation of piping to divert water to the existing stormwater pond south of the and

4. Bid Item 203: Subbase Preparation/Excavation

All labor, materials, and equipment to excavate overburden to subbase grades shown on the Drawings and grade tables, work also includes final subbase grading. Work also includes stockpiling of excess soil for use in Structural Fill (Bid Item 302) and Clay Liner (Bid Item 303).

5. Bid Item 204: Subbase Preparation/Fill

All labor, materials, and equipment to construct temporary delineation berm and fill areas of Phase D1 construction as shown on the construction drawings.

6. Bid Item 205: Unsuitable Soil/Subbase Undercuts & Backfill

Removal of soft or unstable soils from within the limits of waste, below subbase grades, and backfilling these areas with compacted general fill in accordance with project specifications.

7. Bid Item 301: Underdrain System

All labor, materials and equipment to install underdrain collection trench including but not necessarily limited to over excavation of subbase grades along the length of the collection trench and trenching/installing eight-inch perforated SDR 11 gradient control collection and Twelve-inch SDR-11 Side Slope Underdrain Riser Access Pipe, Procuring and installing coarse aggregate pipe bedding and 8oz/sy geotextile wrap. This bid item includes coordination with the geosynthtics installer during installation of geocomposite component of the underdrain system.

8. Bid Item 302: Controlled Fill

Filling and compacting areas requiring controlled fill to achieve bottom of clay liner elevations within the limits of the proposed Phase D1 Liner footprint using general fill from the Phase D1 subbase excavation in accordance with the Specifications. Backfill and compaction of unstable soils / subbase undercuts (as defined in Bid Item 205) are not included in this bid item. Material for controlled fill will be from excess material excavated under Subbase Preparation/Excavation (Bid Item 203) and onsite soil borrow area.

9. Bid Item 303: Clay Liner

All labor, materials and equipment, required to construct the 24-inch thick Clay soil liner to design lines and grades, and tie-in the clay liner to the existing clay soil liners of adjacent landfill phases in accordance with the construction drawings and project specifications. Includes excavation, hauling, placement, compaction and conditioning in accordance with project specifications and CQA Plan. Includes fine grading of upper surface of clay liner to meet required thickness and grades shown in the Drawings and grade tables. All tie-ins to adjacent cells, tapered runout for future cells, and other segments of clay less than 2-ft thickness are considered incidental to this bid item. Material for clay liner will be from excess material excavated under Subbase Preparation/Excavation (Bid Item 203) and onsite soil borrow area.

10. Bid Item 304: Liner Tie-in Preparation

Removal of overburden materials and geomembrane cleaning at existing tie-in locations. Overburden at the tie-in locations may consist of:

a. Clean cover soils which may be hauled to the active area for daily cover or stockpiled at an on-site location designated by owner;

b. Waste materials which must be hauled to the active area for disposal. Waste encountered during liner tie-in preparation is considered incidental to this bid item. No additional allowance shall be provided for waste encountered during liner tie-in preparation.

CONTRACTOR must expose, clean, and maintain a minimum 3-feet wide section of geomembrane the full length of the tie-in for the geosynthetics installer to complete the tie-in weld. CONTRACTOR is also responsible for removing the existing anchor trench, and backfilling the excavated anchor trench with compacted clay soils in accordance with project specifications and the CQA Plan. Excessive damage to the existing geosynthetics runout by the CONTRACTOR (while exposing the geomembrane or while cleaning the geomembrane) will be repaired by the geosynthetics contractor at the

expense of the CONTRACTOR. Metal shovels and other metal or sharp objects shall not be used to clean the geomembrane.

11. Bid Item 305: Geomembrane Surface Preparation and Maintenance

    Final preparation, maintenance, preservation, and preventing desiccation of upper surface of clay soil liner as defined in the Project Manual and CQA Plan until Geosynthetic Contractor has completed installation of geomembrane liner. Also includes final rolling and removal of rocks or other deleterious debris greater than 1 inches in diameter and to the satisfaction of the Owner(s) Representative and acceptance of geomembrane contractor. CONTRACTOR is responsible for providing two portable toilets for the geosynthetics contractor. CONTRACTOR is also responsible for unloading and properly staging the geosynthetics materials upon delivery, in accordance with the project specifications and CQA Plan. CONTRACTOR shall provide sufficient equipment and manpower in the event that geosynthetics contractor works on Saturdays, Sundays, or holidays. CONTRACTOR is responsible for any and all standby time or other fees incurred by owner due to lack of equipment or manpower provided by CONTRACTOR during geosynthetics installation period.

12. Bid Item 306: Rain Flap

    Procurement and installation of additional leachate drainage layer aggregate for the temporary stone delineation berm on the western and northern limit of the cell to the extents and dimensions shown in the construction drawings. The total height of the temporary berm is variable as shown on the construction drawings, the lower 1’ is included in the square foot measurement for the leachate drainage layer (Bid Item 308). Installation of the geosynthetic rain flap over the temporary delineation berm will be completed by the geosynthetics installation contractor.

13. Bid Item 307: Anchor Trench & Clay Wedge

    The excavation of the geomembrane anchor trench. Work also includes the backfilling of the geomembrane anchor trench after geomembrane and geotextile installation have been completed, compaction to project specifications, and providing and installation of the clay wedge berm above the anchor trench as shown on the Drawings. CONTRACTOR is responsible for preparation of sufficient anchor trench so as to not impede the progress of the geosynthetics contractor.

14. Bid Item 308: Leachate Drainage Layer

    Procurement and installation of granular drainage blanket aggregate to the minimum 12-inch-thick leachate drainage layer grades and extents shown on the Drawings. Placement of drainage layer materials must be in accordance with the requirements of the CQA Plan. Drainage layer materials shall not be unloaded at the top and pushed down slope, all sideslope placement shall be from the bottom and pushed upward. Machinery used for hauling and spreading leachate drainage layer materials shall travel on no less than the material thicknesses specified in the CQA Plan. Low ground pressure equipment shall be used to the greatest extent possible to avoid damage to the geomembrane.

15. Bid Item 309: Leachate Collection Piping Installation

Procurement and installation of perforated and solid leachate collection piping and fittings, placing the pipe to the lines and grades shown on the Drawings, bedding the pipe according to the Drawing details and Project Manual, making connections to the existing leachate collection system and providing leachate line jetting and video documentation after construction is complete.

16. Bid Item 310: Leachate Collection Sump

    Procurement and installation of of course and graded filter aggregate and HDPE flatstock in accordance with the Drawings and Project Manual.

17. Bid Item 311: Leachate Head Monitoring Pipe

    Procurement and installation of the leachate head monitoring piping to the location and grades shown on the Construction Drawings. The perimeter ditch crossing for future headwell access is considered incidental to this bid item.

18. Bid Item 312: Leachate Sideslope Riser

    Procurement and installation of the 18-inch leachate sideslope riser pipe and fittings to the lines and grades shown on the Drawings, bedding the headwell piping to the location and grades shown on the Construction Drawings.

19. Bid Item 313: Landfill Gas Belly Collector Piping

    Procurement and installation of perforated and solid Landfill Gas Belly Collector piping and fittings including required aggregate and geotextile, placing the pipe to the lines and grades shown on the Drawings, and bedding the pipe according to the Drawing details and Project Manual.

20. Bid Item 314: Landfill Gas Rock Pads

    Procurement and installation of stone drainage columns (mounds) in the locations and dimensions identified in the construction drawings. The stone drainage columns are to be constructed from materials meeting the leachate drainage layer aggregate specifications.

21. Bid Item 315: Landfill Gas Horizontal Collector

    Procurement and installation of perforated and solid Landfill Gas Belly Collector piping and fittings including required aggregate and geotextile, placing the pipe to the lines and grades shown on the Drawings, and bedding the pipe according to the Drawing details and Project Manual.

22. Bid Item 316: Perimeter Vaults

    Procurement and installation of the perimeter riser vault, pump discharge pipe, and dual contained forcemain stub-outs per the Drawings. Also included is the installation of the plumbing and appurtenances within the vaults other than those shown as “By Others.”

23. Bid Item 317: Geomembrane Leak Location / Electrical Resistivity Preparation

Maintaining sufficient moisture in the granular drainage layer and geotextile over the geomembrane for the electrical resistivity leak test of the geomembrane liner. Include all equipment and manpower required to support the CQA Consultant performing the electrical resistivity test until complete. Maintain a minimum of two-foot (2') width of exposed geomembrane/geotextile (no drainage stone) around the perimeter of Phase D1 during resistivity testing to electrically isolate geomembrane test area. CONTRACTOR should account for up to three geomembrane repairs per acre to be discovered during the leak location survey. CONTRACTOR is responsible for exposing each defect that is discovered, and cleaning a minimum 4-feet diameter area for the geosynthetics contractor to complete the repair. If the defect is greater than 6-inches in any direction, the CONTRACTOR shall expose a minimum of 2-feet in all directions around the perimeter of the defect for the geosynthetics contractor to complete the repair. CONTRACTOR is responsible for replacing the drainage layer materials to the minimum 12-inch thickness, grades, and extents as shown in the construction drawings and per project specifications and CQA Plan requirements upon completion of the geosynthetics repairs.

24. Bid Item 401: 4"x8" D/C Forcemain Piping

    Procurement and installation of all 4"x8" Dual contained leachate forcemain piping connection to the existing piping, connection to the riser vault, and air pressure testing of the forcemain per the Drawings and Project Manual.

25. Bid Item 402: Perimeter Road

    Preperation and grading of the subbase and construction of the perimeter berm access road and ditches as shown on the Drawings. All aggregate, Geotextile, and culvert materials required under this item shall be procured and installed by the CONTRACTOR.

26. Bid Item 403: Access Road & Tipping Pad

    Preperation and grading of the subbase, and construction of the access road and truck tipping pad, and associated culverts as shown on the Drawings. All aggregate, Geotextile, and other materials required under this item shall be procured and installed by the CONTRACTOR.

27. Bid Item 404: Site Restoration

    Final grading of stockpile/borrow areas, loading, hauling and placement of topsoil from on-site stockpile to areas disturbed during construction requiring permanent and/or temporary vegetation, seeding, mulching, fertilizing and establishing permanent vegetation as specified in the construction drawings and per project specifications. Installation of erosion control matting in the locations identified in the construction drawings and per project specifications.

28. Bid Item 501: 24" Flume Pipe

    Furnish and install 24" downslope flumes in the locations, dimensions, and slopes as shown in the construction drawings and in accordance with the project specifications and CQA Plan. All fittings, connections and other associated appurtenances required for the completion of the downslope flumes as drawn on the construction drawings are

considered incidental to this bid item. Removal of the existing flume pipe is considered incidental to this bid item.

29. Bid Item 502: 24" Flume Inlet

    Furnish and install flume inlets at the locations shown on the construction plans. This bid item also includes the installation of the anti-seep collar. The geosynthetics contractor will fabricate the anti-seep collars, but the CONTRACTOR is responsible for working with them to ensure that the collars are compatible with the inlets. The anti-seep collar, as shown in the construction drawings, consists of geomembrane (provided by owner) and geotextile (provided by CONTRACTOR). This bid item shall also include furnishing and installing the rip rap pad.

30. Bid Item 503: Energy Dissipator

    Furnish and install the energy dissipator in the location shown on the construction drawings and in accordance with the construction details and project specifications. Rip-rap apron, connection to downslope flume, and all other associated appurtenances are considered incidental to this bid item.

31. Bid Item 504: Stormwater Berm

    Haul and place general fill soil for construction of diversion berms. Stormwater berms must be constructed from on-site general fill/clayey soil, only the top six inches may be constructed from topsoil. CONTRACTOR to shape the stormwater berms in accordance with the construction drawings. The entire stormwater berm shall be covered with a biodegradable erosion mat upon completion. CONTRACTOR must communicate with third party CQA and owner prior to construction of diversion berms. Alignment of berms may require adjustment to achieve necessary drainage slope and to avoid GCCS components.

32. Bid Item 505: Emergency Spillway

    Furnish and install materials necessary to construct emergency spillway at the location and grades shown on the construction drawings.

33. Bid Item 506: 24" Culvert

    Furnish and install 24” culvert and backfill in the location identified in the construction drawings.

34. Bid Item 507: 18" Culvert

    Furnish and install 18” culvert and backfill in the location identified in the construction drawings.

35. Bid Item 508: Regrade/restore drainage swells

    CONTRACTOR shall grade existing drainage swells to drain to 24” flume inlets. CONTRACTOR to shape the existing swells in accordance with the construction drawings. The entire swell shall be covered with a biodegradable erosion mat upon completion.

B. Bid Alternates: There are Alternate bid items on the Bid Form. OWNER reserves the right to select none, or any combination of the Alternates.

1. Alternate Bid Item A-1: Waive Performance Bond will be a lump sum deduct in cost from Bid Item 1 in contract A and B if the Owner chooses to waive the requirement of the CONTRACTOR to provide a Performance Bond as required by the General Conditions.

2. Alternate Bid Item A-2: Waive Payment Bond will be a lump sum deduct in cost from Bid Item 1 in Contract A and B if the Owner chooses to waive the requirement of the CONTRACTOR to provide a Payment Bond as required by the General Conditions.

3. Alternate Bid Item A-3: Shall be an alternate price per square foot (sf) for use of the alternate leachate drainage stone in leu of drainage sand as described under Bid Item 308. The alternate drainage layer material shall meet the requirements in the technical specifcatons. If Owner chooses this alternate it will be in in lieu of Base Bid Item 308.

1.4 Related Work Performed by Owner or Under Separate Contract

A. OWNER will furnish the following materials for installation by CONTRACTOR. CONTRACTOR will assist OWNER in obtaining OWNER-furnished products to ensure that delivery dates of OWNER-furnished materials do not delay the CONTRACTORs construction schedule.

1. Water, as available on site. CONTRACTOR responsible for locating off-site source if needed.
2. On-site soils from the Phase D1 area.
3. On-site soils from OWNER designated area.
4. Top Soil materials located in various stockpiles on site including existing compost area.

B. OWNER will provide and install the following items under separate contract:

1. Geosynthetic components of the landfill Phase D1 Liner system. The geosynthetic installation will be performed in a maximum of two (2) mobilizations over a total of Twenty (20) geosynthetic working days. A geosynthetic working day is defined as 10 hours of daylight, without precipitation and the temperature for the 10 hours is above 40 degrees Fahrenheit. The CONTRACTOR must allow for a maximum of Two (2) mobilizations and Twenty (20) geosynthetic working days within the Contract Time. Costs of additional mobilizations resulting from lack of coordination on part of CONTRACTOR will be the CONTRACTOR’s responsibility.
2. CQA documentation and pay quantity surveys. (All construction staking and lay-out survey is the responsibility of the CONTRACTOR)
3. Other materials or items denoted in the Drawings “By Others”.

1.5 Commencement of the Work

A. The CONTRACTOR shall not commence the Work nor allow any subcontractor or sub-subcontractor to commence the Work until:

1. The Contract has been fully executed or a Notice to Proceed has been issued.

2. The OWNER has approved the CONTRACTOR's performance and payment bonds, if required.
3. The OWNER has approved evidence of the CONTRACTOR's liability insurance and any other insurance required to be purchased by the CONTRACTOR.
4. The CONTRACTOR has obtained any necessary construction permits.

1.6 Project Schedule and Hours of Work

A. Construction start and end dates are detailed in the Agreement.

B. The operation of heavy equipment and machinery shall be limited. If extended hours are necessary it should be discussed with the site operator should work start or continue outside of the normal working hours for the landfill operations. Operational hours are listed in the Supplementary Conditions.

C. Prior to starting Work submit project schedule. Revise and resubmit to reflect actual progress relative to the proposed schedule every two weeks.

D. Project schedule shall be a comprehensive horizontal bar chart with separate bar for each major trade, subcontractor, or operation, identifying first Work day of each week. Show projected production rates and number of operating equipment on-site. Arrange schedule to indicate required sequencing of activities and to show allowances for submittals, inspections, and similar time margins.

E. Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Show projected percentage of completion of each item of Work at each Application for Progress Payment.

F. Show submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by OWNER.

1.7 Work Sequence

A. Work under the Contract shall be completed under the general sequence shown below for Contract A - Phase D1 Final Cover:

1. Install erosion control and storm water management control devices prior to beginning major construction.
2. Dewater Phase D1 footprint and excavate to subbase grades.
3. Prepare subbase surface for clay placement and install underdrain system components.
4. Place and compact soils on the east perimeter berm if required by OWNER.
5. Place and compact clay liner material.
6. Prepare clay surface for geomembrane placement.
7. Install leachate drainage layer stone, piping and leachate headwells.
8. Install leachate side slope riser pipes and vaults.
9. Extend electrical service, install leachate pumps and panels.
10. Complete access road and install ramp into new cell.

11. Complete site restoration.

1.8 Communications during Construction

A. Inquiries, information and coordination relating to scheduling of work, use of site, interruption of utility services, and similar matters shall be directed to the OWNER.

B. Inquiries regarding interpretation of the Contract Documents and authorization of additional work shall be directed to the OWNER.

1.9 CONTRACTOR Use of Premises

A. The site will be occupied throughout the duration of the Work. Means and methods shall reflect this. Landfill traffic has right of way.

B. Coordinate execution of Work of this Contract with OWNER and other contractors performing work at site under separate contracts. Cooperate with OWNER to minimize conflict and to facilitate OWNER's operations. CONTRACTOR shall notify and receive permission to complete Work that may interrupt Landfill Operations 24 hours prior to performing such Work. CONTRACTOR shall make every attempt to schedule this Work to minimize impact to Landfill Operations.

C. Access to the site is from 190th Street.

D. Use of on-site haul roads shall be as approved by Owner. Existing site perimeter and internal access roads, if used by CONTRACTOR, shall be maintained by CONTRACTOR and restored to pre-existing conditions upon completion of use.

E. Conduct operations so as to permit Owner and public access to areas of the site and existing building areas outside the construction limits. Walks, drives, entrances, exits, and corridors to be used by the Owner and public shall be maintained in a safe condition and shall be kept free and clear of CONTRACTOR's equipment, materials, and debris.

F. Signs, bills, posters and other advertisements for any goods, services, or organizations will not be allowed on or about the site.

G. Site Security: Owner may institute a sign-in/sign-out procedure for CONTRACTOR personnel. The access gate to the site is generally locked. Coordinate with Owner for placement of own padlock on gate to allow entry to site.

1.10 Site Health and Safety

A. A site specific Health and Safety Plan shall be developed and implemented by CONTRACTOR. The CONTRACTOR shall be and remain liable for compliance with the CONTRACTOR's Health and Safety Plan by its employees, agents, and subcontractors, and shall hold ENGINEER and OWNER harmless from claims, damages, suits, expenses, and losses in any way arising from non-compliance with the CONTRACTOR's Health and Safety Plan prepared for this project site

B. The OWNER will make available to CONTRACTOR documents and information available that relate to the identity, location, quantity, nature, or characteristics of hazardous substances near the work site. The OWNER, however, assumes no responsibility or liability for the

accuracy or completeness of such documents or information, and such documents and information shall remain the property of the OWNER.

1.11 Quality Assurance / Coordination

A. CONTRACTOR is solely responsible for conformance of the Work with the Contract Documents. Review and testing by the ENGINEER or OWNER's Testing Laboratories in no way relieves the CONTRACTOR of sole responsibility for the Work and maintaining a quality assurance program.

B. Use adequate numbers of skilled workmen who are thoroughly trained, qualified and experienced in the necessary crafts and who are completely familiar with the specified requirements and methods needed for proper performance of the Work.

C. Provide necessary supervision, planning, scheduling, coordination, and control to perform the Work and meet the requirements of the Contract Documents.

D. Coordinate and integrate elements of Work of the various Specifications Sections to ensure efficient and orderly sequence of installation with provisions for accommodating items installed later.

E. Verify that characteristics of elements of interrelated operating equipment are compatible; coordinate Work of various Specification Sections having interdependent responsibilities for installing, connecting to, and placing in service such equipment.

F. Key members of the CONTRACTOR's staff shall not be changed without the consent of the OWNER, unless such members cease to be employed by the CONTRACTOR in a similar capacity. Prior to commencement of the Work, select a Project Manager who shall have full responsibility for the prosecution of the Work, with full authority to act in matters as necessary for the proper coordination, direction, and administration of the Work.

1.12 Warranties

A. Provide written warranties as required by respective sections of the Contract Documents.

B. Warranties shall be submitted to the OWNER and approved prior to final payment.

C. Warranties shall be in writing and shall be signed by an authorized agent for the CONTRACTOR and the Manufacturer where required.

D. Warranty periods shall start from the Substantial Completion Date of the Work as certified by the ENGINEER. In multi-year projects, warranty periods shall start from the Substantial Completion Date of each phase of the Work, as certified by the ENGINEER.

E. Within the specified warranty period, if repairs are required in connection with warranted Work as a result of materials, equipment, or workmanship, which are inferior, defective, or not in accordance with the terms of the Contract, the CONTRACTOR shall promptly upon receipt of notice from the OWNER, perform the following:

1. Place in satisfactory condition warranted Work, and thus correct defects therein.

2. Place in satisfactory condition other elements of the building or site which are damaged or disturbed in performance of warranty Work.

1.13 Defect Assessment

A. Replace the Work, or portions of the Work, not conforming to specified requirements.

B. If in the opinion of the OWNER or ENGINEER the defective Work is repairable, and it is not practical to remove and replace the Work, the OWNER or ENGINEER will elect one of the following remedies:

   1. The defective Work may remain, but the unit sum/price shall be adjusted.

   2. The defective Work shall be repaired as instructed by the ENGINEER and the unit sum/price shall be adjusted to a new sum/price at the discretion of the ENGINEER.

C. The individual specification sections may modify these options or may identify a specific formula or percentage sum/price adjustment.

1.14 Project Meetings

A. Preconstruction Conference: After contract award, a preconstruction conference will be held at the site. CONTRACTOR's Project Manager, Site Superintendent, and representatives of major subcontractors shall attend. CONTRACTOR shall provide a project schedule and other items requested by OWNER at the preconstruction conference.

B. Project Meetings: Attend project meetings as requested by the ENGINEER and OWNER. Meetings will be held weekly or on an as-needed basis for coordinating, expediting, and scheduling of Work. The CONTRACTOR's Project Manager and Site Superintendent shall attend. Representatives of subcontractors shall attend if requested by the ENGINEER.

1.15 Submittals

A. Make submittals of project schedules, survey and layout data, product data, shop drawings, samples, color charts, quality control test results, photographs, warranties, etc. required by these Specifications. Submit to OWNER. Revise and resubmit as required to establish compliance with specified requirements. Mix designs shall be no more than 6 months old.

B. Prior to each submittal, verify that each item and the submittal for it conform with the specified requirements. If a submittal contains deviations from Contract Document requirements, such deviations shall be clearly noted on the submittal.

C. Submit one copy of each requested submittal. Submittals shall bear the CONTRACTOR's stamp of review and approval.

D. No portion of the Work requiring a shop drawing, sample, certification, or product data submission shall be commenced until the submission has been reviewed by the OWNER for conformity with the design intent of the Project Plans and Specifications.

E. Consecutively number submittals and indicate the applicable specification section. On resubmittals, cite the original submittal number for reference.

F. Make submittals far enough in advance of scheduled dates for installation to provide time for reviews, secure necessary approvals, revisions, resubmittals, and for placing orders and securing delivery. Allow five days for OWNER's review of submittals.

G. Review by the OWNER does not relieve the CONTRACTOR from responsibility for errors which may exist in the submitted data, including non-compliance with the Contract

Documents, unless the CONTRACTOR has indicated in writing such deviation at the time of submission and written approval has been given to the specific deviation.

H. Maintain a submittal log for the duration of the Work, showing current status of submittals. Make available to OWNER upon request.

1.16 Schedule of Values

A. Submit Schedule of Values to OWNER prior to submitting first payment request. Schedule of Values shall provide a detailed breakdown of the agreed upon Contract Sum showing values allocated to each of the various parts of the Work and shall be based on the unit prices on the Contract Bid Form. Total costs of items listed in schedule shall equal the total Contract Sum. Revise and resubmit as required by OWNER.

B. Schedule of Values shall be used as a basis for CONTRACTOR's Payment Request.

C. Revise Schedule of Values to list approved Change Orders with each Application for Payment.

D. Upon request from OWNER, submit data on cost of materials, labor, equipment, overhead, and profit that will substantiate magnitude of values.

1.17 Measurement and payment

A. Perform the Work under a Lump Sum Contract, except for Unit Price items specifically identified on Bid Form.

B. Payment for lump sum work items will be based on percentage of work completed and accepted through the end of the billing period. Percentage complete will be mutually agreed upon prior to submittal of request.

C. Lump sum payment includes full compensation for required labor, tools, products, equipment, transportation, services, and incidentals required for complete and proper erection, application, or installation of an item of the Work, including overhead and profit.

D. Payment for unit price work items shall be based on the actual quantities and measurements accepted by the Owner, multiplied by the unit price of each item incorporated in the Work. Unit quantities shall be agreed upon prior to submittal of payment request. Unit quantities shall be determined per Measurement and Payment Section 01 21 23.

E. Unit price payment includes full compensation for required labor, tools, products, equipment, transportation, services, and incidentals required for complete and proper erection, application, or installation of an item of the Work, including overhead and profit.

F. CONTRACTOR is responsible for performing quantity surveys. Quantity surveys shall be certified by Registered Land Survey or Professional Engineer.

1.18 Application for Payment

A. The Contract Sum as stated in the Agreement between the CONTRACTOR and OWNER is the total amount payable by the OWNER to the CONTRACTOR for the performance of the Work under the Contract Documents.

B. Revise the Contract Sum due to Change Orders on each application for payment after said Change Orders have been approved by the OWNER and Engineer.

C. Submit monthly application for payment to OWNER on AIA Documents G702 and G703, EJCDC Form No. 1910-8-E (1996 Edition), or other OWNER approved form no later than the 25th day of each month.

D. First Application for Payment shall be accompanied by the CONTRACTOR's partial waiver of lien for the full amount of payment due.

E. Each subsequent Application for Payment shall be accompanied by the CONTRACTOR's partial waiver of lien, plus the partial waiver of liens of subcontractors and suppliers, who were included in the immediately preceding Application for Payment to the extent of that previous payment.

F. The final Application for Payment must be accompanied by final waivers of lien for the full amount of contracts from the CONTRACTOR, subcontractors, and suppliers, including those who have not previously furnished such final waivers.

1.19 Union Issues

A. Landfill is a non-union site.

PART 2 - MATERIALS

Not Used

PART 3 - EXECTUTION

Not Used

* * * END OF SECTION * * *

SECTION 01 21 13

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 Section Includes

A. Procedures for measurement and payment for the Work to be done under the respective items listed in the itemized quantity listing and Bid Form for this project.

1.2 General

A. The following paragraphs describe measurement of and payment for the Work included under the respective items listed in the itemized bid form for this contract.

B. Each lump sum and unit price stated in the itemized bid shall constitute full compensation for not only all labor, equipment and materials necessary and required to complete all work specified under that particular item including cleaning up, but also all costs for doing related work as set forth in these Specifications and/or on the Contract Drawings or implied in carrying out their intent.

C. It is anticipated that all work satisfactorily completed will be processed under monthly Payment Requests, each dated on the last day of each month during the construction period.

D. OWNER will provide all documentation and as-built survey. All other construction staking and layout is the responsibility of the CONTRACTOR.

1.3 Computation of Quantities

A. Measurement of quantities expressed as area shall be based upon a horizontal, planimetric projection to the Work limits as determined by survey Record Drawings for each item with no additional allowances for slopes.

B. Measurement of quantities expressed as volume shall be based upon comparison of survey Record Drawings performed both prior to and upon completion of each item.

C. Computation of the volume shall be completed utilizing AutoCAD Civil 3D or equivalent software to compare before and after surfaces.

D. Measurement of linear items such as piping, drainage swales, and access roads will be for quantities actually field installed to the specified work limits, based upon minimum 50 foot surveyed stations (planimetric horizontal distance) recorded along the straight or curved centerline of each respective item with no additional allowances for slope.

E. No partial payments shall be made for items which have not been tested and approved.

F. Payment will be made to the limits as specified in the Contract Documents. If the constructed limits are less than the specified limit, payment will be made to the actual limits of construction as shown on the Record Drawings. Payment for quantities that exceed the specified contract limits will only be made with the approval of the OWNER/ENGINEER. The

payment for quantities that exceed the contract quantities can only be obtained through an approved change order before contract quantities are exceeded.

1.4 Contract Measurement and Payment Items

A. The sections below describe the measurement and payment of the specific Contract Items:

1. Bid Item 101: Mobilization and General Conditions
    a. Measurement: Lump sum (LS).
    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.
2. Bid Item 201: Site Preparation, Erosion Control & Surface Water Drainage Features
    a. Measurement: Lump Sum (LS)
    b. Payment for this item will be partial payments made monthly based on the percent complete status of the contract.
3. Bid Item 202: Dewatering
    a. Measurement: Lump Sum (LS).
    b. Payment for this item will be partial payments made monthly based on the percent complete status of the Contract.
4. Bid Item 203: Subbase Preparation/Excavation
    a. Measurement: Per cubic yard (CY). The excavated, or "cut," measurement is performed based on a pre-construction survey performed by a third-party surveying and/or engineering firm contracted by the owner. The post-construction limits are based on the design subbase (top of subgrade) and perimeter grading surface as provided in the construction drawings. Additional materials excavated beyond these design limits shall be considered incidental to this bid item unless written agreement is provided by owner for the additional excavation.
    b. Payment: Partial payments made monthly based on the actual quantity excavated and approved at the time of the pay request.
5. Bid Item 204: Subbase Preparation/Fill
    a. Measurement: Per cubic yard (CY). The fill measurement is performed based on a pre-construction survey performed by a third-party surveying and/or engineering firm contracted by the owner. The post-construction limits are based on the design subbase (top of subgrade) and perimeter grading surface as provided in the construction drawings. Additional materials added beyond these design limits shall be considered incidental to this bid item unless written agreement is provided by owner for the additional excavation.
    b. Payment: Partial payments made monthly based on the actual quantity filled and approved at the time of the pay request.

6. Bid Item 205: Unsuitable Soil/Subbase Undercuts & Backfill

    a. Measurement: Per cubic yard (CY). Measurement for this item shall be determined in-place based on actual excavated "cut" amounts by comparing a beginning (base) surface to an ending (comparison) surface over the same undercut area. The base surface for this volume is determined by field survey of the undercut, and the comparison surface is based on the design subbase (bottom of clay) or perimeter grading surface provided in the construction drawings over the same undercut area. Contractor must notify CQA personnel prior to backfilling the undercut and allow time for the survey to be completed, failure to do so will result in non-payment. Owner will not pay based on contractor survey unless otherwise agreed upon by owner.

    b. Payment: Partial payments made monthly based on the actual quantity excavated and adequately backfilled, tested and approved at the time of the pay request.

7. Bid Item 301: Underdrain System

    a. Measurement: Lump Sum(LS)

    b. Payment for this item will be partial payments made monthly based on the percent complete status of the contract.

8. Bid Item 302: Controlled Fill

    a. Measurement: Per square foot (SF). The unit price per SF for this item is measured based on the design thickness and extents of 2-foot thick controlled fill as shown in the construction drawings. Extensions and runouts of the controlled fill beyond these limits (tie-ins, future phase transition runout, anchor trench runout, etc.) shall be considered incidental to this bid item. The measurement is based on 2-dimensional area.

    b. Payment: Partial payments made monthly based on the quantity installed, as measured according to the above paragraph, and approved at the time of the pay request.

9. Bid Item 303: Clay Liner

    a. Measurement: Per square foot (SF). The unit price per SF for this item is measured based on the design thickness and extents of 2-foot thick compacted clay liner as shown in the construction drawings. Extensions and runouts of the compacted clay liner beyond these limits (tie-ins, future phase transition runout, anchor trench runout, etc.) shall be considered incidental to this bid item. The measurement is based on 2-dimensional area.

    b. Payment: Partial payments made monthly based on the quantity installed, as measured according to the above paragraph, and approved at the time of the pay request.

10. Bid Item 304: Liner Tie-in Preparation

    a. Measurement: Lump sum (LS).

    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.

11. Bid Item 305: Geomembrane Surface Preparation and Maintenance
    a. Measurement: Lump sum (LS).
    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.
12. Bid Item 306: Rain Flap
    a. Measurement: Per lineal feet (LF). The length of rain flap, measured planimetrically with no additional allowance for three-dimensional slope, shall be based on field survey at the centerline of the completed rain flap.
    b. Payment: Partial payments made monthly based on the actual quantity of rain flap installed and approved at the time of the pay request.
13. Bid Item 307: Anchor Trench & Clay Wedge
    a. Measurement: Per lineal feet (LF). The length of anchor trench, measured planimetrically with no additional allowance for three-dimensional slope, shall be based on field survey at the centerline of the completed anchor trench.
    b. Payment: Partial payments made monthly based on the actual quantity of anchor trench installed and approved at the time of the pay request.
14. Bid Item 308: Leachate Drainage Layer
    a. Measurement: Per square foot (SF). The per SF measurement for this bid item shall be determined based on the design thickness and extents of 1-foot thick leachate drainage layer as shown in the construction drawings. Extensions and runouts of the leachate drainage layer beyond these limits (tie-ins, transition runout, etc.) shall be considered incidental to this bid item. The measurement is based on 2-dimensional area.
    b. Payment: Partial payments made monthly based on the amount of area of completed 12-inch thick leachate drainage layer placed and certified by the RPR.
15. Bid Item 309: Leachate Collection Piping Installation
    a. Measurement: Per lineal feet (LF). The length of leachate collection piping, measured planimetrically with no additional allowance for three-dimensional slope, shall be based on field survey at the centerline of the completed leachate collection piping.
    b. Payment: Partial payments made monthly based on the actual quantity of leachate collection piping installed and approved at the time of the pay request.
16. Bid Item 310: Leachate Collection Sump
    a. Measurement: Lump sum (LS).
    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.
17. Bid Item 311: Leachate Head Monitoring Pipe
    a. Measurement: Lump sum (LS).

b. Payment: Partial payments made monthly based on the percent complete status of the Contract.

18. Bid Item 312: Leachate Sideslope Riser

    a. Measurement: Per lineal feet (LF). The length of side slope riser piping, measured planimetrically with no additional allowance for three-dimensional slope, shall be based on field survey at the centerline of the completed leachate side slope riser piping.

    b. Payment: Partial payments made monthly based on the actual quantity of leachate collection piping installed and approved at the time of the pay request.

19. Bid Item 313: Landfill Gas Belly Collector Piping

    a. Measurement: Per lineal foot (LF). This per LF measurement shall be based on actual quantity of pipe installed, tested, and approved. The measurement is performed by third-party CQA field survey, measured at the top of pipe. This measurement is calculated planimetrically, and no additional allowances for three-dimensional slope are included.

    b. Payment: Made monthly, until completion of the item, based on LF of the installed pipe, and approved by the ENGINEER and documented by CQA at the time of the pay request.

20. Bid Item 314: Landfill Gas Rock Pads

    a. Measurement: Each (EA). Based on quantity of Landfill Gas Rock Pads for LFG extraction wells installed.

    b. Payment: Based on number of Landfill Gas Rock Pads for LFG extraction wells installed and approved at the time of the pay request.

21. Bid Item 315: Landfill Gas Horizontal Collector

    a. Measurement: Per lineal foot (LF). This per LF measurement shall be based on actual quantity of pipe installed, tested, and approved. The measurement is performed by third-party CQA field survey, measured at the top of pipe. This measurement is calculated planimetrically, and no additional allowances for three-dimensional slope are included.

    b. Payment: Made monthly, until completion of the item, based on LF of the installed pipe, and approved by the ENGINEER and documented by CQA at the time of the pay request.

22. Bid Item 316: Perimeter Vaults

    a. Measurement: Each (EA). Based on quantity of Perimeter Vaults Installed installed.

    b. Payment: Based on number of Perimeter Vaults installed and approved at the time of the pay request.

23. Bid Item 317: Geomembrane Leak Location / Electrical Resistivity Preparation

    a. Measurement: Lump sum (LS).

b. Payment: Partial payments made monthly based on the percent complete status of the Contract.

24. Bid Item 401: 4"x8" D/C Forcemain Piping

    a. Measurement: Per lineal foot (LF). This per LF measurement shall be based on actual quantity of pipe installed, tested, and approved. The measurement is performed by third-party CQA field survey, measured at the top of pipe. This measurement is calculated planimetrically, and no additional allowances for three-dimensional slope are included.

    b. Payment: Made monthly, until completion of the item, based on LF of the installed pipe, and approved by the ENGINEER and documented by CQA at the time of the pay request.

25. Bid Item 402: Perimeter Road

    a. Measurement: Per lineal foot (LF). The per LF measurement shall be based on a field survey of the actual length of road constructed, measured along the centerline of the road. This includes the temporary ramp at the west end of the permanent perimeter haul road.

    b. Payment: Partial payments made monthly based on the actual quantity installed and approved at the time of the pay request.

26. Bid Item 403: Access Road & Tipping Pad

    a. Measurement: Lump sum (LS).

    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.

27. Bid Item 404: Site Restoration

    a. Measurement: Per Acre (AC). The per acre measurement shall be calculated based on the actual areas which received topsoil, seed, and e-matting where applicable. Regrading of clay borrow areas and stockpiles are considered incidental to Bid Item 101.

    b. Payment: Partial payments made monthly based on the actual area restored to date, surveyed, and approved by owner. percent complete status of the Contract.

28. Bid Item 501: 24" Flume Pipe

    a. Measurement: Per lineal foot (LF). The total length of downslope flume shall be measured by third party as-built survey of the top of pipe. Inlet segments shall not be included in the lineal foot measurement, those segments are considered incidental to the flume inlet bid items.

    b. Payment: Partial payments made monthly based on the actual quantity completed at the time of the pay request.

29. Bid Item 502: 24" Flume Inlet

    a. Measurement: Each (EA). Total number of flume inlets installed.

b. Payment: Partial payments made monthly based on the actual quantity completed at the time of the pay request.

30. Bid Item 503: Energy Dissipator
    a. Measurement: Each (EA). Total number of energy dissipators installed.
    b. Payment: Partial payments made monthly based on the actual quantity completed at the time of the pay request.
31. Bid Item 504: Stormwater Berm
    a. Measurement: Per lineal foot (LF). The total length of the Stormwater Berm shall be measured by third party as-built survey of the centerline of the berm.
    b. Payment: Partial payments made monthly based on the actual quantity completed at the time of the pay request.
32. Bid Item 505: Emergency Spillway
    a. Measurement: Lump sum (LS).
    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.
33. Bid Item 506: 24" Culvert
    a. Measurement: Per lineal foot (LF). The total length of culvert shall be measured by third party as-built survey of the top of pipe.
    b. Payment: Partial payments made monthly based on the actual quantity completed at the time of the pay request.
34. Bid Item 507: 18" Culvert
    a. Measurement: Per lineal foot (LF). The total length of culvert shall be measured by third party as-built survey of the top of pipe.
    b. Payment: Partial payments made monthly based on the actual quantity completed at the time of the pay request.
35. Bid Item 508: Regrade/restore drainage swells
    a. Measurement: Lump sum (LS).
    b. Payment: Partial payments made monthly based on the percent complete status of the Contract.
36. Bid Item Alternate A1:
    a. Measurement: Per square foot (SF). The per SF measurement for this alternate bid item shall be determined based on the design thickness and extents of 1-foot thick leachate drainage layer as shown in the construction drawings. Extensions and runouts of the leachate drainage layer beyond these limits (tie-ins, transition runout, etc.) shall be considered incidental to this bid item. The measurement is based on 2-dimensional area.
    b. Payment: Partial payments made monthly based on the amount of area of completed 12-inch thick leachate drainage layer placed and certified by the RPR.

PART 2 - MATERIALS

Not Used

PART 3 - EXECTUTION

Not Used

* * * END OF SECTION * * *

SECTION 01 45 00

QUALITY CONTROL

PART 1 - GENERAL

1.1 Section Includes

A. Reference Standards

B. Contractor's Quality Control Services.

C. Code Compliance Testing.

D. Contractor's Convenience Testing.

E. Engineer Services.

F. Testing Laboratory Services.

G. Manufacturer's Field Services.

1.2 Reference Standards

A. For Products or workmanship specified by association, trade, or other consensus standards comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date of specifications, except where a specific date is established by applicable codes.

C. The contractual relationship, duties and responsibilities of the parties in Contract and those of the Engineer shall not be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.3 Contractor's Quality Control Services

A. Monitor quality control over suppliers, manufacturer's products, services, site conditions, and workmanship to produce Work of specified quality.

B. Comply with manufacturer's instructions unless otherwise specified.

C. In the event manufacturer's instructions conflict with Contract Documents, request clarifications from Engineer before proceeding.

D. Perform work with persons qualified to produce workmanship of specified quality.

E. Cooperate with Engineer, Owner's Testing Laboratory, and other inspection personnel, and provide safe access to the Work as required for proper inspection and testing.

F. Provide incidental labor, equipment, and facilities in order that the Engineer, Owner's Testing Laboratory, and inspection personnel may properly perform their services.

G. Furnish material samples and access to materials for testing.

H. Remove waste materials which are a product of sample preparation and testing.

I. Notify the Engineer and Owner's Testing Laboratory at least 48 hours prior to expected time for operations requiring testing or inspection.

1.4 Code Compliance Testing

A. Inspections and tests required by codes or ordinances, or by plan approval authority, and made by legally constituted authority, shall be the responsibility of and shall be paid for by the Contractor.

1.5 Contractor's Convenience Testing

A. Inspection or testing performed exclusively for the Contractor's convenience and his own quality assurance shall be the sole responsibility of the Contractor.

1.6 Engineer Services

A. The Owner will retain the Engineer to review the Contractor's work. The activities of the Engineer are solely the discretion of the Owner, and in no way relieve the Contractor of sole responsibility for performing the Work in accordance with requirements of the Contract Documents.

1.7 Testing Laboratory Services

A. The Owner may retain qualified independent testing laboratories to perform inspection and testing of the Contractor's work. The activities of the Owner's Testing Laboratories are solely the discretion of the Owner, and in no way relieve the Contractor of sole responsibility for performing the Work in accordance with requirements of the Contract Documents.

B. The Owner's Testing Laboratory will perform independent inspections and tests, record observations, interpret and evaluate test results, and submit written reports to the Engineer for final assessment of compliance with the Contract Documents.

C. Tests described in the Contract Documents will be performed by the Owner's Testing Laboratory, except as otherwise noted. Test will be performed in accordance with specified standards, by qualified, experienced personnel. Inspecting, testing, and source quality control may occur on or off the project site.

D. The Owner's Testing Laboratory will immediately inform Contractor and Engineer of materials judged to be non-conforming to specifications. Owner's Testing Laboratory will proceed as directed by the Engineer.

E. Re-inspection and retesting of materials found to be in non-conformance with the Contract Documents shall be performed at the Contractor's expense.

F. Limits on Testing Laboratory Authority:

1. Laboratory may not release, revoke, alter, or enlarge on requirements of the Contract Documents.

2. Laboratory may not approve or accept any portion of the Work.

3. Laboratory may not assume any duties of the Contractor.
4. Laboratory has no authority to stop the Work.

G. Submitted Laboratory Reports to OWNER and CONTRACTOR will include the following minimum information:

1. Project title, number, and date issued.
2. Firm name, address, and name and signature of tester or inspector.
3. Date and time of sampling, test, or inspection.
4. Identification of product and specification section.
5. Location in project, including elevations, grid location and detail.
6. Type of test or inspection and specified standard.
7. Results of test or inspection and interpretation of same, including their opinion regarding compliance with Contract Documents or deviations therefrom.

1.8 Manufacturer's Field Services

A. Specific services and/or requirements for the manufacturer's technical representative are specified in the individual specification sections.

B. When specified in respective Specification Sections, require Supplier to provide qualified personnel to observe field conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance equipment as applicable, and make appropriate recommendations.

C. Manufacturer's Representative shall submit written report to OWNER listing observations and recommendations.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

* * * END OF SECTION * * *

SECTION 01 45 23.13

TESTING PIPING SYSTEMS

PART 1 - GENERAL

1.1 Section Includes

1. This section covers all labor, equipment and materials necessary to pressure test solid piping.

1.2 Submittals

1. Pipe Pressure Test Results

PART 2 - PRODUCTS

2.1 Provisions

1. The CONTRACTOR shall provide compressed air flanges, caps, bulkheads and monitoring apparatus as necessary to complete the pressure test.

2.2 Testing Equipment

A. The CONTRACTOR shall provide all equipment required for this testing procedure.

B. Testing Equipment shall include, but may not be limited to:

1. Polyethylene flange adapter with steel blind flange.
2. Temperature gauge (32ºF to 200ºF) tapped and threaded into blind flange.
3. Pressure gauge (0 to 15 psi) ASME Standard B40.1 Grade 2A (accuracy of ±0.5% of full scale) with minor graduation marks no greater than 0.10 psi.
4. Inlet valve to facilitate compressed air hose.
5. Valve to release pipe pressure at test completion.
6. Polyethylene reducers to be used to adapt test flange to size of pipe being tested.
7. Air compressor shall provide adequate air supply for testing.
8. Pressurizing equipment shall include a regulator set to avoid over-pressurizing and damaging otherwise acceptable pipe.

C. Provide verification and results of gauge calibration prior to and after project completions.

PART 3 - EXECUTION

3.1 Preparation

A. Commence test procedures when the following conditions have been met.

1. Pipe section to be tested is clean and free of dirt, sand or other foreign material.
2. Plug pipe outlets with test plugs. Brace each plug securely to prevent blowouts. Use concrete if necessary.
3. Add compressed air slowly.
4. Pressurizing equipment shall include regulator set to avoid over-pressurizing and damaging an otherwise acceptable section of pipe.

B. Provide necessary pipe connections between the section of line being tested and the compressed air supply, together with test pressure equipment, meters, pressure gauge, and other equipment, materials, and facilities necessary to perform the specified tests.

C. Furnish and install bulkheads, flanges, valves, bracing, blocking or other temporary sectionalizing devices that may be required.

D. Remove temporary sectionalizing devices after tests have been completed.

3.2 Testing

A. ENGINEER shall be given 24-hr notification prior to test.

B. Appropriate safety precautions must be in-place.

C. Pipe Test Segments:

1. Butt-fusion weld pipe segments.
2. Less than 2,000 feet in length.
3. Blind flange with test apparatus on one end and fused cap or blind flange assembly on opposite end.

D. Environment:

1. Bury test segment or lay test segment on ground surface and allow it to reach ambient temperature before test.
2. Perform test during period when pipe segment will be out of direct sunlight to minimize pressure changes as a result of temperature fluctuations.

E. Test:

1. Low Pressure Pipe: (Non-perforated Landfill Gas Pipe & Leachate Forcemain)
   a. Apply test pressure of 10 psig to test segment.
   b. Observe test pressure for 1-hour.
   c. Mathematically correct pressure drop for temperature change.

d. Temperature corrected pressure drop over 1-hour period should not exceed 1%.

2. High Pressure Pipe: (Compressed Airline)

a. Apply test pressure of 100 psig to test segment.

b. Observe test pressure for 1-hour.

c. Mathematically correct pressure drop for temperature change.

d. Temperature corrected pressure drop over 1-hour period should not exceed 1%.

F. Test Failure

1. Perform the following when pipe segment fails test.

a. Check entire length of pipe and fusion welds for cracks, pinholes, perforations or other possible leakage points.

b. Check blocked risers and capped ends for leakage and check gaskets at blind flanges.

c. Verify leaks by applying a soapy water solution and observe for bubble formation.

2. Repair pipe and fused joint leaks by cutting out leak areas and refusing suitable segments.

3. After the leaks are repaired, retest the pipe after the 8 hour relaxation period.

3.3 Fire and First Aid Facilities

1. First Aid Facilities: Provide medical supplies and equipment at the site for first aid service to persons injured in connection with the Work.

2. Fire Protection: Provide temporary fire protection as required by federal, state, and local laws and ordinances. Reasonable precautions against fire shall be taken throughout operations. Flammable material shall be kept to a minimum and shall be properly handled and used in accordance with governing requirements. Open fires are prohibited at the site.

3.4 Test Reporting

A. Each test shall be reported in writing, on Attachment 1 included with this section.

B. Include following information if failure occurs:

1. Location of failure segment.

2. Nature of leaks.

3. Details of repairs performed.

4. Retest results.

PART 4 - MEASUREMENT AND PAYMENT

(Not Used)

ATTACHMENT 1 TO SECTION 01 45 23.13
HDPE PIPE PRESSURE TEST REPORT

Project Name/No.: _____ Date: _____

Contractor: _____ Time: _____

Person Performing Tests: _____

Description/Location of Test Segment: (Pipe Diameter, Length, and SDR's)

_____

_____

Location of Pipe Test Segment
Station From: Station To:

T_i = Initial Temperature = _____ °F
P_i = Initial test pressure = _____ psig
P_c = Initial Pressure in psig corrected for temperature (T_t) at time "t"
t = Time in minutes from initiation of test
T_t = Temperature in °F at time 't'
P_t = Test pressure in psig at time 't'

$$P_c = \frac{(P_i + 14.7)(T_t + 460)}{(T_i + 460)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{P_c - P_t}{P_c} \times 100$$

Time (min)	T_t Temp Reading (°F)	P_t Gauge Pressure (psig)	P_c Corrected Pressure (psig)	Pressure Drop (%)
0				
20				
30				
40				
50				
60				

Pass/Fail: _____ Retest (yes/no) _____

Description/Nature of leaks and repair of retest segment:

_____

_____

*** END OF SECTION ***

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 Section Includes

A. Electricity, Lighting

B. Water

C. Sanitary Facilities

D. Communication Systems

E. Fire and First Aid Facilities

F. Temporary Field Office

G. Barriers and Protection of Work

H. Security

I. Dust, Debris, Construction Water Control

J. Erosion and Sediment Control

K. Water Control (Surface / Subsurface)

L. Temperature and Humidity Control

M. Pollution Control

N. Noise Control

O. Cleaning During Construction

P. Maintenance and Removal

1.2 Quality Assurance

A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.
2. Occupational Safety and Health Standards (OSHA).
3. Utility company regulations.
4. Police, Fire Department, and Rescue Squad rules.
5. Environmental protection regulations.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 Electricity, Lighting

A. Connect to existing service; provide branch wiring and distribution boxes located to allow service and lighting by means of construction-type power cords. Take measures to conserve energy. OWNER will pay costs of energy used. CONTRACTOR shall take precautions to prevent excessive use and overloading of the existing system.

B. Provide additional temporary electrical power, wiring, and lighting as required for execution of the Work.

3.2 Water

A. Provide water for construction operations. OWNER available water at site may be used, but supply may be limited. CONTRACTOR shall provide and maintain hoses and connections from source to point-of-use.

3.3 Sanitary Facilities

A. Provide and maintain enclosed, portable, self-contained sanitary facilities for use of Contractors employees, sub-contractors, and any Owners Contractors performing work on the project under separate contracts.

3.4 Communication Systems

A. Provide telephone.

3.5 Fire and First Aid Facilities

A. First Aid Facilities: Provide medical supplies and equipment at the site for first aid service to persons injured in connection with the Work.

B. Fire Protection: Provide temporary fire protection as required by federal, state, and local laws and ordinances. Reasonable precautions against fire shall be taken throughout operations. Flammable material shall be kept to a minimum and shall be properly handled and used in accordance with governing requirements. Open fires are prohibited at the site.

3.6 Temporary Field Office

A. Field Office: Not required but contractor will need to supply their own office facilities should they chose to have office space at the site.

3.7 Barriers and Protection of Work

A. Provide as required for OWNER's use of site, to prevent public entry to construction areas and to protect existing facilities and adjacent properties from damage.

B. Provide temporary protection for Work in progress and items installed.

C. Control traffic in construction area to minimize damage to completed Work.

D. Provide signs, flagmen, lights, barricades, or other warning devices as required to control vehicular and pedestrian traffic adjacent to the work areas and to prevent unauthorized vehicles and pedestrians from entering areas of the Work.

E. Public streets shall remain open at all times. Protect persons against injury resulting from job operations, movement of materials, and standing equipment.

F. Protection, including overhead, shall be provided around the site to comply with applicable Codes and Ordinances so that persons, materials, improvements, and property on and near the site are fully protected from site construction operations.

G. Minimize the placement of hoses, cords, and other such items in active traffic paths. Provide wood or other appropriate coverings and warning signs when such items are in active areas of the work area.

3.8 Security

A. Provide security program and facilities to protect Work and existing facilities from unauthorized entry, vandalism and theft. Coordinate with OWNER's security program.

3.9 Dust, Debris, and Construction Water Control

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide temporary enclosures or other positive means to control dust, debris, construction related water, sand particles, etc. from entering the non-work areas of the building or site and from being carried airborne off site. Take appropriate action if dust or debris exceeds levels established by authorities having jurisdiction.

C. Do not use oils, bitumens, or chlorides for dust control unless approval is obtained by the OWNER.

3.10 Erosion and Sediment Control

A. Provide and maintain positive erosion control devices and methods to prevent siltation to lands, waterways, and storm sewer systems adjoining the construction area.

B. Erosion control devices and measures shall comply with Best Management Practices, except where specifically modified herein.

C. The erosion control system and methods shall meet the requirements and regulations of the authorities having jurisdiction.

D. Contractor shall maintain erosion control measures until final payment to Contractor is made by Owner at which time Owner will be responsible for maintaining erosion control measures. The Contractor shall not remove erosion control devices unless directed by the Owner. Rather, possession of the installed erosion control measures shall transfer to the Owner upon final payment to the Contractor.

E. Minimize amount of bare soil exposed at one time. Keep duration of exposure of construction materials before final finishing or cover as short as practical.

F. Plan and execute construction to control surface drainage from cuts and fills, and from borrow and waste disposal areas to prevent erosion and sedimentation. Conduct operations to avoid washing or deposition of materials into waterways or off-site.

G. Do not track or spill mud, clay, gravel, or other materials onto adjacent streets or off-site. Clean off inadvertent tracking and spills immediately.

H. Periodically inspect earthwork for evidence of erosion and sedimentation; promptly apply corrective measures.

I. Comply with Best Management Practices.

3.11 Water Control (Surface / Subsurface)

A. Provide necessary pumps, piping, drainage lines, ditches, dams, or other approved means to control accumulation of water in excavations and also ponding of water. Control surface and subsurface water throughout the duration of project within entire limits of construction, including before, during, and after geosynthetic installation. Direct water to locations as approved by Owner or as approved by permits and Drawings.

B. Rough-grade site to prevent standing water and to direct surface water drainage away from Work area and landfill operations.

C. Do not stockpile material such that it restricts surface drainage.

D. If it is necessary to interrupt existing surface water drainage, provide and maintain temporary piping or ditching until permanent drainage is provided. Direct water as approved by Owner. Restore to previous conditions.

E. Provide piping or other positive means to handle discharge flows to prevent erosion or deposit of silt.

3.12 Temperature and Humidity Control

A. Ventilation: Provide adequate ventilation to remove objectionable or noxious vapors generated by the Work so the site can remain operational during Work. Contractor is fully responsible for health claims caused by noxious vapors produced from his operations.

B. Temperature and Humidity Control: Provide temporary temperature and humidity control equipment as required to facilitate progress of the Work, meet specified minimum conditions for installation of materials, protect materials and finishes from damage, and complete the Work in a proper and timely manner.

C. Provide protection against rain, snow, wind, ice, storms, and temperature so as to maintain components, personnel, work, materials, and equipment free from injury or damage. Remove snow and ice as necessary for safety, and proper and timely execution of the Work.

3.13 Pollution Control

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances and pollutants produced by construction operations. Clean-up of spills/releases shall be the responsibility of Contractor.

3.14 Noise Control

A. Provide means, methods, and facilities to prevent noise levels from exceeding 65 decibels at property line.

3.15 Cleaning During Construction

A. Control accumulation of waste materials and rubbish; periodically dispose of as directed by landfill manager.

B. Maintain site in a clean and orderly condition. Clean areas at the end of each day's Work; control dust and other contaminants during operations.

C. Schedule cleaning operations so that newly placed Work is not damaged.

3.16 Maintenance and Removal

A. Maintain temporary construction facilities and controls as long as necessary for safe and proper completion of the Work. Remove prior to final inspection.

B. Restore surfaces damaged as a result of their installation.

PART 4 - MEASUREMENT AND PAYMENT

(Not Used)

*** END OF SECTION ***

SECTION 01 57 13

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 Work Includes

A. Installation of soil erosion control devices.

B. Maintenance of soil erosion devices during construction.

C. Removal of temporary soil erosion control devices after stabilization of disturbed areas.

D. Temporary grassing for soil erosion control.

1.2 Quality Control

A. After installing the soil erosion control devices as called for on the Construction Plans, the CONTRACTOR shall assure himself that all reasonable measures possible have been taken to prevent the siltation of nearby water courses.

PART 2 - PRODUCTS

2.1 Silt Fence and Inlet Protection

A. Posts

1. Silt fence posts shall be post, a minimum of 4.5' long and spaced according to the details in the plans.

B. Woven Wire Fence

1. Wire fence reinforcement shall be a minimum of 14-gauge 4" x 4" hogwire.

C. Filter Fabric

1. Use only a synthetic filter fabric that is approved by the Wisconsin Department of Transportation. Synthetic filter fabric should contain ultraviolet ray inhibitors and stabilizers to provide a minimum of six (6) months of expected usable construction life at a temperature of 0 to 120˚F.

2.2 Rip-Rap and Gravel Drain

A. Stone

1. Stone for rip-rap and gravel drain shall be durable, dense, specifically selected and graded quarried stone. The stone shall be the size specified in the plans.

2.3 Temporary Grassing

A. Temporary seed

1. Temporary seed shall be annual ryegrass, wheat, brown top millet, and pearl millet at the planting rates specified.

2.4 Mulch

1. Mulch for temporary grassing shall consist of grain straw or other acceptable material, and shall have been approved by the ENGINEER before being used. All mulch shall be reasonably free from mature seed bearing stalks, roots, or bulblets of Johnson Grass, Nutgrass, Sandbur, Wild Garlic, Wild Onion, Bermuda Grass, Crotalaria, and Witchweed, and free from an excessive amount of noxious weeds at the time of use of the mulch, and also there shall be compliance with all applicable State and Federal domestic plant quarantines. Straw mulch that is matted or lumpy shall be loosened and separated before being used.
2. Material for holding mulch in place shall be an approved binding material or crimping method. No asphalt tacking material will be allowed on Temporary seeded areas.

2.5 Excelsior Lined Ditch and Slope

A. Excelsior Matting

1. Excelsior matting shall be an erosion control blanket consisting of an excelsior mat with synthetic netting on one side when used on slopes and on both sides when used in ditches, similar and equal to Curlex as manufactured by American Excelsior Company.

2.6 Turf Reinforcement Mat

A. Turf Reinforcement Mat (TRM)

1. TRM shall be an erosion control mat comprised of 100% UV-stabilized, propylene-fiber matrix stitched between two UV-stabilized nettings. The product shall be designed to be non-soil filled and shall provide a minimum bare soil shear stress of 2.0 lbs/sf. The product shall be similar and equal to P300 by North American Green.

B. Anchoring Devices:

1. Anchoring devices for TRM shall be an approved anchoring device recommended by the manufacturer of the product.

2.7 Reno Mattress

A. Mattress and Lacing

1. The Reno mattress shall be a rectangular basket made of heavy galvanized, double twisted, steel woven wire mesh. The mesh and lacing wire shall be PVC coated for additional protection. The single units of the baskets shall be assembled laced together and filled with stone to form a single monolithic structure. All components of the mattress shall meet the requirements of ASTM-A975-97 and be similar and equal to Reno mattresses manufactured by Maccaferri, Inc.

B. The stone for the mattress shall be hard, angular to round and of materials and quality that will not disintegrate in water. The stone shall meet the material properties of WI. DOT Rip-Rap. The size of the stone shall vary based on the height of the mattress and must provide a minimum of two layers of rock when filling the mattress. The stone size must meet the requirements of the manufacturer.

2.8 Flexible Growth Medium – only if approved by Owner

A. Flexible Growth Medium

1. The flexible growth medium shall include appropriate seeding and wood cellulose fiber processed to contain no growth or germination inhibiting factors and dyed an appropriate color to facilitate visual metering of materials applied. The flexible growth medium shall be Flexterra FGM manufactured by PROFILE Products, LLC or approved equal.

B. Seed, Lime, Fertilizer, and Water

1. Seed, lime, and fertilizer installed with flexible growth medium shall meet the requirements specified herein.

PART 3 - EXECUTION

3.1 General

A. Construct temporary and permanent erosion control measures as shown on the plans, as required by site conditions, regulatory agency or ENGINEER. All permanent erosion control work shall be incorporated into the project at the earliest practicable time. Temporary erosion control measures shall be coordinated with permanent erosion control measures and all other work on the project to assure economical, effective, and continuous erosion control throughout the construction and post construction period and to minimize siltation of rivers, streams, lakes, reservoirs, other water impoundments, ground surfaces, or other property. If active construction ceases for more than 14 days, all disturbed areas shall be seeded and mulched using the temporary seed type and planting rates specified herein. The CONTRACTOR shall be liable for all damages to public or private property and fines as may be placed on the project by the local regulatory agencies due to soil erosion from the project site. Clear only those areas required to install the soil erosion control devices, request an inspection by the local agency having jurisdiction.

B. All erosion control devices shall be inspected by the CONTRACTOR after each rainfall. Any required repairs shall be made immediately. Sediment deposits shall be removed when deposits reach approximately one-half of the capacity of the erosion control device.

3.2 Silt Fence

A. Silt fence shall be installed in accordance with the details in the plans.

B. Should the filter fabric deteriorate or become ineffective prior to the end of the construction as determined by the ENGINEER, the fabric shall be replaced immediately at no additional cost to the OWNER.

3.3 Rip-Rap

A. Prepare subgrade to the required lines and grades as shown or indicated on the contract drawings. Place any fill required in the subgrade to a density equal to that of the surrounding area. Place filter fabric on the finished subgrade.

B. Place rip-rap by mechanical methods, augmented by hand placing where necessary to prevent damage to permanent works, provided that when the rip-rap is completed it forms a properly graded, dense, neat layer of stone. The completed rip-rap shall have a thickness as shown on the plans.

3.4 Temporary Grassing

A. Temporary grassing procedures will be implemented when directed by the ENGINEER or as required by the soil erosion inspector and in portions of the site where construction activities have temporarily or permanently ceased but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased.

B. Where construction activity will resume on a portion of the site within 21 days from when activities ceased, stabilization measures do not have to be initiated on that portion of the site by the 14th day after construction activity temporarily ceased.

C. Seeding for temporary grassing shall be applied to all shoulders, side ditches, cut slopes, fill slopes, and any other area disturbed by the CONTRACTOR and not designated for pavement or structures. Temporary seeding shall occur immediately following final land disturbing activities. Any unseeded area which erodes shall be repaired to the satisfaction of the ENGINEER at no additional cost to the OWNER. Temporary seeding shall be applied at the following rates:

Temporary Seeding	LBS / Acre		Depth of Cover	Date of Planting
	Alone	In Mixtures		
Annual Ryegrass	40	n/a	¼" – ½"	8/15 — 3/31
Pearl Millet	50	n/a	¼" – ½"	4/1 — 8/15
Wheat	180	30	¼" – ½"	9/1 — 12/31
Browntop Millet	40	10	¼" – ½"	4/1 — 7/15

3.5 Excelsior Lined Ditch and Slope

A. Construct ditches and slopes to the lines and grades on the plans.

B. Apply lime, fertilizer, and seed to the ditch, slopes, and adjoining areas in accordance with the grassing specifications.

C. Place the excelsior mat in accordance with the detail and table in the erosion control plan.

D. Start laying the mat from the top of the upstream end of the channel or slope and unroll it downgrade. Do not stretch netting.

E. Bury the upslope end and staple the mat every 12" across the top end, every 3' around the edges and across the mat so that it is held closely against the soil. However, do not stretch the mat when stapling.

F. To join ends of strips, insert the new roll of mat in a trench as with upslope end and overlap it 18" with the previously laid upper roll. Turn under 6" of the 18" overlap and staple every 12" across the end.

3.6 Inlet Protection (As Directed)

A. The existing twin culverts shall be provided Protection in accordance with the WDNR standards for Inlet Protection.

3.7 Turf Reinforcement Mat (TRM) for Ditch

A. The ditch or slope shall be constructed to the configuration shown on the plans.

B. Prepare seedbed and apply lime fertilizer and seed in accordance with grassing specifications.

C. Install TRM in accordance with detail on plans and manufacturer's recommendations.

3.8 Reno Mattress

A. The ditch or scour pad shall be constructed to the configuration in the construction drawings.

B. Install the Reno Mattress in accordance with the construction drawings and the manufacturer's recommendations.

3.9 Flexible Growth Medium

A. Seed Bed Preparation

1. Areas to receive flexible growth medium shall have been brought to the required subgrade. New areas to be seeded shall be thoroughly tilled to a minimum depth of four (4) inches by scarifying, Harley Racking, or other approved methods. Remove debris and stones larger than one inch remaining on the surface after tillage.

B. Fertilizer, Lime and Initial Seed Application

1. Apply fertilizer and lime at rates based on the recommendations determined by the topsoil nutrient testing results, and Approved by Owner. Apply 50% of temporary seed mix, as specified above, and a small amount of flexible growth medium, for visual metering, to the slope. Seed must not be submerged in liquid mixture more than one (1) hour prior to application.

C. Mixing

1. A mechanically agitated hydraulic application machine is recommended to mix the flexible growth medium.

a. Fill tank to middle of agitator shaft or tank about 1/3 full of water. Turn on pump to wet or purge lines. Begin agitating.

b. Determine number of bags to be added from application rate chart. Add water slowly while adding flexible growth medium at a rate of 50 lbs per 125 gallons of water.

c. Contact equipment manufacturer to confirm optimum mixing rates. Add remainder of seed to ensure appropriate mixture of seed in slurry and limit submission of seed to one (1) hour or less prior to application.

2. All flexible growth medium should be loaded when the tank is approximately 3/4 full.

3. Mix slurry for a minimum of 10 minutes after adding last of flexible growth medium. Mixing time is required to fully activate the bonding additives and attain proper viscosity.

4. Turn off recirculation valve to minimize potential for air entrainment within the slurry.

D. Surface Application

1. FGM shall be applied to the prepared surface at the following rates:

APPLICATION RATES	
Slope Gradient/Condition	Rate
< 3H to I V	3,000 lb/ac
> 3H to IV and < 2H to 1V	3,500 lb/ac
> 2H to IV and < 1H to 1V	4,000 lb/ac
> 1H to IV	4,500 lb/ac

2. A fan-type nozzle (50-degree tip) shall be used whenever possible to achieve best soil coverage. Apply flexible growth medium from opposing directions to assure 100% soil surface covering.

E. Protection of seeded areas

1. Immediately after seeding, protect the area against traffic and other use by erecting barricades, as required, and placing approved signs at appropriate intervals until final acceptance.

F. Turf Establishment

1. Duration

a. Turf establishment period will be in effect until final acceptance.

2. Maintenance

a. During the turf establishment period, mow the seeded area to an average height of two (2") inches whenever the average height of grass becomes four (4") inches. Remove excess clippings, eradicate weeds, apply water and/or fertilizer, overseed, and perform other operations necessary to promote turf growth.

G. Final Acceptance

1. Final Inspection and Acceptance

    a. At the end of the turf establishment period, final inspection will be made upon written request at least ten (10) days prior to the anticipated date. Final acceptance will be based upon a satisfactory stand of turf, defined as 95 percent ground cover of the established species.

2. Replanting

    a. In areas which do not have a satisfactory stand of turf, replant as directed.

3.10 Removal Of Temporary Erosion Devices

The CONTRACTOR shall remove all sedimentation and erosion control devices upon the approval of permanent seeding and stabilization by the agency having jurisdiction of the area and the ENGINEER. All sediment deposits remaining in place after the erosion control devices are removed shall be dressed to conform to the existing grade, prepared, and seeded. The cost of removal and cleanup shall be included in the cost of the installation of the device or in the cost for maintenance.

3.11 Clean Out Permanent Erosion Control Devices

The CONTRACTOR shall clean out permanent sediment and erosion control devices upon approval of permanent seeding and stabilization by the agency having jurisdiction of the area and the ENGINEER. The devices shall be cleaned out to the original condition. The cost of cleanup shall be included in the cost of installation or in the cost of maintenance of the device.

PART 4 - MEASUREMENT AND PAYMENT

Measurement and Payment shall be in accordance with the Bid Form.

* * * END OF SECTION * * *

SECTION 01 60 00

MATERIAL AND EQUIPMENT

PART 1 - GENERAL

1.1 Selection Includes

A. Products

B. Product Options

C. Substitutions

D. Transportation and Handling

E. Storage and Protection

F. Installation Standards

PART 2 - PRODUCTS

2.1 Provisions

A. Products include material, equipment, and systems. Products may also include existing materials or components required for reuse. Includes accessory items such as finishes and trim necessary for intended use.

B. Do not use materials and equipment removed from existing structure or system, except as specifically required, or allowed by Contract Documents.

C. Comply with Specifications and referenced standards as minimum requirements.

D. Provide components of the same manufacturer, for interchangeable components.

E. Products for restoring work shall match existing materials unless specifically approved in writing by OWNER.

2.2 Product Options

A. For products specified by reference standards or by description only, select any product meeting the standards or description, by any manufacturer.

B. For products specified by naming several products or manufacturers, only select one of the products and manufacturers listed. No options or substitutions allowed.

C. For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating "or equivalent as approved by the Engineer'', the CONTRACTOR has the option to propose a product which is not specified by name, and which meets the requirements of the specifications. Requirements for proposed substitutions are described in Article 2.3 of this Section.

D. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed.

E. Where product options are available, selected products shall be compatible with other proposed materials and products.

F. Selected products shall be provided by single source throughout the duration of the Work unless otherwise approved by the OWNER.

2.3 Substitutions

A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. It is the CONTRACTOR's responsibility to provide sufficient evidence by tests or other means to support any request for approval of substitutions. Each written request for a substitution shall be accompanied by a summary of the cost differential between the specified product and the substituted product, and include a description of the proposed substitutions effects on construction schedule and other changes required in the Work to implement proposed change. The burden of proof that a proposed substitution is equivalent to a specified item shall be on the CONTRACTOR, who shall support his request with complete data substantiating compliance of proposed substitution with the Contract Documents to permit a fair and equitable decision on the merits of the proposal.

B. Request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and has determined that it meets or exceeds, in all respects, specified product, including appearance, longevity, compatibility, and its suitability for the climate and use are comparable to that specified.

2. Will provide the same warranty for substitution as for the specified product.

3. Will coordinate installation and make other changes which may be required for Work to be complete in all respects.

4. Waives claims for additional costs which may subsequently become apparent.

C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

D. OWNER will determine acceptability of proposed substitution, and will notify CONTRACTOR of acceptance or rejection in writing within a reasonable time.

E. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing by the OWNER.

F. No requests for product substitutions will be considered prior to the bid opening except as specifically provided for in the Instructions to Bidders. The Base Bid shall be based upon the use of products specified herein or per issued Addenda. Proposed substitutions shall be listed on the Substitution List included in the Project Manual.

G. The OWNER will act upon formal requests received from the CONTRACTOR for substitution of products proposed in lieu of those specified if it appears the proposed substitution is in the best interest of the OWNER.

H. ENGINEER and OWNER will be the sole judge of equivalency of proposed substitute products. ENGINEER will make written recommendations of acceptance or rejection to the OWNER. OWNER will then authorize ENGINEER to issue to CONTRACTOR written approval or rejection of the substitution. The decision of the OWNER shall be final.

I. CONTRACTOR shall reimburse the OWNER for costs incurred for reviewing and researching substitution items that are not accepted by the OWNER. Costs will be deducted from the Contract.

PART 3 - EXECUTION

3.1 Transportation and Handling

A. Except as otherwise approved by the OWNER, transport and handle products in accordance with manufacturer's instructions. Deliver Products in undamaged, dry condition in manufacturer's unopened containers or packaging.

B. Promptly inspect delivered shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged. Correct deficiencies. Promptly remove damaged products from the job site and replaced with products meeting the specified requirements.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. The OWNER may reject as non-complying such products that do not bear identification satisfactory to the OWNER as to manufacturer, grade, quality, and other pertinent information.

3.2 Storage and Protection

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight climate controlled enclosures as required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on supports above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.

E. Store loose granular materials on solid flat surfaces in well-drained areas. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained under specified conditions.

H. Store and protect existing items removed from the work area which are scheduled to be re-installed so as to prevent damage.

I. Suitably protect in-progress Work and completed Work from damage. In the event of damage, CONTRACTOR shall promptly make replacements and repairs to the approval of the OWNER.

J. Additional time and materials required to secure replacement and to make repairs of damaged products or Work caused by CONTRACTOR will not be considered by the OWNER to justify additional cost or an extension in the contract time of completion.

K. Distribute loads from materials and equipment stored such that supporting surfaces and surrounding areas are not overstressed.

3.3 Installation Standards

A. Comply with manufacturer's instructions, unless otherwise specified. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.

B. Install accurately at specified locations, secured in-place, plumb, and level as applicable.

C. Align with other work. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch work to matching existing adjacent Work in texture and appearance.

D. Quality of materials and workmanship of non-repaired areas of the existing facility shall constitute a minimum standard of acceptance for restoration work.

*** END OF SECTION ***

SECTION 01 71 23

FIELD ENGINEERING

PART 1 - GENERAL

1.1 Section Includes

A. Field Engineering / Surveying

B. Project Record Documents

1.2 Submittals

A. Certificate of Insurance for Errors and Omissions Coverage

B. Project Record Documents

C. Documentation Surveys and Final Site Survey

1.3 Quality Assurance

A. Use skilled persons, trained and experienced in the necessary tasks and techniques for the proper performance of this Work, including licensed Professional Engineers and Surveyors, where applicable.

B. Grade Table forms summarizing the horizontal coordinates and vertical elevations of cap components, and piping systems will be provided to CONTRACTOR prior to construction. Upon completion of each component of the liner system and piping systems for which grade tables have been provided the CONTRACTOR shall submit to OWNER completed Grade Table Forms.

C. Documentation/Record/Pay Quantity Surveys shall be performed by a Registered Land Surveyor (RLS) licensed in the State of Wisconsin. Submitted surveys shall be stamped by the RLS or PE. Documentation/Record Surveys shall be completed and provide information required in accordance with environmental regulatory agency code requirements, Project Specifications, and project CQA plans.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.1 Field Engineering

A. Contractor shall obtain available data related to the site and inspect the site before proceeding with the Work; shall be solely responsible for obtaining and verifying the accuracy of measurements and layout of Work; and shall correct errors or defects due to faulty measurements taken, information obtained, layout, or due to failure to report discrepancies.

B. Verify locations of survey control points prior to starting Work. Notify the Engineer in writing in case of discrepancies between existing conditions and the Project Drawings. Starting work or failure to notify the Engineer of such discrepancies and/or defects shall constitute Contractor acceptance of same.

C. Owner will initially locate control and reference points. Control datum for survey is that shown on Project Drawings. Protect the control and reference points. Preserve permanent reference points during progress of the Work. Do not change or relocate reference points or lines without approval of OWNER. Inform OWNER when reference point is lost, destroyed, or requires relocation.

D. Contractor shall layout work and be responsible for lines, grades, elevations, measurements, and other related work executed under Contract, including surveys and calculations/measurements for earthwork and geosynthetic payment quantities (unit price work only), location of field tests, etc. Contractor shall survey specified documentation points and submit to Owner under Base Bid. Owner will use this information to generate required documentation / Record Drawings.

E. Perform surveying for layout and documentation per code requirements, Project Specifications, and CQA Plan for Work under this Contract.

1. Surveying includes the following for Liner Work:

    a. Top of Subbase

    b. Location of Subsurface Soils Removal

    c. Top of Compacted Clay Liner.

    d. Geomembrane, including seams and anchor trenches. An as-built geomembrane panel layout diagram shall be developed from surveyed points.

    e. Geosynthetic surveys: Survey extent of geosynthetic deployment and inside edge of anchor trench for each layer of geosynthetics and calculate in-place material quantities from data.

    f. Top of Granular Drainage Aggregate area.

    g. Piping inverts every 50', location, x-y-z coordinates of fittings.

    h. Topographic survey of perimeter berms, ditches, disturbed areas, etc. including breaks in grade so as to tie into contours from latest Topo.

    i. Pay-quantity survey for all applicable unit price items unless provided by others.

    j. Topographic survey of restored borrow site.

2. Surveying includes the following for Final Cover Work:

    a. Top of Grading Layer (i.e. top of waste).

    b. Top of Clay Layer.

    c. Geomembrane, including seams, destruct test locations, repairs, anchor trenches. Repairs larger than 6 square feet shall be surveyed at each comer. An as-built geomembrane panel layout diagram including destruct test locations, repairs, anchor trenches, etc. shall be developed from surveyed points.

d. Geosynthetic surveys: Survey extent of geosynthetic deployment and inside edge of anchor trench for each layer of geosynthetics and calculate in-place material quantities from data.

e. Final Grade. Extend minimum outside limits of cap or undisturbed areas so as to tie into contours from latest aerial.

f. Piping inverts, location, x-y-z coordinates of fittings.

g. Topographic survey of perimeter berms, ditches, roads, disturbed areas, etc. including breaks in grade so as to tie into contours from latest Topo.

h. Pay-quantity survey for all applicable unit price items unless provided by others.

i. Topographic survey of restored borrow site.

j. Settlement plates or measurement cylinders shall be used for Item 2 and Item 5.

3.2 Project Record Documents

A. Maintain during construction one complete set of Record Contract Documents. Record clearly and completely deviations from the original provisions of the Contract Documents. Such records shall show the Work as actually executed. Maintain in clean, dry, legible condition.

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract Documents.
5. Reviewed product submittals and submittal log.
6. Field Directives.
7. Field Test records.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction. Label as “Project Record Documents”.

D. Record information concurrent with construction progress. Use red pencil to note changes. Do not conceal any Work until required information has been recorded.

E. Record Documents and Shop Drawings: Legibly mark each item to record actual site conditions including, but not limited to:

1. Field changes of dimensions, materials, and details from those shown on the Drawings.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Details not on original Contract Drawings, but included as supplemental drawings, changes shown during review of shop drawings, and the like, during construction.

F. Specifications shall be clearly and completely marked to record actual construction including the following:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment installed when Contractor's options are available.

2. Changes made by contract modifications or per reviewed shop drawings.

G. Submit to Owner at contract close-out.

PART 4 - MEASUREMENT AND PAYMENT

(Not Used)

* * * END OF SECTION * * *

SECTION 01 77 00

CLOSEOUT PROCEDRUES

PART 1 - GENERAL

1.1 Section Includes

A. Provisions to provide an orderly and efficient transfer of the completed Work to the Owner.

1.2 Quality Assurance

A. Prior to requesting final inspection by the Owner, use adequate means to ensure that the Work is completed in accordance with the specified requirements and is ready for the requested inspection.

B. Maintain finished Work products clean, unmarked, and suitably protected until accepted by the Owner.

1.3 Substantial Completion

A. Contractor shall request a “punchlist inspection” by the Owner when the Work, or designated portion of the Work, is considered substantially complete by the Contractor.

B. Certificate of Substantial Completion will be issued by the Owner after the “punchlist inspection”, provided Work items of punchlist, if any are judged to be minor by the Owner.

1.4 Final Cleaning

A. Execute prior to final walk-through.

B. Remove waste, surplus materials, rubbish, etc. from the site.

C. Repair, patch, or touch up marred surfaces to match finish and quality of acceptable adjacent areas. Damaged areas shall be repaired or replaced by the Contractor at no expense to the Owner in a manner satisfactory to the Owner.

D. Concrete and paved areas shall be broom-clean. Grass and landscaped areas shall be rake-clean. Material spills shall be removed.

1.5 Final Completion

A. Verify that the Work, including punchlist items, is complete in accordance with the Contract Documents and is ready for Owner’s final review.

B. The Owner will make an inspection to verify status of completion. Should the Owner determine the Work is incomplete or defective the Owner will promptly notify the Contractor, in writing, listing the incomplete or defective Work.

C. Remedy the deficiencies promptly, and notify the Owner when ready for re-inspection.

1.6 Closeout Submittals

A. Project Record Documents, including final site survey.

B. Certificate signed under oath or verified by affidavit listing parties supplying services, labor, and materials, and the cost amount already paid to each, and the cost amounts yet due to each or to become due to each.

C. Close-out submittals required for separate portions of the Work as specified elsewhere in these Specifications.

1.7 Final Application for Payment

A. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due. Also include evidence of payments, release of liens, and final waivers of lien. The following documents shall be duly executed before delivery to the Owner:

1. Contractor's Releases or Final Waivers of Lien, conditional on receipt of final payment and on form acceptable to the Owner.

2. Separate Releases or Final Waivers of Liens from each and every party with lien rights against the property of the Owner, including subcontractors and suppliers.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

(Not Used)

PART 4 - MEASUREMENT AND PAYMENT

(Not Used)

* * * END OF SECTION * * *

SECTION 01 87 00

EQUIPMENT and FURNISHINGS REQUIREMENTS

PART 1 - GENERAL

1.1 Section Includes

A. Products.

B. Product Options.

C. Substitutions.

D. Transportation and Handling.

E. Storage and Protection.

F. Installation Standards

PART 2 - PRODUCTS

2.1 Products

A. Products include material, equipment, and systems. Products may also include existing materials or components required for reuse. Includes accessory items such as finishes and trim necessary for intended use.

B. Do not use materials and equipment removed from existing structure or system, except as specifically required, or allowed by Contract Documents or approved by Owner or Engineer.

C. Comply with Specifications and referenced standards as minimum requirements.

D. Provide components of the same manufacturer, for interchangeable components.

E. Products for restoring work shall match existing materials unless specifically approved in writing by OWNER.

2.2 Product Options

A. For products specified by reference standards or by description only, select any product meeting the standards or description, by any manufacturer.

B. For products specified by naming several products or manufacturers, only select one of the products and manufacturers listed. No options or substitutions allowed.

C. For products specified by naming one or more products, but indicating the option of selecting equivalent products by stating “or equivalent as approved by the Engineer”, the Contractor has the option to propose a product which is not specified by name, and which meets the requirements of the specifications. Requirements for proposed substitutions are described in Article 2.3 of this Section.

D. For products specified by naming only one product and manufacturer, there is no option, and no substitution will be allowed.

E. Where product options are available, selected products shall be compatible with other proposed materials and products.

F. Selected products shall be provided by single source throughout the duration of the Work unless otherwise approved by the Engineer.

2.3 Substitutions

A. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. It is the CONTRACTORs responsibility to provide sufficient evidence by tests or other means to support any request for approval of substitutions. Each written request for a substitution shall be accompanied by a summary of the cost differential between the specified product and the substituted product, and include a description of the proposed substitutions effects on construction schedule and other changes required in the Work to implement proposed change. The burden of proof that a proposed substitution is equivalent to a specified item shall be on the CONTRACTOR, who shall support his request with complete data substantiating compliance of proposed substitution with the Contract Documents to permit a fair and equitable decision on the merits of the proposal.

B. Request constitutes a representation that CONTRACTOR:

1. Has investigated proposed product and has determined that it meets or exceeds all respects, specified product, including appearance, longevity, compatibility, and its suitability for the climate and use are comparable to that specified.
2. Will provide the same warranty for substitution as for the specified product.
3. Will coordinate installation and make other changes which may be required for Work to be complete in all respects.
4. Waives claims for additional costs which may subsequently become apparent.

C. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals without separate written request, or when acceptance will require substantial revision of Contract Documents.

D. OWNER will determine acceptability of proposed substitution, and will notify CONTRACTOR of acceptance or rejection in writing within a reasonable time.

E. Do not substitute materials, equipment, or methods unless such substitution has been specifically approved in writing by the Engineer.

F. No requests for product substitutions will be considered prior to the bid opening except as specifically provided for in the Instructions to Bidders. The Base Bid shall be based upon the use of products specified herein or per issued Addenda. Proposed substitutions shall be listed on the Substitution List included in the Project Manual.

G. The Engineer will act upon formal requests received from the Contractor for substitution of products proposed in lieu of those specified if it appears the proposed substitution is in the best interest of the Owner.

H. Engineer and Owner will be the sole judge of equivalency of proposed substitute products. Engineer will make written recommendations of acceptance or rejection to the Owner. Owner will then authorize Engineer to issue to Contractor written approval or rejection of the substitution. The decision of the Owner shall be final.

I. Contractor shall reimburse the Owner for costs incurred for reviewing and researching substitution items that are **not** accepted by the Owner. Costs will be deducted from the Contract.

PART 3 - EXECUTION

3.1 Transportation and Handling

A. Except as otherwise approved by the Engineer, transport and handle products in accordance with manufacturer's instructions. Deliver Products in undamaged, dry condition in manufacturer's unopened containers or packaging.

B. Promptly inspect delivered shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged. Correct deficiencies. Promptly remove damaged products from the job site and replace with products meeting the specified requirements.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

D. The Engineer may reject as non-complying such products that do not bear identification satisfactory to the Engineer as to manufacturer, grade, quality, and other pertinent information.

3.2 Storage and Protection

A. Store and protect products in accordance with manufacturer's instructions, with seals and labels intact and legible. Store sensitive products in weather-tight climate controlled enclosures as required by manufacturer's instructions.

B. For exterior storage of fabricated products, place on supports above ground.

C. Provide off-site storage and protection when site does not permit on-site storage or protection.

D. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to avoid condensation or potential degradation of product.

E. Store loose granular materials on solid flat surfaces in well-drained areas. Prevent mixing with foreign matter.

F. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

G. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained under specified conditions.

H. Store and protect existing items removed from the work area which are scheduled to be re-installed so as to prevent damage.

I. Suitably protect in-progress Work and completed Work from damage. In the event of damage, Contractor shall promptly make replacements and repairs to the approval of the Owner.

J. Additional time and materials required to secure replacement and to make repairs of damaged products or Work caused by Contractor will not be considered by the Owner to justify additional cost or an extension in the contract time of completion

K. Distribute loads from materials and equipment stored such that supporting surfaces and surrounding areas are not overstressed.

3.3 Installation standards

A. Comply with manufacturer's instructions, unless otherwise specified. Prepare surfaces and remove surface finishes to provide for proper installation of new work and finishes.

B. Install accurately at specified locations, secured in-place, plumb and level as applicable.

C. Align with other work. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent Work in texture and appearance.

D. Quality of materials and workmanship of non-repaired areas of the existing facility shall constitute a minimum standard of acceptance for restoration work.

PART 4 - MEASUREMENT AND PAYMENT

(Not Used)

* * * END OF SECTION * * *

SECTION 02140

DEWATERING

PART 1 – GENERAL

1.01 SUMMARY

A. Water levels will vary from area to area and season to season and dewatering may be required for construction of the landfill.

B. Dewatering shall be the sole responsibility of the CONTRACTOR.

1.02 PERFORMANCE REQUIREMENTS

A. The CONTRACTOR shall dewater where necessary to complete the WORK. The CONTRACTOR shall be responsible for adhering to necessary OWNER secured permits to complete the requirements of this Section.

B. The CONTRACTOR shall dewater construction areas sufficiently to allow the WORK to be performed under dry conditions.

1.03 SUBMITTALS

A. Prior to commencement of excavations the CONTRACTOR shall submit a detailed plan and operation schedule for dewatering for review by the ENGINEER. The CONTRACTOR may be required to demonstrate the system proposed and to verify that adequate equipment, personnel, and materials will be available to provide the necessary dewatering.

B. The CONTRACTOR'S dewatering plan must clearly indicate the method and location of dewatering and the means of disposal of excess water.

1.04 QUALITY CONTROL

A. It shall be the sole responsibility of the CONTRACTOR to control the rate and discharge of the dewatering operation so as to avoid all objectionable settlement and subsidence.

B. The CONTRACTOR shall be responsible for implementing all dewatering operations to the extent that the integrity of the finished WORK is maintained.

C. Where structures or facilities exist immediately adjacent to areas of proposed dewatering, reference points shall be established and observed at frequent intervals to detect any settlement or other movement that may occur. The CONTRACTOR shall be responsible for conducting the dewatering operation in a manner that will protect adjacent structures and facilities. The cost of repairing any damage to adjacent structures and restoration of facilities damaged shall be the responsibility and at the expense of the CONTRACTOR.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. Dewatering may include the use of well points, sump pumps, and temporary pipelines for water disposal, rock or gravel placement, and other means conforming to the dewatering plan required in paragraph 1.03 A above. Standby pumping equipment shall be available on the jobsite for a use as required.

B. The CONTRACTOR shall be responsible for furnishing, installing, and operating all equipment necessary for dewatering.

PART 3 – EXECUTION

3.01 APPLICATION

A. The OWNER shall be responsible for the acquisition of permits required for dewatering. Which includes DNR and any other required permits.

B. The CONTRACTOR shall dewater the excavation as necessary in order that the groundwater level is 2-feet below the bottom of the excavation. Therefore, the placement of clay barrier material is completed under dry conditions.

C. The CONTRACTOR shall discharge water to the proper drainageway onsite. The water will flow through this ditch and bio logs placed prior to discharge to discharge off-site. Discharge water shall be free of sediment, shall not appear turbid, and shall comply with State and/or local permit conditions.

D. The CONTRACTOR shall be fully responsible and liable for all damages which may result from failure to keep excavations adequately dewatered.

3.02 GENERAL REQUIREMENTS

A. The CONTRACTOR shall provide all equipment necessary for dewatering and shall have on hand, at all times, sufficient pumping equipment and machinery in good working condition along with competent workmen for the operation of the pumping equipment. Adequate standby equipment shall be kept available at all times to ensure efficient dewatering and maintenance of dewatering operation during power failure.

B. Dewatering excavation shall commence when water is first encountered and shall be continuous until such times as water can be allowed to rise in accordance with the provisions of these specifications.

C. The CONTRACTOR shall grade the site so that at all times:
   1. Surface runoff is diverted from the excavation.
   2. Water entering the excavation from surface runoff is collected in shallow ditches around the perimeter of the excavation, drained to sumps, and pumped or drained by gravity away from the excavation so that a bottom free from standing water is maintained.

D. The CONTRACTOR shall dewater the excavation in such a manner as to preserve the undisturbed bearing capacity of the subgrade soils at the bearing points of the pipe or structure to be installed.

E. If foundation soils subside, are disturbed or loosened by the upward seepage of water or an uncontrolled flow of water, the CONTRACTOR shall consult with ENGINEER before proceeding.

F. The CONTRACTOR shall maintain the water level a minimum of 1-2 feet below the bottom of the excavation during excavation and testing of base soils.

G. If well points or sumps are used for dewatering, the CONTRACTOR shall prevent pumping of fine sands or silts from the subsurface by adequately spacing the well points or using sandpacking or other means to provide the necessary dewatering. The CONTRACTOR shall be responsible for adequate monitoring to ensure that the subsurface soil is not being removed by the dewatering operation.

H. The CONTRACTOR shall release the water to its static level in such a manner as to maintain the undisturbed state of the natural foundation soils.

*** END OF SECTION ***

SECTION 02201

GRANULAR DRAINAGE LAYER

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for the installation of the granular drainage layer placed as shown on the drawings directly over geosynthetic surfaces.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
2. ASTM D2434 – Standard Test Method for Permeability of Granular Soils (Constant Head)
3. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
4. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
5. ASTM D7928 – Standard Test Methods for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.03 SUBMITTALS

A. Location of offsite source of materials.

B. Name, address, telephone number and contact person of independent soils laboratory.

C. Material test results as detailed in Section 1.04.

D. Method of off-site source soils material sampling and analyses.

E. Off-site source material quality control analyses shall be submitted at least 14 days prior to installation.

F. Proposed haul road planned for transportation of all off-site materials to the project site.

1.04 SOIL MATERIAL SOURCE QUALITY ASSURANCE

A. Source testing to be performed by CONTRACTOR. Testing shall be completed by an OWNER approved testing laboratory at no cost to the OWNER. Results of source testing shall be supplied to the ENGINEER seven (7) days prior to installation.

B. No material will be delivered to the site prior to verifying that the specifications have been met.

C. Permeability testing to be done at approximately 95% of Standard Proctor maximum dry density in accordance with ASTM D698.

Property	Test Method	Frequency
Grain Size Analysis	ASTM D6913 and D7928	1 per 2,000 CY (3 min)
Standard Proctor	ASTM D698	1 minimum
Permeability	ASTM D2434	1 per 2,000 CY (3 min)
USCS Soil Classification and Uniformity Coefficient	ASTM D2487	1 per 2,000 CY (3 min)
Calcium Carbonate Content[1]	ASTM D4373	1/Source

[1] Calcium carbonate content is required for granular drainage layer with grain size greater than 99% passing the 3/8" sieve only.

PART 2 – PRODUCTS

2.01 GRANULAR DRAINAGE MATERIAL (CELL CONSTRUCTION)

A. Washed granular sand, consisting of sub-angular to rounded particle material, durable particles (no limestone source rock) free of sharp and angular objects, roots, and debris.
   1. Soil Classification: SC, SW-SM, SW-SC, SP-SM, SP-SC, or SP; coarse aggregate is an acceptable granular drainage layer (no Limestone)
   2. Uniformity coefficient: Less than six (6).
   3. Grain Size: 99% passing 2-inch sieve and maximum 5% by weight which passes the #200 sieve.
      a. Material with maximum grain size exceeding 99% passing the 3/8" sieve must be accompanied by geotextile protective layer. Maximum grain size may vary at time of construction based on the base liner system design per the Drawings.
   4. Minimum permeability of $1x10^{-2}$ cm/sec
   5. Contain no organic matter
   6. Calcium Carbonate content of maximum 15% by weight

B. The OWNER or ENGINEER reserves the option to inspect and reject unsuitable materials.

2.02 GRANULAR DRAINAGE MATERIAL (CLOSURE CONSTRUCTION)

A. Washed granular sand, consisting of sub-angular to rounded particle material, durable particles (no limestone source rock) free of sharp and angular objects, roots, and debris.
   1. Soil Classification: SC, SW-SM, SW-SC, SP-SM, SP-SC, or SP
   2. Uniformity coefficient: Less than six (6).
   3. Grain Size: 99% passing 3/8-inch sieve and maximum 5% by weight which passes the #200 sieve.
   4. Minimum permeability of $1x10^{-2}$ cm/sec
   5. Contain no organic matter

B. The OWNER or ENGINEER reserves the option to inspect and reject unsuitable materials.

PART 3 - EXECUTION

3.01 FILL USAGE

A. Directly over geomembrane or geotextile as shown on Drawings. Protective geotextile installation and material weight will be dependent on grain size of selected drainage material.

3.02 PREPARATION

A. CONTRACTOR to receive OWNER'S permission to begin installation of granular drainage layer.

B. CONTRACTOR shall be responsible for surface water control within construction limits and shall keep the construction well drained and minimize surface water ponding.

C. Subgrade elevation shall be documented by the QAC prior to placement of granular drainage layer material.

3.03 PLACEMENT

A. The CONTRACTOR shall clean the geomembrane surface of all loose soil and debris prior to initiating placement of the granular drainage layer.

B. Placement of granular materials on geomembrane shall not proceed at ambient temperatures below 5°C (40°F).

C. Spread with one pass of low ground pressure tracked equipment or equivalent as approved by ENGINEER prior to placement. Do not allow rubber-tired vehicles on granular blanket after placement. Operation of hauling equipment will be allowed only on areas with a three (3) foot minimum thickness of granular drainage material. Provide a minimum thickness of 12 inches of drainage sand for tracked equipment on the geomembrane.

D. Spread upslope (90^{o} to slope) only. No abrupt stops on slope. No stockpiling on slope.

E. Do not compact material on geosynthetics.

F. Protect buried pipes, geotextiles, geosynthetics, and similar installations.

G. CONTRACTOR shall place granular material by such method as to prevent wrinkling and possible damage to the HDPE liner once the geosynthetic lining system has been accepted by the ENGINEER. If wrinkles form, every effort should be made to smooth the wrinkles out. The ENGINEER may direct the CONTRACTOR to work on other areas until more favorable conditions exist for granular drainage layer placement.

H. It shall be the CONTRACTOR'S responsibility to ensure that the geosynthetics are not damaged. Should they become damaged, the CONTRACTOR shall at their own expense:

1. Immediately notify the ENGINEER, and
2. Have the geosynthetic installer make any necessary repairs at the CONTRACTOR'S expense.

3.04 FIELD QUALITY CONTROL

A. Comply with approved Quality Assurance Manual. CONTRACTOR shall cooperate and assist the ENGINEER with obtaining required documentation and testing.

B. Specified soil layers shall be graded to the minimum thicknesses as shown on drawings and specified herein. Thickness tolerance of the soil layers must be between –0.0 and +0.2 feet.

1. Thicknesses shall also be checked using a measuring tape at locations selected by the ENGINEER.
2. Thickness requirements of the granular drainage layer shall be met based upon the as-built top of the previous layer.

C. Testing:
1. In-place laboratory sampling and testing will be completed by the ENGINEER.
2. Tests performed and frequency of tests specified are listed in the Construction Quality Assurance Manual.

3.05 ADJUSTMENT AND CLEANING

A. Remove excess material not suitable for use from the Site.

3.06 GRANULAR DRAINAGE LAYER MAINTENANCE

A. CONTRACTOR shall be responsible for granular drainage layer thickness, grade, and material quality until punch list items are completed and OWNER accepts ownership of the product.

B. CONTRACTOR shall be responsible for retesting material that has been displaced and removing and replacing material, which does not meet specifications at no additional cost to OWNER.

END OF SECTION

SECTION 02202

COARSE AGGREGATE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for supply and installation of the coarse aggregate as shown on the Drawings in the leachate collection, stormwater, and gas piping systems.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
2. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
3. ASTM D7928 – Standard Test Methods for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.03 SUBMITTALS

A. Location of offsite source of materials.

B. Name, address, telephone number and contact person of independent soils laboratory.

C. Material test results as detailed in Section 1.04.

D. Method of off-site source soils material sampling and analyses.

E. Off-site source material quality control analyses shall be submitted at least 14 days prior to installation.

F. Proposed haul road planned for transportation of all off-site materials to the project site.

1.04 SOIL MATERIAL SOURCE QUALITY CONTROL

A. Independent soils laboratory to be approved by OWNER.

B. Source testing to be performed by CONTRACTOR at no cost to the OWNER.

C. Provide the following source test results for material test requirements:

Property	Test Method	Frequency
Grain Size Analysis	ASTM D6913 and D7928	1/source
USCS Soil Classification and Uniformity Coefficient	ASTM D2487	1/source
Calcium Carbonate Content*	ASTM D4373	1/source

*Test waived if CONTRACTOR can demonstrate the material source is from quartzite, granite, or other igneous non-limestone/dolomite formation.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. CONTRACTOR Supplied Coarse Aggregate

Granular material, bank-run gravel, consisting of sub-angular to rounded particle material, durable particles (no limestone source rock).

1. Uniformity coefficient: Less than 4
2. Grain Size: Range from maximum diameter of 2-inch to minimum diameter of 1/2-inch (maximum 5% by weight passing #200 Sieve).
3. Contains no organic matter
4. Coarse aggregate shall contain less than 15 percent calcium carbonate by weight as determined in accordance with ASTM D4373.
5. If rounded sub-angular aggregate is not readily available, crushed aggregate may be allowed provided underlayment geotextile is designed appropriately. Approval will be dependent on determination provided by ENGINEER.

PART 3 – EXECUTION

3.01 FILL USAGE

A. Coarse Aggregate: Leachate collection line trenches, sumps, gas piping, and stormwater management areas as shown on Drawings.

3.02 PREPARATION

A. CONTRACTOR shall receive OWNER'S permission to begin installation of coarse aggregate.

3.03 PLACEMENT

A. Transport material into areas with geomembrane in a manner that will not damage underlying soil or synthetic layers. Low ground pressure equipment shall be used and no sharp turns with tracked equipment shall be made.

B. Do not compact the material.

C. CONTRACTOR shall place coarse aggregate by such method as to prevent wrinkling and possible damage to the underlying geosynthetics. Once the geosynthetic lining system has been accepted by the OWNER, it shall be the CONTRACTOR'S responsibility to ensure that the geosynthetics are not damaged. Should they become damaged, the CONTRACTOR shall at their own expense:

1. Immediately notify ENGINEER, and
2. Have the geosynthetic installer make any necessary repairs at the CONTRACTOR'S expense.

D. If a rock box is used, a granular drainage layer thickness of three (3) feet shall be present over the underlying geosynthetics below the box.

3.04 FIELD QUALITY CONTROL

A. Comply with approved Construction Quality Assurance Manual. Cooperate with quality control program.

B. Testing:

1. In-place tests performed, and frequency of tests specified in the Construction Quality Assurance Manual.
2. In-Place testing to be performed by the ENGINEER.
3. CONTRACTOR is responsible for all costs related to retests of materials not meeting specifications.

3.05 ADJUSTMENT AND CLEANING

A. Remove excess material not suitable for use for any part of the project from the site.

END OF SECTION

SECTION 02203

INTERMEDIATE FILTER AGGREGATE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for the installation of the intermediate filter aggregate as shown on the Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
2. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
3. ASTM D7928 – Standard Test Methods for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.03 SUBMITTALS

A. Location of off-site source of materials.

B. Name, address, telephone number and contact person of independent soils laboratory.

C. Method of off-site source soils material sampling and analyses.

D. Offsite material source quality control analyses shall be submitted at least 14 days prior to installation.

E. Intermediate filter aggregate relationship to coarse aggregate and granular drainage layer material shall be submitted to show compliance with this spec section.

F. Proposed haul route planned for transportation of all offsite materials to the project site.

1.04 SOIL MATERIAL SOURCE QUALITY CONTROL

A. Independent soils laboratory to be approved by OWNER.

B. Source testing to be performed by CONTRACTOR at no cost to the OWNER.

C. Provide the following source test results for material test requirements:

Property	Test Method	Frequency
Grain Size Analysis	ASTM D6913 and D7928	1/source
USCS Soil Classification and Uniformity Coefficient	ASTM D2487	1/source
Calcium Carbonate Content*	ASTM D4373	1/source

*Test waived if CONTRACTOR can demonstrate that material source is from quartzite, granite, or other igneous non-limestone/dolomite formation

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. CONTRACTOR Supplied Intermediate Filter Aggregate: Durable, washed, coarse rounded to subangular, durable gravel (no limestone source rock).
   a. Crushed aggregate and/or limestone are not allowed.
   b. Contains no organic matter
   c. Coarse aggregate shall contain less than 15 percent calcium carbonate by weight as determined when tested in accordance with ASTM D4373.

B. The intermediate filter aggregate shall exhibit the following relationships to the coarse aggregate:

   1. $\frac{D_{15}\text{ (coarse aggregate)}}{D_{85}\text{ (intermediate filter aggregate)}} \leq 5$

   2. $\frac{D_{50}\text{ (coarse aggregate)}}{D_{50}\text{ (intermediate filter aggregate)}} \leq 25$

   3. $\frac{D_{15}\text{ (coarse aggregate)}}{D_{15}\text{ (intermediate filter aggregate)}} < 20$

C. The intermediate filter aggregate shall exhibit the following relationships to the granular drainage material:

   1. $\frac{D_{15}\text{ (intermediate filter aggregate)}}{D_{85}\text{ (granular drainage material)}} \leq 5$

   2. $\frac{D_{50}\text{ (intermediate filter aggregate)}}{D_{50}\text{ (granular drainage material)}} \leq 25$

   3. $\frac{D_{15}\text{ (intermediate filter aggregate)}}{D_{15}\text{ (granular drainage material)}} \geq 5$

   Where D_{15}, D_{50}, and D_{85} are the diameters with which 15%, 50%, and 85% by weight are finer than, respectively.

PART 3 - EXECUTION

3.01 FILL USAGE

A. Intermediate Filter Aggregate: Leachate collection trenches between coarse aggregate and granular drainage layers as shown on the Drawings.

3.02 PREPARATION

A. CONTRACTOR to receive OWNER'S permission to begin installation of intermediate filter aggregate.

3.03 PLACEMENT

A. Transport material into area with geomembrane in a manner that will not damage underlying soil or synthetic layers. Low ground pressure equipment shall be used and no sharp turns with tracked equipment shall be made.

B. Do not compact the material.

C. CONTRACTOR shall place material by such method as to prevent wrinkling and possible damage to the underlying geosynthetics. Once the geosynthetic lining system has been accepted by the OWNER, it shall be the CONTRACTOR'S responsibility to ensure that the geosynthetics are not damaged. Should they become damaged, the CONTRACTOR shall at their own expense:

1. Immediately notify the ENGINEER, and
2. Have the geosynthetic installer make any necessary repairs at the CONTRACTOR'S expense.

D. If a rock box is used, a granular drainage layer thickness of three (3) feet shall be present below the box.

3.04 FIELD QUALITY CONTROL

A. Comply with approved Quality Assurance Manual. Cooperate with quality control program.

B. Testing:

1. In-place tests performed, and frequency of tests specified in the Quality Assurance Manual.
2. In-Place testing to be performed by the ENGINEER.
2. CONTRACTOR is responsible for all costs related to retests of materials not meeting specifications.

3.05 ADJUSTMENT AND CLEANING

A. Remove excess material not suitable for use from the site.

END OF SECTION

SECTION 02205

CLAY BARRIER LAYER

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for installation of the clay barrier layer as shown on the Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
2. ASTM D854 – Standard Test Method for Specific Gravity of Soils by Water Pycnometer.
3. ASTM D1140 - Standard Test Methods for Determining Amount of Material Finer than the No. 200 (75 µm) Sieve in Soils by Washing
4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3)
5. ASTM D1587 - Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes
6. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8. ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)
9. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
10. ASTM D5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter
11. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
12. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
13. ASTM D7928 – Standard Test Methods for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.03 SUBMITTALS

A. Description of proposed blending equipment seven (7) days prior to clay placement.

B. Name, address, telephone number and contact person of independent soils laboratory.

C. Location of offsite source of materials.

D. Method of offsite source materials sampling and analysis.

E. Offsite source material analyses.

F. Proposed haul road planned for transportation of all offsite materials to the project site.

1.04 SOIL MATERIAL QUALITY CONTROL

A. CONTRACTOR to perform source testing for clay barrier material. Independent soils laboratory shall be approved by OWNER.

B. Source sample permeability testing to be done at minimum 95% of Standard Proctor dry density in accordance with ASTM D698.

Property	Test Method	Frequency
Grain Size Analysis	ASTM D1140 and D6913 and D7928	1 per 3,000 CY
Standard Proctor	ASTM D698	1 per 3,000 CY
USCS Soil Classification	ASTM D2487	1 per 3,000 CY
Atterberg Limits	ASTM D4318	1 per 3,000 CY
Hydraulic Conductivity (Permeability)	ASTM D5084	1 per 5,000 CY

C. ENGINEER will perform in-place material testing in accordance with the Construction Quality Assurance Manual. CONTRACTOR may perform additional in-place material testing at no cost to the OWNER. If CONTRACTOR does perform additional in-place testing, CONTRACTOR shall submit all testing results to the OWNER and ENGINEER.

PART 2 - PRODUCTS

2.01 SOURCE OF MATERIAL

A. The material may be obtained from OWNER designated on-site stockpile/borrow area or the CONTRACTOR may be responsible for furnishing suitable clay barrier material that conforms to the specifications.

2.02 CLAY BARRIER LAYER

A. Clay barrier layer material shall have a USCS classification of SC, CL, or CH exhibiting the following:

Property	Specification
Soil Permeability	$1x10^{-7}$ cm/sec or less when compacted to 95% of Standard Proctor dry density at a moisture content of 0% to 5% wet of optimum
Atterberg Limits	LL: 25% or Greater PI: 12% or Greater
Grain size	100% passing 3" sieve, min. 50% by weight passing #200 sieve, max. % gravel = 5%, max. rock size= 1" diameter, max. clod size= 3"
Compaction	95% of standard proctor maximum dry density or greater at a moisture content 0% to 5% wet of optimum
Soil Classification	CL, CH, SC if meeting permeability requirements, no organics.

B. Clay barrier layer material shall contain no clods larger than three (3) inches and be free of debris, roots, organic material, solid mineral material larger than one (1) inch in diameter, angular stones of any diameter and other materials considered deleterious to the overlying geomembrane liner.

C. Testing results shall be supplied to the ENGINEER two weeks prior to liner construction. The CONTRACTOR shall bear the costs of clay soil sampling and testing required to meet the above specifications.

D. The OWNER and ENGINEER reserves the option to inspect and reject unsuitable materials.

E. Any areas not meeting the compaction or permeability standards hall be reworked at the CONTRACTOR's expense.

PART 3 – EXECUTION

3.01 FILL USAGE

A. Clay barrier layer: Directly below geosynthetic liner system within the limits indicated on the Drawings for new cell construction. The layer thickness as show on Drawings is the compacted thickness.

3.02 PREPARATION

A. Prepare surface to lines and grades as shown on Drawings.

B. CONTRACTOR shall be responsible for surface water control within construction limits and shall keep the construction well drained and minimize surface water ponding. Dewatering shall be executed as necessary.

C. Proof roll surfaces to receive fill and subgrades within limits of excavation to determine existence of soft areas, areas loosened by frost action or softened by flooding, weather or of unsuitable materials.

1 Determination of soft, wet or loose areas will be based on ENGINEER'S judgment.
2. Soft areas will generally be detected by soil deflection of greater than two (2) inches and accompanied with stress cracks in soil when rolled over by heavy construction equipment intended for the placement and compaction of clay.

D. Replace materials determined to be unsuitable or soft soils by sub-cutting two (2) feet and replacing with common fill or other material approved by the ENGINEER in writing.

E. Subgrade elevation shall be documented by the CONTRACTOR prior to placement of clay barrier layer material. Clay barrier layer installation shall not proceed until all subgrade testing, survey, and documentation is completed.

3.03 PLACEMENT

A. The CONTRACTOR shall place clay barrier layer material as follows:

Property	Specification
Maximum Compacted Lift Thickness	6 inches
Minimum Compaction	95% of maximum dry density, ASTM D698 Standard Proctor
Moisture Content	0% to 5% wet of optimum

Maximum Clod Size	Reasonably free of clods; max size 3 inches
Maximum Permeability	$1x10^{-7}$ cm/sec, (ASTM D5084-falling head)

B. The clay barrier material shall be at optimum moisture or greater prior to placement. Clay conditioning may be performed in the area designated by OWNER.

C. Material distribution and gradation throughout clay barrier shall be such that material is free from lenses, pockets, streaks or layers of material differing substantially in texture or gradation from surrounding material. Blend clay prior to compaction.

D. Uniformly distribute moisture content of clay material prior to and during compaction throughout each lift of material. Dry excavated materials too wet for immediate compaction to permit compaction conditions and at proper moisture content. Do not place clay liner at moisture content less than optimum as defined by ASTM D698. No additional payment will be made for drying or wetting materials for use in barrier.

E. Place layers of clay to form continuous monolithic material. Remove excessively dry or wet soil before placement of additional lifts. Knead each lift into previously placed lift.

F. Compact with sheepsfoot roller, or similar kneading type compactor capable of influencing entire lift.

G. Final surface shall be smooth-rolled prior to HDPE liner placement. Finished surface will be smooth and even with no sheepsfoot roller indentations.

H. Construct sidewall liners by pushing clay material up the sidewall from the cell base. Placement or movement of clay down from the top of the sidewall will not be allowed. Placement and compaction of sidewall liner shall be performed in accordance with the specifications. Note that in the slope to floor liner transition area the clay thickness tapers from 12 inches to no clay. Several points in the grade documentation table give the appropriate thickness within the tapered area.

I. Do not place clay below air temperatures of 32^{o}F, unless CONTRACTOR can demonstrate fill material temperature is above freezing.

J. CONTRACTOR shall be responsible for the integrity of the clay liner and shall not allow the surface to dry or desiccate.

K. CONTRACTOR shall be responsible for maintaining the clay surface until it is covered by CONTRACTOR'S liner installation contractor.

L. Surface of clay liner must be approved by the Geosynthetics INSTALLER prior to installation of HDPE liner. Surface rutting or drying will not be acceptable. Surface must be smooth and free of debris, roots, and angular or sharp rocks larger than 3/8 inches in diameter to a depth of four (4) inches below surface to be lined.

3.04 FIELD QUALITY CONTROL

A. Comply with approved Construction Quality Assurance Manual. CONTRACTOR shall cooperate and assist ENGINEER and OWNER with obtaining required documentation and testing.

B. Specified soil layers shall be graded to the minimum thicknesses as shown on drawings and specified herein. Thickness tolerance of the soil layers must be between -0.0 and +0.2 feet. There is no allowance for thickness less then shown on drawings.

C. Testing:

1. Moisture density testing will be performed by the ENGINEER. Testing will proceed at each lift directed by the ENGINEER.
2. Clay barrier layer in-place testing samples will be collected by the CONTRACTOR as directed by the ENGINEERING. In-place laboratory testing will be completed by the ENGINEER.
3. Tests performed and frequency of tests specified are listed in the Construction Quality Assurance Manual.
4. CONTRACTOR is responsible for all costs related to retests of materials not meeting specifications for in-place density, moisture, and permeability.
5. CONTRACTOR shall backfill all perforations of the clay layer by probe or sample tube with a 100% bentonite mixture. The mixture shall be compacted in-place with a tamping rod, or hand tamper, depending on the size of the perforation.

3.05 ADJUSTMENT AND CLEANING

A. Remove excess material not suitable for use to the on-site stockpile. Grade to drain.

*** END OF SECTION ***

SECTION 02207

CONTROLLED FILL

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes descriptions and requirements for construction with controlled fill soils.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft3 (600 kN-m/m3)).
2. ASTM D1140 - Standard Test Method for Amount of Material in Soils Finer than the No. 200 (75 um) Sieve.
3. ASTM D2216 - Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures.
4. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
6. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
7. ASTM D7928 – Standard Test Methods for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis

1.03 SUBMITTALS

A. Location of offsite source of materials.

B. Name, address, telephone number and contact person of independent soils laboratory.

C. Material test results as detailed in Section 1.04.

D. Method of off-site source soils material sampling and analyses.

E. Off-site source material quality control analyses shall be submitted at least 14 days prior to installation.

F. Proposed haul road planned for transportation of all off-site materials to the project site.

1.04 SOIL MATERIAL SOURCE QUALITY CONTROL

A. Independent soils laboratory to be approved by OWNER.

B. Source testing to be performed by CONTRACTOR at no cost to the OWNER.

C. Provide the following source test results for material test requirements:

Property	Test Method	Frequency
Grain Size Analysis	ASTM D6913 and D7928	3 per source
Standard Proctor	ASTM D698	3 per source
USCS Soil Classification	ASTM D2487	3 per source

PART 2 - PRODUCTS

2.01 CONTROLLED FILL

A. Natural soils free of organic and other deleterious material.
B. Material imported by CONTRACTOR to be used for berms, embankments, backfill, and subgrade excavation replacement where applicable.
C. Material free from roots, debris, and stones larger than six (6) inches.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability of surface to receive installation of material.

B. Proof-roll and examine surfaces to receive fill and subgrades within influence zone to determine existence of soft areas, areas loosened by frost action or softened by flooding, groundwater or weather or existence of unsuitable materials.

3.02 PREPARATION

A. Prepare surfaces to receive materials to lines and grades shown on Drawings prior to placement.

3.03 BACKFILLING AND COMPACTION

A. Notify ENGINEER before placing fill material.

B. Do not use frozen material or place fill on frozen subgrade.

C. Where pipes or electrical conduits are located, protect by backfilling influence zone down to undisturbed soil with controlled fill.

D. Place fill simultaneously on both sides of free-standing structures.

E. Provide mechanical compaction for cohesive material and vibratory compaction for granular materials. When approved by ENGINEER, jetting, flooding, puddling, or vibroflotation methods may be used for compacting if CONTRACTOR furnishes test results to confirm required degree of compaction being obtained uniformly throughout entire mass.

Fill Placement	**Maximum Compacted Lift Thickness (inches)**	**Required Compaction Based on Standard Proctor (%)**

Controlled Fill for Anchor Trench Backfill and Piping Installation Backfill	6	"Quality Compaction Method"[1]
Controlled Fill for Temporary Berm Construction	6	"Quality Compaction Method"[1]
Controlled Fill for Subgrade and Berm Construction	8	95

[1] – Quality compaction method based on Type A Compaction defined in IowaDOT Standard Specification Section 2107.

3.04 FIELD QUALITY CONTROL

A. In-place testing shall be performed by OWNER in accordance with the Construction Quality Assurance manual; any laboratory retesting due to test failure will be paid for by the CONTRACTOR.

3.05 TRANSPORTATION AND HAUL ROADS

A. Observe State, County, and Local traffic rules and weight restrictions.

B. All vehicle trips loaded or unloaded shall be on designated haul roads only.

C. CONTRACTOR to coordinate selection of haul roads with the appropriate governing body and acquire any necessary permits.

D. On-site road utilized should be left in same or better condition than at start of project.

END OF SECTION

SECTION 02211

SITE PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes the requirements for preparing the site for construction, stripping existing cover soils, and miscellaneous surface features.

1.02 DEFINITIONS

A. Structures and Surface Features: For purpose of this section, shall mean existing structures and surface features, including but not limited to buildings, pavements, curb and gutter, signs, posts, fences, trees, shrubs, other landscaped features.

B. Salvaged Topsoil: Natural loam, sandy loam, silt loam, silty clay loam, or clay loam humus-bearing soils available from overlying portions of areas to be excavated for construction.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by ENGINEER.

D. Utilities: Existing gas mains; water mains; electric lines; conduits, telephone, and other communication lines; sewer pipe; cable television, other utilities, and appurtenances.

1.03 PROJECT/SITE CONDITIONS

A. CONTRACTOR shall provide 72-hour notice, prior to beginning construction, to OWNERS of utilities, structures, and surface features.

1.04 COORDINATION

A. Coordinate work with others performing work at project site.

B. Call Iowa One Call to check for utilities prior to beginning Work.

C. Coordinate with OWNER to complete private utility locate prior to beginning work.

PART 2 - PRODUCTS

(Not Used)

PART 3 - EXECUTION

3.01 PREPARATION

A. Provide protection and support during construction for existing utilities, structures, and surface features adjacent to construction area or easements and rights-of-way.

B. Remove obstructions such as mounds of dirt, stone or debris located within working limits.

C. Obstructions such as street signs, small culverts, and guard posts located within construction easements of rights-of-way may be removed if promptly replaced to original condition unless otherwise specified.

D. All material stockpile areas shall be stripped of topsoil prior to stockpiling.

E. Provide transportation of material and sites for stockpiles if adequate areas not available within the construction limits as shown on the Drawings.

F. Removal of trees, stumps, and other debris from the project area shall be disposed of on-site as directed by the OWNER.

G. On-site survey control monuments shall be protected from damage or displacement.

H. Trees, plant growth, groundwater monitoring wells, and features designated to remain shall be protected.

3.02 RESTORATION

A. Restore existing utilities, surface features, and structures to condition equal to or exceeding condition which existed prior to construction.

3.03 MAINTENANCE AND RESTORATION OF ONSITE AND OFFSITE HAUL ROADS

A. While hauling operations are in progress, CONTRACTOR shall maintain haul roads in condition satisfactory to the OWNER. Work shall include any or all of the following items:

1. Application of water
2. Bituminous material
3. Calcium chloride
4. Sweeping
5. Others as necessary

B. When hauling operations are completed, CONTRACTOR shall:

1. Restore to condition that existed at the time hauling operations were started; or
2. Compensate the local road authority in the amount satisfactory to that road authority.

C. The OWNER shall make the determination as to the kind and amount of Work required to restore the haul road to a condition equal to the time hauling operations began.

D. When hauling operations are complete and restoration is complete to the satisfaction of the OWNER, the CONTRACTOR will be relieved of any additional obligation in connection to the maintenance and restoration of the haul road.

END OF SECTION

SECTION 02220

EXCAVATION

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in this section includes excavation for cell construction, anchor trench excavation, pipe installation and all excavations as shown on the Drawings. This section also includes any subgrade preparation required prior to backfilling.

1.02 REFERENCES

A. Iowa Department of Transportation (Iowa DOT) “Standard Specifications for Construction”, latest edition.

1.03 SUBMITTALS

A. Shoring, Bracing, and Sheeting Layout and Details: ENGINEER will review submitted material to ascertain effect on new construction. ENGINEER will not review shoring, bracing, and sheeting for structural integrity or effect on existing facilities.

B. Prior to removal of any rock boulders, identify boulders to ENGINEER.

C. Additional soil testing results as may be required.

1.04 QUALITY CONTROL

A. Sheeting, Shoring, and Bracing:

1. If determined necessary by CONTRACTOR, sheeting, shoring, and bracing shall be designed by a licensed Professional Engineer registered in the State of Iowa.
2. Sheeting, shoring, and bracing shall conform to safety requirements of federal, state, or local public agency having jurisdiction over such matters. Most stringent of these requirements shall apply.

1.05 DEFINITIONS

A. Influence Zone Under Foundations or Pavements: Area below foundation or pavement as bounded by two (2) vertical feet to one (1) horizontal foot (2V:1H) extending outward from one (1) foot beyond outer edges of foundation or pavement.

B. Influence Zone Around Piping or Electrical Ducts: Area below limits bounded by line 12 in. above pipe or duct and by two (2) vertical feet to one (1) horizontal foot (2V:1H) extending outward from that line one (1) foot beyond outer edge of pipe or duct.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by ENGINEER.

D. Wherever "rock" is used in the Contract Documents, it shall have the following meaning: Material geologically in-place or as part of mine spoils and of a hardness or size that cannot be excavated and removed without the use of blasting or pneumatic tools. Rock shall also include rock boulders having a minimum volume of one cubic yard or if the boulder is within

a utility trench then having a minimum volume of one-half cubic yard.

1.06 FIELD MEASUREMENTS

A. Verify control monuments and intended elevations for Work as shown on Drawings.

PART 2 – PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability and condition of surfaces to perform Work.

3.02 PREPARATION

A. Identify required lines, grades, levels, contours, and datum.

B. Protect benchmarks, structures, equipment, and partially completed Work.

C. Over-excavate soft areas of subgrade not capable of in-situ compaction as directed by ENGINEER. CONTRACTOR shall notify and receive approval from ENGINEER prior to any undercutting or over-excavation activities due to soft, saturated soils or other reasons.

D. Notify corporations, companies, individuals, or authorities owning above- or belowground conduits, wires, pipes, or other utilities running to property or encountered during excavating operations.

E. Cap or remove and relocate services in accordance with instructions by owners of services.

F. Protect, support, and maintain conduits, wires, pipes, and other remaining utilities in accordance with requirements of owners of said services.

G. CONTRACTOR may encounter groundwater and upward seepage during construction and is responsible for dewatering:

1. Keep excavations free from water.
2. Maintain groundwater minimum of 12 inches below excavations.
3. Remove soil disturbed by pressure or flow of groundwater and replace with free-draining material.
4. Maintain dewatering system to prevent uplifting of structures.
5. Protect adjacent properties from damage resulting from dewatering operations.
6. Dewatering wells shall be drilled, maintained, and abandoned in accordance with federal, state, and local ordinances.

H. Keep construction site free-draining.

I. Fill settled areas where excavations or trenches were backfilled, and holes made by demolition, tree removal, and site preparation work.

J. Remove all topsoil, organic material, and soft, wet, or loose soils below proposed berm and

roadway areas.

K. Replace unsuitable materials with controlled fill material. Soft, wet, loose, and competent soils will be determined by the ENGINEER. CONTRACTOR shall notify and receive approval from ENGINEER prior to any undercutting or over-excavation activities due to soft, saturated soils or other reasons.

L. Disc level surfaces.

M. The CONTRACTOR shall stage construction to prevent slippage or sloughing of the berms during construction.

3.03 COMMON EXCAVATION

A. Excavations shall conform to lines and grades as staked, and as shown on Drawings.

B. Excavations beyond those lines and grades without the ENGINEER's authorization will be considered unauthorized work.

C. Method of excavation shall be consistent with soil types encountered and result in competent subgrade.

D. Remove stumps, roots, debris, large stones or boulders, and any other deleterious material from excavated materials to be used in embankments.

E. Do not excavate within influence zone of existing footings or foundations without prior approval of ENGINEER.

F. Upon completion of excavation, notify ENGINEER before proceeding with further work.

3.04 MUCK EXCAVATION

A. Excavate all saturated and unsaturated mixtures of soil and organic matter not suitable for foundation materials in accordance with Iowa DOT Standard Specifications 6.30: Excavation. CONTRACTOR shall notify and receive approval from ENGINEER prior to any undercutting or over-excavation activities due to soft, saturated soils or other reasons.

3.05 ANCHOR TRENCH EXCAVATION

A. Excavate anchor trench to elevations and dimensions necessary to anchor geomembrane as shown on Drawings.

B. Coordinate all work with geomembrane installer.

3.06 TRENCHING

A. Excavate to elevations and dimensions necessary to complete construction.

B. Trenching Tolerances:

1. Excavate so pipes, ducts, and conduits can be laid straight at uniform grade, without sags or humps, between elevations shown on Drawings.
2. Maximum width of excavation on top of pipe shall be outside diameter of pipe plus 24 inches. When stringers and sheathing required, width of trench may be increased to allow for their use, provided provisions for this excess width of trench are met.
3. Where trench width for that portion of trench depth between trench bottom and outside

top of pipe barrel, for any reason within CONTRACTOR'S control, exceeds specified limits, CONTRACTOR, at their expense, shall furnish pipe with strength adequate for actual trench width.

4. Excavate electrical conduit trenches as required so top of conduit shall be minimum of 36 inches below final grade or as shown on Drawings.

C. Do not advance excavation of trenches more than 300 feet ahead of completed pipe installation.

D. Do not excavate for manholes and other structures until scheduled for construction.

E. Do not excavate within influence zone of existing footings or foundations without prior approval of ENGINEER.

F. Excavation of Rigid Surfacing:

a. Remove width one (1) foot beyond anticipated edge of excavation.
b. Saw to ensure straight joint.
c. Surface replacement shall match existing surfacing.

G. Excavation Across Roadways: Excavation shall conform to the requirements of local highway authority. In no case shall surface replacement edges bear on less than 12 inches of undisturbed soil.

3.07 FIELD QUALITY CONTROL

A. Subgrade elevations shall be surveyed prior to placement of fill material. Elevations of subgrade to be as shown on Drawings.

B. Subgrade elevations shall be between –0.2 and +0.0 feet.

C. Testing: in-place density/moisture testing of the final prepared subgrade surface within the cell construction limits will be performed as specified in the Construction Quality Assurance Manual, prior to clay barrier layer placement. CONTRACTOR shall prepare subgrade to 95% Standard Proctor. CONTRACTOR is responsible for all costs related to retests of materials not meeting specifications for in-place density/moisture.

3.07 ADJUSTMENT AND CLEANING

A. Stockpile excavated material suitable for backfill on site in OWNER designated location and grade to drain.

B. Haul excavated material not suitable for backfilling and unsuitable materials to OWNER designated location within the active working face.

END OF SECTION

SECTION 02225

TRENCHING, BACKFILLING, AND COMPACTING

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in this section includes trenching, backfilling, and compacting for general site grading, piping installation, and structure installation.

1.02 DEFINITIONS

A. Influence Zone Under Foundations, Pavements, Gravel Roads, or Sidewalks: Area below foundation, pavement, gravel road, or sidewalk base bounded by 2 horizontal to 1 vertical slope extending outward from 1 ft beyond outer edges of foundation, pavement, gravel road, or sidewalk.

B. Influence Zone Around Piping or Electrical Ducts: Area below limits bounded by line 12 in. above pipe or duct and by 1 horizontal to 2 vertical slope extending outward from that line 1 ft beyond outer edge of pipe or duct.

C. Unsuitable Material: Topsoil, peat, organic soils, and materials containing slag, cinders, foundry sand, debris, and rubble or soil with less than required bearing capacity as determined by the ENGINEER or independent testing laboratory.

1.03 SUBMITTALS

A. Provide the following test results for each type of soils to be used for backfilling. Testing shall be conducted by CONTRACTOR's independent testing laboratory.

Property	Test Method	Frequency*
Soil Classification	ASTM D2487	1 per soil type
Standard Proctor	ASTM D698	1 per soil type

*Note: Additional testing may be required at the discretion of the ENGINEER.

B. Shoring, Bracing, and Sheet Piling Construction Procedures and Details: Submit procedures and material lists to be used

C. In-place testing results from independent testing laboratory.

1.04 PROJECT/SITE CONDITIONS

A. Check location of all utilities, public and private, prior to beginning work.

B. Known existing underground utilities are shown on the Drawings in a general way. Owner does not guarantee the locations as shown on the Drawings. Contractor shall anticipate variations in both the vertical and horizontal locations of underground utility lines from those shown on the Drawings.

C. Verify control monuments and intended elevations for Work as shown on Drawings.

PART 2 - PRODUCTS

2.01 BACKFILL MATERIAL – INFLUENCE ZONE UNDER FOUNDATIONS, PAVEMENT, GRAVEL ROAD, OR SIDEWALKS

A. More than 3 feet below bottom of pavement or foundation:

1. Native soils classified as SM, SC, SP or SW in the Unified Soils Classification System free of unsuitable material.

B. Less than 3 feet below bottom of pavement or foundation:

1. Native soils classified as SM, SP, or SW in the Unified Soils Classification System free of unsuitable material.
2. Or as otherwise noted.

C. If native soils are unsuitable, backfill shall be placed as indicated on the Drawings.

2.02 BACKFILL MATERIAL – OTHER AREAS

A. Native soils material: Native soils classified as CL, SM, SC, SP or SW in the Unified Soils Classification System free of unsuitable material.

2.03 GRANULAR MATERIAL

A. Granular materials as indicated on Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify acceptability and condition of surfaces to perform Work.

3.02 PREPARATION

A. See Section 02211 – SITE PREPARATION.

3.03 TRENCHING

A. Trenching Tolerances:

1. Excavate so pipes, ducts, and conduits can be laid straight at uniform grade, without sags or humps, between elevations shown on Drawings.
2. Maximum width of excavation on top of pipe shall be outside diameter of pipe plus 24 inches. When stringers and sheathing required, width of trench may be increased to allow for their use, provided provisions for this excess width of trench are met.
3. Where trench width for that portion of trench depth between trench bottom and outside top of pipe barrel, for any reason within CONTRACTOR'S control, exceeds specified limits, CONTRACTOR, at his expense, shall furnish pipe with strength adequate for actual trench width.

B. Do not advance excavation of trenches more than 300 feet ahead of completed pipe installation.

C. Do not excavate for manholes and other structures until scheduled for construction.

D. Excavate to elevations, dimensions, and in locations as shown on Drawings.

E. Upon completion of excavation, notify ENGINEER before proceeding with further Work.

3.04 BACKFILLING AND COMPACTION

A. Notify ENGINEER prior to placing fill material.

B. Install appropriate bedding for pipes, lift station structures, manholes, and other structures as shown on the Drawings.

C. Install and compact backfill material according to the requirements given in the table below. Testing frequency shall be a minimum of one test per lift or one per 2,000 CY whichever is greater.

D. Place fill simultaneously on both sides of free-standing structures.

E. Compaction shall be completed at a minimum of 95% of the standard proctor dry density

3.05 FIELD QUALITY CONTROL

A. In-place testing for conformance performed by OWNER's independent testing laboratory.

B. Any excavation/recompaction (and density retesting) due to test failure will be performed by the CONTRACTOR at no additional cost to the OWNER.

3.06 SUBMITTALS

A. Submit soil classification and standard proctor of imported soil materials at least 14 days prior to use of material.

B. Submit soil classification and standard proctor of native material within 3 days of collecting sample.

END OF SECTION

SECTION 02271

RIPRAP

PART 1 - GENERAL

1.01 SUMMARY

A. Work described in the Section includes description and requirements for **imported** riprap material.

1.02 REFERENCES

A. Iowa Department of Transportation (Iowa DOT) Standard Specifications for Construction, latest edition

1.03 SUBMITTALS

A. Location of source of riprap material.

B. One gradation (or other verification of size information) for each source and class of riprap.

1.04 QUALITY ASSURANCE

A. Testing of materials shall be provided by CONTRACTOR in accordance with this section.

B. Test results shall meet requirements for the class of riprap defined on the Drawings in accordance with Iowa DOT Standard Specification Section 4130.

PART 2 - PRODUCTS

2.01 SOURCE OF MATERIAL

A. The CONTRACTOR is responsible for providing riprap material that conforms to the Technical Specifications.

2.02 MATERIALS

A. Classes of Riprap shall be as shown on Drawings and in accordance with Iowa DOT Standard Specification Section 4130.

B. Individual rock fragments shall be dense, sound and free from cracks, seams and other debris conducive to accelerated weathering. Fractured face acceptance shall be as defined in Section 4130.

C. Geotextile shall be in accordance with Section 02921.

PART 3 - EXECUTION

3.01 PREPARATION

A. Geotextile fabric and riprap shall be installed around surface water control structures as indicated on Drawings.

B. Areas on which geotextile and riprap are to be placed shall be graded and dressed as shown on the Drawings or as required by ENGINEER.

3.02 INSTALLATION

A. CONTRACTOR shall place geotextile under riprap, anchor as shown on the Drawings, and cover completely. No fabric shall be exposed along edges or under riprap. CONTRACTOR shall place riprap so geotextile is not damaged.

END OF SECTION

SECTION 02276

EROSION CONTROL

PART 1 - GENERAL

1.01 SUMMARY

A. Work includes providing the temporary and permanent erosion control as shown on the Drawings and for compliance with the Facility's NPDES permit to discharge stormwater related to industrial activity and site specific SWPPP (available for review from OWNER).

1.02 REFERENCES

A. Iowa Department of Transportation (Iowa DOT) Standard Specifications for Construction, latest edition

1.03 SUBMITTALS

A. Manufacturer's certificates indicating specification conformance test results of furnished material.

B. Proposed hydro mulching mix with application rates, placement recommendations, and performance specifications. Applicators Certificate if requested by OWNER.

PART 2 - PRODUCT

2.01 EROSION CONTROL MATERIALS

A. Erosion control shall conform to IDOT Standard Specification Section 4169 as indicated on the Drawings.

2.02 USAGE

A. Silt fence and bio-roll as determined necessary and in accordance with the site-specific Stormwater Pollution Prevention Plan (SWPPP).

B. Erosion control products shall be placed in areas as shown on Drawings.

C. Hydro mulching in lieu of erosion control blanket or in other applications as approved by the Owner for vegetation establishment/erosion control in accordance with Iowa DOT Standard Specifications. The mix should contain the appropriate amounts or products such as tackifier and reinforcing fibers for the proposed application area. Natural products are preferred.

PART 3 – EXECUTION

3.01 SILT FENCE INSTALLATION

A. Erosion control measures to be installed prior to site disturbance.

B. Installation of silt fence shall be in accordance with Iowa DOT "Standard Specifications" Section 9040.3.17.

C. CONTRACTOR shall be responsible for maintenance and repair of silt fence until final acceptance of the project.

3.02 REMOVAL OF SILT FENCE

A. CONTRACTOR shall remove and dispose of silt fence after completion of project and the establishment of vegetation.

3.03 FILTER SOCK

A. Place in accordance with Manufacturer's recommendations.

B. Installation shall be in accordance with "Standard Specifications" Section 9040.3.07.

3.04 ROLLED EROSION CONTROL PRODUCTS

A. Place in accordance with Manufacturer's recommendations.

B. At a minimum, anchor upstream edges of all materials at least six (6) inches into the soil to prevent underflow.

C. Shingle materials downslope.

D. Overlaps shall be as follows:
   a. End lap – 24 inches minimum
   b. Edges - 6 inches minimum

E. Staple sizes and spacing to be in accordance with "Standard Specifications" Section 3885: Rolled Erosion Control Products.

F. Install rolled erosion control products in accordance with "Standard Specification" Section 9040.3.08.

3.05 HYDROMULCHING

A. Place in accordance with Manufacturer's recommendations and Iowa DOT Standard Specifications.

B. Apply with equipment capable of mechanical agitation and slurry bypass. Manufacturer of Polyacrylamide Tackifier, Organic Fiber Matrix, Bonded Fiber Matrix, Reinforced Fiber Matrix may certify applicators of their product; Applicators Certificate to be provided if requested by OWNER.

END OF SECTION

SECTION 02486

TURF RESTORATION

PART 1 - GENERAL

1.01 SUMMARY

A. This section contains requirements for topsoil, seeding, fertilizing, and mulching.

B. Seed all areas disturbed by construction activities at the site.

1.02 REFERENCES

A. Iowa Department of Transportation (Iowa DOT) Standard Specifications for Construction, latest edition

1.03 SUBMITTALS

A. Test Results:

1. Suppliers analysis for standard products.

B. Seed mix.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Deliver fertilizer to site in original, unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law.
2. Deliver seed to site in unopened, original bags bearing supplier's name and address, type of seed contained, percentage of purity and germination, percentage of hard seed if any, and percentage of inert material.
3. Fertilizer and seed delivered to site shall be stored in a waterproof location as directed by OWNER.
4. Locate mulch on site where indicated by OWNER.

1.05 GUARANTEE

A. Guarantee seeded area for duration of one year after seeding to be alive and in satisfactory growth at end of guarantee period.

1. For purpose of establishing acceptable standard, scattered bare spots, none larger than one (1) square foot will be allowed up to maximum of three (3)% of seeded area.
2. Acceptance will be based upon meeting this standard one (1) year after initial seeding or reseeding.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. CONTRACTOR shall use salvaged topsoil obtained from onsite stockpiles or from on-site excavation activities.

B. Topsoil performance will be determined based on proper vegetation establishment. Topsoil sampling will be conducted only if proper vegetation is not established.

2.02 FERTILIZER

A. In accordance with Standard Specification 2601.
B. Fertilize at the ratio recommended by the soil testing lab after submittal of a topsoil sample (if necessary to establish vegetation).

2.03 GRASS SEED

A. General

1. Local nursery grown seed sources in the specified seed mix.
2. Weeds shall not exceed 0.25%.
3. Comply with current U.S. Department of Agriculture rules and regulations.
4. Mix grass seeds in proportions by weight to meet or exceed minimum percentages of purity and germination. Certified seed as defined in Standard Specifications Section 9010.2.01 or approved equals shall be utilized: Sampling and Testing shall be used.

B. Seeding utilized in the final cover system shall be a shallow rooted drought resistant seed. IDOT Rural Stabilization or approved equal.

C. Seeded areas shall include all pre-vegetated areas damaged during construction by the CONTRACTOR.

2.04 WATER

A. CONTRACTOR shall be responsible for water.

2.05 EROSION CONTROL PRODUCTS

A. Erosion control products shall conform to the applicable Standard Specification Section 4169 where shown on the Drawings.

PART 3 – EXECUTION

3.01 INSPECTION

A. Do not begin ground preparation until boulders, debris, and similar materials have been removed, depressions and ruts filled, and area to be seeded is shaped, trimmed, and finished uniformly to grades and cross-sections shown on Drawings, or to match original grade.

3.02 SITE PREPARATION FOR SEEDING

A. Topsoil

1. Scarify subgrade to depth of three (3) inches for bonding of subsoil with topsoil.
2. No topsoil shall be placed or worked in frozen or muddy condition.
3. Prepare areas to be seeded to required depth of approximately three (3) inches by disking, rototilling, harrowing or other approved means.
4. Remove and dispose of rock, trash, or other materials brought to surface from preparation activities.
5. Fine grade with no more than 15% of rocks or lumps between two (2) inches and 1 ½ inches in greatest dimension.

3.03 TOPSOIL/FINISH GRADING

A. Topsoil/Finish grade is established final grade as shown on Contract Drawings. Grades not otherwise indicated are uniform levels or slopes between points where elevations are given or between such points and existing finished grades. Finish grade shall be approved by the ENGINEER prior to seeding.

B. Grade, rake, and roll with roller weighing not more than 100 lbs./LF and not less than 25 lbs./LF.

C. Maximum allowable variation from correct elevation is 0.0 to +0.2.

3.04 APPLYING FERTILIZER

A. Apply fertilizer uniformly over the designated area using mechanical spreading devices. Mix thoroughly with disk into upper 2 inches of soil.

B. Apply at a rate defined in Section 2.02.A.

C. Apply fertilizer no more than 48 hours prior to seeding.

3.05 SEEDING

A. Do not seed on saturated or frozen soil.

B. Do not seed when wind velocity exceeds six (6) mph.

C. Seed all areas disturbed by construction.

D. Do not seed if surface has been compacted by recent rain event.

E. Apply seed mixtures over designated areas at a rate of 50 lbs per acre, and 50 lbs per acre of additional perennial ryegrass.

F. Seeding as part of hydraulic erosion control product application (hydroseeding) is an acceptable application method.

G. Cover all seeded areas by hand raking or approved means prior to mulching.

3.06 MULCHING

A. Mulch seeded areas not designated to receive erosion control blanket within three (3) days after seeding is complete. Hydromulching is an acceptable application method; see Specification Section 02276.

B. Application rate shall be two (2) tons per acre or no more than one (1) inch in depth.

C. Mulch shall be spread uniformly in a continuous blanket. Mulch shall be started on the windward side of relatively flat area or on the upper part of a steep slope and continued uniformly until area is covered. The mulch shall not be bunched.

D. Do not mulch during periods of excessively high winds.

E. Immediately following the spreading of the mulch, the material shall be anchored securely into the soil a minimum of three (3) inches by means of a mulch anchoring machine

equipped with large coulter-type discs spaced on approximate eight (8) inch centers. All anchoring shall be at right angles to slope. Edges of the discs shall be dull to prevent cutting of the mulching and equipment operation shall be such as to embed the mulch to the required depth. In areas where equipment cannot be used, mulch shall be secured by shallow covering of earth or by embedding with approved hand methods, including straight-bladed spade with dull edge.

F. Mulch in accordance with Standard Specifications Section 2601: Establishing Vegetation and Controlling Erosion.

3.07 CLEANUP

A. Paved surface and other site areas shall be kept clean of seeding, fertilizing, and mulching materials.

B. Clean up shall occur at the end of each work day or as required by OWNER. Pavement shall be swept with a street sweeper as directed by ENGINEER throughout the project.

C. Restore existing utilities, surface features, and structures to condition equal to condition which existed prior to construction.

D. Replace to original condition or better, damaged vegetation or landscape work.

E. Complete project punch-list prepared by ENGINEER.

3.08 MAINTENANCE OF SEEDED AREA

A. Maintenance of seeded areas shall begin immediately following last seeding application. Continue until Work is accepted.

B. Maintain seeded area by watering, mowing, and replanting as necessary to produce uniform stand of grass until Work is accepted.

C. Rework/replace topsoil where original topsoil has eroded or washed away as directed by ENGINEER.

D. Re-mulch any areas where the original mulch has washed away as directed by the ENGINEER.

E. Implement erosion control measures as required to keep area free of rutted and eroded soils and protection fences and barriers as necessary.

3.09 RESEEDING AND REPAIR

A. Reseed areas that fail to show more than 75 plants/square feet and open areas or gaps larger than six (6) inches in diameter.

B. Where plant density is less than 50 plants/square foot, retill and reseed areas in accordance with seeding and maintenance requirements.

3.10 ACCEPTANCE OF SEEDED AREAS

A. CONTRACTOR shall notify OWNER in writing at least seven (7) days prior to inspecting seeded area for acceptance.

B. CONTRACTOR and OWNER shall inspect seeded areas for contract compliance and acceptance of work. Upon completion of inspecting seeded areas, OWNER shall provide written acceptance or rejection to CONTRACTOR with further requirement for completing the seeding work. Seeding work remaining to be completed shall be re-inspected by OWNER before final acceptance.

END OF SECTION

SECTION 02601

PRECAST CONCRETE STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide precast concrete structures as shown on Drawings.

1.02 SUBMITTALS

A. Include results of tests and certification reports with shipment of materials, furnish digital copies to ENGINEER.

B. If manufacturer's test data is inadequate or unavailable, ENGINEER reserves right to require cores drilled for compressive strength tests. Costs of these tests shall be borne by CONTRACTOR.

C. Submit shop drawings showing all applicable dimensions and layout information for concrete structures.

1.03 STRUCTURE DESIGN

A. It is the Contractor’s responsibility to have the vault sections and top and bottom slabs designed and the detailed drawings prepared by a Professional Engineer, experienced in precast concrete structure design, who is registered in the Project’s state.

B. The vault shall be designed for shear strength, flexural strength, and other applicable strengths due to hydrostatic loading. The hydrostatic loading (water table elevations) shall be assumed to be up to the top of structure.

C. All pre-cast concrete structures shall be designed without the use of internal struts, bracing, or other supports spanning the structure’s clear space.

PART 2 - MATERIALS

2.04 PRECAST CONCRETE STRUCTURES

A. Concrete structures shall be constructed in accordance with ASTM C478.

B. Structures shall have integral base with reinforced floors.

C. Structure section joints and joints on top slabs shall be Type R-4.

D. Mark each precast section with name or trademark of manufacturer and date of manufacture. Marking shall be indented into manhole section or shall be painted thereon with waterproof paint.

2.05 FLEXIBLE BOOTS

A. All inlet and outlet pipes shall be joined to the manhole with a watertight, flexible rubber boot. The flexible connection shall be a boot manufactured by Kor-N-Seal or approved equal (ASTM C923).

2.06 METAL CASTINGS

A. Metal castings for concrete structures to be as shown on drawings.

2.07 BEDDING AND BACKFILL

A. Bedding and backfill materials shall conform to Section 02225.

2.08 MORTAR

A. Mortar shall consist of a mixture of one part Portland Hydraulic Cement and two parts of clean washed sand by volume. The quantity of mortar in the mixture shall be sufficient to produce a stiff workable mortar, but shall exceed five and one half (5-1/2) gallons of water per sack of cement. Sand shall conform to ASTM C144. Portland cement shall conform to ASTM C150.

2.09 NON-SHRINK GROUT

A. 5,000 psi minimum 28 day compressive strength.

B. Maximum water-cement ratio of 0.45.

PART 3 – EXECUTION

3.01 CONCRETE STRUCTURES

A. All units shall be properly fitted and sealed to form a completely watertight structure.

B. Maximum number of and/or height of precast concrete adjusting rings shall be as shown on the Drawings.

C. Access hatches for valve vault and lift station shall be cast into structure at concrete factory.

D. Lift holes shall be neatly mortared up.

3.02 EXCAVATION AND PREPARATION OF SUBGRADE

A. Excavate and prepare subgrade as specified in Section 02220, and as shown on Drawings.

3.03 BACKFILL

A. Backfill in accordance with Section 02207.

3.04 PIPE TO STRUCTURE CONNECTION

A. DIP, PVC, and HDPE Pipe: Connect pipe to structure by means of a watertight, flexible rubber boot.

B. Seal all penetrations for electrical and control cables to prevent water from entering structure.

3.05 SETTING FRAMES AND CASTINGS

A. Set at elevation shown on Drawings.

3.06 FIELD QUALITY CONTROL

A. Precast reinforced concrete risers and tops shall be subject to rejection for failure to conform to Specification requirements. In addition, individual sections of risers and tops may be rejected for any of following reasons:
   1. Fractures or cracks passing through shell, except for single end crack not exceeding depth of joint.
   2. Defects indicating imperfect proportioning, mixing, and molding.
   3. Surface defects indicating honeycombed or open texture.
   4. Damaged ends where such damage prevents making satisfactory joint.
   5. Internal diameter of section varying more than 1% from nominal diameter.
   6. Any continuous crack having surface width of 0.01 in. or more-and extending for length of 12 in. or more, regardless of position.

B. During the process of unloading, all pipe and accessories shall be inspected by the CONTRACTOR for damage. The CONTRACTOR shall notify the ENGINEER of all material found to have cracks, flaws or other defects. The ENGINEER shall inspect the damaged materials and have the right to reject any materials found to be unsatisfactory. The CONTRACTOR shall promptly remove all rejected material from the site

END OF SECTION

SECTION 02610

HIGH DENSITY POLYETHYLENE PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes installation of CONTRACTOR supplied piping for the leachate collection system and geothermal system piping.

B. Extent of pipe and fittings required by this section indicated on Drawings.

1.02 REFERENCES

A. American Water Works Association (AWWA)

B. American Society for Testing and Materials (ASTM):

1. ASTM D638- Test Method for Tensile Properties of Plastics
2. ASTM D790- Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating
3. ASTM D1238- Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
4. ASTM D1248 – Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable
5. ASTM D1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique
6. ASTM D1693 – Standard Test Method for Environmental Stress Cracking of Ethylene Plastics
7. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
8. ASTM D1785 – Standard Specifications for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
9. ASTM D2122 - Standard Test Method of Determining Dimensions of Thermoplastic Pipe and Fittings
10. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products
11. ASTM D3035 – Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter
12. ASTM D3261 - Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
13. ASTM D3350 - Standard Specification for Polyethylene Pipe and Fittings Material
14. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

1.03 SUBMITTALS

A. List of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Documentation from the resin's manufacturer showing results of the following tests for resin identification:
   a. Melt Flow Index (ASTM D1238)
   b. Density (ASTM D5105)

C. Complete, detailed shop drawings of all polyethylene pipe, including the location of all fittings, joints and connections to structures.

D. Manufacturer's recommendations for handling, storing and installing pipe and fittings.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Handle and protect product to ensure product is not damaged.

B. Provide factory applied basic end caps on each length of HDPE pipe. Maintain caps during shipping, storage, and handling to prevent end damage.

C. Provide protection for flanges and fittings by storing inside or packaging with impermeable opaque material.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS/SUPPLIERS

A. All HDPE pipe and fittings required for construction will be supplied by the CONTRACTOR.

B. HDPE Pipe:

   1. Acceptable Manufacturers:
      a. Phillips Driscopipe, Inc., Dallas, Texas.
      b. Poly Pipe Industries, Gainesville, Texas.
      c. Or approved equal.
   2. High performance, high molecular weight, high density polyethylene pipe.
   3. Material designation PPI-PE 4710.
   4. ASTM D3350, minimum cell classification value 445574C.
   5. Marking: Intervals of (five) 5 feet or less.
      a. Manufacturer's name or trademark.
      b. Nominal pipe size.
      c. Legend: Industrial pipe SDR as indicated on Drawings.
      d. ASTM F714.
      e. Extrusion date, period of manufacture or lot number.
   6. Perforated pipe:
      a. Pattern as shown on Drawings.

C. Fittings:

   1. Molded from polyethylene compound having cell classification equal or exceeding compound used in pipe to insure compatibility of resins.
   2. Be of same manufacture as pipe.
   3. Fusion weld joints.

4. Markings:
    a. Manufacturer's name or trademark.
    b. Nominal size.
    c. Material designation "HDPE".
    d. ASTM D3261.

PART 3 - EXECUTION

3.01 EXECUTION

A. Examine and verify acceptability of surface to receive product.

3.02 HDPE PIPE INSTALLATION

A. Location, lines, and grades as shown on the Drawings.

B. Welded joints.

1. Weld in accordance with manufacturer's recommendations for butt fusion methods.
2. Butt fusion equipment used in joining procedures capable of meeting conditions recommended by manufacturer, including, but not limited to: temperature required, alignment, and fusion pressures.

C. CONTRACTOR to supply flange adapters and fittings necessary to connect new pipe to existing piping where shown on the Drawings in accordance with manufacturer's recommendations.

D. No defective pipe installed. Defective pipe removed from site and replaced at CONTRACTOR'S expense.

E. Install coarse aggregate and granular bedding as shown on Drawings.

F. Perforations:
1. Penetrate pipe in pattern shown on the Drawings. Note the different perforation patterns in the gas collection piping and the leachate collection piping.
2. Remove all cuttings and shavings prior to placement.

3.03 EXCAVATION AND PREPARATION OF SUBGRADE

A. Excavate and prepare subgrade as specified in Section 02220 and as shown on Drawings.

3.04 BACKFILL

A. Backfill with required pipe bedding and cover material as shown on Drawings.

3.05 FIELD QUALITY CONTROL

A. Pipe may be rejected for failure to conform to specification, or:

1. Fractures or cracks passing through pipe wall, except single crack not exceeding two (2) inches in length at either end of pipe which could be cut off and discarded. Pipes within one shipment will be rejected if defects exist in more than 5% of shipment or delivery.
2. Cracks sufficient to impair strength, durability or serviceability of pipe.
3. Defects indicating improper proportioning, mixing, and molding.

4. Damaged ends, where damage would prevent making satisfactory joint.
5. Noticeable variations from true alignment and grade sufficient cause for rejection of Work.

B. Acceptance of fittings, stubs or other specially fabricated pipe sections based on visual inspection at site and documentation that they conform to these specifications.

C. HDPE piping shall be pressure tested in accordance with Section 02615.

END OF SECTION

SECTION 02615

TESTING HDPE PIPING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes detailed requirements for hydrostatic and air pressure testing for HDPE piping.

1.02 SUBMITTALS

A. Manner, method, and equipment to be used for testing.

B. Test report for each piping segment tested and for installed piping system.

PART 2 – PRODUCTS

2.01 Not Used

PART 3 - EXECUTION

3.01 General

A. Pressure test in presence of ENGINEER.

B. Furnish clean potable water required for testing and provide necessary piping connections between section of piping being tested and nearest available source of water or air supply, together with test pressure equipment, meters, pressure gauge, and other equipment, materials, and facilities necessary to perform specified tests.

C. Provide bulkheads, flanges, valves, bracing, blocking or other temporary sectionalizing devices that may be required.

D. Remove temporary sectionalizing device after tests complete.

E. Perform tests on exposed piping at each end of proposed piping prior to connection to existing piping.

F. Perform tests on piping systems before completely backfilled in trench. Visually inspect to detect leakage at pipe joints.

G. Perform tests on piping that is clean and free of dirt, sand, pipe shavings or other foreign material.

H. Plug pipe outlets with test plugs. Brace each plug securely to prevent blowouts.

I. Add test media slowly as specified herein to allow for initial pipe expansion.

J. Include regulator set to avoid over-pressurizing and damaging piping.

K. Perform pressure test in strict accordance with pipe manufacturer's written instructions, these Specifications, and in accordance with applicable local, state, and federal safety requirements.

L. Correct leaks or defects identified during testing and retest at no additional cost to OWNER.

M. Pressure gauges used for testing purposes shall be marked in increments of 1 psi. Provide documentation of latest gauge calibration to verify accuracy of gauge in use.

3.02 HYDROSTATIC PRESSURE TESTING

A. Perform hydrostatic pressure testing for pressurized piping systems. Hydrostatic pressure testing shall be performed prior to backfilling of each system of piping.

B. Test pressure shall be 100 psig at high point in test section; test fluid shall be water.

C. Open vents at high points to purge air pockets while piping system is filling. Venting may also be provided by loosening flanges or with equipment vents.

D. Testing:

1. After section of piping to be tested has been filled with water, apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of three (3) hours for initial expansion phase while adding sufficient make-up water to maintain test pressure.
2. After initial expansion phase, begin system testing for one (1) to three (3) hours after which measured amount of make-up water shall be added to stabilize test pressure based on Table 1.
3. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to ENGINEER.
4. Maintain test pressure for sufficient length of time to permit ENGINEER to observe piping under test but not less than one (1) hour.
5. If repairs are required, repeat pressure test until pipe installation conforms to specified requirements and is acceptable to ENGINEER.

TABLE 1
MAKE-UP WATER TEST VALUES

Nominal Pipe Size (in.)	***Gallons/100 Foot of Pipe*** 1-hour Test	2-hour Test	3-hour Test
1.25	0.10	0.15	0.25
2	0.10	0.15	0.25
3	0.10	0.15	0.25
4	0.13	0.25	0.40
6	0.30	0.60	0.90
7	0.50	1.0	1.5
10	0.75	1.3	2.1

3.03 AIR PRESSURE TESTING

A. Perform air pressure testing for non-pressurized piping systems and landfill gas piping. Air pressure testing shall be performed prior to backfilling of each system of piping.

B. Test pressure shall take place at high point in test section.

1. Test pressure shall be 10 psig for landfill gas vacuum piping;
2. Test pressure shall be 10 psig for gravity feed lines, as needed;
3. Test pressure shall be 100 psig for landfill gas system air lines

C. Testing:

1. Apply test pressure by means of force pump of such design and capacity that required pressure can be applied and maintained without interruption for duration of three (3) hours for initial expansion phase.
2. After initial expansion phase, begin system testing for one (1) to three (3) hours.
3. Measure test pressure by means of tested and properly calibrated pressure gauge acceptable to ENGINEER.
4. Maintain test pressure for sufficient length of time to permit ENGINEER to observe piping under test but not less than one (1) hour. A maximum of 1% pressure loss is acceptable.
5. If repairs are required, repeat pressure test until pipe installation conforms to specified requirements and is acceptable to ENGINEER.

3.04 TEST REPORT

A. ENGINEER will witness and document final pressure testing. Notify a minimum of 24 hours prior to conducting final testing. Do not begin test without ENGINEER present. Final pressure test shall not be considered valid unless entire test witnessed by OWNER.

B. Test report for each piping system tested shall include following minimum information:

1. Date of test.
2. Description and identification of piping system tested.
3. Type of test performed.
4. Test fluid.
5. Test pressure.
6. Type and location of leaks detected.
7. Corrective action taken to repair leaks.
8. Results of retesting.

ATTACHMENT 1 TO SECTION 02615
FORM
PE PIPE AIR PRESSURE TEST REPORT

PROJECT NAME/NO.		TIME:	
CONTRACTOR:		DATE:	
PERSON PERFORMING TESTS:			
DESCRIPTION/LOCATION OF TEST SEGMENT (Pipe Diameter, Length, and SDRs):			

T_I = Initial temperature in ^oC = _____ ^oC
P_I = Initial test pressure in psig = _____ psig
P_c = Initial pressure in psig corrected for temperature (T_I) at time 't'
T = Time in minutes from initiation of test
T_1 = Temperature in ^oC at time 't'
P_1 = Test pressure in psig at time 't'

$$P_c = \frac{(P_1 + 14.7)(T_1 + 273)}{(T_1 + 273)} - 14.7$$

$$\text{Percent Pressure Drop} = \frac{P_c - P_1}{P_c} \times 100$$

TIME (min.)	P_1 TEMP READING (^oC)	P_1 GAUGE READING (psig)	P_c CORRECTED PRESSURE (psig)	PRESSURE DROP (%)
0				
20				
30				
40				
50				
60				
PASS/FAILURE:			RETEST (yes/no):	
DESCRIPTION/NATURE OF LEAKS AND REPAIRS OF RETEST SEGMENT:				

EXAMPLE CALCULATION SHEET

GIVEN:

P_I = 10 psig
T_I = 21.1°C = 70°F

And at time t = 60 minutes

P_1 = 10.05 psig
T_1 = 23°C = 73°F

Calculated Corrected Initial Pressure

$$P_1 = \frac{(10.0 + 14.7)\,(23.0 + 273)}{(21.1 + 273)} - 14.7$$

P_c = 24.85 – 14.7 = 10.15 psig

Calculate Percent Pressure Loss

$$\% \text{ Pressure Loss} = \frac{10.15 - 10.05}{10.15} \times 100 = 0.98\% < 1\% \text{ ok}$$

NOTE: The difference between the corrected pressure reading (P_c) and the gauge reading (P_1) cannot differ by more than 1% of the corrected pressure reading (P_c) (i.e., .015 @ 19.5 psig over a time interval of 60 minutes.

*** END OF SECTION ***

SECTION 02623

PERFORATED AND NON-PERFORATED DRAIN PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install perforated and non-perforated corrugated polyethylene pipe (CPEP) and appurtenances as shown on Drawings.

1.02 REFERENCES

A. American Association of State Highway and Transportation Officials (AASHTO).

1. AASHTO M252 – Standard Specification Corrugated Polyethylene Drainage Pipe

B. American Society for Testing and Materials (ASTM)

1. ASTM F667/F667M – Standard Specification for 3 through 24 in. Corrugated Polyethylene Pipe and Fittings

1.03 SEQUENCING AND SCHEDULING

A. Include piping activities in the project schedule.

1.04 SUBMITTALS

A. The CONTRACTOR shall submit to the OWNER the manufacturer's literature that describes the physical characteristics of the pipe provided, the recommended installation procedures, and allowable pipe bend radius.

PART 2 - PRODUCTS

2.01 CORRUGATED POLYETHYLENE PIPE, DRAINAGE TUBING (CPEP), AND FITTINGS

A. CPEP and fittings shall meet the requirements of ASTM F667/F667M or AASHTO M252. The pipe shall meet the dimensional requirements indicated on the Contract Drawings and be manufactured by Prinsco, ADS, Hancor, or other approved manufacturer.

B. CPEP used for surface water control (culverts or piping) shall be of double-wall construction with a smooth inner bore and shall have watertight gasketed joints.

C. All CPEP used for surface water control (culverts) shall have flared end sections, both ends.

D. Perforated pipes shall be factory perforated with a minimum inlet area of 1 square inch/ft.

E. Fittings shall be from the same manufacturer as the pipe.

F. See Section 02921 Geotextile for drainage tubing wrap.

PART 3 - EXECUTION

3.01 CPEP AND FITTINGS

A. Install perforated and non-perforated CPEP of the size and in the locations and to the elevations and grades shown in the Drawings.

B. Do not install pipe with bends of smaller radius than the minimum recommended by the manufacturer.

C. Install marker posts at each drainage tubing outlet.

3.02 FILL PLACEMENT AROUND PIPES

A. CONTRACTOR shall mechanically tamp bedding material around the piping in lifts.

B. The CONTRACTOR shall notify OWNER before placing fill around pipes.

C. Do not use frozen filling material or place on frozen subgrade.

D. Pipe installed outside the boundaries of the geomembrane:

1. Install bedding and cover soils making sure pipe haunches are properly shaped.

3.03 FIELD QUALITY CONTROL

A. Pipe and pipe installation will be subject to rejection for any of the following reasons:

1. Failure to conform to the SPECIFICATIONS, particularly compaction under and around the pipe.
2. Fractures or cracks passing through pipe wall or socket.
3. Cracks which, in the opinion of OWNER or OWNER'S On-Site Representative, may impair strength, durability, or serviceability of pipe.
4. Defects indicating improper proportioning, mixing, or molding.
5. Damaged ends where such damage would prevent making a satisfactory joint.

B. Survey Requirements:

1. CONTRACTOR to provide survey information for all inverts and alignments of piping.

END OF SECTION

SECTION 02640

VALVES

PART 1 - GENERAL

1.01 SUMMARY

Section includes general requirements for valves as indicated on the Drawings.

1.02 SUBMITTALS

A. Submit the following information on all valves for approval prior to ordering or installing:

1. Manufacturer's name, address, and telephone number.
2. Valve model number.
3. Valve component materials.

B. Information shall be submitted prior to ordering and at least 21 days prior to installation.

1.03 REFERENCES

A. American Water Works Association (AWWA) Standards

B. American Association of State Highway and Transportation Officials (AASHTO)

C. Iowa Department of Transportation Standard Speficiation, current edition.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle per manufacturer's recommendation.

B. Protect from damage.

PART 2 - PRODUCTS

2.01 VALVES

A. All valves of similar type to be by the same manufacturer.

B. Size and type as shown on the Drawings.

C. Ball Valves
1. Full bore and capable of blocking flow in both directions
2. O-Rings and Gaskets; Viton
3. Union nuts to have buttress threads
4. All components to be replaceable
5. True-union type at both ends with double stop plastic.
6. Body type as shown on Drawings
7. Shall have flanged connections
8. 316 stainless steel bolts and nuts
9. Pressure rating shall be 150psi at 71 deg. F

D. Check Valves
1. Swing Check
2. O-Rings and Gaskets; Viton
3. Union nuts to have buttress threads
4. All components to be replaceable

5. True-union type at both ends with double stop plastic.
6. Body type as shown on Drawings
7. 316 stainless steel bolts and nuts
8. Pressure rating shall be 100psi at 71 deg. F

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine and verify conditions to accept installation of valves.

B. Verify size and location restrictions to place in and around structures.

C. Submit required information and shop drawings for approval.

3.02 PREPARATION

A. Prepare site and construction parts for installation.

3.03 INSTALLATION

A. Coordinate placement of pipe openings to accommodate valves.

B. Install valves in locations shown on Drawings.

C. Valve installation per submitted manufacturer’s recommendations.

D. Test for leakage per Section 02615.

END OF SECTION

SECTION 02775

ELECTRICAL LEAK LOCATION SURVEYING
(SOIL-COVERED GEOMEMBRANE LINER)

PART 1 - GENERAL

1.01 SUMMARY

A. Assisting OWNER contracted leak location contractor in performing leak detection sensitivity testing using “actual leaks” placed by OWNER.

B. Leak location testing will be performed on HDPE geomembrane following placement of granular drainage layer.

C. CONTRACTOR shall repair any and all known geomembrane damage resulting from granular drainage layer installation prior to the leak location survey.

1.02 REFERENCES

A. American Society for Testing and Materials, current edition, hereafter referred to as ASTM.

B. ASTM D7007: Standard Practice for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earth Materials (most current edition).

1.03 SUBMITTALS

Not Applicable

PART 2 PRODUCTS

Not Applicable

PART 3 – EXECUTION

3.01 COORDINATION

A. Contractor shall cooperate with and participate in OWNER’s electrical leak location testing of the installed and covered geomembrane liner. The following activities are required to be completed by Contractor as part of the liner leak location testing:

1. Contractor shall have a representative on-site during the leak location testing.

2. Contractor shall prepare landfill cell area to be tested by electrically isolating the area; an approximate 3 foot wide perimeter boundary shall be bare geomembrane liner. There shall be no pipe crossing across this boundary. Stormwater shall be managed so that water does not electrically connect the test area to the perimeter.

2. Contractor shall provide a generator and fuel for the Leak Testing Contractor.

3. During testing, Contractor shall provide equipment and laborers to expose potential leak locations as identified by testing, including “dummy” holes

placed by OWNER. Contractor shall be responsible to expose up to 6 holes (4 “dummy” and 2 calibration). Contractor shall be responsible for repair of liner defects, “dummy” holes and replacement of cover soils after repairs are made.

3.02 LEAK LOCATION REPAIRS

A. Contractor shall mark detected leak locations with lath, flagging, or similar marking, and shall notify OWNER for removal of cover soil from the area.

B. Resurveying shall be performed in the areas near leak locations to verify that repairs were adequate and that an additional leak is not present which may have been masked by the detected leak.

C. All liner damage or breaches in the geomembrane found shall be repaired by the CONTRACTOR.

END OF SECTION

SECTION 02920

HIGH DENSITY POLYETHYLENE GEOMEMBRANE (HDPE)

PART 1 - GENERAL

1.01 SUMMARY

A. Work covered under this section of the specifications shall include the furnishing of all material, labor, tools, equipment, tests and services necessary to install the textured 60-mil high density polyethylene (HDPE) flexible membrane liner (FML) as shown on the Drawings and in accordance with the specification. Textured FML will be installed in all areas with a slope greater than 10% (side slopes) and smooth FML will be installed in all areas with a slope of 10% and less (base of the cell), as shown on the Drawings. Textured FML may be used in all areas if shown on drawings. This section includes CONTRACTOR's construction of the liner anchor trenches as shown on the drawings.

B. The OWNER has made an Allowance for the CONTRACTOR to provide independent leak detection testing. Any and all repairs deemed necessary to the FML as a result of leak detection testing, shall be made in accordance with these Specifications by the liner installer and paid for by the CONTRACTOR. No additional costs for geosynthetic repairs resulting from the leak detection testing will be borne by the OWNER.

1.02 DEFINITIONS/REFERENCESDEFINITIONS/REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D751 - Standard Test Methods for Coated Fabrics
2. ASTM D792 - Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
3 ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting
4. ASTM D1238 - Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
5. ASTM D1505 - Standard Test Method for Density of Plastics by the Density-Gradient Technique
6. ASTM D1603 - Standard Test Method for Carbon Black Content in Olefin Plastics
7. ASTM D3895 - Standard Test Method for Oxidative-Induction Time of Polyolefins by Differential Scanning Calorimetry
8. ASTM D4218 - Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
9. ASTM D4437/D4437M - Standard Practice for Nondestructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes
10. ASTM D4833/D4833M - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
11. ASTM D5199 - Standard Test Method for Measuring Nominal Thickness of Geosynthetics
12. ASTM D5397 - Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test
13. ASTM D5596 - Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
14. ASTM D5641/D5641M - Standard Practice for Geomembrane Seam Evaluation by Vacuum Chamber
15. ASTM D5721 - Standard Practice for Air-Oven Aging of Polyolefin Geomembranes
17. ASTM D5885/D5885M - Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry

18. ASTM D5994/D5994M - Standard Test Method for Measuring the Core Thickness of Textured Geomembranes
19. ASTM D6365 - Standard Practice for Nondestructive Testing of Geomembrane Seams Using the Spark Test
20. ASTM D6693 - Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes
20. ASTM D6747 - Standard Guide for Selection of Techniques for Electrical Leak Location of Leaks in Geomembranes
21. ASTM D7002 - Standard Practice for Electrical Leak Location on Exposed Geomembranes Using the Water Puddle Method
22. ASTM D7007 - Standard Practices for Electrical Methods for Locating Leaks in Geomembranes Covered with Water or Earthen Materials
23. ASTM D7238 - Standard Test Method for Effect of Exposure of Unreinforced Polyolefin Geomembrane Using Fluorescent UV Condensation Apparatus
24. ASTM D7466/D7466M - Standard Test Method for Measuring Asperity Height of Textured Geomembranes

B. Geosynthetic Research Institute (GRI) Standards:

1. GRI GM 6: Standard Practice for Pressurized Air Channel Test for Dual Seamed Geomembranes
2. GRI GM 9: Standard Practice for Cold Weather Seaming of Geomembranes
3. GRI GM 10: Standard Guide for The Stress Crack Resistance of HDPE Geomembrane Sheet
4. GRI GM 13: Standard Specifications for Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
5. GRI GM 14: Standard Guide for Selecting Variable Intervals for Taking Geomembrane Destructive Seam Samples Using the Method of Attributes
6. GRI GM 19a: Standard Specifications for Seam Strength and Related Properties of Thermally Bonded Polyolefin Geomembranes/Barriers

C. U.S. Environmental Protection Agency Technical Guidance Document “Quality Control Assurance and Quality Control for Waste Containment Facilities,” EPA/600/R-93/182, September 1993, 305 pgs.

1.03 SUBMITTALS

A. The CONTRACTOR shall supply the following with the Proposal:

1. Name of the proposed manufacturer and Installer of HDPE flexible membrane.
2. Itemization of any exceptions to the plans and specifications.

B. The following submittals shall be provided to and approved by OWNER or ENGINEER prior to delivery of geomembrane to the site or mobilization of the geomembrane CONTRACTOR’S crew or equipment:

1. CONTRACTOR shall supply information from the resin manufacturer regarding the resin type, properties as specified herein, and production dates of the resin used for this project. The resin type identification shall include the cell classification of the resin in accordance with the requirements of the latest ASTM D3350.
2. CONTRACTOR shall submit from the geomembrane sheet manufacturer, test methods and results defining physical properties as specified herein, of the geomembrane to be used for this project. Test results at the frequency specified in the GRI standards of geomembrane furnished for this project shall be submitted, and test results shall be reported with corresponding roll identification numbers.

3. CONTRACTOR shall supply a statement of the geomembrane manufacturer's quality control procedures, identification of any resin admixtures, frequency of sampling, methods of material transportation and storage, and acceptance criteria for roll goods delivered to the site.
4. CONTRACTOR shall provide submittals describing the geomembrane sheet manufacturer's details of any factory seaming process proposed. Roll test results which may not be available prior to construction (i.e., environmental stress crack) shall be presented as preliminary prior to construction, with final test results submitted or affected rolls within the construction time frame.
5. CONTRACTOR shall submit from the extrudate weld rod manufacturer, verification that the weld rod was manufactured using the same resin as was used in the geomembrane sheets prior to using material.
6. CONTRACTOR shall submit a proposed panel and seam layout diagram specifying the type and location of all field and factory seams. The layout diagram shall be to scale and used as a construction Plan and shall include all necessary dimensions and details. The layout diagram shall be compatible with the panel and seam layout requirements specified in this Section.
7. CONTRACTOR shall submit a FML delivery and installation schedule.
8. CONTRACTOR shall submit a list of personnel performing field supervision, and quality control, along with experience records and resumes.
9. CONTRACTOR shall submit a list of equipment types proposed to be used in panel layout, membrane seaming, and destructive and nondestructive testing.
11. Copies of the warranties and bonds for preliminary approval by the ENGINEER.
12. Shop drawings of FML and anchor trenches.

B. The CONTRACTOR shall remit the following during geomembrane Installation:

1. CONTRACTOR shall, at the end of each working day provide a detailed report of work completed that day, including:
   a) Panel Placement
   b) Trial Welds Results
   c) Subgrade Acceptance Form
   d) Seams
   e) Seam Testing (air and vacuum tests)
   f) Destructive Tests
   g) Repair Log

2. ENGINEER shall review with the CONTRACTOR and sign the above report at the end of each day. OWNER shall be provided with a copy of the report.

3. CONTRACTOR shall update their liner layout drawings daily. The drawings shall include all panel locations and numbering, seam locations and numbering, and test locations and numbering. The CONTRACTOR shall maintain a current liner layout drawing on the construction site at all times. At the request of OWNER, a copy of the current liner layout drawing will be submitted with 24 hours.

4. CONTRACTOR shall submit final as-built liner layout drawing(s) to OWNER within 14 calendar days of completion of the liner work. Drawings shall be submitted in paper and digital form.

5. Quality control certificates indicating resin type, properties as specified herein, and production dates shall be provided with each shipment of extrudate rods delivered to the site no later than the time of delivery.

6. Prior to the installation of any geomembrane, the CONTRACTOR shall submit their certification in writing that the surface upon which the geomembrane is to be installed is acceptable (complete form contained at end of this Section).

C. Upon Completion of the FML installation:

1. A letter from the INSTALLATION CONTRACTOR stating that the flexible membrane liner was installed in accordance with the manufacturer's specifications and the manufacturer's instructions.
2. A "Field Seam Sampling and Testing Report," including all information described in Part 4.
3. All material and installation warranty submittals as defined in Section 1.06.

1.04 EXPERIENCE

A. The geomembrane installation shall be performed under the direct supervision of a single field supervisor who must remain on-site throughout installation, including inspection of the surface upon which the geomembrane is to be installed, geomembrane handling and storage, panel layout and placement, seaming, seam testing, panel and seam repair, installation of appurtenances, anchorage and other geomembrane-related work. The field supervisor shall have a personal HDPE geomembrane installation record totaling at least 2 million square feet.

1.05 Pre-Installation Meeting

A. Representatives of the CONTRACTOR shall attend a meeting prior to installation of the geomembrane to discuss details of the proposed design, installation, and schedule.

1.06 WARRANTY

A. Material Warranty

1. The Manufacturer shall furnish the OWNER with the manufacturer's written warranty against manufacturing defects and material degradation of the flexible membrane for a period of 20 years from the date of Substantial Completion by the OWNER.
2. Flexible membrane to be warranted against the affects of municipal solid waste leachate.

B. Installation Warranty

1. The INSTALLATION CONTRACTOR shall warrant the installation of the flexible membrane liner against defects for a period of two (2) years from the date of Substantial Completion by the OWNER.
2. The INSTALLATION CONTRACTOR, or their designated representative, shall repair any defects due to improper installation which occur during the warranty period at no cost to the OWNER. This includes results of the leak detection testing.
3. The INSTALLATION CONTRACTOR shall furnish the OWNER with a written warranty covering the above requirements.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Raw Materials:

1. Smooth and textured HDPE geomembrane, and extrudate rods used for this project shall be manufactured of new, first quality resins, designed specifically for use in flexible membrane liner installations.

2. HDPE resin used in manufacturing geomembranes used for this Project shall meet requirements set forth in the latest revision of the Geosynthetics Research Institute (GRI) for HDPE (GRI GM 13).

3. Recycled Polymer shall not be added to the resin. However, the resin may contain polymer reclaimed during the manufacturing process if reclaimed polymer content does not exceed 10% by weight.

B. Geomembrane Roll Goods:

1. HDPE geomembrane sheets used for this project shall meet the requirements set forth in the latest revision of the Geosynthetics Research Institute (GRI) for HDPE, both smooth and textured (GRI GM 13).
2. The geomembranes shall consist of unreinforced high-density polyethylene containing at a maximum 3% by weight additives, fillers, or extenders.
3. The geomembranes shall be free of holes, blisters, striations, undispersed raw material, and contamination by foreign matter.
4. The geomembranes shall be supplied as a continuous sheet with no factory seams in rolls. Each roll shall be identified and labeled with the thickness of the geomembrane, length and width, manufacturer, lot number, and roll identification number. This identification number shall be used to identify roll location on the panel layout record drawing.

C. Extrudate: Resin used in the polyethylene extrudate shall be the same as that used to manufacture the geomembrane sheets. Extrudate rods are to be delivered in original containers with the manufacturer's labeling. Extrudate rods shall be free of dirt, grease, moisture, other contaminants, and shall be free of damage.

D. Neoprene Foam: Closed cell, weatherproof, black neoprene foam with adhesive backing suitable for long-term sun and liquid exposure. Dimensions shall be as specified on the DRAWINGS.

E. Clamped Boots: Boots required to seal the HDPE geomembrane to the structures passing through it shall be made of the same materials as the geomembrane. The boots shall be fabricated so that all field assembly, welding, and seam testing can be accomplished using equipment and procedures regularly employed in the field for equipment and HDPE geomembrane installation. Smooth geomembrane shall be used in all geomembrane boots.

F. Banding Straps: Type 302 stainless steel banding straps suitable for use on the pipe diameters shown on the DRAWINGS. Banding strap dimensions shall be as specified on the DRAWINGS. All surfaces of the banding straps shall be machined smooth to prevent tearing or puncturing of the HDPE pipe boots. Outer lip of boot shall be sealed with silicone sealant as shown on Drawings.

2.02 EQUIPMENT

A. Extruding equipment shall be equipped with a temperature gauge at the barrel and nozzle.

B. Fusion equipment shall be equipped with a temperature gauge capable of continuous monitoring.

C. Provide digital or dial continuous temperature recording instruments, in satisfactory working condition, with each welding unit. Welding equipment shall not be operated

without functioning temperature recording instruments for measuring geomembrane sheet temperature.

D. A coupon cutter and a calibrated tensiometer shall be provided for in-field seaming pre-qualification testing and destructive sample testing.

E. Store, transport, and operate all equipment to avoid damage to geomembranes.

F. Glass top of each vacuum box must be clear and free of scratches for easy reading of pressure gauge. The sealing gasket shall be intact and functioning to form close seals during testing.

G. OWNER reserves the right to order the CONTRACTOR to remove any equipment that in OWNER or ENGINEER'S opinion is not satisfactory. The CONTRACTOR will remove the equipment promptly from the construction site and replace the unsatisfactory equipment with suitable equipment within 24 hours.

PART 3 - EXECUTION

3.01 SUBGRADE INSPECTION

A. CONTRACTOR shall certify in writing that the surface upon which the geomembrane is to be installed is acceptable (acceptance form contained at end of this Section).

B. CONTRACTOR shall provide daily written acceptance for the surface to be covered by the geomembrane in that day's operations. The surface shall be maintained in a manner during geomembrane installation to ensure subgrade suitability.

C. After subsurface has been accepted by CONTRACTOR, it shall be their responsibility to indicate any change in subsurface conditions that may require repair work and perform required repair work. Damage to subsurface caused by work involved in installing geomembrane shall be repaired at CONTRACTOR'S expense. Geomembrane placement over damaged subsurface, as determined by ENGINEER or CONTRACTOR, is not acceptable. Nothing will waive CONTRACTOR'S contractual requirements with respect to warranty on installed system.

3.02 CREST ANCHORAGE SYSTEM

A. Backfilling of Anchor Trench:

1. Backfill of anchor trench and compact will be performed by the CONTRACTOR.
2. CONTRACTOR shall monitor the backfilling of anchor trench to ensure proper method is employed. Any damage noticed shall be reported to OWNER or ENGINEER.

3.03 HANDLING, TRANSPORTATION, AND STORAGE

A. Geomembrane rolls shall be packaged and labeled prior to transporting to the site. Geomembrane rolls delivered to the site shall be wrapped in a relatively impermeable and opaque protective cover which may consist of a sacrificial wrap of geomembrane. The sacrificial wrap shall be removed prior to geomembrane installation.

B. Geomembrane transportation shall be in a manner that minimizes the possibility of material damage during shipment. When offloading geomembrane from the truck, straps

and a spanbar shall be used. Direct contact with forklifts or frontend loaders to offload the material will not be allowed without written consent from OWNER.

C. Onsite storage of the geomembrane rolls shall be in a safe manner, with rolls protected from grease, dirt, moisture, excessive heat, direct sunlight, vehicle traffic, and other possible sources of damage including theft and vandalism. The rolls will be placed in neat order and placed such that identification tags for each roll can be read. Storage areas shall be at the OWNER'S designated location.

D. Geomembrane and appurtenant materials delivered to the site shall be checked for proper labeling and visually inspected for transport or manufacturing damage. OWNER or ENGINEER reserves the right to reject any unacceptable material at no cost to OWNER. Any roll that arrives on site without factory roll identification will not be used for the work and will be removed from the site promptly.

E. Only that quantity of geomembrane that is to be placed on that day shall be removed from the packaging. Geomembrane rolls shall be transported from the storage area to the construction area and deployed using wide lifting straps and properly sized forklifts, front end loaders, or other appropriate equipment.

F. Under no circumstances shall any heavy equipment be allowed directly on the geomembranes unless approved by OWNER or ENGINEER.

G. Prior to placement, the geomembranes shall be visually inspected for compliance with this Section. Geomembrane material which, in the opinion of the OWNER or ENGINEER is damaged or does not meet Specifications will be rejected by the OWNER. Minor damage may be repaired as specified in this Section. Damage to geomembranes caused by CONTRACTOR during handling shall be repaired or replaced at CONTRACTOR'S expense.

3.04 PANEL LAYOUT AND PLACEMENT

A. Panel and Seam Layout Diagram:

1. Prepare panel and seam layout diagram so that panel seams run parallel to the direction of maximum slope (i.e., down the slope).
2. All slopes steeper than or equal to four (4) feet horizontally to one (1) foot vertically (4H:1V), the seams shall be oriented in the direction of the slope. Horizontal seams shall not be allowed on 4:1 slope unless unavoidable, where seam shall be diagonal at 45 degrees.
3. All slopes steeper than 10% shall use geomembrane textured on both sides, unless specifically identified otherwise on the Drawings. Textured panels shall extend a minimum of five (5) feet past the toe of the slope or edge of trench, or as otherwise indicated on the Drawings. The seam connecting to the smooth geomembrane shall be on a surface of less than 10%. Smooth or textured geomembrane may be used in the leachate collection trench. A single panel should run along the entire length of each trench and be centered about the trench centerline, minimizing seaming and/or repairs within the trench.
4. Slope panels shall not be constructed from more than two (2) pieces of geomembrane (i.e., not more than one cross-seam shall be permitted on any one slope panel).
5. Cross seams in slope panels, where allowed, shall be oriented at 45°. Cross seams shall be located on at least the bottom half of the slope, wherever possible.
6. Cross seams in adjacent panels shall be staggered.

7. Assign identification number to each seam for reference to test results and record Drawings.
8. Seams shall not be located at low points in the subgrade unless required by site geometry and approved by OWNER or ENGINEER.

B. PANEL PLACEMENT:

1. Panel size and placement shall be in general accordance with the panel layout diagram submitted to OWNER as defined in this Specification.
2. Geomembrane shall be anchored with sand bags or other approved methods to prevent uplift and damage by wind.
3. A panel identification number shall be assigned to each panel for reference to test results and Record Drawings. The panel identification number and geomembrane roll number shall be written on each panel with a grease pencil, immediately following deployment of the panel.
4. Smoking during placement of panels is prohibited. Wearing damaging shoes or engaging in any behavior which may damage the geomembrane is prohibited.
5. Eating, drinking, disposal of food wraps, drinking bottles and cans on top of geomembrane is not allowed.
6. Place panels with appropriate slack incorporated into geomembrane to accommodate expansion and contraction without jeopardizing the integrity of the geomembrane.
7. Vehicle traffic over geosynthetics as a means of panel deployment is expressly prohibited without the consent of the OWNER.
8. To prevent a ‘trampoline effect’ from forming, the CONTRACTOR shall place sufficient sand bags on the liner along the toe of slopes to ensure full contact of geomembrane to the subgrade.

C. OWNER or ENGINEER and CONTRACTOR will visually inspect in-place panels prior to seaming. Any damaged panels shall be repaired, and if requested by OWNER, replaced at no additional cost. Repairs shall be performed as specified in this Section. All damages and repairs shall be recorded on the Record Drawings.

3.05 SEAMING

A. Seaming Methods: All seams shall be joined using a heat extrusion or hot fusion (split wedge) weld process in accordance with the geomembrane manufacturer's recommendations. The CONTRACTOR shall maintain in working order at the site at least one spare seaming apparatus for each type of welder used. The hot fusion weld process will be used whenever possible. The use of extrusion welded seams shall be limited to repairs and any areas or seam configuration inaccessible to fusion welding equipment.

B. Factory and field seams shall meet the minimum specifications set forth by the latest revision of the GRI GM 19a.

C. Seam Configuration and Preparation:

1. Overlap panels to be seamed at least four (4) inches but not more than six (6) inches. The loose end of the upper panel shall extend no more than three (3) inches from the weld. All seams shall be made in a rainlap manner with the loose end of the upper panel downgradient of potential water flow.
2. Cross seams on slopes, where allowed, shall be made at a 45 ^{o} angle to the edge of the panel.
3. The contact area between panels shall be clean and free of moisture, dust, dirt, debris, and foreign material. A protective layer of filter fabric or a sacrificial HDPE

strip shall be used directly beneath each seam overlap to achieve proper support and a clean work surface, if necessary.

4. Where extrusion welding is used, the contact surfaces between panels shall be ground to remove oxidation prior to welding. Grinding shall not result in grooving of the liner nor reduction of the liner thickness by more than 10%. The grinding motion shall be made perpendicular to the seam. Grinding in a direction parallel to the seam shall not be permitted. All ground areas shall be covered completely with extrudate.
5. Seams shall be aligned to minimize the number and size of wrinkles. The CONTRACTOR shall ensure that wrinkles greater than 4-inches tall are addressed as drainage layer material is being placed in order to minimize wrinkle propagation and accumulation towards the end of granular drainage placement. Wrinkles greater than 4-inches tall will not be accepted.
6. All seam ends shall be staggered a minimum of five (5) feet in length between contiguous panels.

D. Test Seam:

1. A prequalification test seam sample shall be prepared with each piece of seaming equipment/seamer approximately every four hours at the beginning of each seaming period (usually morning and afternoon), unless otherwise directed by OWNER or ENGINEER. Each sample shall be prepared by the operator of the equipment for that seaming period and shall be at least three (3) feet long (in the direction of the seam) by at least one (1) foot wide and may be performed on scrap pieces of geomembrane.
2. Six one (1) inch wide specimens (coupons) from each test seam sample shall be prepared for on-site field testing for shear and peel strength. Coupons shall be prepared using a sheet cutter so that consistent, uniform one (1) inch wide coupons are obtained. Samples should be distributed evenly over the six (6) feet length.
3. The CONTRACTOR will make these test seams in the presence of OWNER or ENGINEER.
4. The extension rates for these tests will not exceed two (2) inches per minute unless permission from the OWNER is given.
5. Three coupons shall be tested in shear and three in peel. All coupons shall exhibit the required strength at yield and failure mechanism FTB as set forth in *Paragraph 3.05B*. Seam separation equal to or greater than 10% of the track width shall be considered a failing test. If any of the coupons fail, the reason for the failure shall be identified and corrected prior to preparing another test seam. The new test seam shall be prepared reflecting adjustments made to the seamer/seaming equipment and a new set of coupons shall be cut and tested.
6. Seaming equipment shall not be used until satisfactory prequalification test seams have been prepared, witnessed by OWNER or ENGINEER.
7. The test results on all prequalification test seams will be reported to OWNER and ENGINEER.

E. Climatic Conditions for Seaming:

1. Seaming shall be performed only when panel temperatures are between 32°F and 170°F, unless otherwise approved by OWNER. If seaming is permitted to be performed at panel temperatures below 32°F, the panel contact surface shall be preheated and CONTRACTOR shall certify in writing that the low-temperature seaming procedures will not cause any short-term or long-term damage to the geomembrane or the welded seam. CONTRACTOR shall demonstrate to OWNER or ENGINEER that field seams comply with project specifications using pre-qualification test seams. CONTRACTOR shall submit to OWNER or ENGINEER, for

approval, detailed procedures for seaming at low temperatures, including the following:

a. Preheating of the geomembrane
b. Provision of a tent or other device if necessary, to prevent heat losses during seaming and rapid heat losses subsequent to seaming.
c. Number of additional test welds to determine appropriate seaming parameters.

2. Seaming during rainy weather or when dew is present on panels shall not be allowed.
3. CONTRACTOR shall provide any special lighting required for seaming during low-light or dark hours.
4. CONTRACTOR shall leave slack in the geomembrane as necessary to account for thermal expansion or contraction of geomembrane. Stress on panels due to thermal expansion and contraction shall be minimized by performing field seaming operations during the coolest parts of the day or night, if necessary. Special scheduling or extended hours of operation require approval by OWNER.

F. All welding shall provide a tight, leak proof, homogeneous bond between panels. All seams shall extend to ends of panels.

G. Welding equipment shall be continuously monitored to control the temperature of extrudate and wedge. If recording equipment allows for a hard copy of the monitoring, a copy of the monitoring labeled with the weld identification number will be submitted to OWNER or ENGINEER.

3.06 PIPE AND STRUCTURE PENETRATION SEALING SYSTEM

A. Penetration sealing systems shall be constructed from the base geomembrane material, flat stock, prefabricated boots and accessories as shown on the Drawings.
B. All penetration sealing systems must be tested. Where field non-destructive testing cannot be performed, field spark testing shall be performed using standard holiday leak detectors in accordance with ASTM 6365. Spark testing should be performed in areas where both air pressure testing and vacuum testing are not possible.

3.07 NONDESTRUCTIVE TESTING OF PRODUCTION SEAMS

A. All field seams shall be non-destructively tested by the CONTRACTOR over the full seam length before the seams are covered. Each seam shall be numbered or otherwise designated. The location, date, test unit, name of test, and outcome of all non-destructive testing shall be recorded and submitted to the OWNER or ENGINEER.

B. Testing shall be done as the seaming work progresses, not at the completion of all field seaming. All defects found during testing shall be numbered and marked immediately after detection. All defects found shall be repaired, retested and remarked to indicated acceptable completion of the repair.

C. Non-destructive tests shall be performed by experienced technicians familiar with the specified test methods.

D. Visual Inspection: A visual inspection of all seams shall be performed. This inspection shall look for obvious flaws in seaming patches, penetration sealing, material defects, or other problems. Deviations from acceptable workmanship standards shall be noted and corrected.

E. Pressure Testing (Double-Fusion Welds): Where a double-fusion weld seaming system is employed, the continuity of the seam shall be tested with air pressure in accordance with

the following procedure. The flow channel must not be obstructed by foreign objects or geomembrane material throughout the length of seam being tested. The vacuum test described in *Paragraph 3.06F* must be employed for testing of all seams that do not have a continuous flow channel.

1. A test device consisting of an inflation needle and pressure gauge mounted on a "T" fitting shall be used for air pressure testing. Insert the needle into the flow channel and seal the end of the channel around the needle. Connect a pump (such as a small bicycle pump) to the test device.
2. Ascertain that the flow channel is continuous by leaving the other end of the channel open and pumping air through the channel. If air does not pass through the channel the test length must be shortened until a continuous length of flow channel is found.
3. Seal and clamp both ends of the flow channel to assure an airtight seal. Inflate the flow channel to a minimum 30 psig. Allow one minute for the seam to stabilize.
4. Re-inflate as needed to achieve a minimum 30 psig on the seam and test for a period of five (5) minutes.
5. At the end of the test period, if the pressure has not dropped more than two (2) psi, the test shall be considered a pass and the following procedure will be implemented:
    a. Remove the test device and clamps.
    b. Make any repairs, if necessary, to the area where the flow channel was clamped or inflated.
    c. Record the test results, mark the seam as a pass, the date tested, and proceed to the next seam.
6. If the pressure drops below the two (2) psi allowance, the test shall be considered a failure and the following procedure shall be implemented to identify the failure:
    a. Check to determine if there is excessive seepage around the inflation needle.
    b. Check both ends of the seam to ensure the flow channel is completely sealed off.
    c. Walk the length of the seam; look and listen for air leaks.
    d. If either of these procedures fail to identify the leak, trim the seam overlap and vacuum test the seam to locate the leak.
    e. Once the leak is identified, make the necessary repairs and retest the seam.
7. Seam to be approved before testing by OWNER or ENGINEER; test to be performed in presence of OWNER or ENGINEER personnel.

F. Vacuum Testing: Vacuum testing shall be used to test the continuity of extrusion welded and mechanical seams. A clear topped vacuum box, supplied by CONTRACTOR, shall be placed over the seam to be tested after application of a soapy solution. Upon evacuation, bubbles will be evident through the viewing window if the seam lacks integrity. The following procedure shall be followed:

1. Wet seam to be tested with a soapy solution mixed at a ratio of one (1) ounce soap to one (1) gallon water. No antifreeze solution is allowed to be added to the water.
2. Place vacuum box over seam to be tested, evacuate box to a vacuum equal to five (5) psig, and tug up to ensure a leak tight seal has been developed.
3. Examine the seam for a minimum of 10 seconds to detect soap bubbles.
4. If the bubbles are not evident, move to next test location. Adjacent test sections are to overlap by at least one (1) inch.
5. If bubbles are present, mark area clearly for repair.

6. If the vacuum testing indicates leakage, the area shall be spot patched; or if major leaks are detected, the entire seam shall be reworked.
7. Seam to be approved before testing by OWNER or ENGINEER; test to be done in presence of OWNER or ENGINEER personnel.

3.08 DESTRUCTIVE TESTING OF PRODUCTION SEAMS

A. The purpose of destructive testing is to verify that the seaming process has produced seams of acceptable mechanical integrity. One seam sample shall be taken at random for each 500 feet of seam. Sample locations shall be designated by OWNER or ENGINEER. Each sample shall be shown on the panel layout drawing. All holes in the installed geomembrane resulting from obtaining samples shall be repaired immediately. The sample ID number shall be marked on the patch. All repairs shall be 100% vacuum tested for continuity.

B. *Maximum frequency of test locations shall be agreed upon by the CONTRACTOR, OWNER, and ENGINEER prior to commencement of installation*. Additional test locations, not to exceed agreed upon maximum frequency, shall be determined during seaming at OWNER or ENGINEER'S discretion. Selection of such locations may be prompted by suspicion of excess crystallinity, contamination, offset welds or other potential cause of imperfect welding.

C. CONTRACTOR shall not be informed in advance of locations where seam samples will be taken.

D. Cut samples as seaming progresses in order to obtain documentation test results prior to completion of liner installation. Number each sample and identify sample number and location on panel layout drawing.

E. Samples shall be 12 inches wide by 36 inches long with seam centered lengthwise. Cut one (1) 25 mm (1 in.) wide strip from each end of sample and test in field, by hand or tensiometer, for peel and shear respectively. The tested sample shall not fail through the seam. If tensiometer is not available and if 25 mm (1.0 in.) wide specimen is too difficult to test by hand, 10 mm (0.5 in.) wide specimen is acceptable. Cut remaining sample into three (3) parts and distribute as follows.

1. One portion to CONTRACTOR for field documentation testing, 12 inches by 12 inches.
2. One portion to OWNER independent laboratory testing, 12 inches by 12 inches.
3. One portion to OWNER for archive storage, 12 inches by 12 inches.

F. For field testing, the CONTRACTOR shall cut 10 identical 1-inch wide replicated specimens from his sample. The CONTRACTOR shall test five (5) specimens for seam shear strength and five (5) for peel strength. Peel tests shall be performed on both inside and outside weld tracks. To be acceptable five out of five specimens must pass the test criteria with less than 10% separation. The CONTRACTOR shall submit field documentation test results to the OWNER or ENGINEER as soon as they become available, but no later than 2 working days after the sample was taken. Field seams shall meet the minimum specifications of GRI GM 19a.

Note: All seams must exhibit a film tear bond (FTB).

G. All testing equipment required for these quality control tests shall be provided by CONTRACTOR. Any seams failing the quality control tests shall be repaired at

CONTRACTOR'S expense until passing test results are obtained. At all times, care shall be exercised to avoid damaging the geomembrane.

H. ENGINEER shall be present for all field documentation testing of seam strength.

I. CONTRACTOR shall submit results of test it performs as a result of its quality control assurance program to OWNER and ENGINEER.

3.09 PROCEDURES FOR DESTRUCTIVE TEST FAILURE

A. The following procedures shall apply when sample fails lab destructive test.

1. Obtain additional destructive test samples at locations approximately 10 feet on either side of the failed test location.
2. Perform destructive tests.
3. If test passes, the seam shall be considered adequate.
4. If tests fail, all seams represented by the original destructive test shall be repaired with a cap-strip extrusion welded to all sides of the capped area. All cap-strip seams shall be non-destructively tested until adequacy of the seams is achieved. Cap strip seams exceeding 150 feet in length shall be destructively tested.

B. In any case, acceptable seams shall be bounded by two (2) passed test locations (i.e., above procedure shall be followed in both directions from original failed location), and one sample for destructive testing shall be taken within reconstructed area.

C. If sample fails laboratory destructive test (whether conducted by independent laboratory or by CONTRACTOR'S laboratory), above procedures shall be followed considering laboratory tests exclusively. Since final seam must be bounded by two (2) passed test locations, it may be necessary to take one or more new samples for laboratory testing in addition to one required in reconstructed seam area.

3.10 DEFECTS AND REPAIRS

A. Identification: Broom or wash geomembrane if amount of dust or mud inhibits inspection.

B. Evaluation: Non-destructively test each suspect location in seam and non-seam areas. Repair each location failing nondestructive testing.

C. Repair Procedures:

1. Repair defective seams by reconstruction.
2. Repair tears or pinholes by seaming or patching.
3. Repair blisters, larger holes, undispersed raw materials, and contamination by foreign matter with patches.
4. Surfaces of geomembrane to be patched shall be abraded no more than 1 hour prior to repair.
5. Seams used in repairing patches shall be approved extrusion welded seams and may be subjected to same destructive test procedures as outlined for other seams.
6. Patches shall be made of same geomembrane, extend minimum of 150 mm (6 inches) beyond edge of defects, and applied using approved extrusion welding methods only. Report areas of repair to OWNER and ENGINEER immediately.

D. SEAM RECONSTRUCTION PROCEDURES:

1. Seam reconstruction for extrusion welding process shall be achieved by installing a cap strip over the defective weld a minimum of six (6) inches either side of the weld and extrusion welding.

2. Seam reconstruction for fusion process shall be achieved by cutting out existing seam and welding in replacement strip, or reseaming by extrusion welding along the overlap at the outside seam edge left by the fusion welding process or welding a cap strip over the defective seam length.

E. Verification of Repairs: Test each repair non-destructively. Repairs passing nondestructive test shall be taken as indication of adequate repair. Failed tests indicate repair shall be redone and retested until passing test results.

3.11 GEOMEMBRANE ACCEPTANCE

A. CONTRACTOR shall retain ownership and responsibility for geomembrane until acceptance by OWNER. Geomembrane liner will be accepted by OWNER when:

1. Written certification letter, including "as-built" drawings, is received by OWNER.
2. Installation of the geomembrane is complete.
3. All required documentation of installation is submitted to OWNER, including inspector's final report.
4. Verification of adequacy of field seams and repairs, including associated testing, is complete and all paperwork accepted and approved by OWNER or ENGINEER.
5. The five (5) year material and one-year workmanship warranties are received.

3.12 DEWATERING

A. The CONTRACTOR shall take all steps necessary, such as ditching, diking, and pumping to keep the excavation areas clear of water/leachate during the progress of the work and until the finished work is safe from damage. The CONTRACTOR shall provide all power, pumps, materials, and miscellaneous apparatus necessary, and shall be responsible for disposing of the water/leachate pumped from the excavation in a manner which will not interfere with other Work within the area or cause damage to property. The CONTRACTOR shall be held responsible for all erosion, sediment deposit, or other adverse results because of the dewatering operations and shall repair any areas affected at no additional cost the OWNER.

1. CONTRACTOR shall note that leachate may not be discharged to surface water or directly onto ground surface. Leachate must be managed in accordance the Landfill's *Leachate Management Plan* (i.e. pumped into leachate management system or back into a lined landfill cell).

B. CONTRACTOR and liner installation contractor responsible for keeping water from getting between FML and clay. If water does accumulate between the FML and the liner, the area should be dewatered and area reworked as necessary.

3.13 CLEANUP

A. The CONTRACTOR shall place ALL material scraps in OWNER designated area at the end of each working day. Disposal of scraps in the anchor trenches will not be acceptable. No scraps of materials will be allowed to be left on top of liner.

B. Once liner installation is complete the CONTRACTOR shall:

1. Remove all sand bags from site; or
2. Remove all sand bags and place in OWNER designated area; or
3. If sand in sand bags is acceptable as a drainage layer material the CONTRACTOR may empty each bag and remove and dispose of the empty bags. This will only be allowed if the material meets the criteria for a granular drainage layer. The CONTRACTOR must receive permission from OWNER prior to emptying the sand bags onto the liner.

END OF SECTION

Certificate of Acceptance of
Geomembrane Subgrade Surface by CONTRACTOR

DESCRIPTION OF AREA TO BE CERTIFIED:_____

_____

LOCATION:_____

PROJECT:_____

ADDRESS:_____

The undersigned, _____ certifies that he is a representative of _____ _____, duly authorized to execute this certificate, that he visually inspected the subgrade surface described above on _____ and found the surface to be acceptable for installation of the geomembrane.

This certification is based on observations of the surface of the subgrade only. No sub terrain inspections or tests have been performed and_____ (company) makes no representations or warranties regarding conditions which may exist below the surface of the subgrade.

Date: _____ Signature: _____

Name:_____ Title:_____

CERTIFICATE RECEIVED BY CONTRACTOR CERTIFICATE RECEIVED BY OWNER

Date:_____ Date:_____

Contractor:_____ Company:_____

Name:_____ Name: _____

Signature_____ Signature_____

Title_____ Title:_____

SECTION 02921

GEOTEXTILE

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section includes manufacture, fabrication (if needed), furnishing and installation of geotextile, as required on the Drawings:

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D3776—Standard Test Methods for Mass per Unit Area (Weight) of Fabric.
2. ASTM D4491—Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
3. ASTM D4533—Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
4. ASTM D4632—Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
5. ASTM D4751—Standard Test Method for Determining Apparent Opening Size of a Geotextile.
6. ASTM D4833—Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.

B. Geosynthetics Research Institute (GRI)

1. GT7 – Determination of Long-Term Design Strength of Geotextiles
2. GT8 – Fine Fraction Filtration Using Geotextile Filters.
3. GT12a – Test Methods and Properties for Nonwoven Geotextiles Used as Protection (or Cushioning) Materials
4. GT13a – Test Methods and Properties for Geotextiles Used as Separation between Subgrade Soil and Aggregate.

1.03 SUBMITTALS

A. Manufacturer's certificates indicating conformance test results of furnished material to the Technical Specifications.

1.04 QUALITY ASSURANCE AND MATERIAL HANDLING

A. Roll Identification:

1. Provide geotextiles in rolls wrapped in relatively impermeable and opaque protective covers and marked or tagged with following information:
   a. Manufacturer's name
   b. Product identification
   c. Lot number
   d. Roll number
   e. Roll dimensions
2. Indicate special handling marked on geotextile itself, e.g., "This Side Up".
3. Conformance testing indicating conformance with Technical Specifications.

B. Handle geotextiles in such manner as to ensure geotextiles are not damaged.

PART 2 - PRODUCT

2.01 GENERAL

A. Unless otherwise noted on the Drawings, furnish materials whose minimum average roll values as defined by GRI, meet or exceed Geotextile Fabric Properties.

B. Except when specifically authorized, supplier shall not furnish special run or value-added products.

C. Orient polymeric yarns or fibers into stable network to retain relative structure during handling placement, and long-term service.

D. Unless longer durability is specified, geotextiles shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration.

PART 3 - EXECUTION

3.01 GEOTEXTILES INSTALLATION

A. General

1. On Slopes, roll down slope in such manner as to continually keep geotextile sheet in tension.
2. In presence of wind, weight geotextiles with sandbags or equivalent. Install sandbags during placement and keep in place until replaced with cover materials.
3. Take necessary precautions to prevent damage to underlying layers during placement of geotextile.
4. During placement of geotextiles, care shall be taken not to entrap in geotextile, stones, excessive dust or moisture that could damage geomembrane or hamper subsequent seaming.
5. Do not expose geotextiles to precipitation prior to being installed and do not expose to direct sunlight for more than 15 days, unless otherwise specified.

B. Seams and Overlaps:

1. On slopes steeper than 10:1, seam geotextiles:
   a. Seam by sewing, adhesive, fusion or other approved means.
   b. Continuously seam; do not spot seam.
   c. Overlap geotextile 6 inches prior to seaming.
   d. Sew horizontal seams along slope, not across slope.
   e. Using polymeric thread with properties equal to or exceeding those of geotextile.

2. On slopes less than 10:1, seam or overlap geotextile:
   a. Overlap 18 inches.
   b. Spot seaming when overlapping may be considered as a measure to mitigate against wind uplift.
   c. Orient overlaps in direction of earth placement equipment travel.

C. Geotextile Repair:

1. On slopes:

a. Sew fabric patch into place using double sewn lock stitch, seams 1/4 to 3/4 in. apart and no closer than 1 in. from any edge.
b. Should any tear exceed 10% of width of roll, remove roll from slope and replace.

2. On non-slope areas: spot seam a fabric patch in place with minimum of 24-inch overlap in each direction.
3. Remove soil or other material that may have penetrated torn geotextile.

D. Appurtenances:

1. Install geotextile around appurtenances protruding through geotextile as shown on the Drawings.
2. After material is placed and seamed, complete final field seam connection between appurtenance sleeve or shield or geotextile. Maintain sufficient initial overlap of appurtenance sleeve so shifts in location of geotextile can be accommodated.
3. Care shall be taken while welding around appurtenances since both nondestructive and destructive testing might not be feasible. Do not damage geotextile while making connections to sumps and appurtenances.

END OF SECTION

SECTION 02924

GEONET GEOCOMPOSITE

PART 1 - GENERAL

1.01 SUMMARY

A. Work includes manufacture, fabrication (if needed), supply, and installation of the Geonet Geocomposite as shown on the Drawings.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM D792 – Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
2. ASTM D1238 – Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer
3. ASTM D1505 – Standard Test Method for Density of Plastics by the Density-Gradient Technique
4. ASTM D3776/D3776M – Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
5. ASTM D4218 – Standard Test Method for Determination of Carbon Black Content in Polyethylene Compounds by the Muffle-Furnace Technique
6. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus
7. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity
8. ASTM D4632/D4632M – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
9. ASTM D4716/D4716M – Standard Test Method for Determining the (In-plane) Flow Rate per Unit Width and Hydraulic Transmissivity of a Geosynthetic Using a Constant Head
10. ASTM D4751 – Standard Test Methods for Determining Apparent Opening Size of a Geotextile
11. ASTM D4833/D4833M – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
12. ASTM D5035 – Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
13. ASTM D5199 – Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
14. ASTM D5261 – Standard Test Method for Measuring Mass per Unit Area of Geotextiles
15. ASTM D6241 – Standard Test Method for Measuring Static Puncture Strength of Geotextiles and Geosynthetic-Related Products Using a 50-mm Probe
16. ASTM D7005/D7005M – Standard Test Method for Determining the Bond Strength (Ply Adhesion) of Geocomposites
17. ASTM D7179 – Standard Test Method for Determining Geonet Breaking Force

B. Geosynthetics Research Institute (GRI) Standard Specifications (Latest Edition):
1. GRI-GN4 – Test Methods, Required Properties and Test Frequency for Biplanar Geonets and Biplanar Genet Composites

1.03 SUBMITTALS

A. Raw Materials

1. Copy of quality control certificates issued by HDPE resin supplier.
2. Production date(s) of HDPE resin.
3. Statement that no reclaimed polymer added to resin during manufacture of Geonet for this project.

B. Copy of quality control certificates for each roll. The certificates to include:

1. Manufacturer's name.
2. Product identification.
3. Lot number.
4. Roll number.
5. Roll dimensions.
6. Installation layout, certifying placement patterns and seams delivery, storage, and handling.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Transportation

1. Handle rolls by appropriate means to prevent damage from occurring.

B. Onsite Storage

1. Storage of geonet shall be CONTRACTOR'S responsibility.
2. Protect geonet from damage, maintain roll package integrity, and keep rolls out of water, mud or dust. Geonet that becomes clogged or damaged may be repaired or replaced at CONTRACTOR'S expense.

1.05 SEQUENCING AND SCHEDULING

A. Submit material delivery and installation schedule for incorporation into the Project schedule.

PART 2 - PRODUCTS

2.01 OWNER SUPPLIED GEOCOMPOSITE

A. The geocomposite shall consist of an HDPE drainage net heat bonded to two layers (sandwiched) of geotextiles to create double-sided geocomposite or to one layer to create single-sided geocomposite. The geotextiles shall extend a minimum of six (6) inches beyond the edges of drainage net on both sides of the geocomposite roll. The geotextile shall not be bonded to the drainage net within six (6) inches from the edges of the rolls. Geocomposites shall meet physical properties in conformance with the product specifications reflected on the DRAWINGS (i.e. geotextile weight and geonet thickness).

B. The compound of the geocomposite rolls shall meet the minimum property values identified within the Geosynthetics research Institute (GRI) GN4 specifications (latest edition) per the material specified on the DRAWINGS.

PART 3 - EXECUTION

3.01 GEOCOMPOSITE HANDLING AND PLACEMENT

A. The CONTRACTOR shall handle all geocomposites in such a manner as to ensure the geocomposites are not damaged in any way. Comply with the following:

1. On slopes, the geocomposites shall be secured in the anchor trench and then rolled down the slope in such a manner as to continually keep the drainage net sheet in tension. If necessary, the geocomposites shall be positioned by hand after being unrolled to minimize wrinkles. Geocomposites can be placed in the horizontal direction (i.e., across the slope) in some special locations (e.g., if an extra layer of geocomposite is required at the toe of a slope, this extra layer of geocomposite can be placed in the horizontal direction).
2. In the presence of wind, all geocomposite shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with overlying material.
3. Geonets shall only be cut using scissors.
4. The CONTRACTOR shall take any necessary precautions to prevent damage to underlying layers during placement of the geocomposite.
5. During placement of geocomposite, care shall be taken not to entrap in the geonet, dirt or excessive dust that could cause clogging of the geocomposite and/or stones that could damage the adjacent geomembrane. If dirt or excessive dust is entrapped in the geocomposite, it shall be hosed clean prior to placement of the next material on top of it. In this regard, care shall be taken with the handling of sandbags to prevent rupture or damage of the sandbag.
6. Care shall be taken not to leave tools on or in the geocomposite.
7. Orient seams of fabric covering to overlap in the direction of earth filling.

3.02 TACKING AND JOINING

A. Adjacent geonets and geocomposites shall be joined according to CONTRACTOR'S panel drawings and specifications. As a minimum, the following requirements will be met:

1. Adjacent rolls shall be overlapped by at least four (4) inches and on slopes each end shall be overlapped two (2) feet in a shingle configuration.
2. Geonet overlaps shall be secured by tying at a minimum every five (5) feet on adjacent panel edges, two (2) rows of two (3) foot spaced cable on end sections.
3. Tying shall be achieved by polymer cable ties. Tying devices shall be white or yellow for easy observation. Metallic devices are not allowed.
4. In the corners of the side slopes of rectangular landfills, where overlaps between perpendicular geonet strips are required, an extra layer of geonet shall be unrolled along the slope, on top of the previously installed drainage nets, from top to bottom of the slope.
5. The fabric covering on the geonet shall be heat sealed (leistered or stitched) to adjacent slabs to prevent foreign material from entering the geonet and provide a smooth surface for subsequent HDPE installation.

3.03 GEONET REPAIR

A. Any holes or tears in the geonet shall be repaired by placing a patch extending two (2) feet beyond edges of the hole or tear. The patch shall be secured to the original geonet by tying every six (6) inches or a minimum of four (4) ties, whichever is greater. If the hole or tear width across the roll is more than 50% the width of the roll, the damaged area shall be cut out and the two portions of the geonet shall be joined as indicated in Paragraph 3.02.

3.04 GEOCOMPOSITE REPAIR

A. Any holes or tears in the geotextile covering shall be repaired by placing a patch extending 12 inches beyond edges of hole or tear. patch shall be secured to original geotextile using approved thermal bonding techniques.

B. Any holes or tears in the geonet shall be repaired in accordance with paragraph 3.03 of this Section.

C. If a hole or tear exceeds 50% of the roll width, remove and replace panel.

3.05 CLEANUP

A. The CONTRACTOR shall place ALL material scraps in OWNER designated area at the end of each working day. Disposal of scraps in the anchor trenches will not be acceptable. No scraps of materials will be allowed to be left on top of geonet or geotextile.

B. Once liner installation is complete the CONTRACTOR shall:

1. Remove all sand bags from site; or
2. Remove all sand bags and place in OWNER designated area; or
3. If sand in sand bags is acceptable as a drainage layer material the CONTRACTOR may empty each bag and remove and dispose of the empty bags. This will only be allowed if the material meets the criteria for a granular drainage layer. The CONTRACTOR must receive permission from OWNER prior to emptying the sand bags onto the liner.

END OF SECTION

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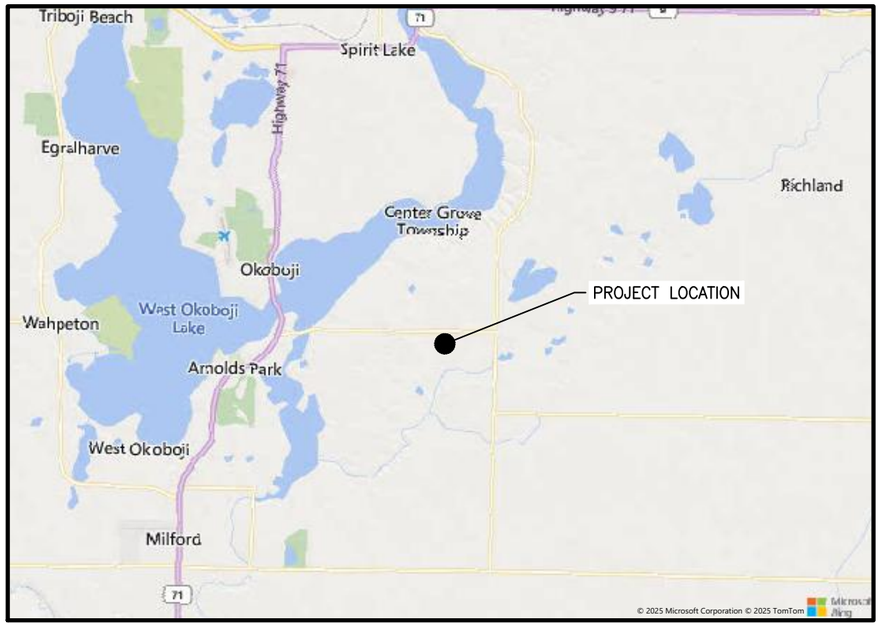
2026 CELL D1 CONSTRUCTION PLANS

PREPARED FOR
WASTE MANAGEMENT
DICKINSON LANDFILL, INC.

DEC. 2025



DICKINSON LANDFILL, INC.
VICINITY MAP

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GRAPHIC SCALE IN FEET

DICKINSON LANDFILL, INC.
PROJECT LOCATION MAP

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INDEX OF SHEETS

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL 22698
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

SEAL

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA. MY LICENSE RENEWAL DATE IS 12/31/2026.

PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT
Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
COVER AND INDEX SHEET

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
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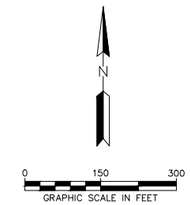

LEGEND

- EW-1 — EXISTING GAS EXTRACTION WELL
- MW-21A — MONITORING WELL LOCATION AND NUMBER
- LW-1 — LEACHATE MONITORING WELL PIEZOMETER
- GP-1 — GAS PROBE
- GP-8 — GAS PROBE DISCONTINUED
- TEMPORARY GAS PROBE (INSTALLED APRIL 2022)
- CLOSURE LIMIT
- PERMITTED WASTE LIMITS
- PHASE LIMITS
- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCELINE
- EXISTING CULVERT
- EXISTING UNDERDRAIN
- FM — EXISTING LEACHATE FORCEMAIN
- EXISTING UNDERDRAIN
- E — E — EXISTING ELECTRICAL LINE
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) — PHASE ID
- [D] — FUTURE PHASE ID
- [1454] — GROUNDWATER UNDERDRAIN SUMP ELEVATION
- LEACHATE COLLECTION SUMP

SURVEY NOTES:

1. HORIZONTAL DATUM IS IOWA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NORTH AMERICAN DATUM NAD83(2011), US SURVEY FEET,
2. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 88 (NAVD88). CONTOUR INTERVAL IS TWO FEET.
3. TOPOGRAPHY SURVEY COMPLETED BY TETRATECH IN MARCH 19, 2025.

HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

POINT I.D.	NORTHING SPCS NAD83(2011) (FEET)	EASTING SPCS NAD83(2011) (FEET)	ELEVATION (FT-NAVD88)	DESCRIPTION
1	3,966,660.45	4,499,614.05	1496.275	REBAR
2000	3,966,663.58	4,499,340.25	1494.057	REBAR
2004	3,966,655.42	4,502,218.34	1520.534	REBAR
2007	3,965,333.43	4,499,937.44	1470.796	REBAR
2010	3,964,182.39	4,499,283.55	1454.470	REBAR
2015	3,964,752.63	4,501,313.87	1493.670	REBAR
2017	3,964,573.95	4,502,020.64	1483.964	REBAR

LICENSED PROFESSIONAL ENGINEER — MEGAN AMBUEHL 22598 — IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

SEAL

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PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
EXISTING CONDITIONS

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO. 227708272

SHEET NO. C-101

REV NO. 0

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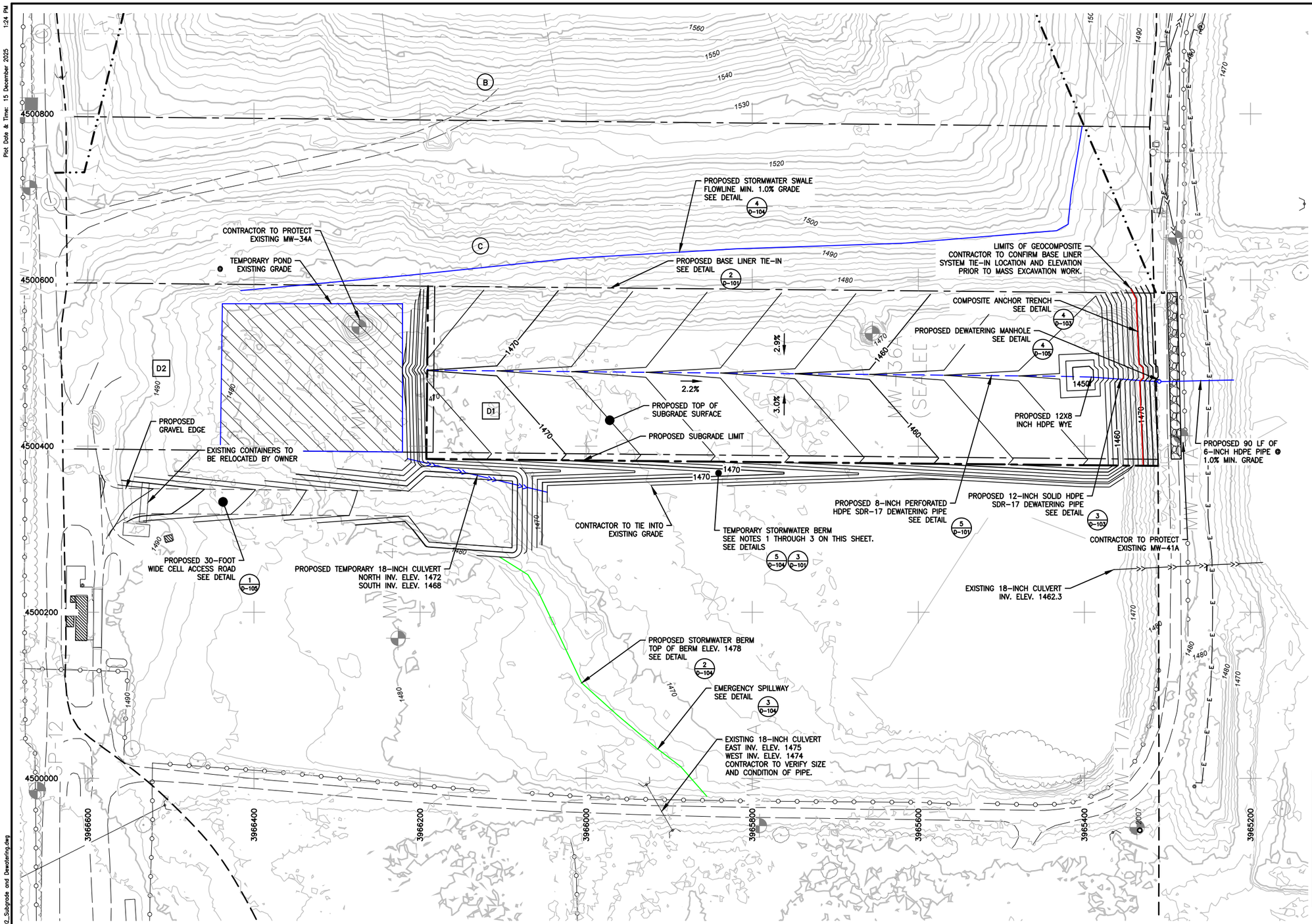
Plot Date & Time: 15 December 2025 1:24 PM



0 60 120
GRAPHIC SCALE IN FEET

LEGEND

- EW-1 — EXISTING GAS EXTRACTION WELL
- MW-21A — MONITORING WELL LOCATION AND NUMBER
- LW-1 — LEACHATE MONITORING WELL PIEZOMETER
- GP-1 — GAS PROBE
- GP-8 — GAS PROBE DISCONTINUED
- TEMPORARY GAS PROBE (INSTALLED APRIL 2022)
- CLOSURE LIMIT
- PERMITTED WASTE LIMITS
- PHASE LIMITS
- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCELINE
- EXISTING CULVERT
- EXISTING UNDERDRAIN
- FM — EXISTING LEACHATE FORCEMAIN
- E — E — EXISTING ELECTRICAL LINE
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- A — PHASE ID
- D — FUTURE PHASE ID
- 1454 — GROUNDWATER UNDERDRAIN SUMP ELEVATION
- LEACHATE COLLECTION SUMP
- PROPOSED TOP OF SUBGRADE MAJOR CONTOUR
- PROPOSED TOP OF SUBGRADE MINOR CONTOUR
- PROPOSED SUBGRADE LIMIT
- PROPOSED PERIMETER ROAD EDGE

NOTE:

1. CONTRACTOR IS RESPONSIBLE FOR PREPARATION AND EXECUTION OF CONSTRUCTION DEWATERING AS NEEDED TO COMPLETE CONSTRUCTION ACTIVITIES. BASED ON HISTORIC PONDING AND NATURAL GROUNDWATER ELEVATIONS, SURFACE AND SUBSOILS MAY BE WET OR SATURATED.
2. THE TEMPORARY STORMWATER BERM IS FOR CONSTRUCTION STORMWATER MANAGEMENT. CONSTRUCTION SEQUENCING OF THE TEMPORARY STORMWATER BERM IS THE RESPONSIBILITY OF THE CONTRACTOR TO MAINTAIN ACCESS AND MINIMIZE RUN-ON INTO THE CONSTRUCTION LIMITS.
3. TEMPORARY BERM TO BE REGRADED TO PROMOTE STORMWATER DRAINAGE AWAY FROM THE CELL LIMITS UPON COMPLETION OF THE GEOMEMBRANE RAINFLAP.

SURVEY NOTES:

1. HORIZONTAL DATUM IS IOWA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NORTH AMERICAN DATUM NAD83(2011), US SURVEY FEET,
2. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 88 (NAVD88). CONTOUR INTERVAL IS TWO FEET.
3. TOPOGRAPHY SURVEY COMPLETED BY TETRATECH IN MARCH 19, 2025.

HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

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2007	3,965,333.43	4,499,937.44	1470.796	REBAR
2010	3,964,182.39	4,499,283.55	1454.470	REBAR
2015	3,964,752.63	4,501,313.87	1493.670	REBAR
2017	3,964,573.95	4,502,020.64	1483.964	REBAR

LICENSED PROFESSIONAL ENGINEER — MEGAN AMBUEHL 22698 — IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

SEAL

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PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

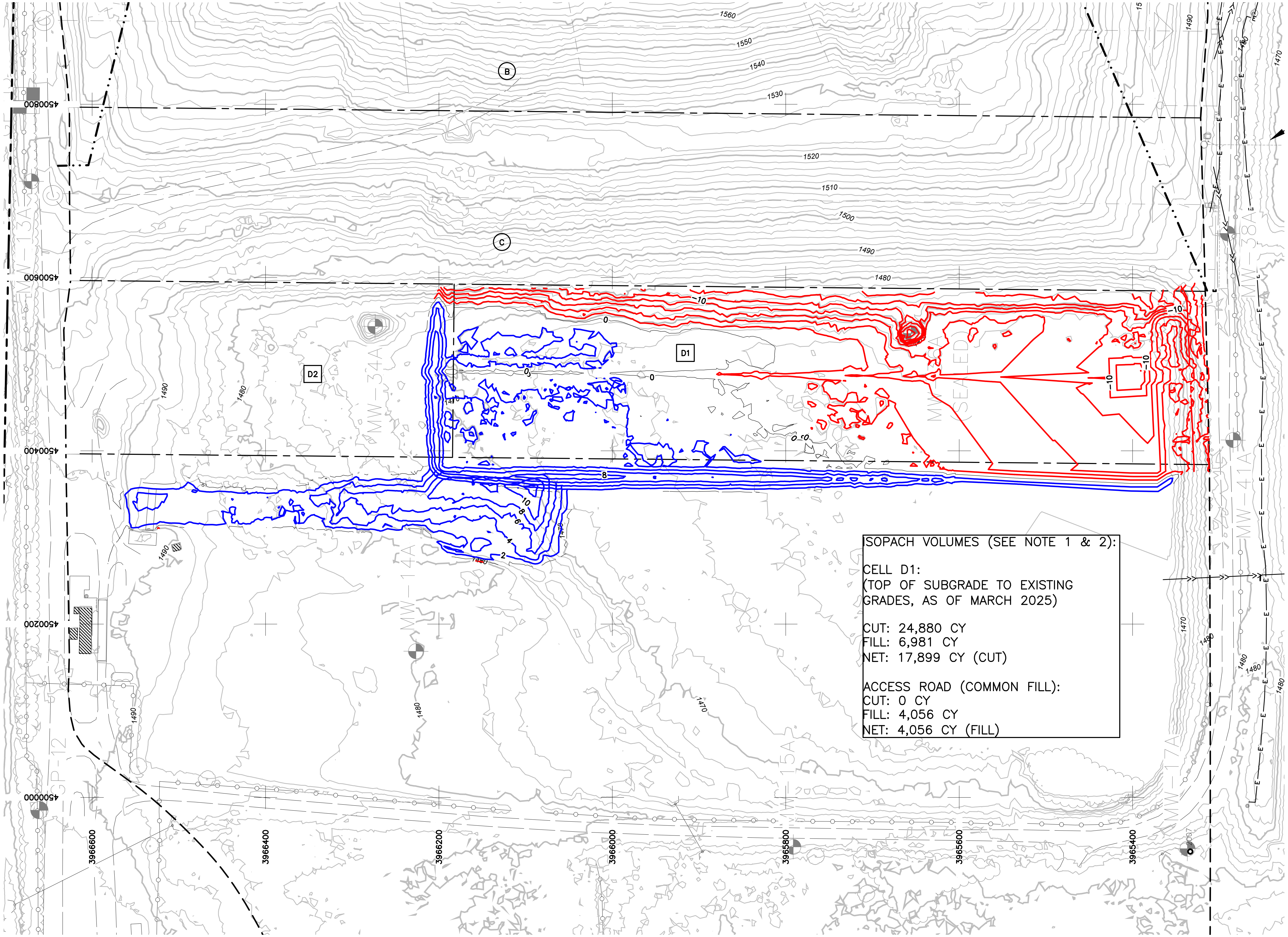
SHEET TITLE
PROPOSED TOP OF SUBGRADE & WATER MANAGMENT PLAN

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	C-102	0

I:\227708272\drafting\civ - Cell\C-102_Subgrade and Dewatering.dwg



ISOPACH VOLUMES (SEE NOTE 1 & 2):

CELL D1:
(TOP OF SUBGRADE TO EXISTING GRADES, AS OF MARCH 2025)

CUT: 24,880 CY
FILL: 6,981 CY
NET: 17,899 CY (CUT)

ACCESS ROAD (COMMON FILL):
CUT: 0 CY
FILL: 4,056 CY
NET: 4,056 CY (FILL)

N

0 60 120
GRAPHIC SCALE IN FEET

LEGEND

- EW-1 — EXISTING GAS EXTRACTION WELL
- MW-21A — MONITORING WELL LOCATION AND NUMBER
- LW-1 — LEACHATE MONITORING WELL PIEZOMETER
- GP-1 — GAS PROBE
- GP-8 — GAS PROBE DISCONTINUED
- TEMPORARY GAS PROBE (INSTALLED APRIL 2022)
- CLOSURE LIMIT
- PERMITTED WASTE LIMITS
- PHASE LIMITS
- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCELINE
- EXISTING CULVERT
- EXISTING UNDERDRAIN
- FM — EXISTING LEACHATE FORCEMAIN
- E — EXISTING ELECTRICAL LINE
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) PHASE ID
- [D] FUTURE PHASE ID
- [1454] GROUNDWATER UNDERDRAIN SUMP ELEVATION
- LEACHATE COLLECTION SUMP
- PROPOSED CUT CONTOUR
- PROPOSED FILL CONTOUR

NOTES

1. QUANTITIES MAY VARY. SURFACE WATER PRESENT AT TIME OF EXISTING SURVEY.
2. TOP OF SUBGRADE IS BASED ON THE BASE LINER SECTION SHOWN ON SHEET D-101.

SURVEY NOTES:

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HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

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LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

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PRINT NAME MEGAN AMBUEHL
SIGNATURE Megan Ambuehl
DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT
Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

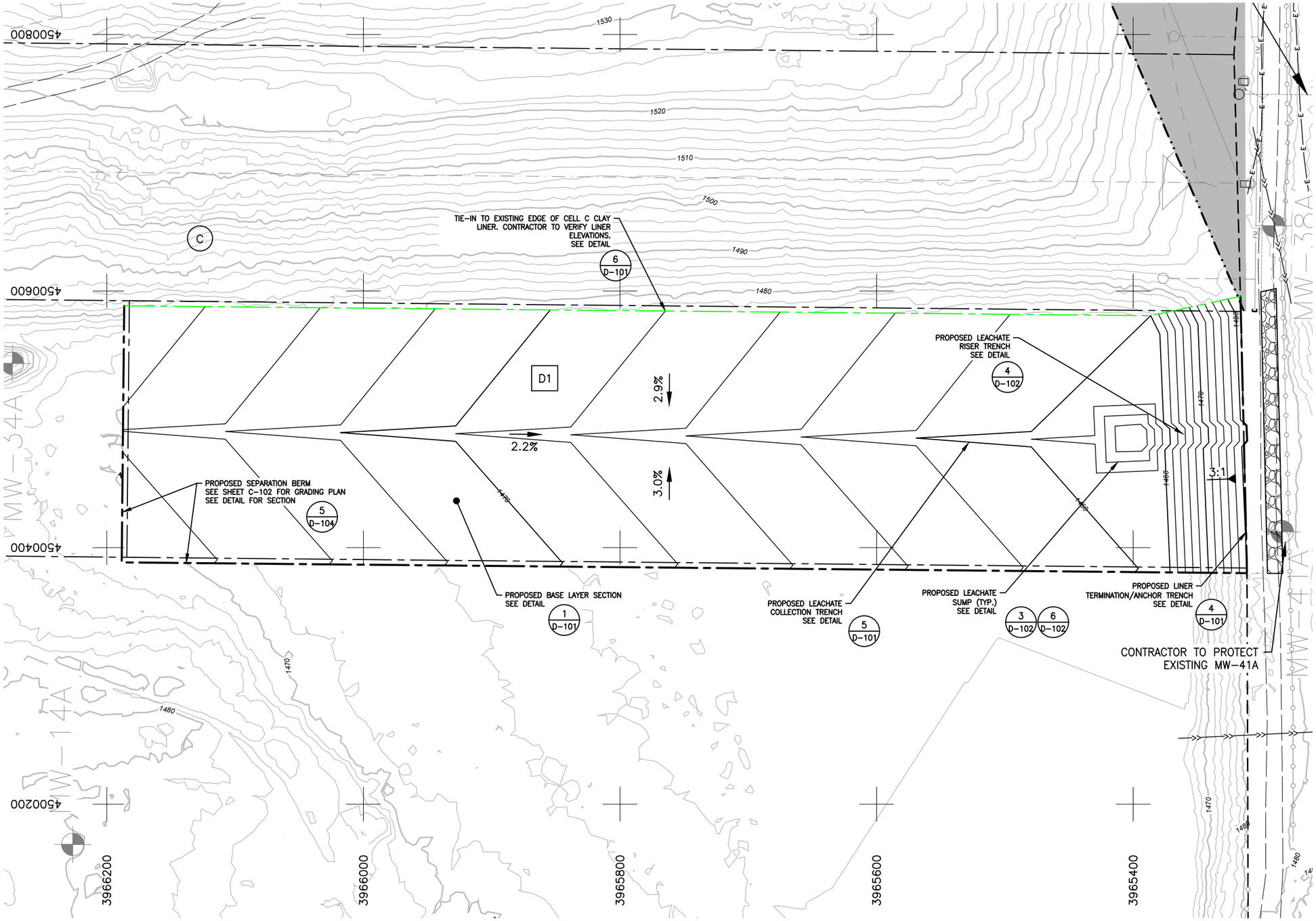
DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
ISOPACH – EXISTING TO TOP OF SUBGRADE

DWN BY	CHK'D	APP'D	DWG DATE	SCALE
JJT	PDS	MMA	DEC. 2025	AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	C-103	0



0 40 80
GRAPHIC SCALE IN FEET

LEGEND

- EW-1 — EXISTING GAS EXTRACTION WELL
- MW-21A — MONITORING WELL LOCATION AND NUMBER
- LW-1 — LEACHATE MONITORING WELL PIEZOMETER
- GP-1 — GAS PROBE
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- TEMPORARY GAS PROBE (INSTALLED APRIL 2022)
- CLOSURE LIMIT
- EXISTING CLOSED AREA
- PERMITTED WASTE LIMITS
- PHASE LIMITS
- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- FM — EXISTING LEACHATE FORCEMAIN
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) PHASE ID
- [D] FUTURE PHASE ID
- [1454] GROUNDWATER UNDERDRAIN SUMP ELEVATION
- LEACHATE COLLECTION SUMP
- PROPOSED TOP OF CLAY MAJOR CONTOUR
- PROPOSED TOP OF CLAY MINOR CONTOUR
- PROPOSED PERIMETER ACCESS ROAD
- PROPOSED CLAY LIMIT BOUNDARY
- EXISTING CELL C CLAY BOUNDARY

SURVEY NOTES:

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3. TOPOGRAPHY SURVEY COMPLETED BY TETRATECH IN MARCH 19, 2025.
4. PROPOSED CONTOURS SHOWN ARE TOP OF CLAY BARRIER LAYER.

HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

POINT I.D.	NORTHING SPCS NAD83(2011) (FEET)	EASTING SPCS NAD83(2011) (FEET)	ELEVATION (FT-NAVD88)	DESCRIPTION
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LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22698
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
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SIGNATURE Megan Ambuehl
DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT
Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

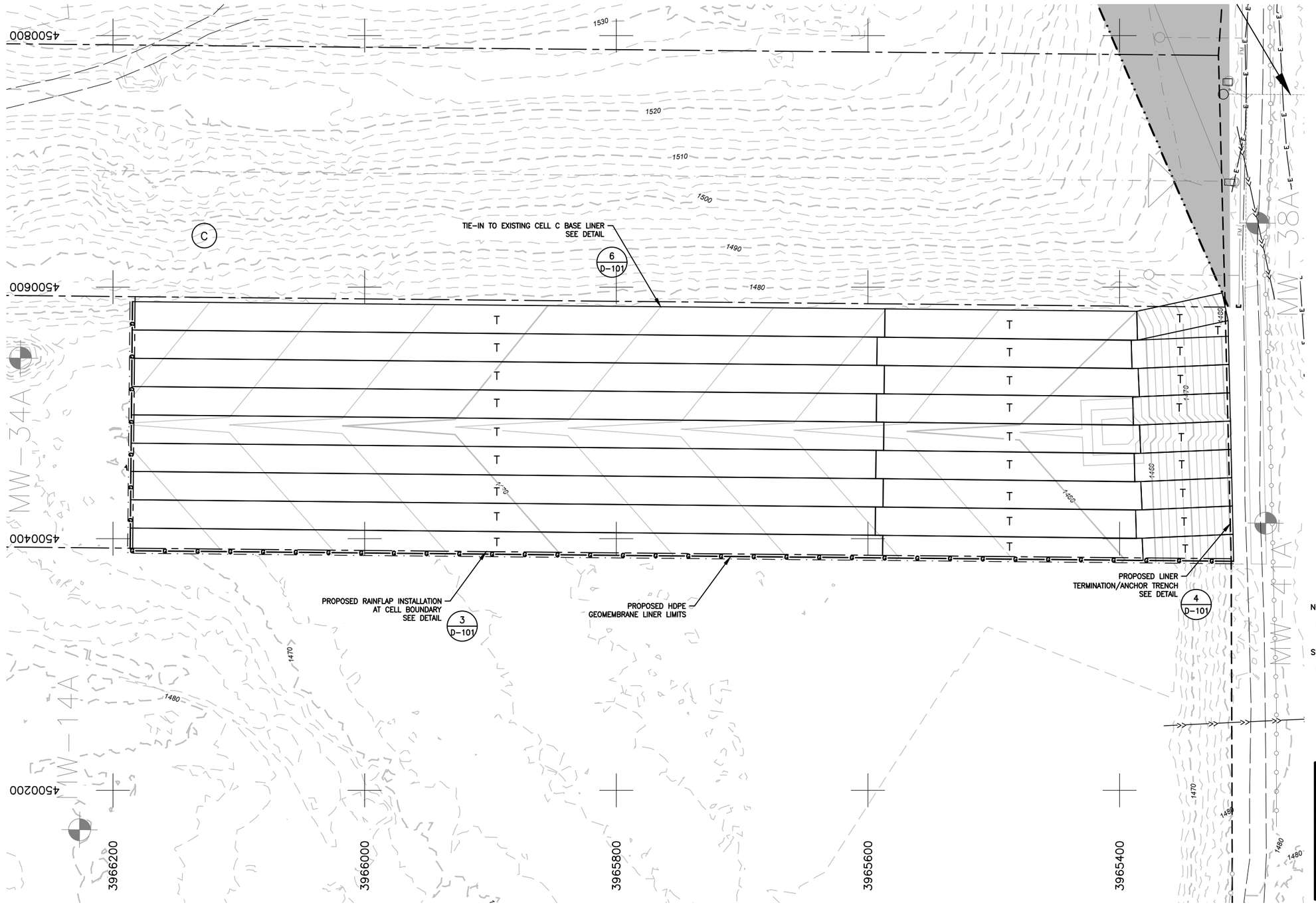
SPIRIT LAKE, IOWA

SHEET TITLE
PROPOSED TOP OF CLAY LINER

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	C-104	0



N

0 40 80
GRAPHIC SCALE IN FEET

LEGEND

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- FM — EXISTING LEACHATE FORCEMAIN
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) PHASE ID
- [D] FUTURE PHASE ID
- [1454] GROUNDWATER UNDERDRAIN SUMP ELEVATION
- LEACHATE COLLECTION SUMP
- PROPOSED CLAY LINER LIMIT
- PROPOSED GEOMEMBRANE LINER LIMIT
- PROPOSED PERIMETER ACCESS ROAD
- PROPOSED TOP OF CLAY MAJOR CONTOUR
- PROPOSED TOP OF CLAY MINOR CONTOUR

NOTES:

1. FINAL LINER PLACEMENT TO BE DETERMINED BY GEOSYNTHETICS INSTALLER.

SURVEY NOTES:

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HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

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LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

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PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
HDPE GEOMEMBRANE PANEL LAYOUT MAP

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	C–105	0

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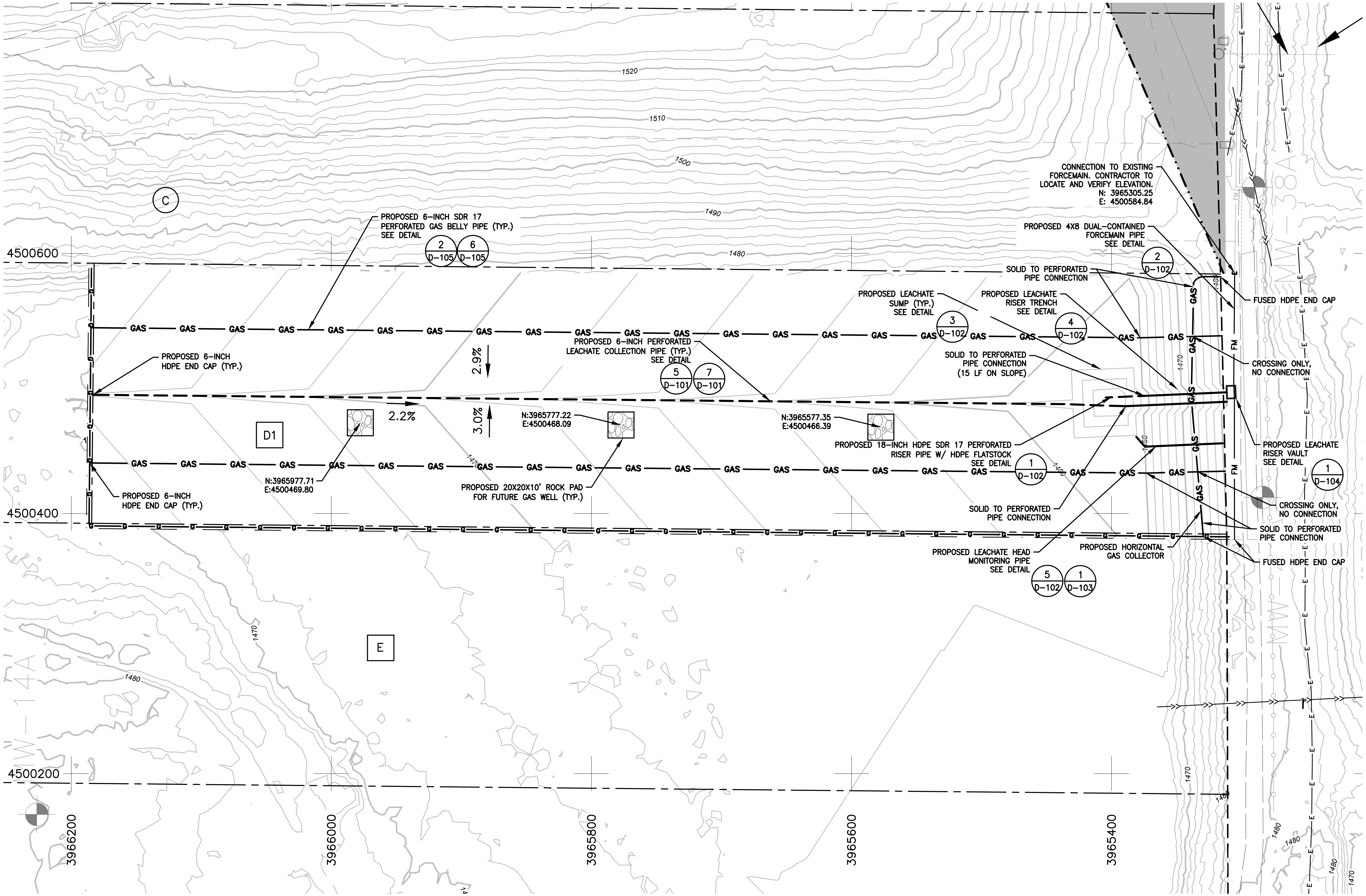

GRAPHIC SCALE IN FEET (0, 40, 80)

LEGEND

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- CLOSURE LIMIT
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- PHASE LIMITS
- PROPERTY BOUNDARY
- FM — EXISTING LEACHATE FORCEMAIN
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) PHASE ID
- [D] FUTURE PHASE ID
- LEACHATE COLLECTION SUMP
- PROPOSED PERIMETER ACCESS ROAD
- PROPOSED LEACHATE COLLECTION PIPE
- FM — PROPOSED LEACHATE FORCEMAIN PIPE
- PROPOSED CLAY LINER LIMIT
- G — PROPOSED GEOMEMBRANE LINER LIMIT
- GAS — PROPOSED LANDFILL GAS PIPE
- PROPOSED LEACHATE RISER VAULT

SURVEY NOTES:

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LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
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PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

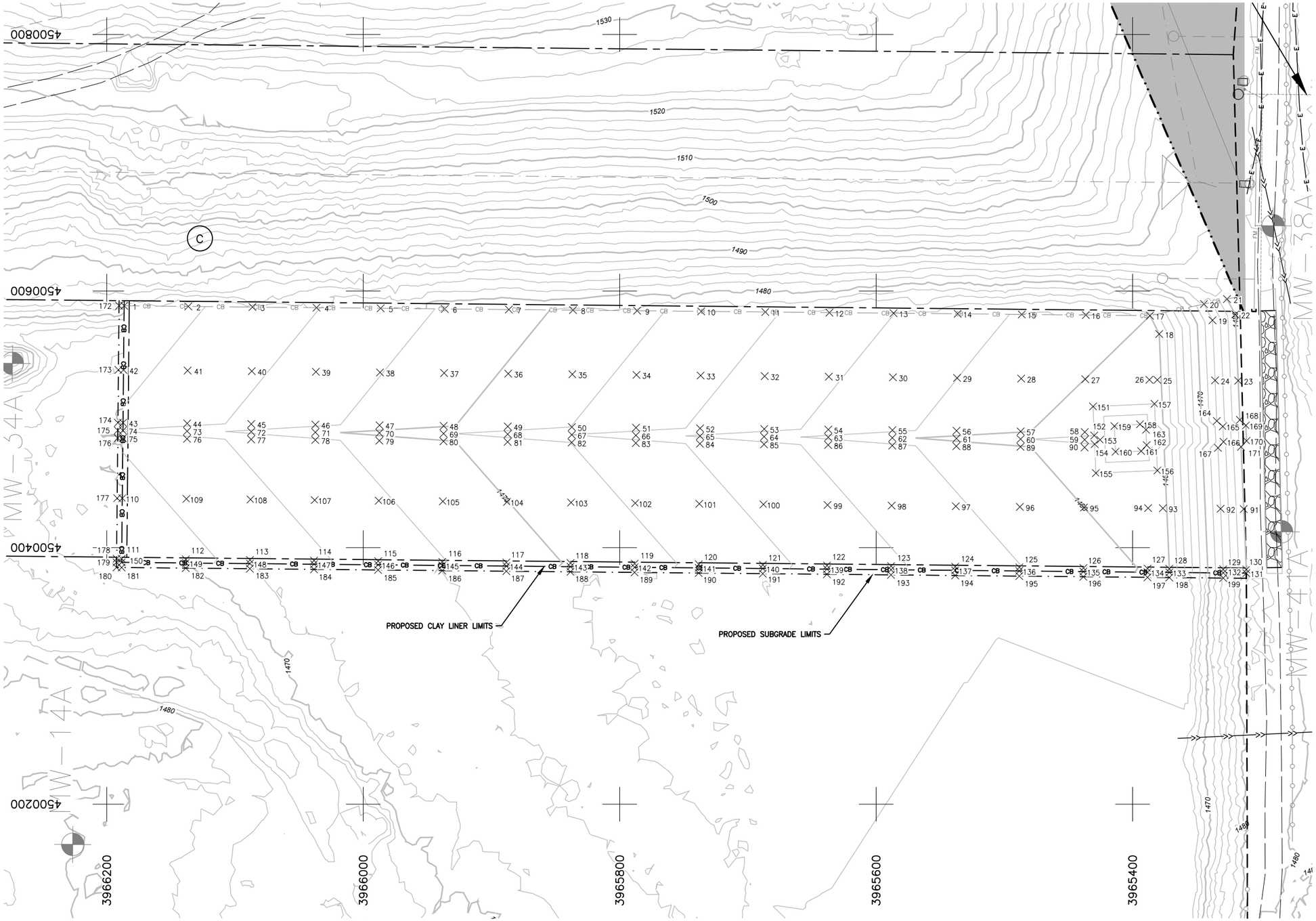
SHEET TITLE
PROPOSED PIPING PLAN

DWN BY	CHK'D	APP'D	DWG DATE	DEC. 2025
JJT	PDS	MMA	SCALE	AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	C-106	0

U:\227708272\drafting\civ - Cell\C-106_Leachate Management Plan.dwg

Plot Date & Time: 15 December 2025 9:50 AM



N

0 40 80
GRAPHIC SCALE IN FEET

LEGEND

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- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- FM — EXISTING LEACHATE FORCEMAIN
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) PHASE ID
- [D] FUTURE PHASE ID
- [1454] GROUNDWATER UNDERDRAIN SUMP ELEVATION
- LEACHATE COLLECTION SUMP
- PROPOSED PERIMETER ACCESS ROAD
- CB — EXISTING CELL C CLAY LIMITS
- CB — PROPOSED CELL D1 CLAY LIMITS
- PROPOSED CELL D1 SUBGRADE LIMITS

SURVEY NOTES:

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HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

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2010	3,964,182.39	4,499,283.55	1454.470	REBAR
2015	3,964,752.63	4,501,313.87	1493.670	REBAR
2017	3,964,573.95	4,502,020.64	1483.964	REBAR

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

SEAL

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA. MY LICENSE RENEWAL DATE IS 12/31/2026.

PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
SURVEY VERIFICATION MAP

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	C-107	0

I:\227708272\drafting\civ - Cell\C-107_Verification Map.dwg

Plot Date & Time: 15 December 2025 8:58 AM

POINT	NORTHING	EASTING	TOP OF SUBGRADE DESIGN ELEV.	TOP OF SUBGRADE RECORD ELEV.	TOP OF GENERAL FILL DESIGN ELEV.	TOP OF GENERAL FILL RECORD ELEV.	TOP OF COMPACTED CLAY DESIGN ELEV.	TOP OF COMPACTED CLAY RECORD ELEV.	TOP OF DRAINAGE LAYER DESIGN ELEV.	TOP OF DRAINAGE LAYER RECORD ELEV.	DESCRIPTION
1	3966186.426	4500588.485	1473.41		1475.41		1477.4133		1478.41		TIE-IN (CONTRACTOR TO CONFIRM)
2	3966136.428	4500588.01	1472.29		1470.29		1472.2933		1473.29		TIE-IN (CONTRACTOR TO CONFIRM)
3	3966086.43	4500587.534	1471.18		1473.18		1475.1833		1476.18		TIE-IN (CONTRACTOR TO CONFIRM)
4	3966036.433	4500587.049	1470.06		1472.06		1474.0633		1475.06		TIE-IN (CONTRACTOR TO CONFIRM)
5	3965986.435	4500586.574	1468.94		1466.94		1468.9432		1469.94		TIE-IN (CONTRACTOR TO CONFIRM)
6	3965936.437	4500586.089	1467.83		1465.83		1467.8331		1468.83		TIE-IN (CONTRACTOR TO CONFIRM)
7	3965886.439	4500585.613	1466.71		1468.71		1470.71		1471.71		TIE-IN (CONTRACTOR TO CONFIRM)
8	3965836.442	4500585.138	1465.60		1463.60		1465.60		1466.60		TIE-IN (CONTRACTOR TO CONFIRM)
9	3965786.444	4500584.653	1464.48		1462.48		1464.48		1465.48		TIE-IN (CONTRACTOR TO CONFIRM)
10	3965736.446	4500584.177	1463.37		1465.37		1467.37		1468.37		TIE-IN (CONTRACTOR TO CONFIRM)
11	3965686.449	4500583.702	1462.25		1464.25		1466.25		1467.25		TIE-IN (CONTRACTOR TO CONFIRM)
12	3965636.451	4500583.167	1461.13		1459.13		1461.13		1462.13		TIE-IN (CONTRACTOR TO CONFIRM)
13	3965586.453	4500582.741	1460.02		1462.02		1464.02		1465.02		TIE-IN (CONTRACTOR TO CONFIRM)
14	3965536.455	4500582.257	1458.89		1460.89		1462.89		1463.89		TIE-IN (CONTRACTOR TO CONFIRM)
15	3965486.458	4500581.778	1457.79		1459.79		1461.79		1462.79		TIE-IN (CONTRACTOR TO CONFIRM)
16	3965436.46	4500581.305	1456.67		1458.67		1460.67		1461.67		TIE-IN (CONTRACTOR TO CONFIRM)
17	3965386.462	4500580.82	1456.00		1458.00		1460.00		1461.00		TIE-IN (CONTRACTOR TO CONFIRM)
18	3965379.259	4500566.48	1456.00		1458.00		1460.00		1461.00		BASE SYSTEM GRADING
19	3965337.73	4500577.229	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
20	3965344.366	4500589.87	1469.79		1471.89		1474.00		1475.05		TIE-IN (CONTRACTOR TO CONFIRM)
21	3965326.381	4500593.749	NA		1478.00		1480.00		1481.00		TIE-IN (CONTRACTOR TO CONFIRM)
22	3965319.93	4500581.832	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
23	3965317.693	4500530.159	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
24	3965335.703	4500530.332	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
25	3965380.725	4500530.763	1455.00		1457.00		1459.00		1460.00		BASE SYSTEM GRADING
26	3965386.941	4500530.822	1454.89		1456.89		1458.89		1459.89		BASE SYSTEM GRADING
27	3965436.939	4500531.302	1455.98		1457.98		1459.98		1460.98		BASE SYSTEM GRADING
28	3965486.937	4500531.781	1456.91		1458.91		1460.91		1461.91		BASE SYSTEM GRADING
29	3965536.934	4500532.26	1458.01		1460.01		1462.01		1463.01		BASE SYSTEM GRADING
30	3965586.932	4500532.739	1459.14		1461.14		1463.14		1464.14		BASE SYSTEM GRADING
31	3965636.93	4500533.218	1460.25		1462.25		1464.25		1465.25		BASE SYSTEM GRADING
32	3965686.927	4500533.697	1461.37		1463.37		1465.37		1466.37		BASE SYSTEM GRADING
33	3965736.925	4500534.176	1462.48		1464.48		1466.48		1467.48		BASE SYSTEM GRADING
34	3965786.923	4500534.655	1463.60		1465.60		1467.60		1468.60		BASE SYSTEM GRADING
35	3965836.921	4500535.134	1464.71		1466.71		1468.71		1469.71		BASE SYSTEM GRADING
36	3965886.918	4500535.613	1465.82		1467.82		1469.82		1470.82		BASE SYSTEM GRADING
37	3965936.916	4500536.092	1466.94		1468.94		1470.94		1471.94		BASE SYSTEM GRADING
38	3965986.914	4500536.572	1468.05		1470.05		1472.05		1473.05		BASE SYSTEM GRADING
39	3966036.911	4500537.051	1469.17		1471.17		1473.17		1474.17		BASE SYSTEM GRADING
40	3966086.909	4500537.53	1470.29		1472.29		1474.29		1475.29		BASE SYSTEM GRADING
41	3966136.907	4500538.009	1471.40		1473.40		1475.40		1476.40		BASE SYSTEM GRADING
42	3966186.914	4500538.488	1472.52		1474.52		1476.52		NA		LIMIT OF CLAY
43	3966187.299	4500497.315	1471.78		1473.78		1475.78		NA		LIMIT OF CLAY
44	3966137.301	4500496.835	1470.66		1472.66		1474.66		1475.66		BASE SYSTEM GRADING
45	3966087.303	4500496.354	1469.55		1471.55		1473.55		1474.55		BASE SYSTEM GRADING
46	3966037.306	4500495.874	1468.44		1470.44		1472.44		1473.44		BASE SYSTEM GRADING
47	3965987.308	4500495.394	1467.32		1469.32		1471.32		1472.32		BASE SYSTEM GRADING
48	3965937.31	4500494.914	1466.21		1468.21		1470.21		1471.21		BASE SYSTEM GRADING
49	3965887.313	4500494.434	1465.09		1467.09		1469.09		1470.09		BASE SYSTEM GRADING
50	3965837.315	4500493.954	1463.98		1465.98		1467.98		1468.98		BASE SYSTEM GRADING
51	3965787.317	4500493.474	1462.86		1464.86		1466.86		1467.86		BASE SYSTEM GRADING
52	3965737.32	4500492.994	1461.75		1463.75		1465.75		1466.75		BASE SYSTEM GRADING
53	3965687.322	4500492.514	1460.63		1462.63		1464.63		1465.63		BASE SYSTEM GRADING
54	3965637.324	4500492.034	1459.52		1461.52		1463.52		1464.52		BASE SYSTEM GRADING
55	3965587.326	4500491.553	1458.41		1460.41		1462.41		1463.41		BASE SYSTEM GRADING
56	3965537.329	4500491.073	1457.29		1459.29		1461.29		1462.29		BASE SYSTEM GRADING
57	3965487.331	4500490.593	1456.18		1458.18		1460.18		1461.18		BASE SYSTEM GRADING
58	3965437.333	4500490.113	1455.06		1457.06		1459.06		1460.06		BASE SYSTEM GRADING
59	3965437.391	4500484.113	1453.06		1455.06		1457.06		1458.06		BASE SYSTEM GRADING
60	3965487.389	4500484.594	1454.18		1456.18		1458.18		1459.18		BASE SYSTEM GRADING
61	3965537.386	4500485.074	1455.29		1457.29		1459.29		1460.29		BASE SYSTEM GRADING
62	3965587.384	4500485.554	1456.41		1458.41		1460.41		1461.41		BASE SYSTEM GRADING
63	3965637.382	4500486.034	1457.52		1459.52		1461.52		1462.52		BASE SYSTEM GRADING
64	3965687.379	4500486.514	1458.63		1460.63		1462.63		1463.63		BASE SYSTEM GRADING
65	3965737.377	4500486.994	1459.75		1461.75		1463.75		1464.75		BASE SYSTEM GRADING
66	3965787.375	4500487.474	1460.86		1462.86		1464.86		1465.86		BASE SYSTEM GRADING
67	3965837.372	4500487.954	1461.98		1463.98		1465.98		1466.98		BASE SYSTEM GRADING
68	3965887.37	4500488.434	1463.09		1465.09		1467.09		1468.09		BASE SYSTEM GRADING
69	3965937.368	4500488.914	1464.21		1466.21		1468.21		1469.21		BASE SYSTEM GRADING
70	3965987.365	4500489.395	1465.32		1467.32		1469.32		1470.32		BASE SYSTEM GRADING
71	3966037.363	4500489.875	1466.44		1468.44		1470.44		1471.44		BASE SYSTEM GRADING
72	3966087.361	4500490.355	1467.55		1469.55		1471.55		1472.55		BASE SYSTEM GRADING
73	3966137.359	4500490.835	1468.71		1470.66		1472.66		1473.66		BASE SYSTEM GRADING
74	3966187.375	4500491.315	1469.90		1471.78		1473.78		NA		LIMIT OF CLAY
75	3966187.434	4500485.315	1471.76		1473.78		1475.78		NA		LIMIT OF CLAY
76	3966137.416	4500484.835	1470.66		1472.66		1474.66		1475.66		BASE SYSTEM GRADING
77	3966087.418	4500484.355	1469.55		1471.55		1473.55		1474.55		BASE SYSTEM GRADING
78	3966037.421	4500483.875	1468.44		1470.44		1472.44		1473.44		BASE SYSTEM GRADING
79	3965987.423	4500483.395	1467.32		1469.32		1471.32		1472.32		BASE SYSTEM GRADING
80	3965937.425	4500482.915	1466.21		1468.21		1470.21		1471.21		BASE SYSTEM GRADING
81	3965887.428	4500482.435	1465.09		1467.09		1469.09		1470.09		BASE SYSTEM GRADING
82	3965837.43	4500481.955	1463.98		1465.98		1467.98		1468.98		BASE SYSTEM GRADING
83	3965787.432	4500481.474	1462.86		1464.86		1466.86		1467.86		BASE SYSTEM GRADING
84	3965737.434	4500480.994	1461.75		1463.75		1465.75		1466.75		BASE SYSTEM GRADING
85	3965687.437	4500480.514	1460.63		1462.63		1464.63		1465.63		BASE SYSTEM GRADING
86	3965637.439	4500480.034	1459.52		1461.52		1463.52		1464.52		BASE SYSTEM GRADING
87	3965587.441	4500479.554	1458.41		1460.41		1462.41		1463.41		BASE SYSTEM GRADING
88	3965537.444	4500479.074	1457.29		1459.29		1461.29		1462.29		BASE SYSTEM GRADING
89	3965487.446	4500478.594	1456.18		1458.18		1460.18		1461.18		BASE SYSTEM GRADING
90	3965437.449	4500478.087	1455.06		1457.06		1459.06		1460.06		BASE SYSTEM GRADING
91	3965313.362	4500430.113	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
92	3965331.397	4500430.286	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
93	3965376.418	4500430.717	1455.00		1457.00		1459.00		1460.00		BASE SYSTEM GRADING
94	3965387.899	4500430.827	1454.86		1456.89		1458.89		1459.89		BASE SYSTEM GRADING
95	3965437.897	4500431.306	1456.00		1458.00		1460.00		1461.00		BASE SYSTEM GRADING
96	3965487.894	4500431.785	1457.11		1459.11		1461.11		1462.11		BASE SYSTEM GRADING
97	3965537.892	4500432.264	1458.23		1460.23		1462.23		1463.23		BASE SYSTEM GRADING
98	3965587.89	4500432.743	1459.34		1461.34		1463.34		1464.34		BASE SYSTEM GRADING
99	3965637.887	4500433.223	1460.46		1462.46		1464.46		1465.46		BASE SYSTEM GRADING
100	3965687.885	4500433.702	1461.57		1463.57		1465.57		1466.57		BASE SYSTEM GRADING

POINT	NORTHING	EASTING	TOP OF SUBGRADE DESIGN ELEV.	TOP OF SUBGRADE RECORD ELEV.	TOP OF GENERAL FILL DESIGN ELEV.	TOP OF GENERAL FILL RECORD ELEV.	TOP OF COMPACTED CLAY DESIGN ELEV.	TOP OF COMPACTED CLAY RECORD ELEV.	TOP OF DRAINAGE LAYER DESIGN ELEV.	TOP OF DRAINAGE LAYER RECORD ELEV.	DESCRIPTION
101	3965737.883	4500434.181	1462.69		1464.69		1466.69		1467.69		BASE SYSTEM GRADING
102	3965787.881	4500434.66	1463.80		1465.80		1467.80		1468.80		BASE SYSTEM GRADING
103	3965837.878	4500435.139	1464.91		1466.91		1468.91		1469.91		BASE SYSTEM GRADING
104	3965887.876	4500435.618	1466.03		1468.03		1470.03		1471.03		BASE SYSTEM GRADING
105	3965937.874	4500436.097	1467.14		1469.14		1471.14		1472.14		BASE SYSTEM GRADING
106	3965987.871	4500436.576	1468.26		1470.26		1472.26		1473.26		BASE SYSTEM GRADING
107	3966037.869	4500437.055	1469.37		1471.37		1473.37		1474.37		BASE SYSTEM GRADING
108	3966087.867	4500437.534	1470.49		1472.49		1474.49		1475.49		BASE SYSTEM GRADING
109	3966137.864	4500438.013	1471.60		1473.60		1475.60		1476.60		BASE SYSTEM GRADING
110	3966187.891	4500438.493	1472.61		1474.72		1476.72		NA		LIMIT OF CLAY
111	3966188.351	4500391.323	1473.42		1475.66		1477.66		NA		LIMIT OF CLAY
112	3966138.316	4500390.843	1472.47		1474.54		1476.54		1477.54		BASE SYSTEM GRADING
113	3966088.319	4500390.363	1471.43		1473.43		1475.43		1476.43		BASE SYSTEM GRADING
114	3966038.321	4500389.883	1470.32		1472.32		1474.32		1475.32		BASE SYSTEM GRADING
115	3965988.323	4500389.403	1469.20		1471.20		1473.20		1474.20		BASE SYSTEM GRADING
116	3965938.325	4500388.923	1468.09		1470.09		1472.09		1473.09		BASE SYSTEM GRADING
117	3965888.328	4500388.443	1466.97		1468.97		1470.97		1471.97		BASE SYSTEM GRADING
118	3965838.33	4500387.962	1465.86		1467.86		1469.86		1470.86		BASE SYSTEM GRADING
119	3965788.332	4500387.482	1464.74		1466.74		1468.74		1469.74		BASE SYSTEM GRADING
120	3965738.335	4500387.002	1463.63		1465.63		1467.63		1468.63		BASE SYSTEM GRADING
121	3965688.337	4500386.522	1462.52		1464.52		1466.52		1467.52		BASE SYSTEM GRADING
122	3965638.339	4500386.042	1461.40		1463.40		1465.40		1466.40		BASE SYSTEM GRADING
123	3965588.342	4500385.562	1460.29		1462.29		1464.29		1465.29		BASE SYSTEM GRADING
124	3965538.344	4500385.082	1459.17		1461.17		1463.17		1464.17		BASE SYSTEM GRADING
125	3965488.346	4500384.602	1458.06		1460.06		1462.06		1463.06		BASE SYSTEM GRADING
126	3965438.349	4500384.122	1456.94		1458.94		1460.94		1461.94		BASE SYSTEM GRADING
127	3965388.351	4500383.642	1455.83		1457.83		1459.83		1460.83		BASE SYSTEM GRADING
128	3965371.373	4500383.479	1456.00		1458.00		1460.00		1461.00		BASE SYSTEM GRADING
129	3965338.353	4500383.162	1469.79		1471.89		1474.00		1475.00		BASE SYSTEM GRADING
130	3965311.353	4500382.924	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
131	3965311.339	4500380.107	NA		1478.00		1480.00		NA		LIMIT OF CLAY
132	3965338.38	4500380.366	1469.79		1471.89		1474.00		NA		LIMIT OF CLAY
133	3965371.351	4500380.682	1456.00		1458.00		1460.00		NA		LIMIT OF CLAY
134	3965388.378	4500380.845	1455.77		1457.77		1459.77		NA		LIMIT OF CLAY
135	3965438.375	4500381.324	1456.89		1458.89		1460.89		NA		LIMIT OF CLAY
136	3965488.373	4500381.803	1458.00		1460.00		1462.00		NA		LIMIT OF CLAY
137	3965538.371	4500382.281	1459.12		1457.12		1459.12		NA		LIMIT OF CLAY
138	3965588.368	4500382.76	1460.23		1458.23		1460.23		NA		LIMIT OF CLAY
139	3965638.366	4500383.239	1461.34		1463.34		1465.34		NA		LIMIT OF CLAY
140	3965688.364	4500383.718	1462.46		1464.46		1466.46		NA		LIMIT OF CLAY
141	3965738.362	4500384.197	1463.57		1465.57		1467.57		NA		LIMIT OF CLAY
142	3965788.359	4500384.676	1464.69		1466.69		1468.69		NA		LIMIT OF CLAY
143	3965838.357	4500385.155	1465.80		1467.80		1469.80		NA		LIMIT OF CLAY
144	3965888.355	4500385.633	1466.92		1464.92		1466.92		NA		LIMIT OF CLAY
145	3965938.352	4500386.112	1468.03		1466.03		1468.03		NA		LIMIT OF CLAY
146	3965988.35	4500386.591	1469.15		1471.15		1473.15		NA		LIMIT OF CLAY
147	3966038.348	4500387.07	1470.26		1472.26		1474.26		NA		LIMIT OF CLAY
148	3966088.345	4500387.549	1471.37		1473.37		1475.37		NA		LIMIT OF CLAY
149	3966138.343	4500388.028	1472.45		1474.49		1476.49		NA		LIMIT OF CLAY
150	3966188.378	4500388.507	1473.46		1475.60		1477.60		NA		LIMIT OF CLAY
151	3965430.879	4500510.016	1454.00		1456.00		1458.00		1459.00		SUMP GRADING
152	3965429.903	4500487.353	1454.00		1456.00		1458.00		1459.00		SUMP GRADING
153	3965425.311	4500483.997	1452.79		1454.79		1456.79		1457.79		SUMP GRADING
154	3965429.616	4500480.687	1454.00		1456.00		1458.00		1459.00		SUMP GRADING
155	3965428.642	4500458.064	1454.00		1456.00		1458.00		1459.00		SUMP GRADING
156	3965380.687	4500460.128	1454.00		1456.00		1458.00		1459.00		SUMP GRADING
157	3965382.923	4500512.08	1454.00		1456.00		1458.00		1459.00		SUMP GRADING
158	3965394.243	4500496.179	1450.00		1452.00		1454.00		1455.00		SUMP GRADING
159	3965414.205	4500494.719	1450.00		1452.00		1454.00		1455.00		SUMP GRADING
160	3965413.345	4500474.738	1450.00		1452.00		1454.00		1455.00		SUMP GRADING
161	3965393.338	4500475.198	1450.00		1452.00		1454.00		1455.00		SUMP GRADING
162	3965389.039	4500479.888	1450.00		1452.00		1454.00		1455.00		SUMP GRADING
163	3965389.557	4500491.877	1450.00		1452.00		1454.00		1455.00		SUMP GRADING
164	3965334.338	4500498.762	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
165	3965329.649	4500494.46	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
166	3965329.13	4500482.471	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
167	3965333.431	4500477.782	1469.79		1471.89		1474.00		1475.05		LIMIT OF GEOCOMPOSITE/SUBGRADE
168	3965316.367	4500499.537	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
169	3965311.677	4500495.235	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
170	3965311.158	4500483.246	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
171	3965315.459	4500478.557	NA		1478.00		1480.00		1481.00		BASE SYSTEM GRADING
172	3966190.425	4500588.524	1473.50		1475.50		NA		NA		LIMITS OF SUBGRADE
173	3966190.904	4500538.526	1472.61		1474.61		NA		NA		LIMITS OF SUBGRADE
174	3966191.299	4500497.353	1471.87		1473.87		NA		NA		LIMITS OF SUBGRADE
175	3966191.375	4500491.353	1470.00		1472.00		NA		NA		LIMITS OF SUBGRADE
176	3966191.433	4500485.354	1471.86		1473.86		NA		NA		LIMITS OF SUBGRADE
177	3966191.891	4500438.531	1472.69		1474.69		NA		NA		LIMITS OF SUBGRADE
178	3966192.352	4500391.362	1473.50		1475.50		NA		NA		LIMITS OF SUBGRADE
179	3966192.379	4500388.545	1473.55		1475.55		NA		NA		LIMITS OF SUBGRADE
180	3966192.418	4500384.545	1473.64		1475.64		NA		NA		LIMITS OF SUBGRADE
181	3966188.379	4500384.507	1473.55		1475.55		NA		NA		LIMITS OF SUBGRADE
182	3966138.382	4500384.028	1472.41		1474.41		NA		NA		LIMITS OF SUBGRADE
183	3966088.384	4500383.549	1471.29		1473.29		NA		NA		LIMITS OF SUBGRADE
184	3966038.386	4500383.07	1470.18		1472.18		NA		NA		LIMITS OF SUBGRADE
185	3965988.388	4500382.591	1469.07		1471.07		NA		NA		LIMITS OF SUBGRADE
186	3965938.391	4500382.112	1467.95		1469.95		NA		NA		LIMITS OF SUBGRADE
187	3965888.393	4500381.634	1466.84		1468.84		NA		NA		LIMITS OF SUBGRADE
188	3965838.395	4500381.155	1465.72		1467.72		NA		NA		LIMITS OF SUBGRADE
189	3965788.398	4500380.676	1464.61		1466.61		NA		NA		LIMITS OF SUBGRADE
190	3965738.4	4500380.197	1463.49		1465.49		NA		NA		LIMITS OF SUBGRADE
191	3965688.402	4500379.718	1462.38		1464.38		NA		NA		LIMITS OF SUBGRADE
192	3965638.404	4500379.239	1461.26		1463.26		NA		NA		LIMITS OF SUBGRADE
193	3965588.407	4500378.76	1460.15		1462.15		NA		NA		LIMITS OF SUBGRADE
194	3965538.409	4500378.282	1459.04		1461.04		NA		NA		LIMITS OF SUBGRADE
195	3965488.411	4500377.803	1457.92		1459.92		NA		NA		LIMITS OF SUBGRADE
196	3965438.414	4500377.324	1456.81		1458.81		NA		NA		LIMITS OF SUBGRADE
197	3965388.416	4500376.845	1455.78		1457.78		NA		NA		LIMITS OF SUBGRADE
198	3965371.381	4500376.681	1456.00		1458.00		NA		NA		LIMITS OF SUBGRADE
199	3965338.418	4500376.366	1469.79		1471.89		NA		NA		LIMITS OF SUBGRADE

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL 22598
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

SEAL

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PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
SURVEY VERIFICATION TABLE

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

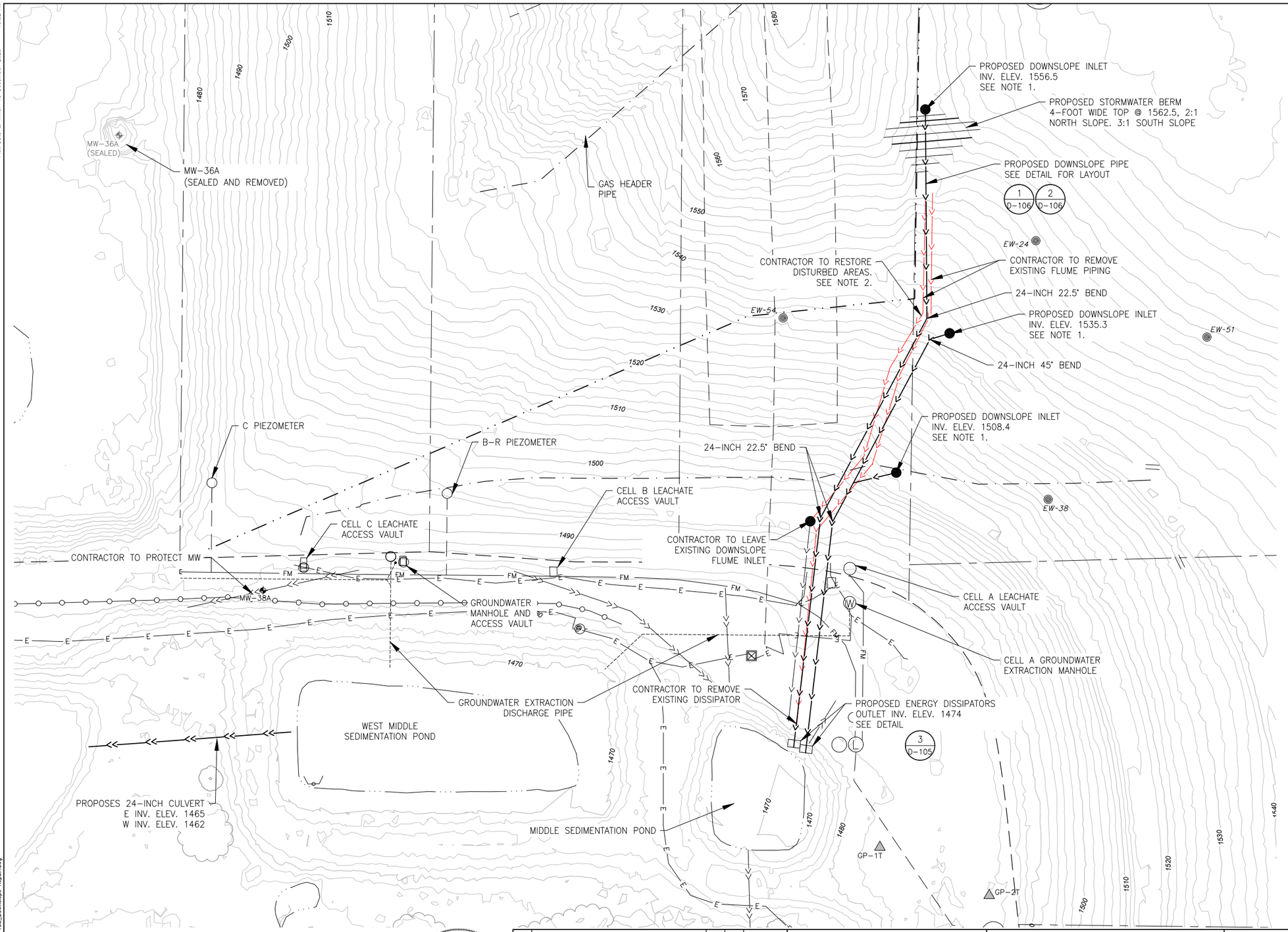
SCALE AS SHOWN

PROJECT NO. 227708272

SHEET NO. C-108

REV NO. 0

I:\227708272\drafting\cdv - Cell\C-108_Verification Table.dwg



N

0 40 80
GRAPHIC SCALE IN FEET

LEGEND

- EW-1 — EXISTING GAS EXTRACTION WELL
- MW-21A — MONITORING WELL LOCATION AND NUMBER
- LW-1 — LEACHATE MONITORING WELL PIEZOMETER
- GP-1 — GAS PROBE
- GP-8 — GAS PROBE DISCONTINUED
- TEMPORARY GAS PROBE (INSTALLED APRIL 2022)
- CLOSURE LIMIT
- PERMITTED WASTE LIMITS
- PHASE LIMITS
- PROPERTY BOUNDARY
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING FENCELINE
- EXISTING CULVERT
- EXISTING UNDERDRAIN
- EXISTING LEACHATE FORCEMAIN
- EXISTING OUTFALL
- EXISTING SURVEY CONTROL POINT
- (A) PHASE ID
- [D] FUTURE PHASE ID
- EXISTING DOWNSLOPE PIPE TO BE REMOVED
- PROPOSED DOWNSLOPE PIPE
- PROPOSED CULVERT PIPE

NOTES:

1. ELEVATIONS MAY VARY AT TIME OF CONSTRUCTION. FLUME INLETS SHALL BE INSTALLED AT EXISTING GRADE IN CENTERLINE OF SWALES. EXISTING SURFACE TO BE REGRADED TO PROMOTE DRAINAGE TO REFLECTIVE FLUME INLETS.
2. DISTURBED AREAS UNDER REPAIR SHALL BE RESEEDED AND RECEIVE RECP TYPE 2.B. DITCH FLOW LINES SHALL RECEIVE TRM TYPE 5.C.

SURVEY NOTES:

1. HORIZONTAL DATUM IS IOWA STATE PLANE COORDINATE SYSTEM, NORTH ZONE, NORTH AMERICAN DATUM NAD83(2011), US SURVEY FEET,
2. VERTICAL DATUM IS NORTH AMERICAN VERTICAL DATUM 88 (NAVD88). CONTOUR INTERVAL IS TWO FEET.
3. TOPOGRAPHY SURVEY COMPLETED BY TETRATECH IN MARCH 19, 2025.

HORIZONTAL AND VERTICAL CONTROL POINT LOCATIONS

POINT I.D.	NORTHING SPCS NAD83(2011) (FEET)	EASTING SPCS NAD83(2011) (FEET)	ELEVATION (FT-NAVD88)	DESCRIPTION
1	3,966,660.45	4,499,614.05	1496.275	REBAR
2000	3,966,663.58	4,499,340.25	1494.057	REBAR
2004	3,966,655.42	4,502,218.34	1520.534	REBAR
2007	3,965,333.43	4,499,937.44	1470.796	REBAR
2010	3,964,182.39	4,499,283.55	1454.470	REBAR
2015	3,964,752.63	4,501,313.87	1493.670	REBAR
2017	3,964,573.95	4,502,020.64	1483.964	REBAR

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

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SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
PROPOSED DOWNSLOPE REPAIR

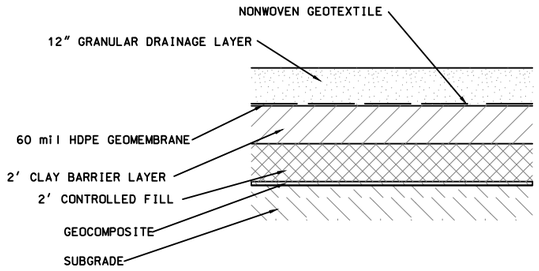
DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO. 227708272

SHEET NO. C-109

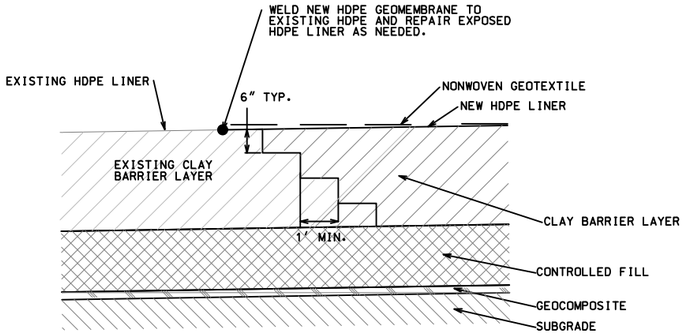
REV NO. 0



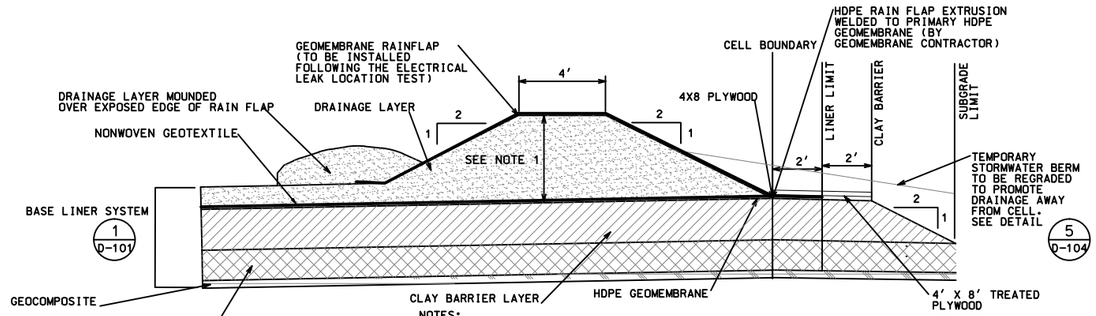
NOTE:

1. NON-WOVEN GEOTEXTILE IS DEPENDENT ON DRAINAGE LAYER GRAIN SIZE.
2. LIMITS OF GEOCOMPOSITE SHOWN ON SHEET C-102.
3. TOP OF CLAY BARRIER SURFACE GRADED ON SHEET C-104. TOP OF SUBGRADE SURFACE GRADED ON SHEET C-102.

BASE LINER SYSTEM SECTION DETAIL 1 D-101
NOT TO SCALE



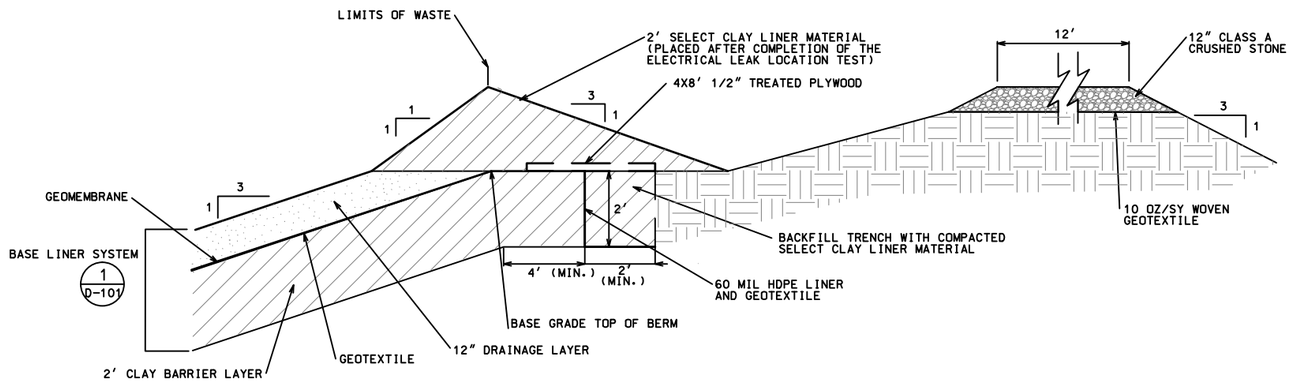
BASE LINER SYSTEM TIE-IN DETAIL 2 D-101
NOT TO SCALE



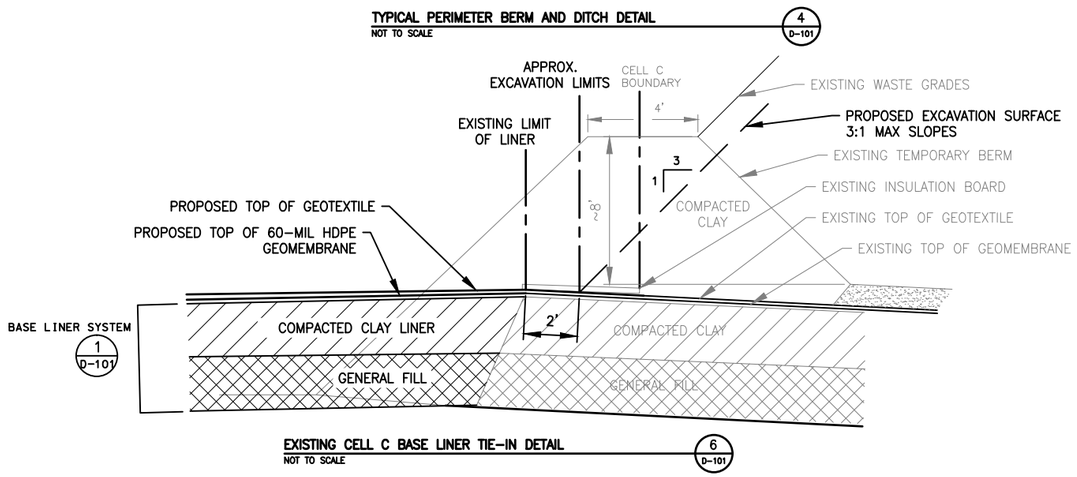
NOTES:

1. MINIMUM TOP OF BERM ELEVATION TO BE 1466 OR MINIMUM HEIGHT OF BERM TO BE 4-FOOT WHICHEVER IS GREATER.
2. RAINFLAP TO BE INSTALLED ALONG ENTIRE NORTH AND WEST CELL BOUNDARIES.

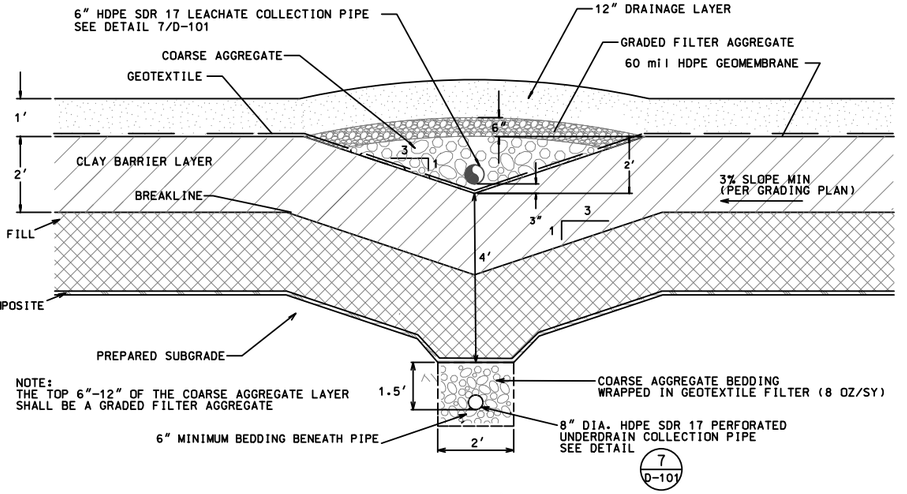
TYPICAL RAINFLAP BERM DETAIL 3 D-101
NOT TO SCALE



TYPICAL PERIMETER BERM AND DITCH DETAIL 4 D-101
NOT TO SCALE

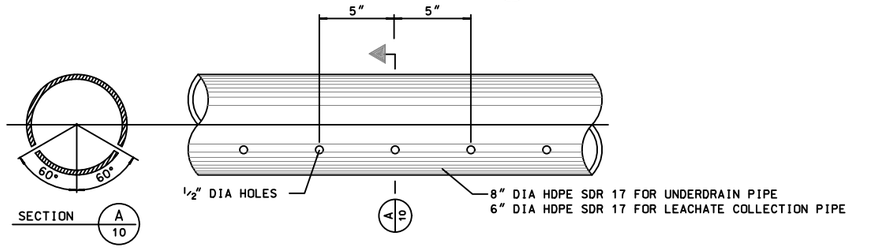


EXISTING CELL C BASE LINER TIE-IN DETAIL 6 D-101
NOT TO SCALE



NOTE:
THE TOP 6"-12" OF THE COARSE AGGREGATE LAYER SHALL BE A GRADED FILTER AGGREGATE

LEACHATE COLLECTION PIPE TRENCH W/ UNDERDRAIN SECTION DETAIL 5 D-101
NOT TO SCALE



LEACHATE COLLECTION PIPE AND UNDERDRAIN PERFORATION DETAIL 7 D-101
NOT TO SCALE

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

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PRINT NAME MEGAN AMBUEHL
SIGNATURE Megan Ambuehl
DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT
Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

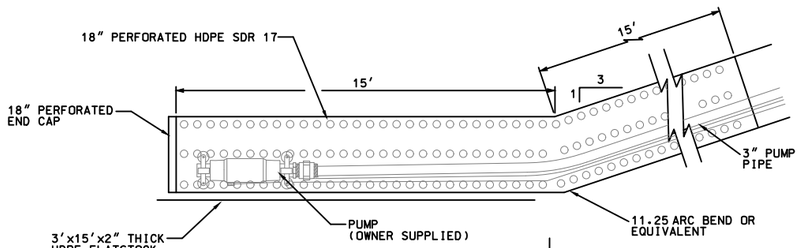
SPIRIT LAKE, IOWA

SHEET TITLE
BASE LINER/LEACHATE DETAILS

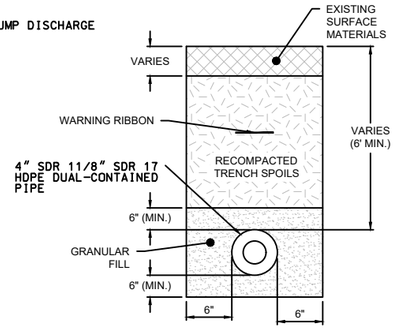
DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

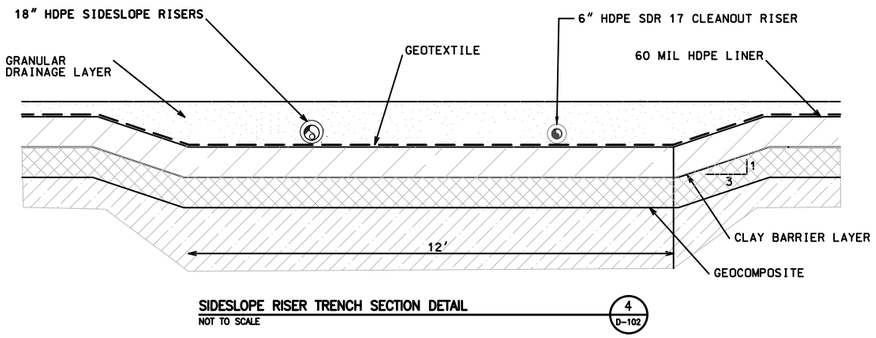
PROJECT NO.	SHEET NO.	REV NO.
227708272	D-101	0



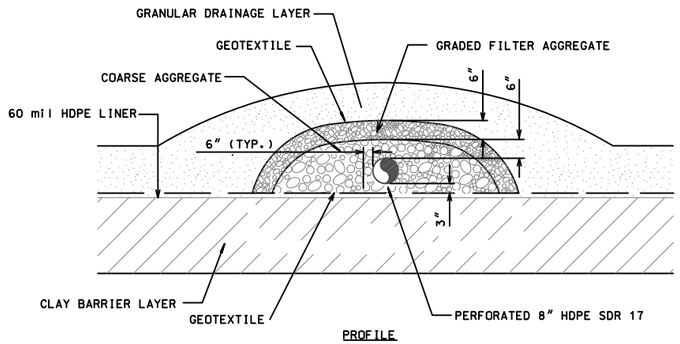
RISER PIPE BASE PLATE DETAIL
NOT TO SCALE — 1 D-102



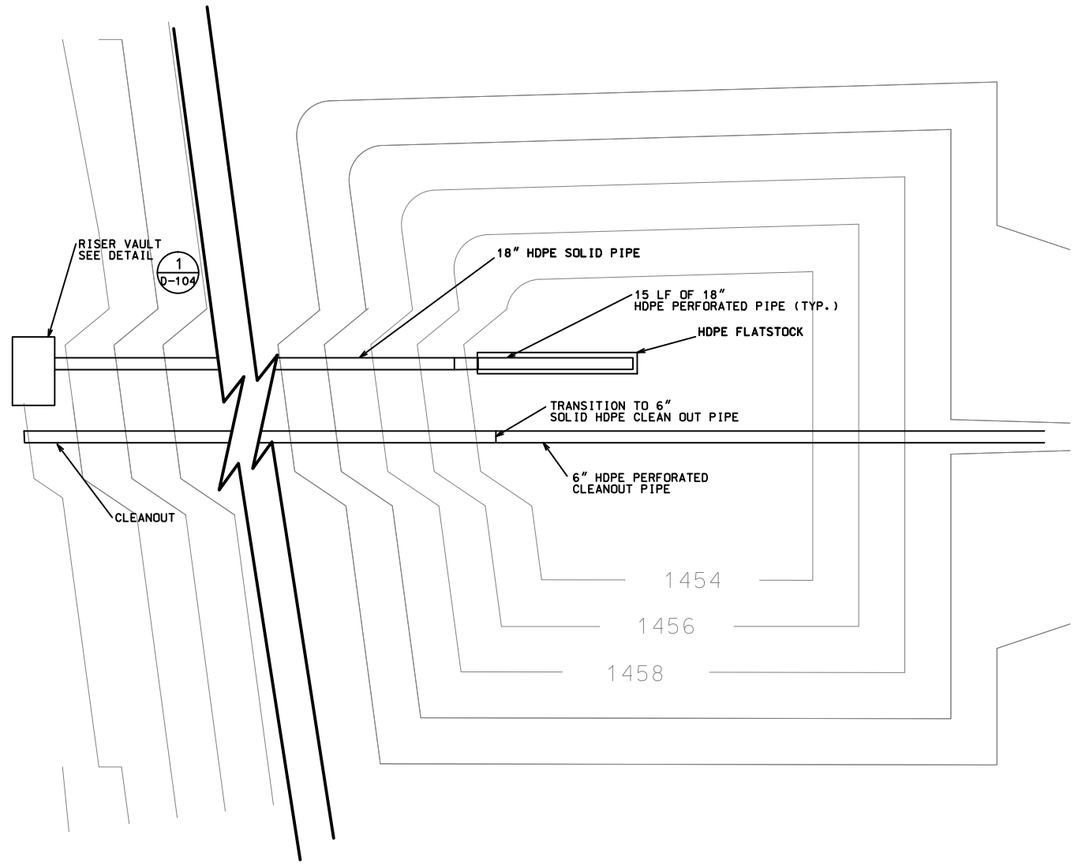
FORCEMAIN TRENCH DETAIL
NOT TO SCALE — 2 D-102



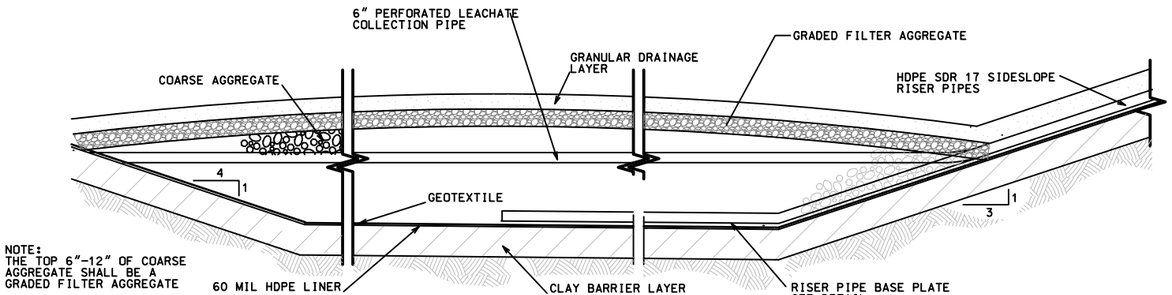
SIDESLOPE RISER TRENCH SECTION DETAIL
NOT TO SCALE — 4 D-102



LEACHATE HEAD MONITORING PIPE SECTION DETAIL
NOT TO SCALE — 5 D-102



TYPICAL LEACHATE COLLECTION SUMP LAYOUT DETAIL
NOT TO SCALE — 3 D-102



LEACHATE COLLECTION SUMP SECTION DETAIL
NOT TO SCALE — 6 D-102

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22698
IOWA

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SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
LEACHATE COLLECTION DETAILS

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO. 227708272

SHEET NO. D-102

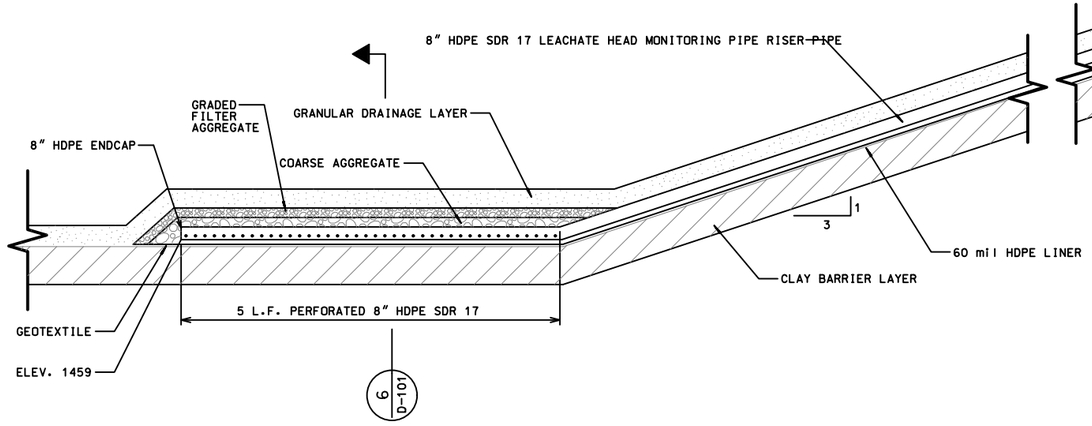
REV NO. 0

NOTES:

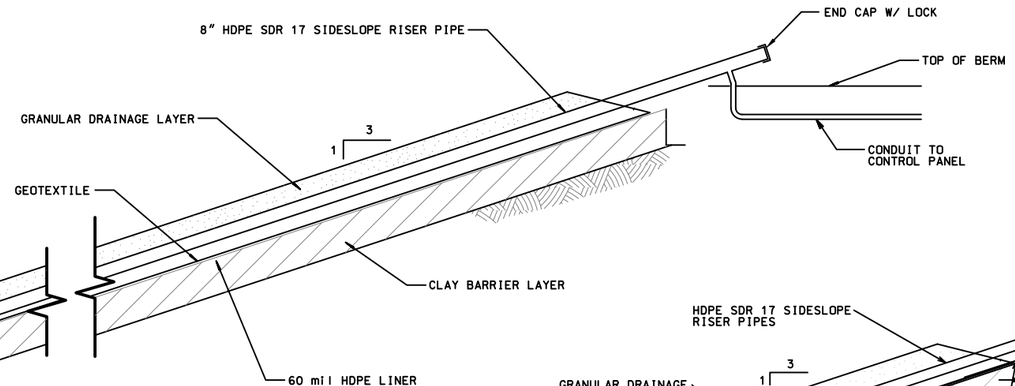
1) PERFORATED SECTION OF 8" HDPE SDR 17 CONTAINS LEACHATE HEAD MONITORING DEVICE. (TO BE SUPPLIED AND INSTALLED BY OWNER)

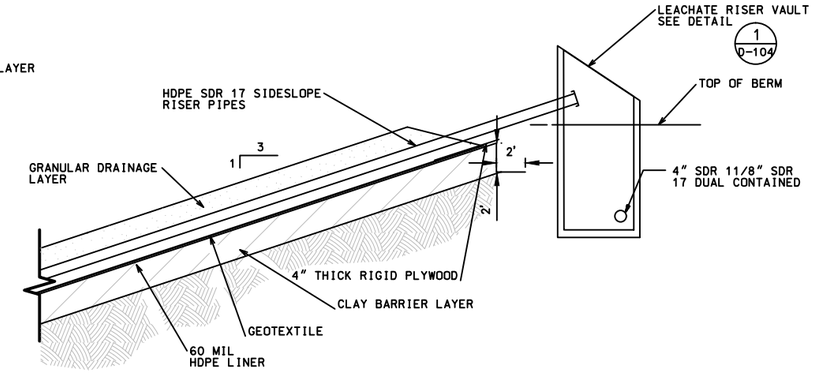
2) CONDUIT FROM MONITORING DEVICE TO BE RUN TO LOCAL CONTROL PANEL FOR HEAD MONITORING LEVEL DISPLAY. (CONDUIT INSTALLATION BY OWNER)

3) 5' SECTION SHALL BE PARALLEL TO CONTOUR

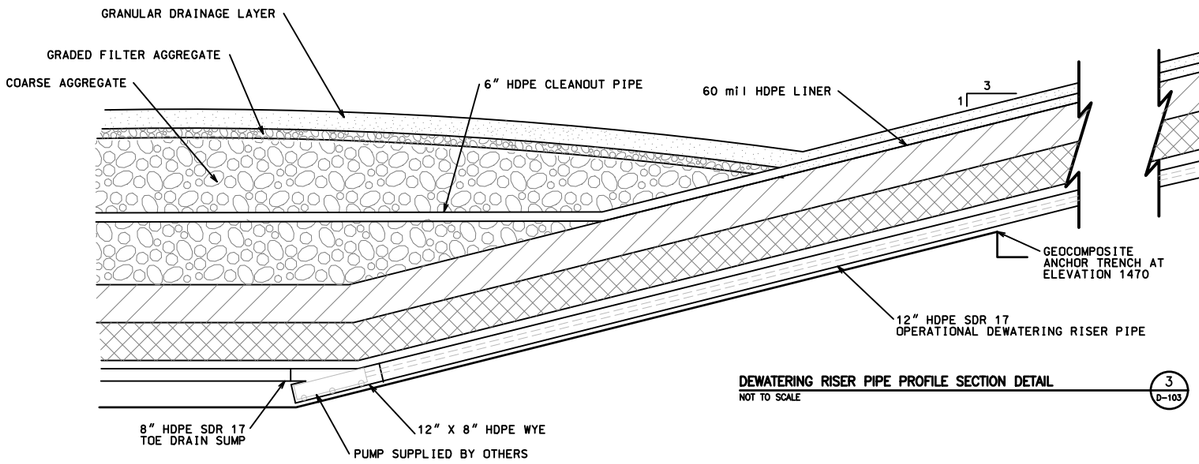


LEACHATE HEAD MONITORING PIPE PROFILE
NOT TO SCALE — 1 / D-103

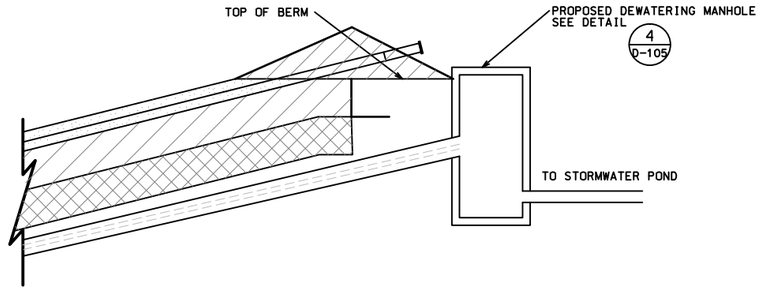


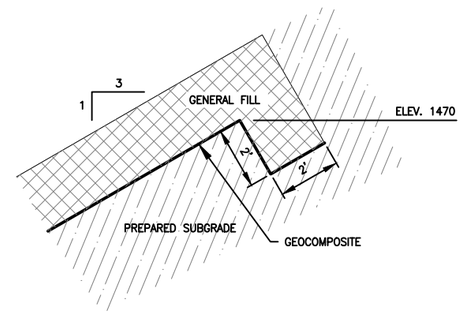


SIDESLOPE RISER TRENCH PROFILE DETAIL
NOT TO SCALE — 2 / D-103



DEWATERING RISER PIPE PROFILE SECTION DETAIL
NOT TO SCALE — 3 / D-103





GEOCOMPOSITE ANCHOR TRENCH DETAIL
NOT TO SCALE — 4 / D-103

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL 22598
IOWA

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SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

SPIRIT LAKE, IOWA

SHEET TITLE
LEACHATE COLLECTION DETAILS

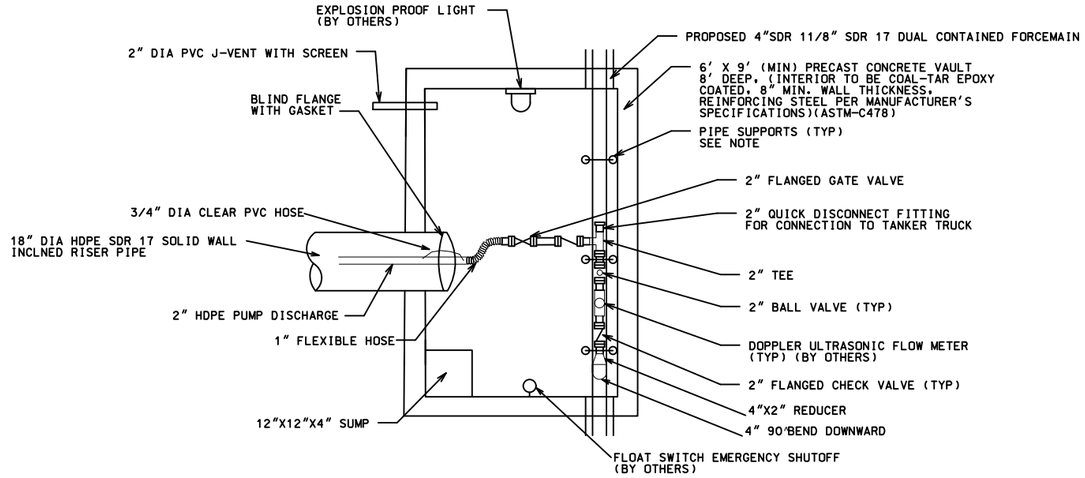
DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

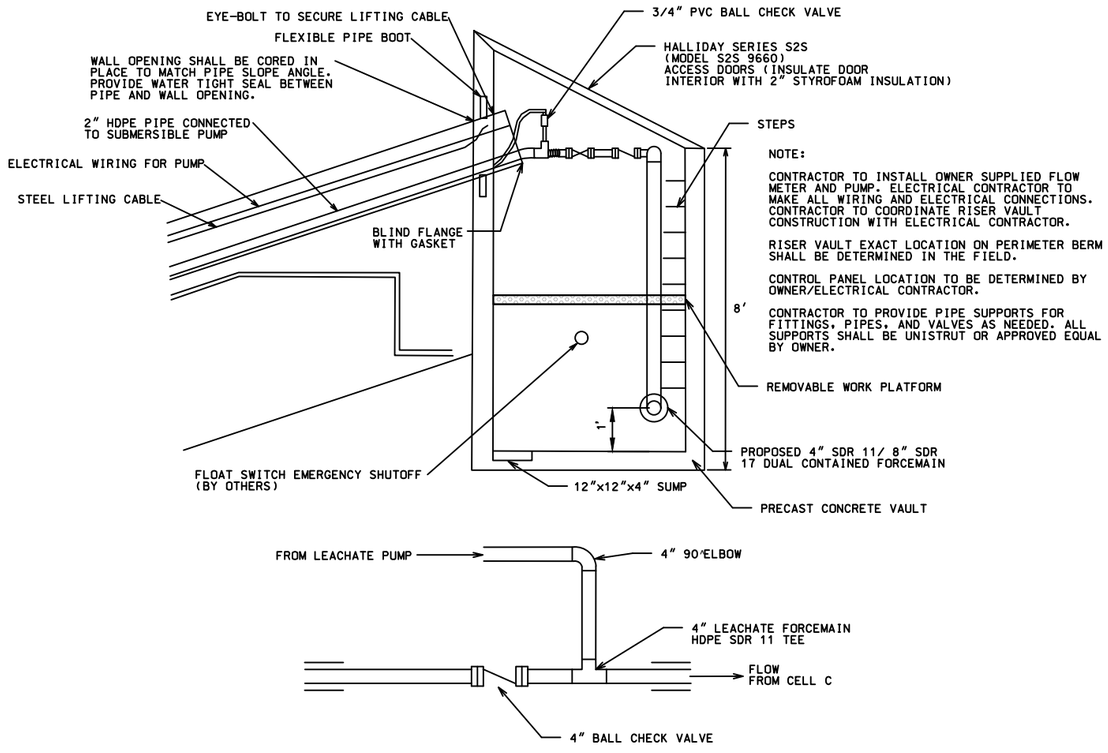
SCALE AS SHOWN

PROJECT NO. 227708272

SHEET NO. D-103

REV NO. 0





NOTE:

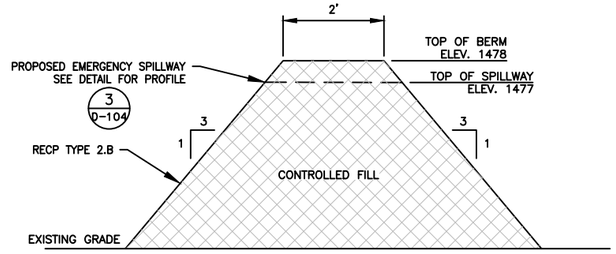
CONTRACTOR TO INSTALL OWNER SUPPLIED FLOW METER AND PUMP. ELECTRICAL CONTRACTOR TO MAKE ALL WIRING AND ELECTRICAL CONNECTIONS. CONTRACTOR TO COORDINATE RISER VAULT CONSTRUCTION WITH ELECTRICAL CONTRACTOR.

RISER VAULT EXACT LOCATION ON PERIMETER BERM SHALL BE DETERMINED IN THE FIELD.

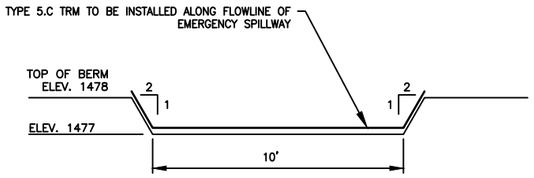
CONTROL PANEL LOCATION TO BE DETERMINED BY OWNER/ELECTRICAL CONTRACTOR.

CONTRACTOR TO PROVIDE PIPE SUPPORTS FOR FITTINGS, PIPES, AND VALVES AS NEEDED. ALL SUPPORTS SHALL BE UNISTRUT OR APPROVED EQUAL BY OWNER.

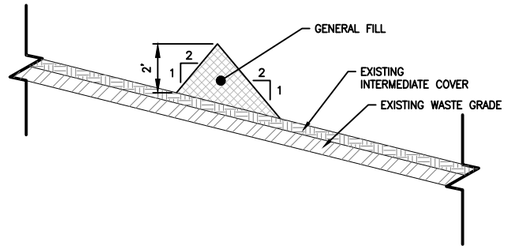
LEACHATE COLLECTION RISER VAULT SECTION DETAIL 1/D-104
NOT TO SCALE



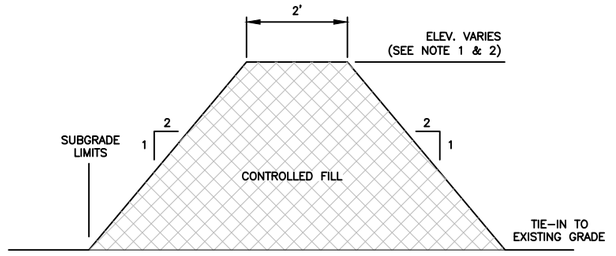
NORTHWEST STORMWATER BERM SECTION DETAIL 2/D-104
NOT TO SCALE



EMERGENCY SPILLWAY SECTION DETAIL 3/D-104
NOT TO SCALE



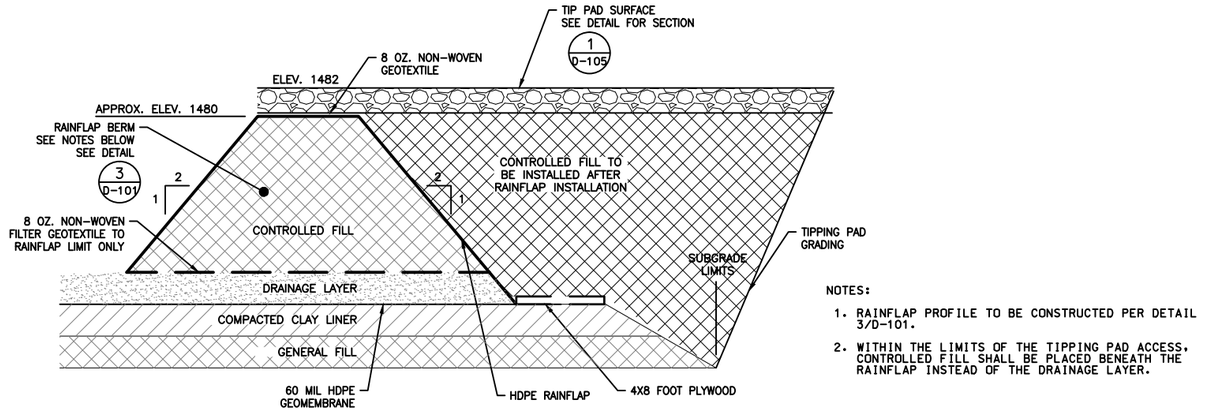
STORMWATER DIVERSION SWALE DETAIL 4/D-104
NOT TO SCALE



NOTES:

1. BERM GRADES ARE REFLECTED ON SHEET C-102.
2. BERM SHALL BE REGRADED TO PROMOTE DRAINAGE AWAY FROM CELL D1, AFTER GEOMEMBRANE RAINFLAP HAS BEEN INSTALLED PER DETAIL 3/D-101.

TEMPORARY STORMWATER BERM DETAIL 5/D-104
NOT TO SCALE



NOTES:

1. RAINFLAP PROFILE TO BE CONSTRUCTED PER DETAIL 3/D-101.
2. WITHIN THE LIMITS OF THE TIPPING PAD ACCESS, CONTROLLED FILL SHALL BE PLACED BENEATH THE RAINFLAP INSTEAD OF THE DRAINAGE LAYER.

TEMPORARY BERM AND TIPPING PAD SECTION DETAIL 6/D-104
NOT TO SCALE

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL 22698
IOWA

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
0	ISSUED FOR BID	JJT	MMA	12/15/25

SEAL

I HEREBY CERTIFY THAT THIS PLAN, SPECIFICATION, OR REPORT WAS PREPARED BY ME OR UNDER MY DIRECT SUPERVISION AND THAT I AM A DULY LICENSED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA. MY LICENSE RENEWAL DATE IS 12/31/2026.

PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

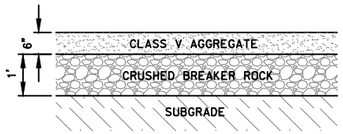
SPIRIT LAKE, IOWA

SHEET TITLE
STRUCTURE & STORMWATER MANAGEMENT DETAILS

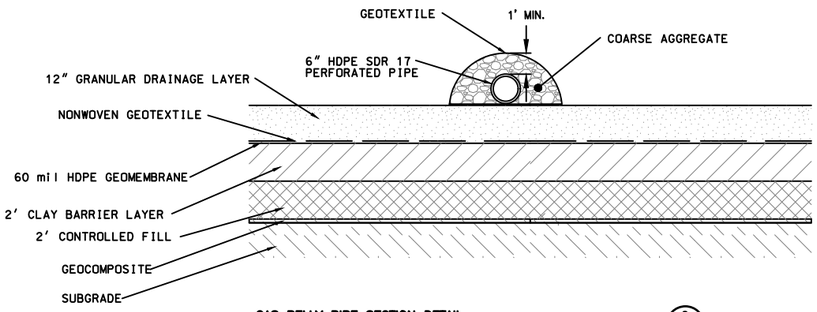
DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

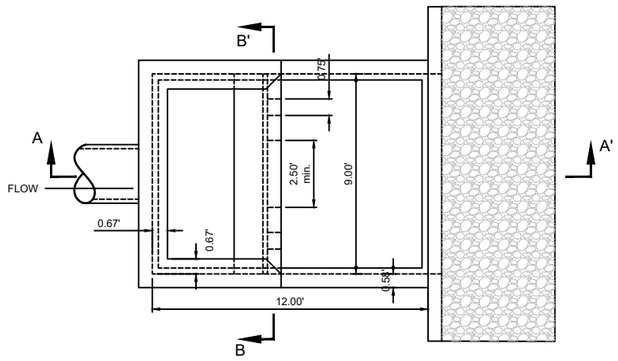
PROJECT NO.	SHEET NO.	REV NO.
227708272	D-104	0



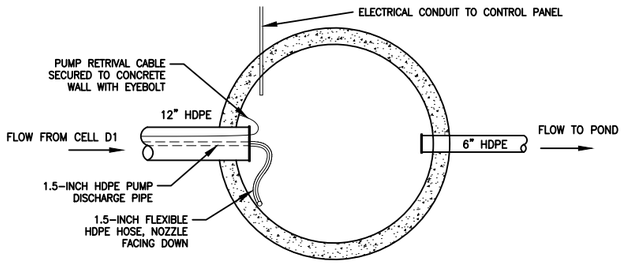
TIPPING PAD SECTION DETAIL (1 / D-105)
NOT TO SCALE

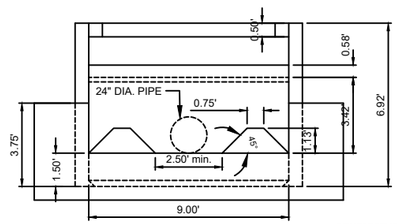


GAS BELLY PIPE SECTION DETAIL (2 / D-105)
NOT TO SCALE

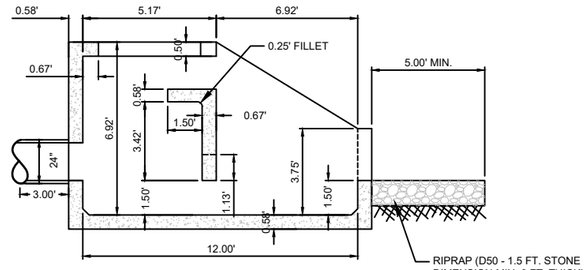


PLAN





SECTION B-B'

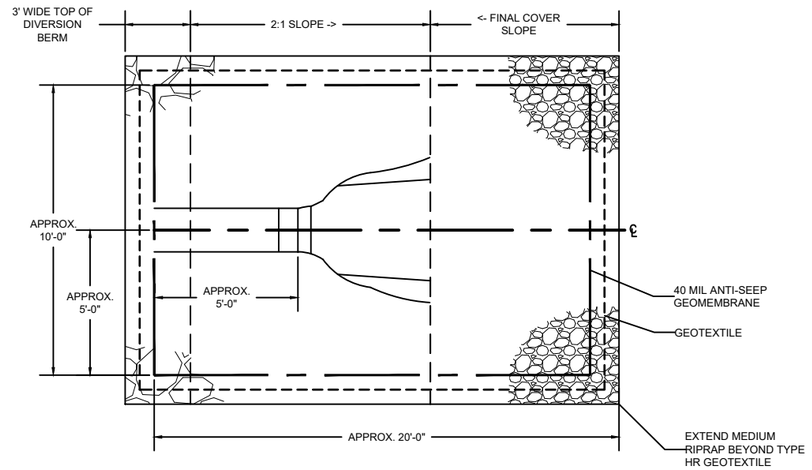


SECTION A-A'

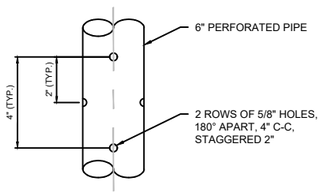
REINFORCEMENT NOTES:
1. REBAR THROUGHOUT STR TO BE #4 @ 12" O.C.
2. MIDDLE WEIR WALL TO BE #4 BAR 8" O.C.

DEWATERING MANHOLE STRUCTURE DETAIL (4 / D-105)
NOT TO SCALE

TYPICAL ENERGY DISSIPATOR DETAIL (3 / D-105)
NOT TO SCALE



DOWNSLOPE STRUCTURE INLET DETAIL (5 / D-105)
NOT TO SCALE



NOTES FOR PERFORATED PIPE:
1. CONTRACTOR TO USE FACTORY PERFORATED PIPING ONLY. FIELD PERFORATIONS ARE NOT ALLOWED.

TYPICAL LANDFILL GAS PERFORATED PIPE (6 / D-105)
NOT TO SCALE

LICENSED PROFESSIONAL ENGINEER
MEGAN AMBUEHL
22598
IOWA

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PRINT NAME MEGAN AMBUEHL
SIGNATURE Megan Ambuehl
DATE 12-15-2025 LICENSE # P22598

PRIME CONSULTANT
Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

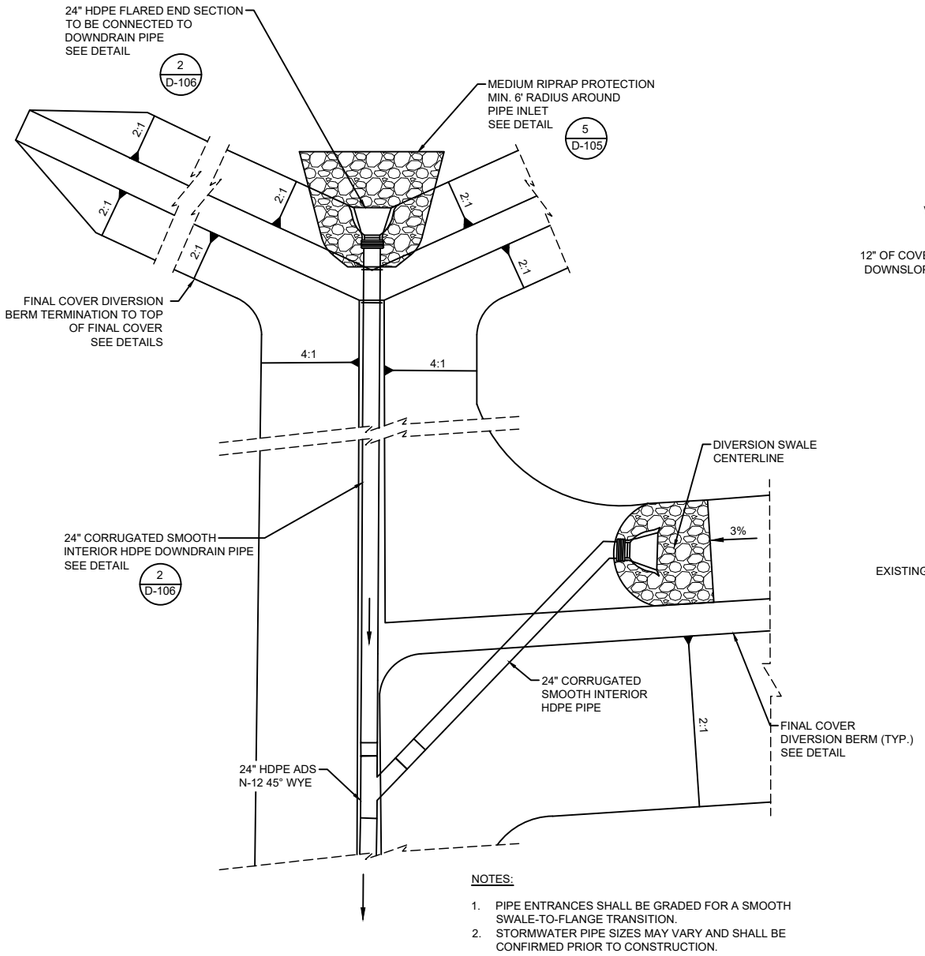
SPIRIT LAKE, IOWA

SHEET TITLE
MISCELLANEOUS DETAILS

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO.	SHEET NO.	REV NO.
227708272	D-105	0



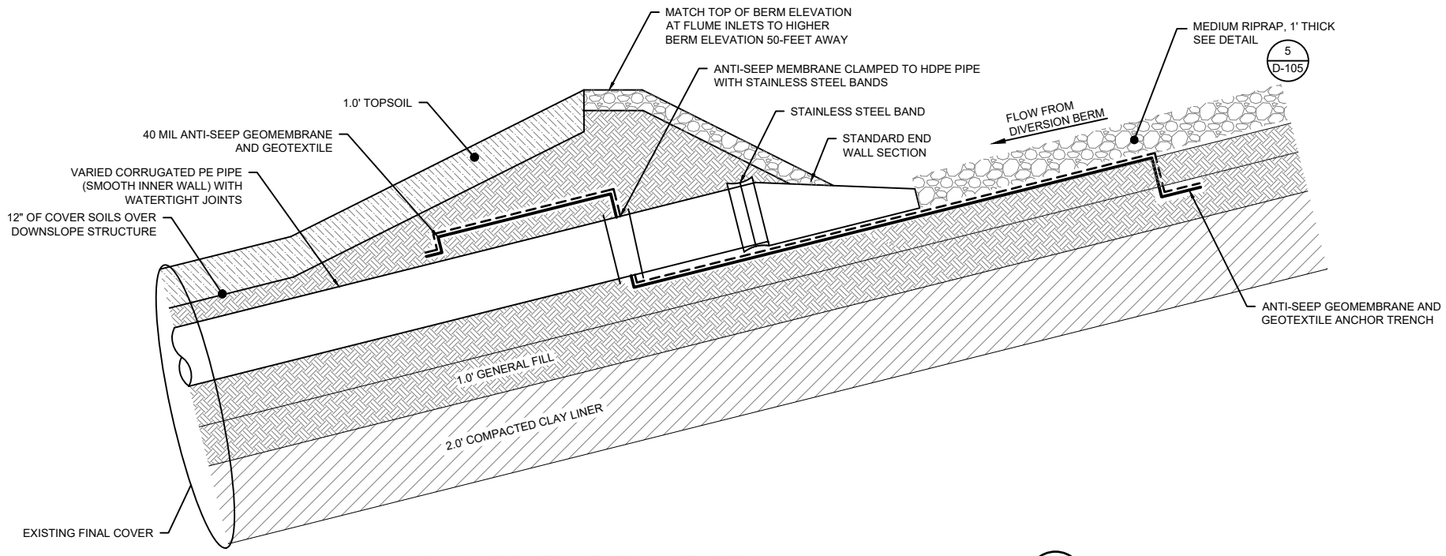
NOTES:

1. PIPE ENTRANCES SHALL BE GRADED FOR A SMOOTH SWALE-TO-FLANGE TRANSITION.
2. STORMWATER PIPE SIZES MAY VARY AND SHALL BE CONFIRMED PRIOR TO CONSTRUCTION.

DOWNSLOPE STRUCTURE INLET DETAIL

NOT TO SCALE

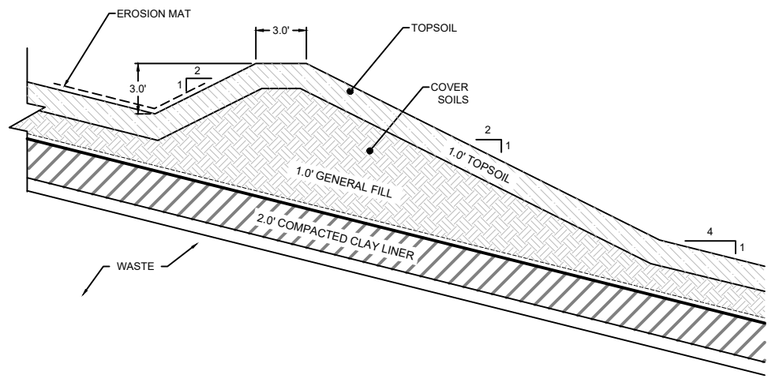
1
D-106



DOWNSLOPE STRUCTURE INLET DETAIL

NOT TO SCALE

2
D-106



DIVERSION BERM ANND SWALE DETAIL

NOT TO SCALE

3
D-106

REV	REVISION DESCRIPTION	DWN	APP	REV DATE
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PRINT NAME MEGAN AMBUEHL

SIGNATURE Megan Ambuehl

DATE 12-15-2025 LICENSE # P22598

LICENSED PROFESSIONAL ENGINEER — MEGAN AMBUEHL 22598 — IOWA

PRIME CONSULTANT

Stantec

PROJECT TITLE
2026 CELL D1 CONSTRUCTION

DICKINSON LANDFILL, INC.
WASTE MANAGEMENT

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SHEET TITLE
MISCELLANEOUS DETAILS

DWN BY	CHK'D	APP'D	DWG DATE
JJT	PDS	MMA	DEC. 2025

SCALE AS SHOWN

PROJECT NO. 227708272

SHEET NO. D-106

REV NO. 0