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New York City Department of Environmental Protection

Corrective Measures Work Plan for Landfill Gas System Maintenance

Pelham Bay Landfill, Bronx, New York

March 2010

ARCADIS

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Corrective Measures Work Plan for Landfill Gas System Maintenance

Pelham Bay Landfill, Bronx, NY

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New York City Department of Environmental Protection

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1. Introduction

ARCADIS of New York, Inc. (ARCADIS), at the request of the New York City Department of Environmental Protection (DEP), has prepared this Corrective Measures Work Plan for Landfill Gas System Maintenance (Work Plan) for the maintenance (replacement) of four landfill gas (LFG) extraction wells at the Pelham Bay Landfill (PBL), located in Bronx, New York. As previously discussed with the New York State Department of Environmental Conservation (NYSDEC), evaluation and maintenance of the PBL LFG Collection and Flare System, pursuant to maintenance requirements specified in the NYSDEC-approved PBL Site Management Plan (SMP), has been conducted over the last year and a half. This Work Plan briefly summarizes the results of this evaluation, as well as the maintenance for four (4) of the Landfill Gas System gas extraction wells, which, based on evaluations conducted in 2009, were determined to need replacement. Detailed specifications and protocols for well replacement are provided in Appendix A (Bid Specifications) of this Work Plan; a site-specific Health and Safety Plan (HASP) covering this proposed work scope will be prepared and submitted under separate cover. The work described herein is being conducted as part of routine maintenance.

2. Landfill Gas Flare System Evaluation and Recommendations

Over the last year and a half, the PBL Operation, Maintenance and Monitoring (OM&M) contractor has reported that maintaining continuous (24 hours per day, 7 days per week) operation of the LFG Collection and Flare System has been increasingly difficult. Over this same time period, decreasing concentrations of methane in influent LFG has been observed. To assess the cause(s) for this situation and determine what, if any, action was needed, the DEP requested that ARCADIS and the OM&M contractor conduct an evaluation of the system in accordance with the maintenance requirements of the PBL SMP.

Findings from the LFG Collection and Flare System evaluation are as follows:

- Minor air leaks were identified at several of the LFG extraction wellheads, valves, passive vents, and piping. Where feasible, corrective action has been taken to repair these leaks.

- Field measurements indicated integrity concerns (i.e., measured well depths were shallower than as-built depths) with several of the LFG extraction wells. Based on video logging of all 22 LFG extraction wells, it was determined that 11 of the

LFG extraction wells (Wells EW-1, 4, 5, 6, 7, 8, 9, 11, 15, 17 and 20 – see Figure 1) were damaged to varying degrees, although many are still somewhat functional.

- Eight of the 11 damaged wells (Wells EW-1, 4, 6, 7, 8, 9, 11 and 15) are located in the central portion of the landfill, which has the greatest thickness of waste, and are screened deeper than extraction wells installed along the perimeter of the landfill where the waste is thinnest.

- Low methane concentrations and low total LFG flow rates were detected at the Flare influent, resulting in frequent Flare shutdowns and, at times, requiring a pulsed Flare operation. Based on the evaluations conducted, the primary cause for this situation is believed to be the degree of damage to certain of the deeper LFG extraction wells located in the central portion of the landfill where, based on historic and current data (e.g., temperature), the LFG generating activities (i.e., methane generation) is greatest. Specifically, the greatest amount of well screen damage and resultant reduction in LFG flow rates was observed in LFG Extraction Wells EW-4, EW-7, EW-9 and EW-15.

- Air infiltration (i.e., overdrawing) into the landfill was observed, primarily along the landfill perimeter, as evidenced by increased oxygen levels and decreased methane concentrations in perimeter LFG extraction wells. The primary cause of this air infiltration is believed to be the lower than designed (based on the original design) combined total gas collection flow coming from the damaged extraction wells and the resultant greater than designed (based on the original design) combined total gas collection flow coming from the undamaged extraction wells located along the landfill perimeter.

- Although overdrawing is seen at the perimeter LFG extraction wells, there have also been detections (below action levels) of methane and carbon dioxide in the off-site LFG monitoring wells, which we believe is attributable to insufficient control over the LFG generated at depth in the central portion of the landfill where damage to the extraction wells is greatest.

Based on these evaluation findings, ARCADIS has made the following recommendations:

- Replace damaged LFG Extraction Wells EW-4, EW-7, EW-9, and EW-15 to allow better collection of LFG generated in the central portion of the PBL.

- Replace gas extraction well ball valves with gate valves to allow for more accurate flow control.

- Replace or modify gas extraction wellheads, based on inspection, to include a flow measurement component, which is necessary to allow the proper balancing of wells to achieve the required LFG characteristics at the flare, in accordance with the design.

- Install LFG ports, flow measuring components, and butterfly valves at main nodes of the LFG collection system piping to allow isolation of branches and for the ability to identify leaks in the line.

- Additionally, following completion of the above recommendations, the LFG System should be rebalanced and re-evaluated to determine if the changes/repairs made are sufficient to achieve the LFG Collection and Flare System objectives. If the evaluation confirms that LFG control has been established, the DEP will then petition the NYSDEC for a change to the current system design. If control of LFG and the prevention of the migration of the LFG from the site have not been achieved, repair or replacement of additional damaged LFG extraction wells may be required.

3. Scope of Work/Methodology

The scope of work proposed herein includes replacing four (4) LFG extraction wells (Wells EW-4, EW-7, EW-9, and EW-15), followed by LFG Collection and Flare System rebalancing and re-evaluation. The locations of the four wells to be replaced are shown on Figure 1, proposed well construction details are summarized in Table 1, and detailed specification for the well replacement work are provided in Appendix A . The various tasks associated with this work are described in Subsections 3.1 through 3.8 below.

Upon NYSDEC acceptance of this Work Plan and following subcontractor procurement and HASP preparation, the selected drilling subcontractor will mobilize a drill rig and all equipment, materials and personnel (to the site) necessary to complete LFG extraction well replacement. The anticipated schedule for well replacement activities is discussed in Section 6 of this Work Plan. ARCADIS will provide full-time oversight of the proposed LFG extraction well replacement and LFG system rebalancing activities.

3.1 HASP Preparation

This project is being performed within, over and adjacent to buried wastes and refuse. As these buried materials decompose, they may generate landfill gas, which normally consists of methane, carbon dioxide, and occasionally hydrogen sulfide and other gases, depending on the composition of the buried materials. Additionally, this project is being performed at a New York State Superfund Site that is identified as a Class 2 Inactive Hazardous Waste Disposal Site by the NYSDEC. Therefore, there is a potential for hazardous conditions at the site. Site-specific HASPs will be updated/prepared by ARCADIS and the drilling subcontractor prior to the initiation of the field activities. The ARCADIS HASP (which will also include a Community Air Monitoring Plan [CAMP}) will be prepared for ARCADIS staff overseeing the drilling subcontractor (and submitted under separate cover as Appendix B to this Work Plan). The specific requirements for the drilling subcontractor's HASP are identified in the Bid Specifications (Appendix A); this HASP will be prepared by the drilling subcontractor and submitted to ARCADIS and NYCDEP for review and acceptance. The HASPs will address all the potential hazards associated with the site, the excavation activities, the well drilling and installation activities, and the liner repair activities. The HASPs will also include a section describing the air monitoring to be conducted in each work area, including air monitoring for methane, carbon dioxide, hydrogen sulfide, volatile organic compounds (VOCs), and dust. In addition, the HASPs will include a CAMP to be implemented at the site during intrusive work activities.

3.2 Site Preparation

Prior to initiating any field activities, all subsurface utilities will be cleared, as necessary. In addition the New York City One Call Center will be notified prior to beginning any activities.

At each proposed drill location, the existing fence enclosure will be removed and disposed, and the cover soils will be removed to expose the underlying geocomposite liner. The excavated cover soils will be segregated (topsoil and loamy soil) and staged adjacent to each work area. The excavated cover soils will be staged on and covered with plastic for future backfilling upon completion of the well installation and liner repairs.

The excavation area will be of sufficient size to accommodate the drill rig and all necessary equipment and personnel to complete the work. The excavation side walls will be sloped or benched to prevent side wall collapse and provide a safe work area.

The excavation will include a sloped access for the drilling equipment and personnel to safely enter/exit the excavated work area. All precautions and means necessary as to not breach the geocomposite liner will be used. The base of each excavation (work area) will be covered with plywood (or other approved material) to protect the geocomposite liner from damage. The drill rig and all drilling equipment and personnel will remain on the plywood base during drilling operations.

Once the excavation is completed and the geocomposite liner is exposed, a qualified/certified landfill liner installer will remove the geocomposite liner around each borehole. The section of liner to be removed will be minimized and of sufficient size to accommodate advancement of the drilling equipment.

The LFG Collection and Flare system will be turned off and the passive vents opened prior to breaching the geocomposite liner and will remain off until the LFG extraction wells are replaced and the liner re-sealed. The length of time that the LFG Collection and Flare system will be turned off is estimated to be between 8 to 12 weeks.

3.3 Equipment Mobilization and Decontamination

The OM&M contractor will designate an on-site area for drill rig and equipment decontamination. A heavy-duty lined decontamination pad of sufficient size to accommodate containerization of all fluids generated during decontamination will be constructed in this area. The drill rig, drill bits, rods, tremie pipe, and any other tools necessary for the well installation operations will be decontaminated prior to the drilling of the first borehole, and after the drilling and installation of each LFG extraction well. The drilling subcontractor will provide a steam-cleaning unit to be used for equipment decontamination. All water generated during decontamination will be temporarily containerized in 55-gallon drums for later disposal. The volume of water generated during decontamination is expected to be minimal. It is anticipated that the water generated during decontamination will be disposed of into the site leachate collection system.

3.4 Borehole Drilling and LFG Extraction Well Installation

The LFG extraction well boreholes will be advanced using bucket auger drilling methodology, or other drilling methods capable of advancing a 24-inch diameter borehole to the proposed depths. The existing LFG extraction well at each proposed location will be over-drilled and the boreholes will be advanced to a depth equal to the depth of the water table. The proposed, approximate borehole depths and

construction details of the replacement LFG extraction wells are provided in Table 1 and shown on Figure 2. The actual boring depths will be determined in the field based on existing conditions. No sampling will be conducted during the drilling of the boreholes.

All and any means necessary to prevent fire or explosion, due to methane at the landfill, will be employed by the drilling subcontractor. This could include the introduction of a continuous flow of nitrogen into the borehole, through the drilling apparatus, during drilling operations to displace the methane in the borehole, or other approved method. The subcontractor's HASP will include detailed procedures to be used.

One replacement LFG extraction well will be installed in each borehole. The LFG extraction wells will be constructed of 8-inch diameter perforated high density polyethylene (HDPE) well screen and 8-inch diameter HDPE riser pipe. The riser pipe will extend to five feet above the top of the existing geomembrane liner and will be temporarily finished with a sealed cap until the installation of the wellhead assembly is completed (see Subtask 3.6, below). The proposed screen lengths of each well are presented in Table 1 and shown on Figure 2. Once the well casing and screen have been installed, the gravel pack will be emplaced in the borehole annulus. The gravel pack will consist of 1-inch to 1 ½-inch washed crushed stone and shall extend to a depth of two feet above the screen perforations. Well graded clean backfill will be emplaced in the borehole annulus from the top of the gravel pack to a depth of 3 feet 4 inches below the geomembrane liner. A bentonite seal will be emplaced from the top of the clean backfill to the bottom of the geomembrane liner. A piece of geocomposite drainage material will be cut into a circle and placed beneath the bentonite to act as a separator between the backfill and bentonite. Typical well construction details are shown on Figure 2.

3.5 Liner and Cover System Repair

Upon completion of the well installations, a geomembrane boot will be installed around each gas extraction well. The installation of the geomembrane boot and the repairs to the existing cover system will be conducted by a certified landfill liner installer The geomembrane boot will be sealed to the existing liner and extend a minimum of three feet above the top of the geocomposite liner. Typical geomembrane boot details are shown on Figure 2.

Upon completion of the geomembrane boot installations and liner repairs, each excavation area will be backfilled using the same materials that were excavated while preparing the drill site. The soils will be placed as a two (2) foot layer of loamy soil directly above the geocomposite liner followed by a six (6) inch topsoil layer. The area will be re-seeded, as necessary, in accordance with DEP requirements. A typical cover soil section is shown on Figure 3.

3.6 Gas Extraction Wellhead Installation

Upon completion of the gas extraction well installation and liner/cover system repair, each well will be furnished with a CE-LANDTECH ACCU-FLO (Model 300) landfill gas wellhead. The wellhead assembly will include:

- A transition from the 8-inch diameter HDPE well casing to the 3-inch wellhead assembly
- A dust cap
- A static pressure port
- An impact pressure port
- A temperature port or permanent thermometer
- A union disconnect
- A flow control gate valve
- A gas sample port
- A 3-inch diameter flex hose connecting the wellhead assembly to the gas conveyance system

Typical landfill gas extraction wellhead assembly details are shown on Figure 2.

In addition to the installation of the new wellhead assemblies, the following components will also be installed on the LFG flare as part of this maintenance program:

- Oxygen sensor
- Flow meter

3.7 Site Restoration

Upon completion of the well installation, liner and cover system repairs, and wellhead installation, a new chain link fence enclosure will be installed around each LFG extraction well. The fence enclosure details are shown on Figure 4.

As part of site restoration, each work area will be graded and seeded, as necessary, in accordance with DEP requirements.

3.8 LFG System Rebalancing

Upon completion of the above tasks, LFG System rebalancing will commence. System rebalancing will be conducted by the OM&M contractor with ARCADIS supervision. LFG System rebalancing will consist of restarting the LFG Collection and Flare System, adjusting the flow rates from each of the 22 LFG extraction wells, and monitoring landfill gas concentrations and vacuum at the extraction wells and flare inlet. During this process, the flow rates will be adjusted by opening or closing the valves at each LFG extraction wellhead until a stable vacuum and gas concentrations are measured at each extraction well (in accordance with protocols specified in the SMP). Once the valve positions are initially set, the LFG system will remain operational for a period of time allowing the system to equilibrate (typically several days). During this time, vacuum and gas concentrations will continue to be measured daily. After the LFG system has stabilized the vacuum readings and gas concentrations will be reviewed to determine if additional adjustments are necessary. If additional adjustments are made the system will again remain operational until it stabilizes. These procedures will continue to be followed until stable, continuous flow and flare operation are maintained, or it is determined that additional action (e.g., replacement of other LFG extraction wells or other) is necessary.

4. Reporting

Upon completion of the LFG extraction well installation and system rebalancing, an engineering report will be prepared, by ARCADIS, to summarize the well replacement activities and results of LFG system rebalancing. In addition, this report will include all field logs generated, a table of well construction details, LFG data collected, and any

recommendations (if necessary) for future system operation and modifications. The engineering report will also include as-built drawings showing the modifications made to the LFG Collection and Flare System.

5. Schedule

DEP will be implementing the LFG extraction well replacement program under the OM&M contract. The OM&M contractor will contract with a drilling subcontractor who will prepare and submit all the necessary submittals (HASP, certificates of insurance, project schedules, etc.) for review and approval. Upon review and approval of the necessary submittals, the field activities will commence. It is anticipated that the well installation activities will take approximately eight weeks to complete, depending of field conditions encountered. System rebalancing will take approximately two to three weeks. It is anticipated that all of the filed activities will be completed by July 1, 2010, with the engineering report and as-built drawing completed and submitted approximately four to six weeks later.

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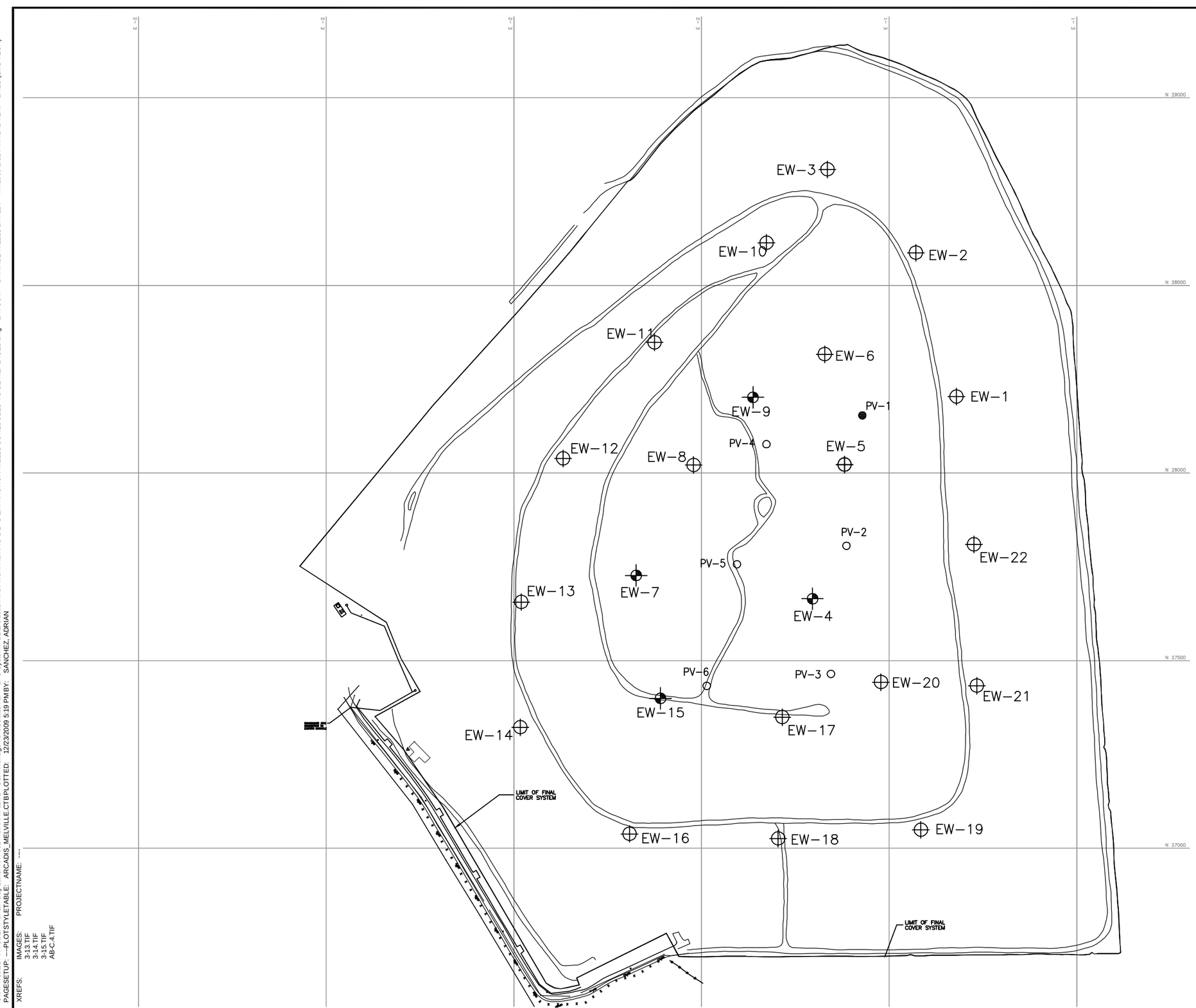
Table 1. Proposed Replacement Landfill Gas Extraction Well Construction Details Pelham Bay Landfill Bronx, New York.

Well ID	Original Well Design/Installed Details					Total Depth Measured on 10/2008	Proposed Replacement Well Details [2]				
	Total Depth	Length of Slotted Pipe	Length of Solid Pipe	Well Diameter	Borehole Diameter		Total Depth [1]	Length of Slotted Pipe	Length of Solid Pipe	Well Diameter	Borehole Diameter
EW-4	82 feet	41 feet	41 feet	4 inches	36 Inches	39.85 feet	135 feet	90 feet	45 feet	8 Inches	24 Inches
EW-7	80 feet	40 feet	40 feet	4 inches	36 Inches	43.75 feet	125 feet	80 feet	45 feet	8 Inches	24 Inches
EW-9	72 feet	36 feet	36 feet	4 inches	36 Inches	42.7 feet	125 feet	80 feet	45 feet	8 Inches	24 Inches
EW-15	78 feet	39 feet	39 feet	4 inches	36 Inches	44.3 feet	130 feet	85 feet	45 feet	8 Inches	24 Inches

Notes:
Depth increase justification are based on the following:

1) Based on the ROD and 6NYCRR Part 360 Regulations, gas extraction wells should be drilled to 80% to 90% of the refuse thickness as propose herein. Therefore the deeper propose total well depths does not consitute a design change.

2) The recommended installation depth of landfill gas collection wells for landfills with no bottom liner (Reference 1- "ENGINEERING AND DESIGN LANDFILL OFF-GAS COLLECTION AND TREATMENT SYSTEMS" USACE EM 1110-1-4016, May 2008, Reference 2- GUIDANCE FOR EVALUATING LANDFILL GAS EMISSIONS FROM CLOSED OR ABANDONED FACILITIES, EPA-600/R-05/123a September 2005.



LEGEND:

EW-1 ⊕ LFG EXTRACTION WELLS

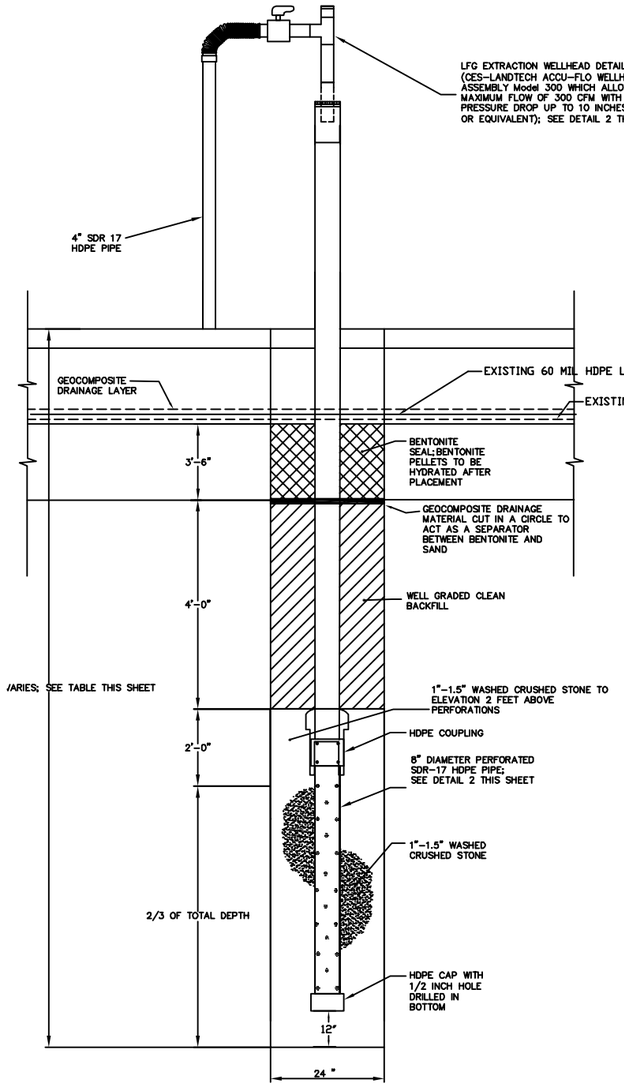
EW-4 ⊕ LFG EXTRACTION WELLS TO BE REPLACED

NEW YORK CITY DEPARTMENT OF ENVIROMENTAL PROTECTION
PELHAM BAY LANDFILL
BRONX, NEW YORK

LOCATION OF LANDFILL GAS EXTRACTION WELLS SCHEDULED TO BE REPLACED

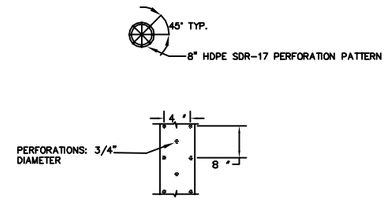
ARCADIS

FIGURE
1



TYPICAL GAS EXTRACTION WELL (1)

NOT TO SCALE



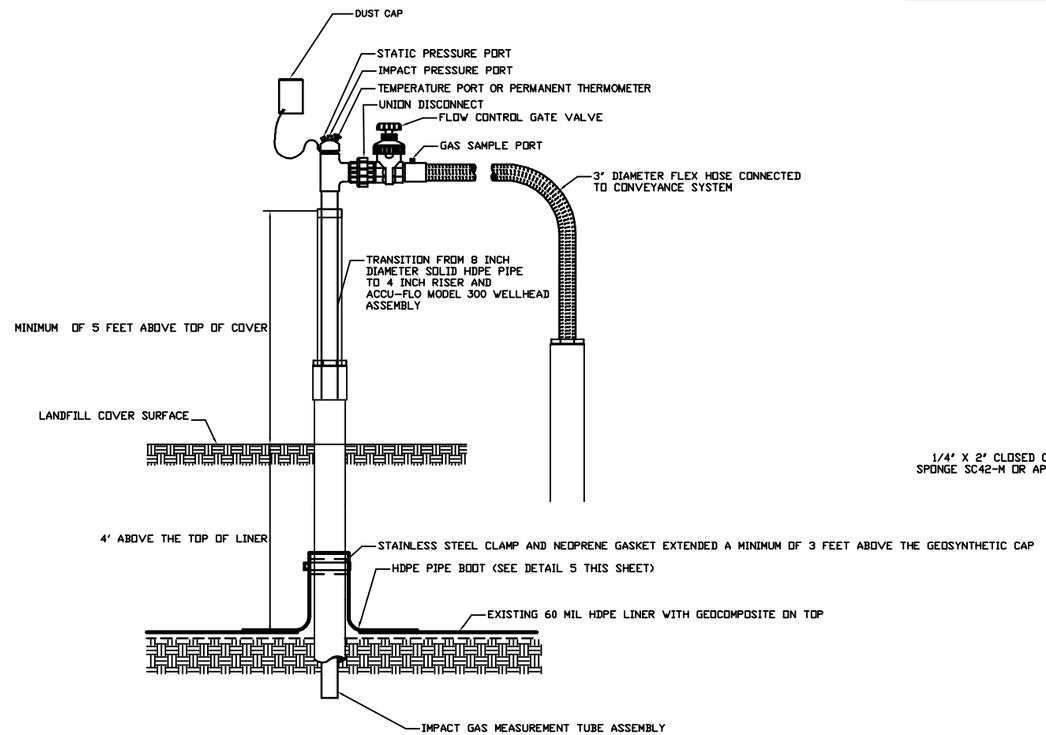
TYPICAL PIPE PERFORATIONS (2)

NOT TO SCALE

Phase	Well ID	Approximate Elevation of Landfill Surface (Bronx Datum)	Approximate Transition Length Of SDR-17 HDPE Pipe (Transition from 8 inch Diameter to 4 Inch Diameter) (Ft)	Approximate Length Of 8 Inch SDR-17 HDPE Riser in feet (Approx. 1/3 of Well Depth)	Approximate Length Of 8Inch Diameter SDR-17 HDPE Perforated Screen (Ft)	Approximate Boring length in ft below top of landfill cover (36 inch diameter)
Phase 1 Replacement Wells	EW-9	126	6	40	80	125
	EW-15	131	6	40	85	130
	EW-4	137	6	40	90	136
	EW-7	131	6	40	80	125
					Total	516

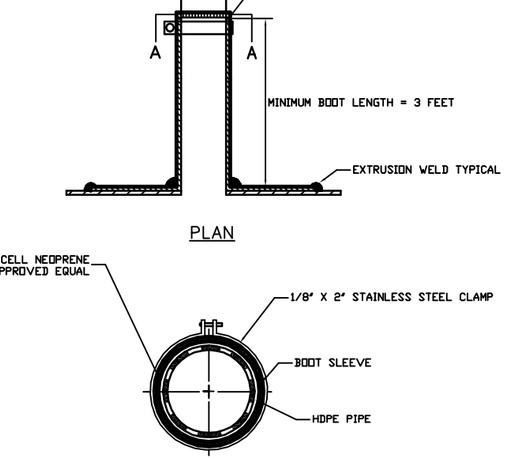
Notes:
1. Final boring depths will be determined in the field based on existing conditions.
2. Wells are listed in an order of priority.

LANDFILL GAS EXTRACTION WELLHEAD SCHEDULE



LANDFILL GAS EXTRACTION WELLHEAD ASSEMBLY (3)

NOT TO SCALE



GEOMEMBRANE BOOT (5)

NOT TO SCALE

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ASC096E5DD1.dib
ASC15A85AFB.dib
ASC22B844BA.dib
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ASC3ECE5DA8.dib
ASC49B37438.dib
ASC72710701.dib
ASC7D7A1789.dib

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
G:\APROJECTNYCDEP\Pelham Bay Landfill\NY001443.XXX\Task 1 - O&M Management\Subtask 1.4 - LFG System\PBL Extraction Well Work Plan\FIG-2 LFG EXTRACTION WELL DETAILS PBL.dwg LAYOUT: 2SAVED: 12/23/2009 5:06 PM ACADVER: 17.1S (LMS TECH) PAGESETUP: ---
PLOTSTYLETABLE: MONOCHROME.CTB PLOTTED: 12/23/2009 5:07 PM BY: SANCHEZ, ADRIAN

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: _____ USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name	(PE'S FULL NAME)	
Professional Engineer's No.	(PE NUM)	
State (ST)	Date Signed	Project Mgr. (MGR)
Designed by (DSN)	Drawn by (DFT)	Checked by (CHK)

ARCADIS OF NEW YORK, INC.

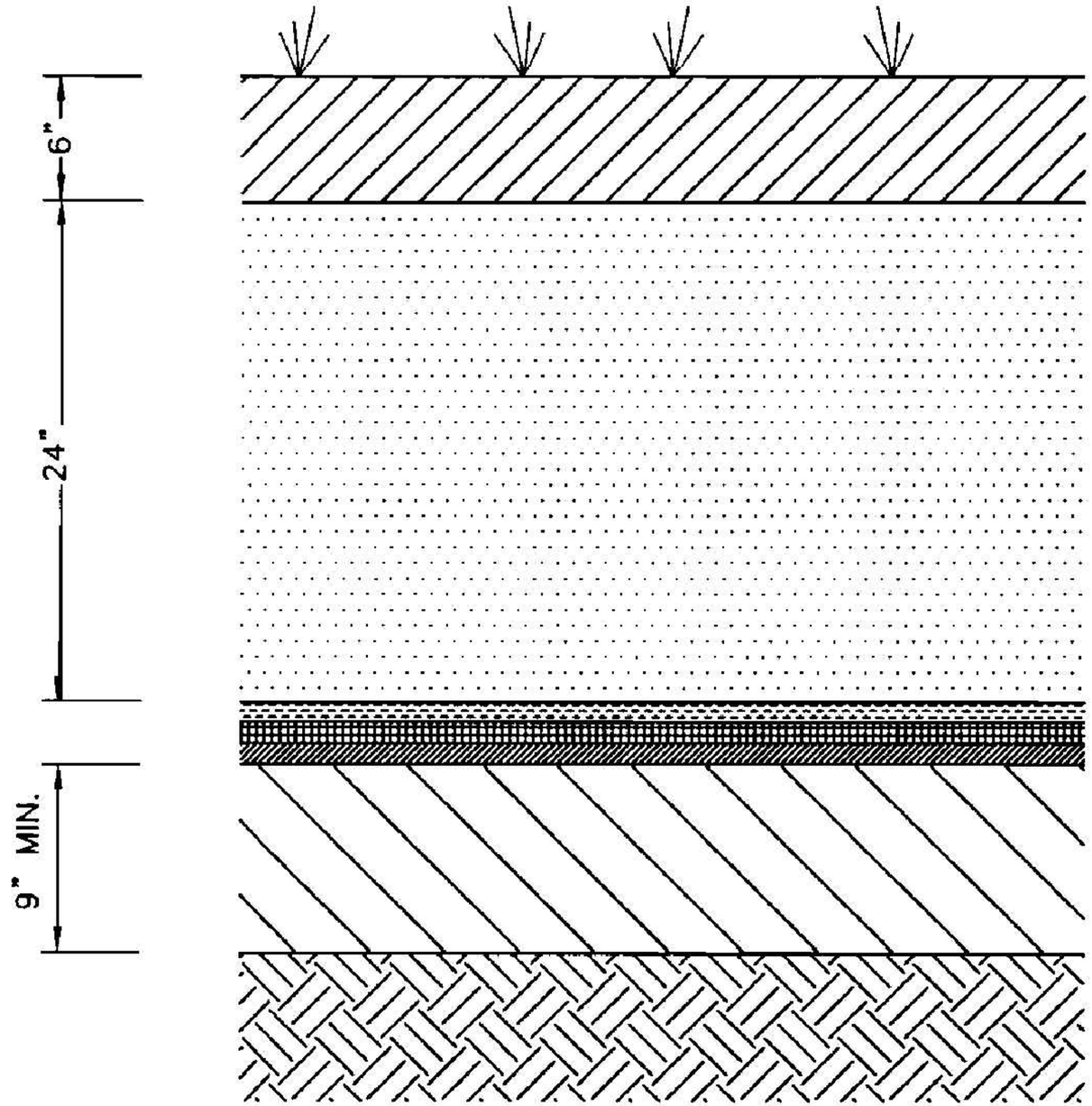
NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION • BRONX NEW YORK CITY

PELHAM BAY LANDFILL REPLACEMENT LANDFILL GAS EXTRACTION WELL

ARCADIS Project No. 12345678.0000.12345

Date (DATE)

ARCADIS
ADDRESS LINE1
ADDRESS LINE2
CITY, STATE
TEL. XXX.XXX.XXXX



VEGETATED TOPSOIL LAYER

LOAMY SOIL LAYER

GEOCOMPOSITE

60mil HDPE GEOMEMBRANE

RANDOM SOIL CLASS II

WASTE OR RANDOM SOIL CLASS I

TYPICAL COVER SECTION

NOT TO SCALE

NYDEP
PELHAM BAY, NEW YORK

TYPICAL COVER SOIL SECTION

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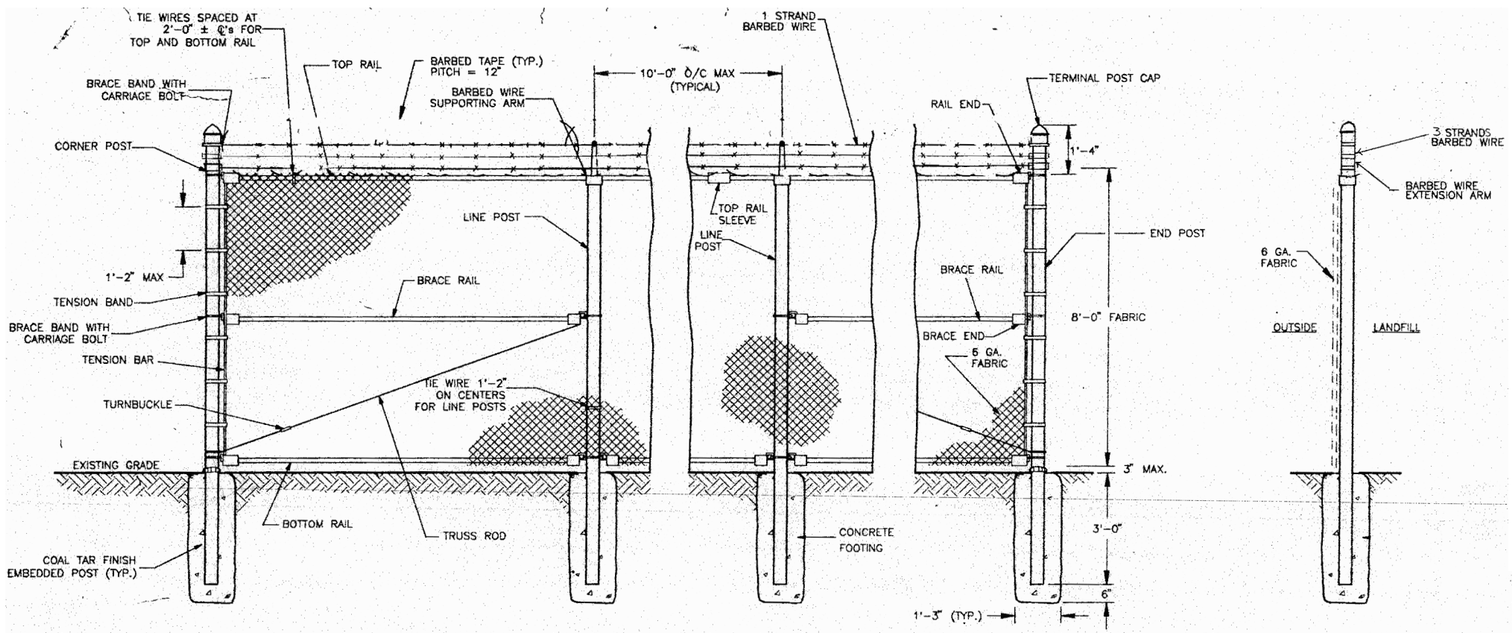
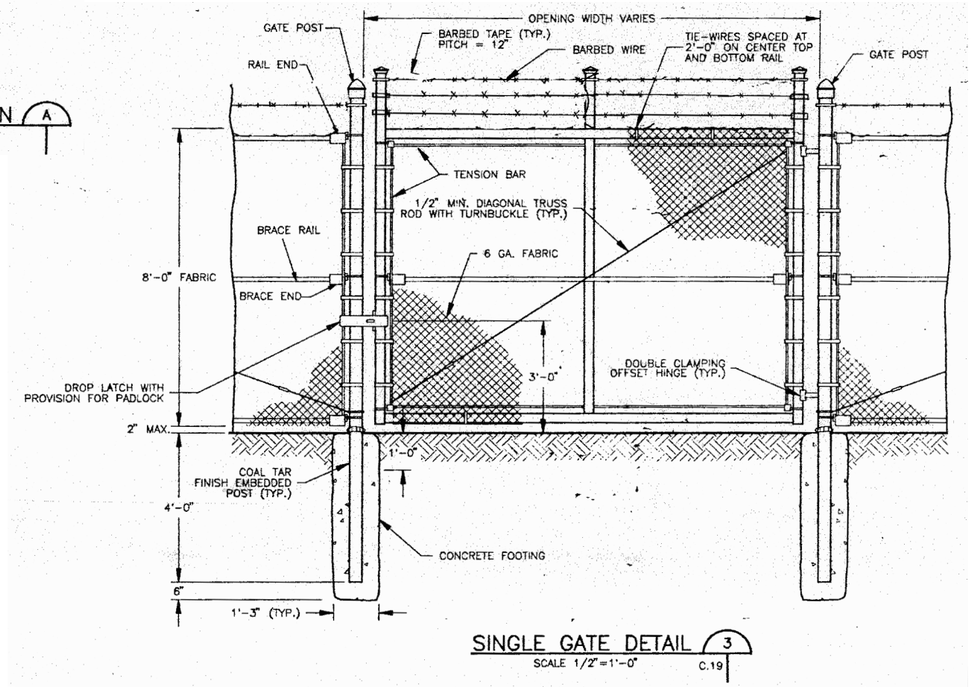
FIGURE
3



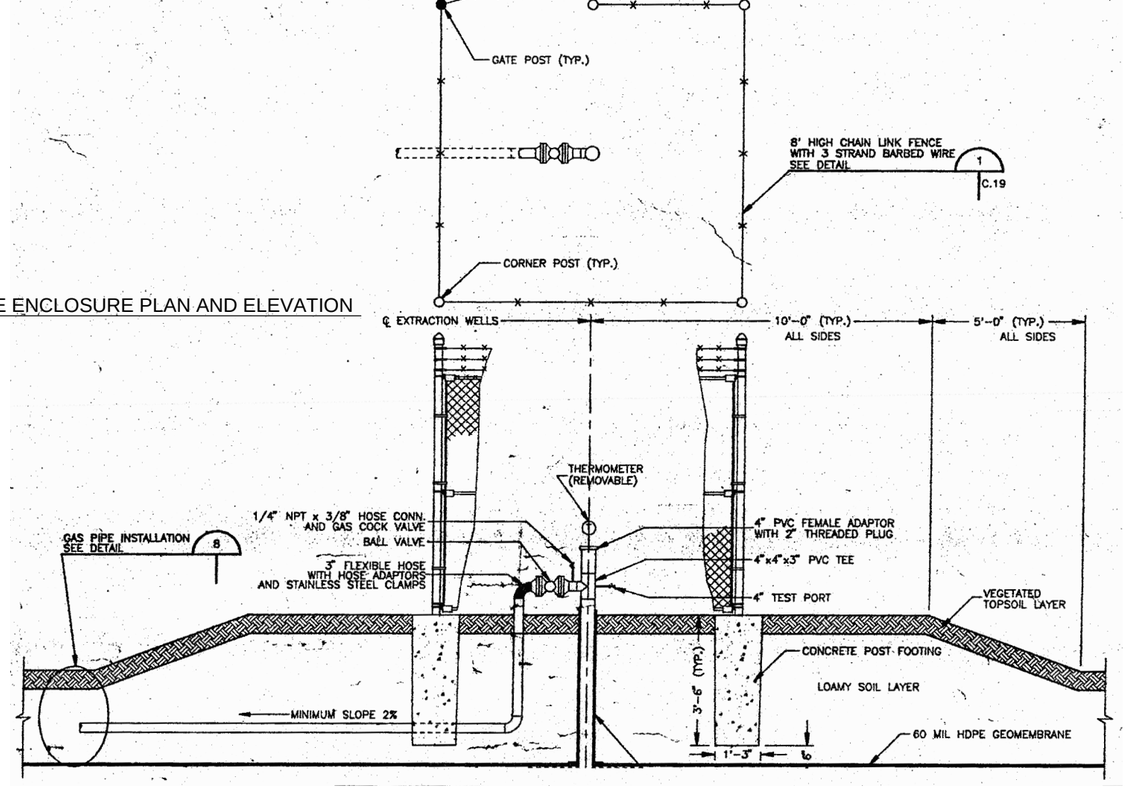
GALVANIZED STEEL CHAIN LINK FENCE 1
SCALE 1/2"=1'-0"
C.17

BARBED TAPE SECTION A
SCALE 1/2"=1'-0"



SINGLE GATE DETAIL 3
SCALE 1/2"=1'-0"
C.19

FENCE ENCLOSURE PLAN AND ELEVATION



AB-GS3.jpg
C19.jpg

NYDEP
PELHAM BAY, NEW YORK

FENCE ENCLOSURE DETAIL

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FIGURE
4

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Appendix A

Landfill Gas Extraction Well
Replacement Specifications

INDEX OF TECHNICAL SPECIFICATIONS

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SECTION 01010

SUMMARY OF WORK

ARCADIS (ENGINEER), on behalf of the New York City Department of Environmental Protection (DEP), is soliciting bids for landfill gas extraction well drilling and replacement services at the Pelham Bay Landfill (PBL or Site), located in Bronx, New York. This work will be contracted by Severn Trent Environmental Systems, Inc. (STES), who is the current PBL Operation, Maintenance and Monitoring (OM&M) CONTRACTOR, and will be funded by New York City. As such, all cost estimates must be based on prevailing New York City wage rates, and the selected bidder (hereinafter referred to as the CONTRACTOR) and any proposed subcontractors must be VENDEX approved. For review purposes, a draft copy of the contract document(s) is attached to this bid solicitation (Attachment 1).

All bid proposals should include the estimated time that it will take to complete the project and any additional information, which may be helpful in evaluating bids, should be attached to the bid proposal.

Completed bid proposals, as described in Section 01010, Part 3, herein, are to be received at the following address by no later than 5:00 PM EST on July 23, 2009:

ARCADIS
2 Huntington Quadrangle, Suite 1S10
Melville, New York 11747
Attention: Mr. Arnas Nemickas

Additionally, there will be an optional, Pre-Bid Meeting for all interested bidders at 10:00 AM EST, on Thursday, July 9, 2009. The Pre-Bid Meeting will take place at the Pelham Bay Landfill, 301 Shore Road, Bronx, New York, and is being held to provide prospective bidders an opportunity to see the Site setting where the work will be conducted.

A representative of the ENGINEER will conduct the pre-bid meeting and will be available to answer questions. It is the bidder's responsibility to understand the Site setting and work scope requested when submitting a response to this bid solicitation.

The CONTRACTOR shall perform all operations, and provide all necessary manpower, materials, equipment, tools, and services required to drill and install up to four (4) replacement landfill gas extraction wells. The subject work will be performed at the PBL located in, Bronx County, New York. Additionally, the CONTRACTOR is advised that this project is being performed at a New York State Superfund Site, and is identified as a Class 2 Inactive Hazardous Waste Disposal Site by the New York State Department of Environmental Conservation (NYSDEC).

The scope of work is generally summarized below. Please note that the provisions of this Section are supplementary to other provisions specified elsewhere in the Contract Documents.

PART 1 - GENERAL

1. The CONTRACTOR shall obtain all permits, certificates, and licenses required of him by law for the execution of this work.
2. The CONTRACTOR shall comply with all federal, state, and local laws, ordinances, or rules and regulations relating to the performance of the work specified herein.

3. All work shall be conducted in accordance with a site-specific Health and Safety Plan (HASP) to be developed by the CONTRACTOR (in accordance with Section 10190 of this bid solicitation) and submitted to the ENGINEER and DEP for approval, prior to start of any field work. It is anticipated that work will be conducted in Level D personal protection, unless otherwise required, based on the HASP. CONTRACTOR shall be responsible for providing OSHA HAZWOPR-trained crews with necessary personal protection to conform to the HASP requirements. CONTRACTOR shall provide copies of the OSHA 40-hour training certificates and 8-hour annual refresher certificates for all field crew members and all other certifications required under OSHA.
4. In addition to the HASP described above, prior to initiation of any intrusive work, the CONTRACTOR will be required to develop and implement a Community Air Monitoring Program (CAMP), consistent with requirements provided in Appendix 1A of NYSDEC DER-10. The draft CAMP must be provided to the DEP and ENGINEER for review prior to use.
5. Water is available on-site.
6. The DEP reserves the right to contract none, some, or all of the work specified herein.

PART 2 – WORK REQUIRED

A. Mobilization/Demobilization
   1. CONTRACTOR shall mobilize/demobilize rig(s) (including all tools), full crew, support truck, and any necessary equipment and materials to/from the 4 extraction well locations.
   2. The drill rig shall be a track-mounted rig to distribute the weight of the rig, and minimize disturbance to the landfill cover system.
   3. A staging area for equipment will be provided on-site and shall be coordinated with the DEP and on-site OM&M Contractor.

B. Site Preparation
   1. CONTRACTOR shall clear all subsurface utilities, as necessary, and notify New York City One Call Center prior to beginning any activities.
   2. CONTRACTOR shall remove and dispose of the existing fence enclosure around each extraction well drilling location.
   3. CONTRACTOR shall remove the cover soils to expose the underlying geocomposite liner. The excavation area shall be of sufficient size to accommodate the drill rig and all necessary equipment and personnel to complete the work. The excavation side walls shall be sloped or benched to prevent side wall collapse and provide a safe work area. The excavation shall include a sloped access for the drilling equipment and personnel to safely enter/exit the excavated work area.
   4. CONTRACTOR shall use all precautions and means necessary as to not breach the geocomposite liner.
   5. The excavated cover soils shall be segregated (topsoil and loamy soil) and staged adjacent to each work area. The excavated cover soils are to be staged on and covered with plastic for future backfilling upon completion of the well installation and liner repairs.
   6. The base of each excavation (work area) shall be covered with plywood (or other approved material) to protect the geocomposite liner from damage. The drill rig and all

drilling equipment and personnel shall remain on the plywood base during drilling operations.

7. CONTRACTOR shall provide the necessary excavation dimensions to complete the task with the proposal and cost estimate submission.
8. CONTRACTOR shall hire a qualified/certified landfill cap installer to remove the geocomposite liner around each borehole. The section of liner to be removed shall be minimized and of sufficient size to accommodate advancement of the drilling equipment.

C. Decontamination of Equipment

1. An on-site area will be designated by the OM&M CONTRACTOR for decontamination of the drill rig and drilling equipment.
2. The CONTRACTOR shall provide/construct a heavy-duty lined decontamination pad of sufficient size to accommodate containerization of all fluids generated during decontamination of the drilling rig, tools, and ancillary equipment.
3. Prior to the drilling of the first borehole, and after the drilling, installation of each well, the CONTRACTOR shall decontaminate all drilling bits, rods, tremie pipes, and any other tools to be used in the drilling and well installation operations.
4. The CONTRACTOR shall have a steam-cleaning unit on the work site to be used for decontamination of his equipment.
5. The volume of water generated during decontamination is expected to be minimal. There will be no disposal of water without NYCDEP approval. If a sufficient volume of water is generated that requires disposal, it is anticipated that the water will be disposed of into the site leachate collection system after NYCDEP approval.

D. Borehole Drilling

1. A 36-inch diameter borehole is required at each drilling location (Figures 1 and 2). The boreholes will be drilled using methodology capable of drilling this diameter to the proposed depths.
2. The CONTRACTOR shall over-drill the existing gas extraction well at each proposed location.
3. The boreholes shall be advanced to a depth equal to the depth of the existing water table. A table summarizing the approximate target depths is provided on Figure 2. Actual boring depths will be determined in the field based on existing conditions.
4. All and any means necessary to prevent fire or explosion, due to methane at the landfill, shall be employed by the CONTRACTOR. This could include the introduction of a continuous flow of nitrogen into the borehole, through the drilling apparatus, during drilling operations to displace the methane in the borehole, or other approved method. The bid proposal shall specify what method will be used and the CONTRACTOR's HASP shall include this procedure.
5. No sampling will be conducted during the drilling of the borehole.

E. Gas Extraction Well Installation

1. One replacement gas extraction well will be installed in each borehole. Typical well construction details are provided on Figure 2.

2. The gas extraction wells will be extend to 5-ft above the top of the existing geomembrane/composite liner and finished with a sealed cap until the installation of the wellhead assembly.
3. Detailed Specifications for the landfill gas extraction wells and wellheads are provided on in Section 02670.

F. Liner and Cover System Repair

1. Upon completion of the well installations, a geomembrane boot shall be installed around each gas extraction well. A certified landfill liner installer shall install the geomembrane boot and complete repairs to the existing cover system. The geomembrane boot shall be sealed to the existing liner and extend a minimum of three (3) feet above the top of the geocomposite liner. Typical geomembrane boot details are provided on Figure 2.
2. After all geomembrane boots are installed and any other liner repairs made, each excavation area shall be backfilled using the same materials that were excavated while preparing the drill site. The soils shall be placed as a two (2) foot layer of loamy soil directly above the geocomposite liner followed by a six (6) inch topsoil layer. A typical cover soil section is provided on Figure 3.

G. Gas Extraction Wellhead Installation

1. Upon completion of the gas extraction well installation, each well will be furnished with a CE-LANDTECH ACCU-FLO (Model 300) landfill gas wellhead.
2. The wellhead assembly shall include:
    - A transition from the eight (8) inch diameter HDPE well casing to the three (3) inch wellhead assembly
    - A dust cap
    - A static pressure port
    - An impact pressure port
    - A temperature port or permanent thermometer
    - A Union disconnect
    - A flow control gate valve
    - A gas sample port, and
    - A three (3) inch diameter flex hose connecting the wellhead assembly to the gas conveyance system
3. Typical landfill gas extraction wellhead assembly details are provided on Figure 2.

H. Site Restoration

1. Upon completion of the well and wellhead installation, CONTRACTOR shall furnish and install all material necessary to construct chain link fence enclosures around each gas extraction well.
2. The fence enclosure details are provided on Attachment 2.
3. Each work area shall be graded and seeded in accordance with DEP requirements.

PART 3 - MISCELLANEOUS

1. The CONTRACTOR shall, at all times, limit access to the drill sites and excavated areas by the use of barricades, fencing, etc. and maintain the work area in a clean, workable condition.

2. Working hours shall be 8-hr work day; Monday through Friday.
3. Bidders shall prepare a bid proposal for submittal to the ENGINEER to include, at a minimum:
    a. Description of Work
    b. Means and Methods to complete work, including a list of all subcontractors proposed for use
    c. Materials
    d. Schedule
    e. Cost Estimate, prepared and submitted on the attached Bid Form provided as Attachment 3
    f. Comments to draft contract document(s)
    g. Other
4. Prior to site mobilization, the CONTRACTOR shall finalize subcontractor agreements; provide insurance and indemnification, as required by STES.
5. Reflective of the DEP's policy to seek Women/Minority-owned enterprises (W/MBE) participation to the maximum extent possible, proposals should demonstrate the level of participation of W/MBE firms, either as Prime, Sub-contractors or as joint ventures. The NYCDEP recognizes the Minority and Women-Owned Business Enterprise (W/MBE) certification of the New York City Department of Small Business Services; New York State Empire State Development Corporation's Division of Minority and Women's Business Development and the Port Authority of New York & New Jersey. W/MBE certification from another state other than New York and New Jersey is not acceptable. Bidders shall provide copies of certificates in their bid package.

PART 4 - SCHEDULE

Deliverable/Milestone	Date
Site/Bid Walk	07/09/2009 at 10 AM
Proposal, bid documents and cost estimate due	07/23/2009 by 5 PM
Field mobilization	2 weeks following notice to proceed
Well replacement completion	To be determined

END OF SECTION 01010

SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Methods for measuring and calculating quantities for the Bid Form (i.e., Schedule of Values).

B. Basis of payment for all contract bid items in the Bid Form.

C. Values of unit prices.

D. Description for payment of extra work or changes.

E. Discussion of payment for rejected materials.

1.2 MEASUREMENT

A. Performed according to United States Standard measure.

B. Based on actual units installed or neat line dimensions of work completed.

1.3 CALCULATION OF QUANTITIES

A. Progress Payment Quantities: CONTRACTOR will compute all quantities of Work performed, or of materials and equipment delivered to the site for progress payment purposes.

B. Final Payment Quantities: CONTRACTOR will compute all quantities of Work performed, or of materials and equipment delivered to the site for final payment purposes.

1.4 PAYMENT

A. In accordance with lump sum or unit price as provided on the Bid Form.

B. Includes all costs for overhead and profit and for supplying materials, labor, equipment, and tools, necessary to complete the Work in accordance with the Specifications, Drawings, and Contract Conditions.

1.5 QUANTITIES

A. The number of units and quantities contained in the Bid Form are approximate only. It shall be the CONTRACTOR'S responsibility to verify all bid quantities prior to submittal of bids, as well as for the performance of the work. Final payment will be made for the actual number of units and quantities incorporated in the work or made necessary to complete the project.

B. In the event that work and materials or equipment are required to be furnished to a greater or lesser extent than is indicated by the Contract Documents, such work and materials or equipment will be furnished in greater or lesser quantities.

1.6 CHANGES AND EXTRA WORK

A. Changes and extra work will be measured and paid for in accordance with the requirements of this Section.

1.7 REJECTED MATERIALS

A. Quantities of material wasted or disposed in a manner not called for in the Specifications; rejected loads of material, including material rejected after it has been placed by reasons of the failure of CONTRACTOR to conform to the provisions of the Specifications; material not unloaded from the transporting vehicle; material placed outside the limits indicated by the Drawings or established by the Contract or material remaining on hand after completion of the Work, will not be paid for, and such quantities will not be included in the final total quantities. No compensation will be permitted for loading, hauling, and disposing of rejected material.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01025

SECTION 01052

LAYOUT OF WORK AND SURVEYS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: General requirements for survey work to be performed by the CONTRACTOR for layout of work features, for performance of work, and for field measurements of work quantities for payment purposes.

B. Before commencing any surveys, the CONTRACTOR shall notify the ENGINEER at least 2 days written notice so that the ENGINEER may witness such Work.

1.2 DESCRIPTION

A. Reference Points: The reference points to be provided by the ENGINEER will include referenced monuments and elevation bench marks on the property. If displaced by the CONTRACTOR or the CONTRACTOR's agents, replacement of these reference points will be at the expense of the CONTRACTOR. All other necessary reference points shall be established by the CONTRACTOR.

B. The CONTRACTOR shall furnish all necessary detail survey including all lines, grades, and appropriate surveys as specified.

C. The ENGINEER reserves the right to perform any desired checking and correction of the CONTRACTOR's surveys but this shall not relieve the CONTRACTOR of the responsibility for adequate performance of the Work.

D. Equipment and Personnel: The CONTRACTOR's instruments and other survey equipment shall be accurate, suitable for the surveys required in accordance with recognized professional standards, and in proper condition and adjustment at all times. Initial layout and record surveys shall be performed under the direct supervision of a licensed surveyor.

E. Field Notes and Records: The CONTRACTOR shall record surveys in field notebooks. A duplicate of each field notebook shall be furnished to the ENGINEER when filled or completed.

F. Use by the ENGINEER: The ENGINEER may at any time use line and grade points and markers established by the CONTRACTOR. The CONTRACTOR's surveys are a part of the Work and may be checked by the ENGINEER or representatives of the DEP at any time. The CONTRACTOR shall be responsible for (1) any lines, grades, or measurements which do not comply with specified or proper tolerances, or which are otherwise defective, and (2) for any resultant defects in the Work. The CONTRACTOR will be required to conduct resurveys or check surveys to correct errors indicated by review of the field notebooks or otherwise detected.

1.3 SURVEYS FOR LAYOUT AND PERFORMANCE OF WORK

A. The CONTRACTOR shall perform all surveys for layout and performance of the Work, make necessary calculations, and prepare drawings necessary to carry out such work.

B. Record Documentation Survey to include:

1. Location and area of excavation.
2. Location and elevations of ground surface at installed wells.
3. Location of replacement fence.
4. Limits of any disturbed areas caused by access.
5. Elevations of well head, well bottom, and geomembrane boot.

1.4 SURVEYS FOR MEASUREMENT FOR PAYMENT

A. When the Specifications require quantities of work to be measured by surveying methods, the CONTRACTOR will coordinate with the site surveyor to perform the surveys. The ENGINEER or DEP may independently perform the surveys. In the case of discrepancy, the ENGINEER or DEP measurement shall be used.

1.5 SURVEYING ACCURACY AND TOLERANCES IN SETTING OF SURVEY STAKES

A. Control traverse field surveys and computations shall be performed to an accuracy of at least 1:25,000.

B. The tolerances generally applicable in setting survey stakes shall be as set forth below. Such tolerances shall not supersede stricter tolerances required by the Contract Drawings and Technical Specifications, and shall not otherwise relieve the CONTRACTOR of responsibility for measurements in compliance therewith.

Type of Line or Mark	Horizontal Position	Elevation
Permanent reference points	in 10,000	± 0.01-feet
General excavation and earthwork	in 2,000	± 0.03-feet

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01052

SECTION 01190

HEALTH AND SAFETY

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. General requirements for the protection of Health and Safety of personnel involved in the project,
2. General requirements for furnishing services of a Site Safety Officer
3. General requirements for preparation of a Community Air Monitoring Program, and
4. Preparation of Safety Program

B. The provisions of this Section are supplementary to other provisions specified elsewhere in the Contract Documents.

C. The CONTRACTOR shall be familiar with the Safety Guidelines as prepared by the Solid Waste Association of North America (SWANA) National Landfill Gas Committee. Copies may be obtained by writing to SWANA, 8750 Georgia Avenue, Suite 140, Sever Spring, Maryland 20910, telephone number (301) 585-2898,

D. Nothing in this Section shall preclude the CONTRACTOR from complying with the more stringent requirements of the applicable Federal, State, County, DEP and Industry Standards, rules and regulations.

1.2 HAZARDOUS SITE CONDITIONS

A. The CONTRACTOR is advised that this project is being performed within, over and adjacent to buried wastes and refuse. As these buried materials decompose, they may generate landfill gas (LFG), which normally consists of methane (CH_4), carbon dioxide (CO_2), and occasionally hydrogen sulfide (H_2S) and other gases, depending on the composition of the buried materials. Additionally, the CONTRACTOR is advised that this project is being performed at a New York State Superfund Site, and is identified as a Class 2 Inactive Hazardous Waste Disposal Site by the NYSDEC.

1.3 POTENTIAL FOR HAZARDS

A. The following landfill and landfill gas related information is included to assist the CONTRACTOR in developing his Safety Program and is not intended to encompass all steps that may be necessary to protect the CONTRACTOR's workers and comply with applicable regulations. Prior to initiation of any field work, a copy of the CONTRACTOR's Safety Program shall be submitted to the DEP and to the ENGINEER for their information.

1. Landfill gases cannot vent to the atmosphere through the PBL cover system due to the existence of the geomembrane cap. The passive vent monitoring data indicates that methane is present within the gas collection layer directly below the geomembrane component of the cover system.
2. Landfill gases have the potential to create hazardous conditions if not controlled or recognized. Some of the hazards are:

a. Fires may start spontaneously from exposed and/or decomposing refuse.

b. Fires and explosions may occur from the presence of methane gas.

c. Landfill gases may cause an oxygen deficiency in underground trenches, vaults, conduits, and structures.

d. Hydrogen sulfide, a highly toxic and flammable gas, or other toxic gas may be present.

e. Possible caving of trenches and excavations when working over or in refuse fills.

B. Shoring or protection of excavations may be required. CONTRACTOR is responsible for all excavation protection at no cost to the DEP.

1.4 SITE SAFETY OFFICER

A. The CONTRACTOR shall be responsible for the health and safety of his worker and subcontractors. The Contractor shall provide a person who will be designated as the Site Safety Officer. The Site Safety Officer shall be thoroughly trained in rescue procedures, and in the use of safety equipment and gas monitoring/detection equipment. The Site Safety Officer shall be present at all times during working hours whenever open trenches or excavations are greater than 2-feet in depth, when refuse is exposed or when landfill gas is likely to be present (e.g., during drilling operations). The jobsite superintendent may not be assigned as the Site Safety Officer and during work requiring the Site Safety Officer; the designated person shall be dedicated to the assignment.

B. The CONTRACTOR shall submit the qualifications of the proposed Site Safety Officer subject to approval by the ENGINEER.

C. The Site Safety Officer shall have appropriate instruments (detector[s]) to test for oxygen deficiency and for the presence of methane gas and hydrogen sulfide gas. The Site Safety Officer shall calibrate the Instruments as required by the manufacture and regularly monitor the excavation areas and other work spaces for safe working conditions and ensure that appropriate safety equipment is available at the Site.

D. The Site Safety Officer shall have the delegated authority to order workers on the project Site to comply with the Site safety requirements and stop all work. Failure to observe the Site Safety Officers order shall be cause for removal of the worker from the project

E. The Site Safety Officer will evacuate or not permit any workers to enter any excavated area where there is less than 19.5-percent oxygen, greater than 1.5-percent of methane, or greater than 10-parts per million by volume (ppmv) of hydrogen sulfide. The Contractors HASP plan can provide stricter limits.

1.5 SAFETY PROGRAM SUBMITTAL

A. Supplemental to the CONTRACTOR regular safety program, the CONTRACTOR shall develop appropriate additions to address the impact of landfill gas in the work area and institute procedures to Inform all workers, ground water treatment personnel and Site visitors of the potential for the presence of methane and other landfill gases emanating from the natural decomposition of refuse buried at or near the job site and the importance of safety precautions to ensure the safety of workers and the public. The CONTRACTOR shall also instruct all workers and maintain strict control of construction activities to protect and maintain the integrity of the work features as they are installed.

B. CONTRACTOR shall submit its safety program, to the ENGINEER prior to work at the Project Site.

C. The CONTRACTOR shall submit a site-specific HASP in accordance with OSHA requirements found at 29 CFR 1910.120 to Engineer 7 days before site mobilization. The CONTRACTOR may not mobilize until the ENGINEER and DEP approves the submittal.

1.6 SAFETY PRECAUTIONS

A. In addition to conforming to the safety rules and regulations of governmental authorities having jurisdiction, the CONTRACTOR shall take the following precautionary measures:

1. During construction, the workspace should be monitored for concentrations of oxygen, methane and hydrogen sulfide. Workers shall not be permitted to enter a workspace where there is an oxygen deficiency or a combustible mixture of gases without appropriate protection. Positive fan-forced ventilation to dilute gas mixtures and avoid oxygen deficiency should be provided when work is necessary in any workspace.

2. Smoking shall be prohibited in or near open excavations and workspaces, exposed refuse, and in the vicinity of well installation activities. The cap vegetation is not mowed and presents a potential fire hazard. Smoking is prohibited on the landfill cap. Smoking will be permitted only in those areas designated by the Site Safety Officer.

3. In the event toxic gases are present at concentrations hazardous to the workers and other site personnel, the CONTRACTOR shall immediately evacuate all persons from the area until the area is determined safe by the Site Safety Officer.

4. Soil shall be stockpiled adjacent to work space in areas of exposed refuse for firefighting purposes.

5. The use of explosives or firearms shall not be permitted on the Site.

6. Refuse generated from PBL landfill waste may be encountered during gas well drilling. Such refuse shall not be accumulated in the construction area for a period extending beyond the day on which it was generated.

7. Temporary staging of the daily accumulation shall be maintained completely upon barrier material such as poly sheeting and shall be covered with poly sheeting as needed to control odors. If odors cannot be controlled by covering the refuse with poly sheeting, CONTRACTOR shall implement other measures as needed, subject to approval by the ENGINEER. The refuse from well drilling shall be placed by CONTRACTOR in roll-off containers in the lay down area (on property but not on landfill cap) and covered by the CONTRACTOR with roll-off trap before the end of Work each day.

8. No welding shall be permitted in excavation areas, enclosed areas, or over refuse unless performed in areas of the Site tested and approved by the Site Safety Officer.

9. Combustion engine powered construction equipment used in excavating activities and/or drilling operations shall be equipped with vertical exhaust and spark arrestors.

10. Electric motors and controls utilized in excavation areas shall be explosion-proof.

11. As construction progresses, all pipe openings and valves shall be closed as soon as installed to prevent the migration of gases through the pipeline systems.

1.7 Community Air Monitoring Program (CAMP)

A. In accordance with NYSDEC DER-10 guidance, prior to initiation of any intrusive work, the CONTRACTOR will develop and implement a CAMP. Prior to use, the draft CAMP must be provided to the DEP and ENGINEER for review.

END OF SECTION 01190

SECTION 01300

SUBMITTALS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: General requirements for preparation and submission of the following submittals required for the completion of the Work of the Contract.

1. Submittals Requiring Approval:

a. Schedule of Submittals
b. Manufacturer's Instructions
c. Certificates of Compliance
d. Schedule and Reports
e. Project Construction Schedule
f. Equipment List and Labor Rates
g. Safety Program

2. Submittals Not Requiring Approval;

a. Weekly Status Report

B. All submittals shall be in English.

C. The CONTRACTOR shall submit all submittals to the ENGINEER.

D. The CONTRACTOR shall submit the number of copies of each submittal that the CONTRACTOR requires to be returned, plus three (3) copies that will be retained by the ENGINEER.

E. The ENGINEER will clearly label the submittals as follows and return to the CONTRACTOR:

1. Approved
2. Approved as Noted
3. Revise and Resubmit
4. Rejected
5. Information Only

F. When submittals are returned marked with “Revise and Resubmit” or "Rejected"; the CONTRACTOR shall make such revisions and corrections as required and resubmit the submittal with the same submittal number followed by Rev-01, for example: S-1 Rev-01.

1.3 SUBMITTALS REQUIRING APPROVAL

A. Schedule of Submittals:

1. The CONTRACTOR shall prepare and submit a Technical Submittals Schedule (i.e. submittal log) listing all technical submittals required by these technical specifications. The Contractor will submit the completed log to the ENGINEER10 days after the project award.

2. The Technical Submittals Schedule shall designate submittals by major specification section. This Schedule shall include submittal delivery dates, required return dates, material delivery dates, and other pertinent data required to ensure that the CONTRACTOR meets the project schedule.

B. Manufacturer's Instructions: When required by the manufacturer's warranty requirements, the CONTRACTOR shall submit manufacturer's printed instructions for delivery, storage, shelf life, assembly, installation, adjusting, and finishing.

C. Certificates of Compliance:

1. The CONTRACTOR shall submit certificates of compliance for certain materials and products in lieu of the specified sampling and testing procedures as specified in each Technical Specification section. Submit certificates required for demonstrating proof of compliance of materials with specification requirements in duplicate with each lot of materials delivered to the Work. The lot so certified shall be clearly identified by the certificate. Certificates shall be signed by an authorized representative of the producer or manufacturer and shall state that the material complies in all respects with the requirements of the Contract Documents. In the case of multiple shipments, each shipment shall be accompanied by a certificate of compliance.

2. The certificate of compliance shall be accompanied by a certified copy of test results or shall state that such test results are on file with the producer or manufacturer and shall be furnished to the ENGINEER on request. The certificate shall give the information specified for samples in Paragraph C above, the name and address of the organization performing the tests, the date of the tests, and the quantity of material shipped.

3. Materials used on the basis of a certificate of compliance may be sampled and tested at any time. The fact that material is used on the basis of a certificate of compliance shall not relieve the CONTRACTOR of responsibility for incorporating material in the Work that conforms to the requirements of the contract and any such material not conforming to such requirements will be subject to rejection, whether in place or not.

4. The ENGINEER reserves the right to refuse to permit the use of certain materials on the basis of a certificate of compliance.

D. Schedules and Reports:

1. The CONTRACTOR shall prepare and submit Schedules and Reports in accordance with the requirements of this Section.

2. The schedules and reports shall describe the CONTRACTOR's work plan in sufficient

detail as delineated below to provide:

a. Assurance to the ENGINEER that the finished work complies accurately with the
Contract Documents,

b. A basis for determination the progress of the work, and

c. A basis for the internal planning activities.

3. Within ten (10) calendar days after Notice to Proceed, the CONTRACTOR shall provide the ENGINEER with initial copies of the Submittals specified in this Section.

4. Unless otherwise specified, the schedule shall be presented in graphic format and transmitted to the ENGINEER.

5. The CONTRACTOR shall obtain approval of the various schedules specified in this Section before submitting the first application for payment. Schedule revisions also require ENGINEER approval.

6. A completion report and a survey report should be submitted within 2 weeks of the completion of the project.

E. Project Construction Schedule:

1. Scheduling: A preliminary issue of the Project Construction Schedule shall be prepared by the CONTRACTOR and submitted with the bid. Two (2) days after receipt of Notice to Proceed, the CONTRACTOR shall submit the Project Construction Schedule for approval and issue the approved Project Construction Schedule ten days after receipt of approval and comments from the ENGINEER.

2. Format: The Project Construction Schedule shall consist of the following items, each compatible with the other and developed from the same basis:

3. Critical Milestone Dates as listed below.

a. Start/complete mobilization.

b. Start/complete installation of the landfill gas wells.

c. Start/complete excavating, backfilling, and compacting.
d. Start/complete final inspection.
e. Start/complete demobilization.

F. Equipment List and Labor Rates:

1. The CONTRACTOR shall submit Equipment List and Labor Rates Schedule for use in conjunction with any Force Account Work done on a time *and* material basis, to determine compensation to the CONTRACTOR.
2. The schedule shall include all equipment and personnel that the CONTRACTOR expects to use on this project. It shall also include any other equipment and personnel that the CONTRACTOR has available that may be used on the Project.
3. The rate shall include all costs and constitute full payment to the CONTRACTOR for use of operated equipment and personnel. This list shall be submitted with the bid.

G. Safety Program:

1. The CONTRACTOR for presentation and discussion at the pre-construction meeting shall prepare a preliminary Safety Program. The CONTRACTOR's Site Safety Officer shall be named and be present at the pre-construction meeting. Although the Safety Program will not be formally approved, the OWNER or ENGINEER may review and comment of its adequacy.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01300

SECTION 01505

MOBILIZATION & DEMOBILIZATION

PART I GENERAL

1.1 SECTION INCLUDES

A. Mobilization consists of preparatory work and operations, including but not limited to, those necessary for the movement of personnel, project health and safety, project security including adequate personnel, equipment, supplies, and incidentals to the project site; for the establishment of offices, buildings, and other facilities necessary for work on the project; for premiums on bond and insurance for the project and for other work and operations the CONTRACTOR must perform or costs the CONTRACTOR must incur before beginning work on the project, which are not covered in other bid items.

B. Demobilization consists of work and operations included but not limited to, those necessary for movement of personnel, equipment, supplies, incidentals, and offices off site.

PART 2 PRODUCTS

(Not Used)

PART 3 EXECUTION

(Not Used)

END OF SECTION 01505

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INDEX OF TECHNICAL SPECIFICATIONS

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02200
EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, labor, tools, equipment and transportation necessary for all construction as it pertains to the excavating, stockpiling, backfilling, compacting, grading, preparation of a working platform for the installation of LFG extraction wells, and access road completion associated with the LFG extraction well replacement work.

B. The CONTRACTOR is responsible for returning the site to the pre-existing condition following completion of work and meeting the requirements in the drawings and specifications.

C. The Work shall include, but not be limited to, the following activities:

1. Excavating and backfilling of trenches or small excavation;
2. Foundation (for re-installation or replacement of fencing associated with the Landfill Gas Replacement Extraction Wells) preparation and site grading;
3. Stockpiling soils;
4. Furnishing or re-use, preparing, hauling, testing, placing and compacting structural fill;
5. Furnishing or re-use, preparing, hauling, testing, placing and compacting protective cover;
6. Furnishing or re-use, preparing, hauling, testing, and placing topsoil; and,
7. Preparing earthwork for the installation of all structures and systems.

D. No soils shall be removed from the site unless otherwise instructed or approved by the ENGINEER. Every effort shall be made to re-use cover materials removed/excavated from above the geomembrane composite liner. Additionally, every effort should be made to return/bury underneath the geomembrane composite liner, any materials that were removed/excavated from below the geomembrane composite liner.

E. All soil types shall consist of material approved by the ENGINEER from off-site sources which have previously been accepted, and/or approved materials removed from stripping or excavation. Further, in accordance with the PBL Site Management Plan, any materials import on-site must meet the Restricted-Residential Use Soil Clean-Up Objectives. During construction, the construction area shall be well

drained. No materials shall be backfilled when either the material or the surfaces on which it is to be placed is frozen, excessively wet or soft. When the Work is interrupted by heavy precipitation or freezing temperatures, fill operations shall not be resumed until the ENGINEER determines that the moisture content, density and integrity of the previously-placed soils are as specified.

1.02 DEFINITIONS

A. "Protective cover" includes those soils utilized above geosynthetics or other soil layers to protect the underlying components.

B. "Topsoil" includes soils that shall be utilized at the fill surface to support vegetative growth.

1.03 RELATED WORK

A.	Section 01010	SUMMARY OF WORK
B.	Section 01025	MEASUREMENT AND PAYMENT
C.	Section 01190	HEALTH AND SAFETY
D.	Section 02711	GEOTEXTILE
E.	Section 02712	GEOCOMPOSITE
F.	Section 02713	SYNTHETIC MEMBRANE
G.	Section 02670	LFG EXTRACTION WELLS AND WELLHEADS

1.04 REFERENCES

A.	ASTM D-422	Particle-Size Analysis of Soils
B.	ASTM D-698	Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft.-lb./ft^3)
C.	ASTM D-1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
D.	ASTM D-1557	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 Pound Rammer and 18-Inch Drop.

E.	ASTM D-2216	Standard Method for Laboratory Determination of Water Content of Soil, Rock, and Soil-Aggregate Mixtures
F.	ASTM D-2487	Classification of Soils for Engineering Purposes
G.	ASTM D-2922	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
H.	ASTM D-3017	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
I.	ASTM D-4318	Liquid Limit, Plastic Limit, and Plasticity Index of Soils

1.05 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subjected to strict quality control monitoring as detailed herein. The placed fill soils shall conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate the Construction Quality Assurance (CQA) activities and account for these activities in the installation schedule.

1.06 SUBMITTALS

A. The CONTRACTOR shall submit to the ENGINEER for review the proposed methods of construction, including excavation, filling, compaction, and backfilling for the various portions of the Work. Review shall be for method only. The CONTRACTOR shall remain responsible for the adequacy and safety of the methods.

B. The CONTRACTOR shall submit to the ENGINEER a Stockpiling Plan prior to commencement of earthwork activities. The plan shall indicate the location and contents of each stockpile.

C. The CONTRACTOR shall submit a 50-pound sample from each of the off-site borrow pits proposed to furnish the required quantity of general fill materials. The samples shall be submitted to the ENGINEER no less than two weeks prior to the

anticipated placement of any general fill materials. Samples are not required if the existing topsoil and protective cover soil are used as backfill.

D. The CONTRACTOR shall submit the results of the ASTM tests listed below for each borrow pit location and designated soil classification to verify that the soil materials meet the technical requirements of Section 02200. Test results are not required if the existing topsoil and protective cover soil are used as backfill.:

PARAMETER	ASTM TEST METHOD	FREQUENCY FOR CQC TESTING	FILL CLASSIFICATION
Moisture Content	D-2216	One per Source	Protective Cover, Topsoil
Soil Classification	D-2487	One per Source	Protective Cover, Topsoil
Particle-Size Analysis	D-422	One per Source	Protective Cover, Topsoil
Modified Proctor	D-1557	One per Source	Protective Cover
Atterberg Limits	D-4318	One per Source	Protective Cover, Topsoil
pH	D-4972	One per Source	Topsoil
Organic Content	D-2974	One per Source	Topsoil

1.07 SOIL TESTING

A. Prior to the general placement of the fill, and during such placement, the ENGINEER shall select areas within the limits of the fill for testing the degree of compaction obtained. The CONTRACTOR shall be responsible for the cost of all quality control testing. The CONTRACTOR shall cooperate fully to allow the ENGINEER to perform supplemental quality assurance testing.

B. Payment for any supplemental in-place quality assurance testing verification will be made by the ENGINEER. If test results are unsatisfactory, all costs involved in correcting deficiencies in compacted materials to the satisfaction of the ENGINEER and any additional costs for retesting will be borne by the CONTRACTOR.

C. The testing frequency required in Paragraph 1.06 of this Section may be increased at the discretion of the ENGINEER when visual observation or construction performance indicates a potential problem.

PART 2 - MATERIALS

2.1 PROTECTIVE COVER

Common borrow shall be used as the protective cover layer. It shall be free from organic materials, loam, wood, trash, and other objectionable materials which may be compressible or which cannot be properly compacted. Protective cover shall have a maximum plasticity index of 40 and shall be classified according to the Unified Soil Classification System (USCS) as SP-SM, SM, SC, or ML. Protective cover shall not contain material larger than one (1) inch in the first 12-inch thick lift immediately above any geosynthetic material. The protective cover shall not contain material larger than three (3) inches in any other lifts. Protective cover shall not contain sound rock, broken concrete, masonry rubble, or other similar materials. It shall have physical properties such that it can be rapidly spread and compacted during filling. Snow, ice and frozen soil shall not be permitted.

2.2 TOPSOIL

Topsoil shall consist of loose, friable, and loamy soil material (loam, sandy loam, silty loam, sandy clay loam, clay loam) and shall be free of debris, trash, stumps, rocks, roots, and weeds. Vegetative soil shall be able to support healthy vegetation and shall not contain substances which may be toxic to humans or plants. The fraction of particles passing through the 10-mesh sieve shall not contain more than 40 percent clay. No particle shall be larger than 2". Organic matter content shall be greater than 3.75 percent but less than 20 percent by weight, and pH shall be within the range 6.0 and 8.0. Lime shall be added appropriately if the pH is less than 6.0.

PART 3 - EXECUTION

3.1 GENERAL

A. If trenches, diversion ditches, or other activities require excavations, they shall be cut accurately as directed by the ENGINEER. All rock and foreign matter in the sides and bottom of excavations shall be removed. Excavations and filling shall

conform to the slope, grade, and shape of the section shown. Care shall be taken not to excavate below the grades indicated. Excessive excavation shall be backfilled to grade with suitable, thoroughly compacted fill material as directed by the ENGINEER with no additional cost to the OWNER. Any required shoring activities shall be conducted in accordance with local, state and federal codes, and is approved by the ENGINEER. All trenches, ditches, and structures excavated under this Section shall be maintained until final acceptance of the Work.

B. If the moisture content of the fill material is outside the acceptable range, the soil shall be wetted or dried, as appropriate.

C. Any delays in progress due to wetting or drying of soil are the responsibility of the CONTRACTOR.

D. Soils placed in fill areas shall be graded to smooth true lines, strictly conforming to the grades indicated on the Drawings, or as otherwise approved by the ENGINEER.

E. The CONTRACTOR shall subcontract a Professional Land Surveyor registered in the City of New York to certify that all soil material has been placed to the lines, grades, and elevations presented on the Drawings. The CONTRACTOR may use in-house personnel for the certification, provided the certification is performed by a surveyor registered in the City of New York.

F. Fill materials shall be placed in such a manner as to facilitate drainage at all times. Ponding of surface-water run-off shall not be permitted.

G. If compaction or other tests indicate that any portion of the Work does not meet the specified requirements, then the CONTRACTOR shall remove that section, replace and re-compact at no additional cost to the DEP. Determinations of the extent of removal and the acceptability of the in-place fill materials shall be made by the ENGINEER.

H. If significant precipitation causes wet conditions, placement and compaction activities shall be terminated until the conditions have dried sufficiently to continue according to the ENGINEER.

I. Equipment or vehicles shall not be allowed to travel in a single track or form ruts. Any ruts or irregularities formed shall be scarified and re-compacted by the CONTRACTOR at its expense as required and directed by the ENGINEER.

J. Inspection:

1. Prior to implementing any of the Work in this Section, the CONTRACTOR shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed Work of other Sections, the CONTRACTOR shall notify the ENGINEER in writing. Failure to notify the ENGINEER prior to conducting Work within this or other Sections shall be construed as the CONTRACTOR's acceptance of the related Work of all other Sections.

K. The CONTRACTOR shall protect on-going and completed work from precipitation, excessive heat, freezing, and other elements to avoid compromising the integrity of prior Work. Prior Work affected by such conditions shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

3.2 EXCAVATION

A. Excavation shall be made to the grade of geocomposite layer shown on the Drawings. Care shall be exercised when stripping or removing soil so as to prevent over-excavation.

B. All excavation activities shall be conducted in compliance with all applicable OSHA regulations.

3.3 BACKFILLING

A. Protective Cover

1. Protective cover soil material shall meet the requirements of Part 2.2 of this Section.

2. Protective cover soil shall be placed in 12-inch compacted lifts. The remaining compaction of the protective cover shall be accomplished by any appropriate means required to achieve the minimum in-place densities as long as it will not damage the underlying geosynthetics.

3. Protective cover soil shall be compacted to as required by the OMM&M Plan, or as otherwise approved by the ENGINEER.

B. Topsoil

1. Topsoil shall meet the requirements of Part 2.05 of this Section. Soil mixing is permitted to achieve the desired characteristics. Soil mixing shall be conducted prior to placing the material, and the mixed material shall be tested in accordance with this Section.
2. All ground areas disturbed by construction during this project and not built over, paved or otherwise surfaced shall be covered with vegetative soil.
3. Prior to placing topsoil, vegetation shall be removed from the area and the ground surface cleared of all other materials that would hinder proper grading, tillage or subsequent maintenance operations.
4. Previously-constructed grades shall be repaired, if necessary, so that the areas to be covered with vegetative soil shall conform to the section indicated on the Drawings upon completion of vegetative soil placement.
5. Subsequent to grading, the areas to be covered with topsoil shall be thoroughly scarified by approved means to a depth of at least 3 inches for bonding of vegetative soil with the subsoil. The Work shall be performed only during periods when beneficial results are likely to be obtained; i.e. when conditions are such, by reason of drought, excessive moisture, or other factors, that satisfactory results are not likely to be obtained, the Work will be stopped by the ENGINEER and shall be resumed only when directed. Undulations or irregularities in the surface that would interfere with further construction operations or maintenance shall be leveled before the next specified operation.
6. The vegetative soil layer shall be uniformly distributed on the designated areas and evenly spread to a minimum loose thickness of 6 inches. The spreading shall be performed in such manner that planting can proceed with little additional soil preparation or tillage. The surface resulting from placing topsoil shall meet the final grades as indicated on the Drawings. Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or the proposed planting.

3.4 EXCESS MATERIALS

A. No excavated materials shall be removed from the site, except as specified or approved by the ENGINEER. All general waste or debris shall be containerized on-site and periodically disposed off-site in accordance with these Specifications.

B. Suitable materials, as determined by tests discussed in these specifications, shall be classified and stockpiled in approved areas for immediate or future use.

C. Stockpiles shall be graded to drain; no surface-water ponding is permitted on stockpiles. Stockpiles may be covered with plastic sheeting or other material to preserve the soil integrity. Proper erosion controls; i.e., silt fence, shall be installed at the perimeter of the stockpile.

3.5 GRADING

A. Uneven areas and low spots which may develop in the stripping and grading operations shall be eliminated via minor excavations or placement of appropriate fill materials. Levels, profiles and contours of the site configuration shall be maintained as established on the Drawings.

B. The areas to be backfilled shall be uniformly graded to within the limits of grading under this Section. A smooth finished surface shall result within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades to the satisfaction of the ENGINEER.

C. Constructed slopes shall be blended into existing undisturbed areas gradually in order to provide neat, clean transition zones. Feathering of constructed slopes into existing grades shall be accomplished to promote natural drainage and to eliminate possible surface-water ponding.

D. The right is reserved by the ENGINEER to make minor adjustments or revisions in lines or grades if found necessary as the Work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction. Any suspected discrepancies shall be reported to the ENGINEER as soon as detected.

3.6 CRITERIA AND TOLERANCES

A. Compaction and moisture content criteria and tolerances are discussed in Part 3.3 of this Section.

B. Final grades shall be within two tenths of one (0.2) foot below to two tenths of one (0.2) foot above (-0.2 to +0.2) the grades and contours indicated on the Drawings, or as dictated by changed field conditions, and approval by the ENGINEER.

C. In recognition of the moisture-density relationship of soils, the ENGINEER may direct that the compaction and moisture content tolerances be modified if required by variability in the soils. This decision, if required, will be based on the ENGINEER's interpretation of the laboratory analyses for each soil.

D. No additional payment will be made for quantities of soils placed in excess of that amount required to achieve the minimum specified thickness.

3.7 FIELD QUALITY CONTROL

A. The CONTRACTOR shall test the in-place density and moisture content of the protective cover and structural fill in accordance with ASTM D-2922 and ASTM D-3017, respectively and these Specifications. The testing shall be conducted at a frequency of not less than five (5) tests per acre per lift. All test locations shall be surveyed, recorded, and provided on the "As-Built" drawings.

B. The CONTRACTOR shall provide access and repair any damage to subgrade caused by all performed tests, and cooperate in other ways necessary to permit the ENGINEER to conduct testing when and where he/she desires and as expeditiously as possible.

C. Fill material shall not be placed over a lift which has not been tested and approved by the ENGINEER.

END OF SECTION

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02290
EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Work covered by this Section consists of furnishing all materials, equipment, tools and labor to construct and maintain erosion and sediment control systems.

B. The Work to be performed includes, but is not limited to the installation or silt fences, straw bales, erosion mat, and seeding as specified herein and as shown on the Drawings.

C. Provide temporary controls to prevent erosion, sedimentation, and dust.

D. Provide erosion mat to protect disturbed areas from the erosive effect of rainfall and prevent sheet erosion during the establishment of grass or other vegetation, and to reduce soil moisture loss due to evaporation.

E. Maintain all controls.

1.02 RELATED WORK

B. Section 01025 MEASUREMENT AND PAYMENT

C. Section 01300 SUBMITTALS

D. Section 02200 EARTHWORK

PART 2 - PRODUCTS

2.01 EROSION AND SEDIMENT CONTROL MATERIALS

A. Silt Fence: the CONTRACTOR shall supply silt fence to control surface-water runoff and sediment. Acceptable silt fence material shall meet or exceed the criteria provided in Table 02290-1.

B. Erosion Mat: The CONTRACTOR shall place erosion mat in the locations specified on the Drawings. The erosion mat shall be used prior to the establishment of vegetation and placed in areas with potentially-high, concentrated surface-water flow as designated by the ENGINEER. The erosion mat shall be a blanket providing open space for vegetative growth and shall be of the type indicated on the Drawings or equivalent.

PART 3 - EXECUTION

3.01 TRANSPORTATION, HANDLING AND STORAGE

A. Materials shall be handled in such a manner as to prevent damage to the material. Materials shall not be dropped or dragged over the ground. Any materials damaged shall be replaced at no expense to the DEP.

3.02 EROSION AND SEDIMENT CONTROL STRUCTURES

A. Silt Fence: The CONTRACTOR shall install silt fence in accordance with the specifications and installation instructions provided by the manufacturer or as shown on the Drawings, or as directed by the ENGINEER. Presiding authority shall be as follows, in descending order: ENGINEER's direction, Drawings, Specifications, manufacturer's installation instructions. The CONTRACTOR shall maintain the silt fence until permanent vegetation is established.

B. Erosion Mat:

1. The seedbed for erosion mat placement shall be free of rocks or clods greater than 1.5 inches in diameter, contain a minimum of 6 inches of topsoil, and shall be graded to ensure uniform soil contact with the erosion mat.
2. The sod staples used to hold the erosion mat against the soil shall be 6 to 10 inches in length of No.11 gauge or heavier wire.
3. The top end of the erosion mat shall be firmly anchored in a 6-inch trench.
4. When joining two rolls together, the new roll shall be anchored in a 6-inch trench and the previous roll shall be overlapped 18 inches.
5. Adjacent erosion mat strips shall be overlapped 4 inches and stapled on 18 inch centers.
6. The outside edges of the erosion mat shall be stapled on 2 foot centers.
7. The staple pattern shall be as indicated on the Drawings.
8. The CONTRACTOR shall adhere to any other installation guidelines specified by the manufacturer or deemed appropriate by the ENGINEER.

Table 02290-1

SILT FENCE PROPERTIES[1]

PROPERTIES	QUALIFIER	SPECIFIED VALUE	TEST METHOD
Grab Tensile Strength	minimum	90 lb.	ASTM D-1682
Mullen Burst Strength	minimum	190 psi	ASTM D-3786
Flow Rate	maximum	0.3 gal/min/f^2	
Equivalent Opening Size		40-80	US Std - Sieve CW-02215
Ultraviolet Radiation Stability	minimum	90%	ASTM G-26

END OF SECTION

SECTION 02670

LANDFILL GAS EXTRACTION WELLS & WELLHEADS

PART 1 - GENERAL

1.1. DESCRIPTION

A. Scope of Work: The CONTRACTOR shall provide all equipment, materials, and labor needed to install replacement landfill gas (LFG) extraction wells and wellheads as specified herein and as indicated on the attached drawings, remove the existing fence that surrounds the extraction wells, replacement of the fence after completion of the LFG extraction wells, and repair of the cover system.

B. General work included in this Section: The drilling and installation of landfill gas vertical extraction wells and at the locations shown on the Contract Drawings. CONTRACTOR shall provide and install temporary soil benches on the landfill slopes to install vertical wells.

C. Work includes staging of well drill cuttings (mixed waste from the landfill) in a watertight container(s) provided by the CONTRACTOR. If feasible, drill cuttings generated from beneath the geomembrane composite liner should be returned to beneath the liner. If the volume drill cuttings does not permit on-site return to beneath the liner, the characterization and disposal of the drill cuttings shall be the responsibility of the CONTRACTOR. No off-site disposal is permitted without approval of the DEP, Engineer, and NYSDEC.

D. Related Sections include but are not necessarily limited to:

1. Section 01190 — Health and Safety
2. Section 01300 — Submittals

E. It is expected that combustible methane gas will be venting from boreholes drilled to install the extraction wells. The CONTRACTOR'S bid price shall include provision for all equipment and procedures necessary to safely install wells under this condition. The CONTRACTOR is responsible for all health and safety associated with their work or their subcontractor’s work and shall submit a project specific health and safety plan and a community air monitoring program for review and approval prior to commencement of work.

1.2. SUBMITTALS

A. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval catalog cuts on materials furnished, and manufacturer's brochures containing complete information and instructions pertaining to the storage, handling, installation, inspection, and quality control testing for piping, wellhead assemblies, liner repair and testing, and other appurtenances furnished.

B. The CONTRACTOR shall submit to the ENGINEER for review and approval health and safety procedures, site health and safety plan, and Community Air Monitoring Plan.

C. The CONTRACTOR shall prepare and submit to the ENGINEER for review and approval Shop Drawings showing dimensions, materials, and configuration of the wellhead assembly for monitoring probes and extraction wells unless the wellheads are supplied to the contractor by the Client

D. Submit one copy of the Vertical Extraction Well Data on a weekly basis, and upon completion of drilling.

1. Vertical Extraction Well Log: During the drilling of the well the CONTRACTOR shall complete a vertical extraction well log report that includes at a minimum, but not limited to:

    a. Loggers Name,

    b. Date Begun,

    c. Date Completed,

    d. Location,

    e. Boring identification number,

    f. Weather conditions,

    g. Equipment used,

    h. Drilling crew,

    i. Time (time to depth, down time, stand-by, etc.),

    j. Footage (Total Depth, Vertical Extraction Well Depth),

    k. General descriptions of strata, encountered,

    l. Depth and thickness of Intermediate covers/soil layers,

m. General soils descriptions, Estimates of moisture content, Notation of wet or saturated zones,

n. Air monitoring results,

o. Materials used,

p. Vertical extraction well construction (materials used, type, quantity, etc.),

q. Relevant notations and Verification of activities.

2. Vertical Extraction Well Installation Log. Upon completion of the vertical extraction wells, the CONTRACTOR shall complete a vertical extraction well installation report that includes at a minimum, but not limited to:

a. Installer's Name,

b. Dale Begun,

c. Date Completed,

d. Location,

e. Boring identification number,

f. 1. Equipment used,

g. Installation crew,

h. Time (time to depth, down time, stand-by, etc.),

i. Footage (Total Depth, Vertical Extraction Well Depth),

j. Materials used,

k. Size and depth of pipe casing,

l. Length of perforated and solid pipe casing,

m. Depth and type of gravel pack,

n. Depth and thickness of bentonite seal,

o. Depth and thickness of backfill materials(s),

p. Type and thickness of surface seal,

q. Casing elevation,

r. Relevant notations and verification of activities.

3. CONTRACTOR will provide copies of Drillers Reports, Vertical Extraction Well and Condensate Drainage Sump Logs and Vertical Extraction Well Installation Logs for review and approval by the designated representative prior to initiation of well construction.

4. CONTRACTOR shall provide copies of the Detailed Vertical Extraction Well Installation logs for review and approval by the designated representative prior to initiation of vertical extraction well construction.

1.3. SITE STANDARD DRILLING PROCEDURES

A. Mobilize to the project Site.

1. Mobilization will include Drill Rig, Excavator, Off-Road Truck and Water Truck.
2. Mobilization will also include materials needed to complete vertical extraction wells (pipe, valves, caps, and bentonite).
3. Mobilization will include stone and soil backfill for temporary soil benches, vertical extraction wells.

B. Set up and pre-construction meeting

1. Attend the Safety orientation.
2. The Drilling crews will unload trucks and set up staging area as directed by the Site Project Engineer.
3. The Drilling crews shall review all required site safety equipment requirements and calibrate and check the required equipment prior to set-up at the drill sites.
4. The Drilling supervisor and all appropriate crew members shall attend a pre-construction meeting.

C. Decontamination of Equipment

1. An on-site area will be designated by the OM&M CONTRACTOR for decontamination of the drill rig and drilling equipment.
2. The CONTRACTOR shall provide/construct a heavy-duty lined decontamination pad of sufficient size to accommodate containerization of all fluids generated during decontamination of the drilling rig, tools, and ancillary equipment.
3. Prior to the drilling of the first borehole, and after the drilling, installation of each well, the CONTRACTOR shall decontaminate all drilling bits, rods, tremie pipes, and any other tools to be used in the drilling and well installation operations.
4. The CONTRACTOR shall have a steam-cleaning unit on the work site to be used for decontamination of his equipment.

5. The volume of water generated during decontamination is expected to be minimal. There will be no disposal of water without NYCDEP approval. If a sufficient volume of water is generated that requires disposal, it is anticipated that the water will be disposed of into the site leachate collection system after NYCDEP approval.

D. Drill Rig staging and vertical extraction well site set-up.

1. The CONTRACTOR's Drilling Supervisor and the Project Representative will check the staked locations for accuracy and depth.
2. The aforementioned personnel shall sign an “approval form” agreeing on the location accuracy and proposed depth prior to initiating the drilling.
3. The Drilling crews will build bench or platform if required, move the Drill Rig and all other required equipment to the site, set up a spoils container, and stage the First aid station/Fire extinguisher/Eyewash/and any other needed supplies. A litter fence will be moved from drill site and deployed in a semicircle around the well.
4. The drilling crews will continually mist the area around the borehole or apply other odor controls approved by the ENGINEER, but keep far enough away as to not make the area around the borehole a slip hazard.

E. Drilling and Completion of Vertical Extraction Wells

1. As drilling commences the drilling crew will haul spoils and refuse in a timely manner to the staging area. Odor neutralizing product will be applied directly to the spoils, as needed to suppress any fugitive odors.
2. An LEL/02/meter will be tested, calibrated if outside of parameters (Daily — Records available for review) and utilized for continuous monitoring for safety.
3. As the drilling proceeds the drilling crews will prepare the vertical extraction well casings and bentonite for a timely completion for the vertical extraction well when the desired drilling depth is reached. While drilling the crew will also proceed to the next vertical extraction well to build appropriate working platforms if necessary.
4. While the completion crew is completing the first vertical extraction well the driller will proceed to the next well for set up and a timely initiation of drilling on the second vertical extraction well.
5. Completion crews won't move to the next well until well boots, sleeves and bentonite slurry are completed. A liner crew will install a boot as soon as possible.
6. When drilling through lined area, the drilling crew will use an excavator to expose a minimum of 6-feet by 6-feet area.
7. Any vertical extraction well that is started shall be completed the same day/shift and temporarily closed or covered connected to a vacuum source. Temporary connections are allowed overnight but a permanent connection

must be completed the next day.

8. All drilling refuse will be delivered to the staging area and covered to prevent odors and wind-blown debris by 4:00 P.M. and heavy equipment shall be shut down no later than 5:00 P.M.
9. The driller will keep a daily and well log that will be signed off on at the end of each day by the ENGINEER.
10. During all drilling and completions the drilling crews will insure the equipment and areas are kept clean/neat and orderly. Work site areas will be graded and completed in a "Better than found" condition daily.
11. Drilling and support equipment will be cleaned and decontaminated prior to demobilization from the drilling sites. Additional cleaning and decontamination and cleaning will be completed prior to leaving the property.

F. Waste Container

1. Prior to mobilization, the CONTRACTOR shall submit detailed information regarding the size, type and proposed location of the waste container for drill cuttings.
2. The container shall be approved by the manufacturer to hold municipal waste.
3. The ENGINEER shall approve the container type and location.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Backfill Materials:

1. Gravel fill shall be between 1 inch and 1.5 inches in diameter (unless otherwise noted on the drawings), and shall be composed of clean, washed, hard and durable material, free of silt, clay, dirt, vegetation and other objectionable matter. Gravel shall be non calcium carbonate material.
2. Soil backfill material shall be clean well graded granular fill free of stones larger than 1-inch, construction debris, refuse, muck, soft clay, loam, sponge material, vegetation/organic matter, or angular rock.
3. "Bentonite Seal" as shown on the Drawing 2, shall refer to a well seal comprised of hydrated sodium bentonite pellets or chips of a thickness indicated on the drawing. Bentonite material shall consist of clay greater than 85% sodium montmorillonite, without additives.

B. Perforated High Density Polyethylene Pipe (HDPE): The piping shall be as SDR-17 HDPE (PE 3408); 8 inch diameter. The slots in extraction well piping shall be as shown on the drawings and may be field- fabricated or supplied by the factory.

C. Solid High Density Polyethylene Pipe (HDPE) Rigid Pipe for Riser.

D. Wellhead Assembly for extraction wells shall be a pre-fabricated unit consisting of a 3-inch gate valve, 3-inch union disconnect, an impact pitot tube suitable for flow measurements, adapter bushing or other approved reducer fitting, temperature gauge, impact and static pressure ports, and dust caps. Wellhead assembly shall be manufactured by CES-Landtec, or approved equal.

PART 3 - **EXECUTION**

3.1 **DRILLING**

A. The CONTRACTOR shall coordinate the start of drilling with the ENGINEER.

B. The CONTRACTOR shall provide a thoroughly experienced, competent driller during all drilling operations. The driller shall be licensed in New York.

C. The CONTRACTOR shall survey and stake the well locations prior to drilling. Well locations will be approved and may be adjusted by the ENGINEER or the OWNER prior to beginning drilling.

D. The CONTRACTOR must use dry drilling equipment. Wet rotary drilling equipment may not be used.

E. Wells are to be drilled to the depth and diameter as shown on Drawing 2. The boring depths shown on Drawing 2 are estimated and may be adjusted in the field by the ENGINEER.

1. Wet Borings on landfill:

    a. If water is encountered in a boring, the CONTRACTOR may be directed to drill beyond the point at which it was encountered. If wet conditions remain, the boring may be terminated and the length of perforated pipe adjusted by the ENGINEER. If wet conditions cease (e.g., due to a perched water layer), then drilling will continue to the design depth.

    b. If water is encountered in a boring at a shallow depth, the ENGINEER may decrease the well depth and length of perforated pipe, or relocate the well.

2. Abandoned Borings: If, in the opinion of the ENGINEER, the borehole has not reached a sufficient depth to function as an effective extraction well, the CONTRACTOR shall abandon this borehole by backfilling it with cuttings removed during drilling. If cuttings are unsuitable as backfill (for example, box springs, tires, etc.) the CONTRACTOR shall use soil backfill material. A 2-foot thick bentonite plug will be placed in the borehole when the depth is 4 feet below the existing liner. The remaining

2 feet of the borehole will then be filled with soil material and compacted to approximately match the elevation of the existing grade. Compensation for abandoned borings shall be at 1/3 the unit price for this pay item.

3. If the ENGINEER adds or deletes a well, or adjusts the depth of a well, either less than or greater than the depth shown on the well schedule, the CONTRACTOR will be compensated or will credit the OWNER per foot of variance according to the unit price for this pay item.

4. The bore for the well shall be straight and the well pipe shall be installed in the center of the borehole. The CONTRACTOR shall take all necessary precautions to maintain the well pipe vertically plumbed during the backfill operation of the bored hole to the satisfaction of the ENGINEER. If the pipe installed is out of plumb, as determined by the ENGINEER, the CONTRACTOR, at his own expense, shall correct the alignment.

F. The CONTRACTOR shall keep detailed well logs for all wells drilled, including total depth of well, the static water level, the depth, thickness, and description of soil or waste strata, the occurrence of any water bearing zones. The logs shall also include detailed well construction diagrams for all wells installed. These diagrams shall include dimensions that indicate total well depth, length of slotted pipe, length of solid pipe, length of stick-up to the top of the wellhead, thickness of stone, thickness of bentonite plug, and thicknesses of soil material. Well logs shall be submitted to the ENGINEER.

3.2 **JOINING OF PIPES**

A. Pipes shall be joined by welding/fusion or as approved by the Engineer.

3.3 **BACKFILLING**

A. Backfilling of the well shall commence immediately after well drilling is completed and the well piping has been installed. Backfill materials shall be placed carefully within the wells to the dimensions shown on Drawing 2 and as approved by the ENGINEER. The ENGINEER, on the basis of a visual examination, may reject gravel and soil backfill containing foreign material. Both well piping and backfill shall be installed with a safety grate installed over the boring as approved by the ENGINEER.

B. The bentonite seal shall be backfilled in 6-inch lifts. Prior to placing each lift, the CONTRACTOR shall soak the in-place bentonite in accordance with manufacturer recommendations.

C. Soil backfill shall be rodded in the boring to provide even distribution and compaction.

D. The ENGINEER shall inspect the extraction well borings 4 to 8 weeks after completion of the final well. Excessive settlement (6" or more below surrounding grade) in the boring shall be repaired by the CONTRACTOR by adding compacted fill around the well casing at no additional cost to the OWNER.

3.4 **TEMPORARY CAP**

A. The CONTRACTOR shall temporarily cap the riser pipe of the vertical extraction well to prevent direct venting of LFG through the riser pipe. The temporary cap shall be removed during the installation of the wellheads.

3.5 **WASTE DISPOSAL**

A. All drill cuttings requiring off-site disposal will be treated as contaminated and regulated material and will be disposed of in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e. clean soil removed from the area above the cap), a formal request with an associated plan will be made to NYSDEC's Project Manager. Unregulated off-Site management of materials from this Site is prohibited without formal NYSDEC approval.

B. Material that does not meet Track 1 unrestricted SCOs (see 6 NYCRR Part 375) is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

C. The following documentation will be provided by the CONTRACTOR for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the CONTRACTOR to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation site in New York State. The letter will provide the project identity and the name and phone number of the CONTRACTOR. The letter will include as an attachment a letter from all receiving facilities stating it is in receipt of the correspondence (above) and is approved to accept the material.

D. Non-hazardous contaminated soils (if any) taken off-Site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2.

E. Contaminated soils (if any) from the Site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

F. Soils that are contaminated but non-hazardous (if any) and are being removed from the Site are considered by the Division of Solid & Hazardous Materials (DSHM) in NYSDEC to be Construction and Demolition (C/D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C/D processing facility without

permit modifications only upon prior notification of NYSDEC Region 2 DSHM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DSHM, special procedures will include, at a minimum, a letter to the C/D facility that provides a detailed explanation that the material is derived from a DER remediation Site, that the soil material is contaminated and that it must not be redirected to on-Site or off-Site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported.

G. Documentation associated with disposal of all material must include records and approvals for receipt of the material. Bill of Lading system or equivalent will be used for off-Site movement of non-hazardous wastes and contaminated soils.

H. Hazardous wastes derived from on-Site will be handled and disposed on-Site (i.e., beneath the Landfill Cover System), whenever possible. If it is impossible to dispose of the hazardous waste on-Site, then the waste will be stored, transported, and disposed of in full compliance with applicable local, State, and Federal regulations.

I. Appropriately licensed haulers will be used for material removed from this Site and will be in full compliance with all applicable local, State and Federal regulations.

J. Waste characterization will be performed for off-Site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported by the CONTRACTOR. All data available for soil/material to be disposed of at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

K. The CONTRACTOR shall not dispose of construction waste, including well cuttings, unless approved by the ENGINEER and the DEP. The CONTRACTOR shall remove spoils daily and shall be responsible for controlling odors from the spoils.

3.6 **WELLHEAD INSTALLATION**

A. Wellhead assembly shall be installed on the vertical well in accordance with the manufacturer's recommendations. Care shall be taken not to damage the impact pitot tube during installation. If a pitot tube is damaged during installation, CONTRACTOR shall replace it at no cost to the OWNER.

B. The wellhead shall be connected to the lateral via flexible hose, as shown on the PLANS.

END OF SECTION

02711
GEOTEXTILE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the manufacture, storage, delivery, installation, and testing of the geotextile portions of this project, including installation as herein specified and as shown on the Drawings.

B. The CONTRACTOR shall perform the replacement of the geotextiles removed during well drilling in the excavated area in conjunction with all necessary construction geocomposites, protective cover soil, and other components of the liner system.

1.02 RELATED WORK

A.	Section 01025	MEASUREMENT AND PAYMENT
B.	Section 01300	SUBMITTALS
C.	Section 02200	EARTHWORK
D.	Section 02712	GEOCOMPOSITES

1.03 REFERENCES

A.	ASTM D-5261	Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
B.	ASTM D-3776	Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
C.	ASTM D-4491	Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
D.	ASTM D-4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
E.	ASTM D-4632	Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).

F. ASTM D-4751 Standard Test Method for Determining Apparent Opening Size of a Geotextile.

G. ASTM D-4833 Standard Test Method for Index Puncture Resistance of Geotextiles and Geomembranes

1.04 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subjected to strict quality control monitoring as detailed herein. The installed geotextiles shall conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate the CQA activities and account for these activities in the installation schedule.

1.05 SUBMITTALS

A. Prior to shipment of any geotextile materials, the CONTRACTOR shall submit the following information on the geotextile production to the ENGINEER:

1. Roll numbers and identification numbers.

2. Quality control certificates that provide reference to the roll numbers and identification numbers, sampling procedures, test methods and test results and other items such as:

   a. Name of Manufacturer
   b. Chemical Composition
   c. Product Identification
   d. Statement of Compliance
   e. Signature of Authorization

   All certificates shall be signed by a representative of the manufacturer.

3. Geotextile quality control tests include:

Test	**Procedure**
Flow Rate	ASTM D-4491

Permittivity	ASTM D-4491
Fabric Weight	ASTM D-5261 or D-3776
Trapezoidal Tear Strength	ASTM D-4533
Grab Elongation	ASTM D-4632
Apparent Opening Size	ASTM D-4751
Puncture Strength	ASTM D-4833

4. Unless otherwise specified, the quality control tests shall be conducted at the frequency of one per lot. One lot is defined as a group of consecutively numbered rolls or panels from the same manufacturing line.

5. The geotextile manufacturer shall replace any rolls that are rejected because they do not comply with these specifications.

6. If a sample fails to meet the quality control requirements, the manufacturer shall test each roll manufactured from the same resin batch or at the same time as the failing roll. Testing shall be at the manufacturer's expense and shall continue until a pattern of acceptable test results is established.

C. Upon delivery to the site, the CONTRACTOR and the ENGINEER shall inspect the physical condition of each roll of material. If the protective wrapping is damaged, or if damage to the roll is suspected by the ENGINEER, the roll shall be separated from the lot for more detailed inspections.

PART 2 - PRODUCTS

2.01 GEOTEXTILE MATERIAL

A. General Requirements

1. Unless otherwise noted on the Drawings, geotextiles suppliers shall furnish materials whose "Minimum Average Roll Values", as defined by the Federal Highway Administration (FHWA), meet or exceed the criteria specified in Table 02711-1. The geotextiles provided by the supplier shall meet or exceed the property value specified and shall be stock products; i.e., unless authorized, the supplier shall not furnish products specially manufactured to meet the specifications of this project.

2. The supplier shall furnish test results for the design criteria, as well as written certification that the materials meet the specifications in accordance with Section 01300 - SUBMITTALS.

3. The geotextile material shall also perform the following:

   a. Retain its structure during handling, placement and long-term service;

   b. The material shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration; and,

   c. The material shall be chemically compatible with leachate from a typical solid waste landfill facility.

B. Labeling

1. The geotextile shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

2. The geotextile and rolls shall be marked or tagged with the following information:

   a. Manufacturer's name;

   b. Product identification;

   c. Lot number;

   d. Roll number; and,

   e. Roll dimensions.

3. Additionally, if any special placement is required, it shall be so marked on the geocomposite material; e.g., "This Side Up", or "This Side Against Soil to be Retained".

2.02 TRANSPORTATION, HANDLING, AND STORAGE

A. Transportation of the CONTRACTOR-supplied geotextile materials is the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damages to the materials incurred prior to and during transportation to the site.

B. Handling, storage, and care of the CONTRACTOR-supplied geotextile materials prior to and following installation at the site is the responsibility of the

CONTRACTOR. The OWNER shall provide adequate storage space at the site. The CONTRACTOR shall be liable for all damage to the materials incurred during transportation, storage and installation, and prior to final acceptance of the liner system by the OWNER.

C. During shipment and storage, geotextiles shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, punctures, cutting or any other damaging or deleterious conditions. Any additional storage procedures required by the geotextile manufacturer shall be the CONTRACTOR's responsibility.

PART 3 - EXECUTION

3.01 HANDLING AND PLACEMENT

A. The CONTRACTOR shall handle all geotextiles in such a manner as to ensure that they are not damaged in any way.

B. In the presence of wind, all geotextiles shall be weighted with sandbags or the equivalent. Such sandbags shall be installed during placement and shall remain until replaced with earth cover materials.

C. Inspection:

1. Prior to implementing any of the Work in this Section, the CONTRACTOR shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed work of other Sections, the CONTRACTOR shall notify the ENGINEER in writing prior to the start of the Work of this Section. Failure to inform the ENGINEER in writing will be construed as the CONTRACTOR's acceptance of the related Work of all other Sections.

B. During placement, care shall be taken not to entrap in the geotextile stones, excessive dust, or moisture that could damage the synthetic membrane, generate clogging of drains or filters, or hamper subsequent seaming.

C. An examination of the geotextile over the entire surface, after installation, shall be conducted to ensure that no potentially harmful foreign objects, such as needles, are

present. Any foreign objects so encountered shall be removed by the CONTRACTOR or the geotextile shall be replaced.

D. The geotextile shall only be cut using a geotextile cutter or other methods approved by the ENGINEER.

E. After unwrapping the geotextile from its opaque wrapping, the geotextile shall not be left exposed for longer than 14 days, unless approved by the ENGINEER.

3.02 **SEAMS AND OVERLAPS**

A. All geotextiles shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped 6 inches prior to seaming.

B. Horizontal butt seams shall not be permitted on side slopes of 10 percent or greater.

C. The CONTRACTOR shall pay particular attention at seams to ensure that no earth cover material is inadvertently inserted beneath a geotextile.

D. Any sewing shall be done using polymeric thread with chemical and ultravoilet light resistance properties equal to or exceeding those of the geotextile. The color of the thread should contrast the color of the geotextile. The seams shall be sewn with a "flat", "J", or "butterfly" seam using a two-thread chain stitch (stitch type 401) and a double row stitch (Federal Standard Type SSa-2).

E. Seams shall be sewn a minimum of one (1) inch from the edge and shall have an average stitch count of 3 to 7 stitches per inch, or as approved by the ENGINEER.

F. The Geosynthetic Materials Installer shall maintain at least one spare operable seaming apparatus on site.

3.03 **REPAIR**

A. Any holes or tears in the geotextile shall be repaired by one of the following methods:

1. Liestering a patch made from the same geotextile over the affected area, with a minimum of 1 foot overlap in all directions.

2. Sewing a patch made from the same geotextile over the affected area with a minimum of 6 inch overlap in all directions.

3.04 PLACEMENT OF SOIL MATERIALS

A. The CONTRACTOR shall place all soil materials located on top of the geotextile in such a manner as to ensure:

1. No damage of the geotextile or underlying layers;

2. Minimal slippage between the geotextile and the underlying layers; and,

3. No excess tensile stresses in the geotextile.

B. Equipment shall not be driven directly on the geotextile. Unless otherwise specified by the ENGINEER, all operational equipment assessing areas where geotextile is placed shall adhere to the following soil thicknesses:

Maximum Allowable Equipment Ground Pressure (psi)	**Soil Thickness Above Geosynthetics (feet)**
<5	1.0
<10	1.5
<20	2.0
≥20	3.0

Table 02711-1

REQUIRED PROPERTY VALUES FOR GEOTEXTILES

PROPERTIES	QUALIFIER	SPECIFIED VALUE	TEST METHOD
Polymer Composition	minimum	95% weight polypropylene or polyester	-----
Flow Rate	minimum	75 gpm/sq.ft.	ASTM D-4491
Permittivity	minimum	$0.9/sec.^{-1}$	ASTM D-4491
Trapezoidal Tear Strength	minimum	85 lbs.	ASTM D-4533
Grab Elongation	minimum	50%	ASTM D-4632
Fabric Weight	minimum	10 oz/sq. yd	ASTM D-5261 or D-3776
Apparent Opening Size (A.O.S.)	-----	Sieve Size: 100 to 70	ASTM D-4751
Puncture Resistance	minimum	125 lbs	ASTM D-4833

END OF SECTION

02712
GEOCOMPOSITES

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the manufacture, storage, delivery, and testing of the geocomposite drainage cover for the system as herein specified and as shown on the Drawings.

B. The CONTRACTOR shall perform the replacement of the geocomposite removed during extraction well drilling in the excavated area in conjunction with construction of the re-compacted clay liner, synthetic membrane, protective cover soil, and other components of the liner system.

1.02 RELATED WORK

A.	Section 01025	MEASUREMENT AND PAYMENT
B.	Section 02200	EARTHWORK
C.	Section 02711	GEOTEXTILES

1.03 REFERENCES

A.	ASTM D-1238	Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer.
B.	ASTM D-751	Standard Test Method for Coated Fabrics (Section 6).
C.	ASTM D-1777	Standard Test Method for Thickness of Textile Materials
D.	ASTM D-792	Standard Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement.
E.	ASTM D-1004	Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting.

F.	ASTM D-1204	Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature.
G.	ASTM D-1505	Standard Test Method for Density of Plastics by Density-Gradient Technique.
H.	ASTM D-1603	Standard Test Method for Carbon Black in Olefin Plastics.
I.	ASTM D-1693	Standard Test Method for Environmental Stress Cracking of Ethylene Plastics.
J.	ASTM D-5596	Recommended Practice for Microscopical Examination of Pigment Dispersion in Geosynthetics
K.	ASTM D-3083	Standard Specification for Flexible Poly (Vinyl Chloride) Plastic Sheeting for Pond, Canal, and Reservoir Lining.
L.	ASTM D-4716	Standard Test Method for Constant Head Hydraulic Transmissivity (In-Plane Flow) of Geotextiles and Geotextile Related Products.
M.	ASTM D-5261	Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
N.	ASTM D-3776	Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
O.	ASTM D-4491	Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
P.	ASTM D-4533	Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
Q.	ASTM D-4632	Standard Test Method for Breaking Load and Elongation of Geotextiles (Grab Method).

R.	ASTM D-4751	Standard Test Method for Determining Apparent Opening Size of a Geotextile.
S.	ASTM D-4833	Standard Test Method for Index Puncture Resistance of Geotextiles and Geomembranes.
T.	ASTM D-413	Standard Test Method for Comparison of Bond Strength or Ply Adhesion of Similar Laminates Made from Flexible Materials.

1.04 QUALIFICATIONS

A. The Geosynthetic Materials Installer shall be trained and qualified to install a geocomposite drainage system. The installer shall be approved and/or licensed by the manufacturer or the fabricator of the material. A copy of the approval letter or license shall be submitted by the installer to the ENGINEER. Prior to confirmation of any contractual agreement with the construction contractor, the Geosynthetic Materials Installer shall provide the ENGINEER with the following written information:

1. Equipment and personnel to be utilized.

2. Daily anticipated installation rate.

3. Quality control manual for installation.

4. Samples of seams and certified test results.

B. The personnel to perform the seaming operations under the supervision of the Geosynthetic Materials Inspector shall be qualified by experience. The field crew foreman must have documented experience of successfully installing at least 50 acres of landfill or comparable geosynthetic systems on a total of at least five different projects. He/she shall also have experience seaming geocomposites using the same method of seaming that will be used for this specific project. The field crew foreman shall provide direct supervision over less experienced seamers; no field seaming shall be performed without the foreman being present.

1.05 QUALITY ASSURANCE

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subjected to strict quality control monitoring as detailed herein. The installed geocomposite drainage system shall

conform exactly to the Drawings and Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate the CQA activities and account for these activities in the installation schedule.

1.06 **SUBMITTALS**

A. Prior to shipment of any geocomposite materials, the CONTRACTOR shall submit the following information on the raw materials to the ENGINEER:

1. Origin and production date of the resin;

2. A copy of the quality control certificates issued by the resin supplier;

3. Reports of tests conducted by the manufacturer to verify that the quality of the geocomposite is in conformance with all requirements identified in this section; and,

4. Certification that no reclaimed polymer is added to the resin.

B. Prior to shipment of any geocomposite materials, the CONTRACTOR shall submit the following information on the geocomposite production to the ENGINEER:

1. Roll numbers and identification numbers.

2. Quality control certificates that provide reference to the roll numbers, identification numbers, sampling procedures, test methods and test results and other items such as:

a. Name of Manufacturer

b. Chemical Composition

c. Product Identification

d. Statement of Compliance

e. Signature of Authorization

All certificates shall be signed by a representative of the manufacturer.

3. Geocomposite manufacturer quality control tests include:

Component	Test	Procedure
Geotextile	Flow Rate	ASTM D-4491
	Permittivity	ASTM D-4491
	Fabric Weight	ASTM D-3776
	Trapezoidal Tear Strength	ASTM D-4533
	Grab Elongation	ASTM D-4632
	Apparent Opening Size	ASTM D-4751
	Puncture Strength	ASTM D-4833
	Flow Rate	ASTM D-4491
	Trapezoidal Tear Strength	ASTM D-4533
Geonet	Specific Gravity	ASTM D-1505
	Carbon Back Content	ASTM D-1603
	Nominal Thickness	ASTM D-5199
	Melt Index	ASTM D-1238
Geocomposite	Peel Strength	ASTM D-413
	Transmissivity Under Load	ASTM D-4716
	Permittivity	ASTM D-4491

4. Unless otherwise specified, the quality control tests shall be conducted at the frequency of one per lot or one per each 100,000 square feet whichever is more frequent. One lot is defined as a group of consecutively numbered rolls or panels from the same manufacturing line.

5. The geocomposite manufacturer shall replace any rolls that are rejected because they do not comply with these Specifications.

6. If a sample fails to meet the quality control requirements, the manufacturer shall test each roll manufactured from the same lot, or at the same time as the failing roll. Testing shall be at the manufacturer's expense and shall continue until a pattern of acceptable test results is established.

C. Upon delivery to the site, the Geosynthetic Materials Installer and the ENGINEER shall inspect the physical condition of each roll of material. If the protective wrapping is damaged, or if damage to the roll is suspected by the ENGINEER, the roll shall be separated from the lot for more detailed inspections.

PART 2 - PRODUCTS

2.01 GEOCOMPOSITE MATERIAL

A. General Requirements

1. The geocomposite material shall consist of a geotextile thermally-bonded to each side of a geonet component. The thermal bonding shall not compromise the geotextiles and geonet to the point where proper function is impeded. Adequate, not excessive, bonding of the geotextiles to the geonet is necessary. Refer to the minimum peel strength provided in this section.

2. The geotextile, geonet, and geocomposite components shall meet or exceed the property values specified in Table 02712-1. The supplier shall furnish the test results for design criteria as well as written certification that the materials meet the specifications in accordance with Section 01300 - SUBMITTALS.

3. The geocomposite material shall also perform the following:

   a. Retain its structure during handling, placement, and long-term service;

   b. The material shall be capable of withstanding direct exposure to sunlight for 14 days with no measurable deterioration; and,

   c. The material shall be chemically compatible with the waste type and leachate extracted from this waste type.

B. Labeling

1. Geocomposites shall be supplied in rolls wrapped in relatively impermeable and opaque protective covers.

   a. Geocomposite and rolls shall be marked or tagged with the following information:

   b. Manufacturer’s name;

   c. Product Identification;

   d. Lot Number;

   e. Roll Number; and,

   f. Roll Dimensions

3. Additionally, if any special placement is required, it shall be so marked on the geocomposite material, e.g., “This Side Up”, or “This Side Against Soil to be Retained”.

2.02 TRANSPORTATION, HANDLING, AND STORAGE

A. Transportation of the CONTRACTOR-supplied geocomposite materials is the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damages to the materials incurred prior to and during transportation to the site.

B. Handling, storage, and care of the CONTRACTOR-supplied geocomposite materials prior to and following installation at the site is the responsibility of the CONTRACTOR. The DEP shall provide adequate storage space at the site. The CONTRACTOR shall be liable for all damages to the materials incurred during transportation, storage and installation, and prior to final acceptance of the liner system by the OWNER.

C. During shipment and storage, geocomposites shall be protected from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging or deleterious conditions. Any additional storage procedures required by the geotextile manufacturer shall be the CONTRACTOR’s responsibility.

PART 3 - EXECUTION

3.01 HANDLING AND PLACEMENT

A. Inspection:

1. Prior to implementing any of the Work in this Section, the CONTRACTOR shall carefully inspect the installed Work of all other Sections and verify that all Work is complete to the point where the Work of this Section may properly commence without adverse impact.

2. If the CONTRACTOR has any concerns regarding the installed Work of other Sections, the CONTRACTOR shall notify the ENGINEER in writing prior to the start of the Work of this Section. Failure to inform the ENGINEER in writing will be construed as CONTRACTOR’s acceptance of the related Work of all Sections.

B. The CONTRACTOR shall handle all geocomposite materials in such a manner as to ensure they are not damaged in any way.

C. On slopes, the geocomposite shall be rolled down the slope in such a manner as to continually keep the geocomposite in tension. If necessary, the geocomposite shall be positioned by hand after being rolled to minimize wrinkles.

D. In the presence of wind, all geocomposites shall be weighted with sandbags or the equivalent if applicable. Such sandbags shall be installed during placement and shall remain until replaced with liner material.

E. Geocomposite shall only be cut using hooked utility blade or other methods approved by the ENGINEER.

F. The CONTRACTOR shall take any necessary precautions to prevent damage to underlying layers during replacement of the geocomposite removed during well drilling.

G. During replacement, care shall be taken not to entrap in the geocomposite stones, excessive dust, or moisture that could damage the underlying geosynthetic liner, generate clogging, or hamper subsequent seaming.

H. An examination of the geocomposite over the entire surface, after installation, shall be conducted to ensure that no potentially harmful foreign objects, such as needles, are present. Any foreign objects so encountered shall be removed by the CONTRACTOR or the geocomposite shall be replaced.

I. Care should be taken not to leave tools on the geocomposite.

J. After unwrapping the geocomposite from its opaque wrapping, the geocomposite shall not be left exposed for longer than 14 days, unless approved by the ENGINEER.

3.02 SEAMS AND OVERLAPS

A. The geotextile and geonet components of the geocomposites shall not be bonded at the ends and edges of the rolls for a length sufficient to permit seaming and overlaps as discussed in this section.

B. Horizontal butt seams shall not be permitted on side slopes of 10 percent or greater.

C. Each component (geotextile or geonet) shall be secured or seamed to a similar component of the adjacent panel as described in the following discussion and as shown on the Drawings. Geocomposite panels should be staggered such that any cross seams (on slopes flatter than 10 percent) between panels are not continuous.

D. Geonet Components: Adjacent geonets shall be joined according to the Drawings and Specifications. As a minimum, the following requirements shall be met:

1. Adjacent rolls shall be overlapped by at least 6 inches. The geotextile component shall be unbounded from the geonet, if required, to expose the geonet to achieve the minimum 6 inch overlap.

2. Overlaps shall be secured by tying.

3. Tying can be achieved by plastic fasteners or polymer braid. Tying devices shall be white or yellow for ease of inspection. Metallic devices are not allowed. Fasteners shall not penetrate the bottom geotextile to protect the synthetic membrane from abrasion. Welding of the geonet to the synthetic membrane shall not be permitted.

4. Tying shall be every 5 feet along the slope, every 2 feet across the slope (end-to-end seam), and every 6 inches at the grade break on top of the landfill.

5. In corners and difficult areas of the landfill, where overlaps between perpendicular geocomposite strips are required, an extra layer of geocomposite shall be unrolled along the slope, on top of the previously installed geonets, from top to bottom of the slope.

E. Geotextile Components:

1. The bottom layers of geotextile shall be overlapped. The top layers of geotextile shall be continuously sewn (i.e., spot sewing is not allowed). Geotextiles shall be overlapped 6 inches prior to seaming. No horizontal

seams shall be allowed on side slopes (i.e., seams shall be along, not across, the slope, except as required by a patch).

2. The CONTRACTOR shall pay particular attention at seams to ensure that no earth liner material is inadvertently inserted beneath a geotextile.

3. Any sewing shall be done using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. The color of the thread should contrast the color of the geotextile. The seams shall be sewn with a "flat", "J", or "butterfly" seam using a two-thread chain stitch (stitch type 401) and a double row stitch (Federal Standard Type SSa-2).

4. Seams shall be sewn a minimum of one (1) inch from the edge and shall have an average stitch count of 3 to 7 stitches per inch, or as approved by the ENGINEER.

F. The Geosynthetic Materials Installer shall maintain at least one spare operable seaming apparatus on site.

3.03 REPAIR

A. Any holes or tears in the geonet shall be repaired by placing a patch extending 2 feet beyond edges of the hole or tear. The patch shall be secured to the original geocomposite by tying every 6 inches, with approved tying devices, through the bottom geotextile and geonet of the patch, and through the top geotextile and geonet components of the geocomposite needing repair. Other methods shall require approval from the ENGINEER. An additional geotextile patch shall be placed and liestered to the top geotextile of the geocomposite needing repair. If the hole or tear width across the roll is more than 50 percent of the width of the roll, the damaged area shall be cut out and the two portions of the geocomposite shall be joined as indicated in Paragraph 3.02 of this Section.

3.04 PLACEMENT OF SOIL MATERIALS

A. The CONTRACTOR shall place all soil materials located on the top of the geocomposite in such a manner as to ensure:

1. No damage of the geocomposite or underlying layers;

2. Minimal slippage between the geocomposite and the underlying layers; and,

3. No excess tensile stresses in the geocomposite.

B. On the sideslopes, soil placement shall proceed from the bottom of the slope upward, unless otherwise approved by the ENGINEER.

C. Equipment shall not be driven directly on the geocomposite. Unless otherwise specified by the ENGINEER, all operational equipment accessing areas where geocomposite is placed shall adhere to the following soil thicknesses overlying the geocomposite:

Maximum Allowable Equipment Ground Pressure (psi)	**Soil Thickness Above Geosynthetics (feet)**
<5	1.0
<10	1.5
<20	2.0
≥20	3.0

Table 02712-1

GEOCOMPOSITE PROPERTY VALUES

PROPERTIES	QUALIFIER	SPECIFIED VALUE	ASTM TEST METHOD
Geonet Component			
Specific Gravity	minimum	0.935 g/cm3	D-1505
Melt Index	range	0.1 - 1.0 g/10 minutes	D-1238
Carbon Black Content	range	2 - 3%	D-1603
Nominal Thickness	minimum	.25 inches	D-5199
Geotextile Components:			
Flow Rate	minimum	75 gpm/sq. ft.	D-4491
Permittivity	minimum	0.9/ $sec.^{-1}$	D-4491
Trapezoidal Tear Strength	minimum	85 lbs.	D-4533
Grab Elongation	minimum	50 %	D-4632
Fabric Weight	minimum	10 oz/sq. yd.	D-3776
Apparent Opening Size	----	Sieve Size: 70 to 100	D-4751
Puncture Resistance	minimum	125 lbs.	D-4833
Geocomposite:			
Transmissivity [2]	minimum	7.25 gal/ft/min.	D-4716
Peel Strength	minimum	2 lbs/in.	D-413
Permittivity	minimum	0.5 sec^{-1}	D-4491

Notes:
1. The specific gravity of the net polymer shall not exceed that of the synthetic membrane.(See Table 02713-1)
2. The tests shall be performed at least once every 100,000 square feet.

END OF SECTION

02713
SYNTHETIC MEMBRANE

PART 1 - GENERAL

1.01 DESCRIPTION

A. The CONTRACTOR shall furnish all labor, materials, tools, supervision, transportation, and installation equipment necessary for the manufacturing, storage, delivery, installation, and testing of the smooth and textured High Density Polyethylene (HDPE) synthetic membranes for the liner system as herein specified.

B. The CONTRACTOR shall furnish and install smooth 60-mil HDPE synthetic membranes (same as what is removed prior to well drilling) in conjunction with construction of the current approved cover system including geocomposite, geotextile, natural drainage medium, protective cover and other components of the liner system.

C. The synthetic membrane shall be installed in the areas designated on the Drawings and in accordance with these specifications.

1.02 RELATED WORK

A.	Section 01150	MEASUREMENT AND PAYMENT
B.	Section 02200	EARTHWORK
C.	Section 02711	GEOTEXTILES
D.	Section 02712	GEOCOMPOSITES

1.03 REFERENCES

A.	ASTM D-570	Standard Test Method for Water Adsorption.
B.	ASTM D-638, Mod	Standard Test Method for Tensile Properties of Plastics.
C.	ASTM D-751	Standard Test Method for Coated Fabrics.
D.	ASTM D-1004	Standard Test Method for Tear Resistance.
E.	ASTM D-1204	Standard Test Method for Dimensional Stability.
F.	ASTM D-1238	Standard Test Method for Melt Flow Index.
G.	ASTM D-1505	Standard Test Method for Density.

H.	ASTM D-1603	Standard Test Method for Carbon Black Content.
I.	ASTM D-3015	Standard Test Method for Carbon Black Dispension.
J.	ASTM D-3083	Standard Test Method for Resistance to Soil Burial.
K.	ASTM D-4437	Standard Test Method for Geosynthetic Seam Strength.
L.	ASTM D-4833	Standard Test Method for Puncture Resistance.
M.		ASTM D-5199 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
N.		ASTM D-5994 Standard Test Method for Measuring Core Thickness of Textured Geomembrane
O.	FTMS 101B	Method 2065 Test Method for Puncture Resistance.

1.04 **QUALIFICATIONS**

A. The Geosynthetic Materials Installer shall be trained and qualified to install both a smooth and a textured HDPE synthetic membrane system. The installer shall be approved and/or licensed by the manufacturer or the fabricator of the material. A copy of the approval letter or license shall be submitted by the installer to the ENGINEER. The Geosynthetic Materials Installer shall provide the ENGINEER with the following written information:

1. Equipment and personnel to be utilized.
2. Daily anticipated installation rate.
3. Quality control manual for installation.
4. Samples of seams and certified test results.

B. The personnel to perform the seaming operations under the supervision of the Geosynthetic Materials Installer shall be qualified by experience. The field crew foreman must have documented experience of successfully installing at least 50 acres of landfill or comparable geosynthetic systems on a total of at least five different projects. He/she shall also have experience seaming HDPE synthetic membrane using the same method of seaming that will be used for this specific project. The field crew foreman shall provide direct supervision over less experienced seamers; no field seaming shall be performed without the foreman being present.

1.05 **QUALITY ASSURANCE**

A. All materials, procedures, operations, and methods shall be in strict conformance with the Drawings and Specifications, and shall be subject to strict quality control monitoring as detailed herein. The installed synthetic membrane system shall conform exactly to the Drawings and these Specifications, except as otherwise authorized in writing by the ENGINEER.

B. The CONTRACTOR shall comprehend and anticipate the CQA activities and account for these activities in the installation schedule.

1.06 **SUBMITTALS**

A. A minimum of two weeks prior to the anticipated placement of any HDPE synthetic membrane material, the CONTRACTOR shall submit the synthetic membrane panel diagram to the ENGINEER for approval.

B. A minimum of two weeks prior to the anticipated on-site delivery and placement of any HDPE synthetic membrane material, the CONTRACTOR shall submit the synthetic membrane manufacturer and installer warranties to the ENGINEER. The ENGINEER shall submit the warranties to the DEP for review and approval.

C. Prior to shipment of any synthetic membrane materials, the CONTRACTOR shall submit the following information on the raw materials to the ENGINEER:

1. Origin and production date of the resin;

2. A copy of the quality control certificates issued by the resin supplier;

3. Reports of tests conducted by the manufacturer to verify that the quality of the HDPE synthetic membrane is in conformance with all requirements identified in this section; and,

4. Certification that no reclaimed polymer is added to the resin.

D. Prior to shipment of any HDPE synthetic membrane materials, the CONTRACTOR shall submit the following information on the HDPE synthetic membrane production to the ENGINEER:

1. Roll numbers and identification numbers;

2. Quality Control certificates that provide reference to the roll numbers, identification numbers, sampling procedures, test methods, and test results and other items, such as:

a. Name of Manufacturer;

b. Chemical Composition;

c. Product Identification;

d. Statement of Compliance; and,

e. Signature of Authorization.

All certificates shall be signed by a representative of the manufacturer.

3. HDPE synthetic membrane manufacturer quality control tests include:

Test	Procedure
Melt Flow Index	ASTM D-1238
Density	ASTM D-1505
Test	Procedure
Thickness	ASTM D-5199 or D-5994
Carbon Black Content	ASTM D-1603
Carbon Black Dispersion	ASTM D-5596
Tensile Properties	ASTM D-638
Puncture Resistance	FTMS 101, Method 2065 or ASTM D-4833
Tear Resistance	ASTM D-1004, Die C
Dimensional Stability	ASTM D-1204
Seam Strength	ASTM D-4437

4. Unless otherwise specified, the quality control tests shall be conducted at the frequency of one per lot or one per each 100,000 square feet. One lot is defined as a group of consecutively-numbered rolls or panels from the same manufacturing line. The direct shear tests shall be conducted to verify the performance of the materials three times prior to placement of any geosynthetics.

5. The HDPE synthetic membrane manufacturer shall replace any rolls that are rejected because they do not comply with these Specifications.

6. If a sample fails to meet the quality control requirements, the manufacturer shall test each roll manufactured from the same lot, or at the same time as

the failing roll. Testing shall be at the manufacturer's expense and shall continue until a pattern of acceptable test results is established.

E. Upon delivery to the site, the Geosynthetic Materials Installer and ENGINEER shall inspect the physical condition of each roll of material. If the protective wrapping is damaged, or if damage to the roll is suspected by the ENGINEER, the roll shall be separated from the lot for more detailed inspections.

F. Throughout the HDPE synthetic membrane installation process, the Geosynthetic Materials Installer shall provide the ENGINEER with subbase acceptance certificates, signed by the installer, for each area to be covered by HDPE synthetic membrane.

G. Warranty: The HDPE synthetic membrane manufacturer and Geosynthetic Materials Installer shall furnish a 5-year warranty for the integrity of, and installation of the products. Warranty conditions shall be acceptable to the OWNER.

PART 2 - MATERIALS

2.01 HDPE SYNTHETIC MEMBRANE

A. General Requirements:

1. The synthetic membrane shall consist of both a textured (on both sides) and smooth 60-mil High Density Polyethylene (HDPE).

2. The HDPE synthetic membrane shall meet or exceed the property values specified in Tables 02713-1 and 02713-2. The supplier shall furnish the test results for these procedures as well as certification that the materials meet the specifications.

3. The interface shear strength of the textured synthetic membrane and the overlying geocomposite and underlying subgrade shall meet or exceed the parameters presented by the curve in Figure 02713-1 when tested in the direct shear box assembly (ASTM D-4437).

B. Resin:

1. The polyethylene synthetic membrane shall be manufactured from new, first-quality polyethylene resin, and shall be designed and manufactured specifically for use in synthetic membranes. Reclaimed polymer shall not be added to the resin. The polyethylene resin shall meet the following specifications.

Specific Gravity: >0.940, ASTM D-792, Method A, or ASTM D-1505

Melt Index: ASTM D-1238. 0.3/10 min. (maximum)

2. The synthetic membrane shall meet the specifications shown in Table 02713-1. In addition, the synthetic membrane shall:

a. Contain a maximum of 1% by weight of additives, fillers or extenders (not including carbon black).

b. Contain 2% to 3% carbon black for ultra-violet light resistance.

c. Not have striations, roughness, pinholes, or bubbles on the surface.

d. Be produced so as to be free of holes, blisters, undispersed raw materials or any sign of contamination by foreign matter.

C. Labeling:

1. Labels on each roll or factory panel shall identify:

a. Thickness of the material;

b. Length and width of the roll or factory panel;

c. Manufacturer;

d. Directions to unroll the material;

e. Product identification;

f. Lot number; and,

g. Roll or field panel number.

2.02 TRANSPORTATION, HANDLING, AND STORAGE

A. Transportation of the CONTRACTOR-supplied HDPE synthetic membrane materials is the responsibility of the CONTRACTOR. The CONTRACTOR shall be liable for all damage to the materials incurred prior to and during transportation to the site.

B. Handling, storage, and care of the CONTRACTOR-supplied HDPE synthetic membrane materials prior to and following installation at the site is the responsibility of the CONTRACTOR. Materials shall be temporarily stored in areas designated on the Drawings. The CONTRACTOR shall be liable for all damage to the materials incurred during transportation, storage and installation, and prior to final acceptance of the liner system by the OWNER.

C. During shipment and storage, the HDPE synthetic membrane shall be protected from excessive heat or cold, ultraviolet light exposure, puncture, cutting, or other damaging or deleterious conditions. Any additional storage procedures required by the HDPE synthetic membrane manufacturer shall be the CONTRACTOR's responsibility.

D. Rolls shall be lifted by inserting a steel bar, capable of supporting the full weight of the roll, through the center core.

PART 3 - EXECUTION

3.01 HANDLING AND PLACEMENT

A. Surface Preparations:

1. The CONTRACTOR shall be responsible for approving the supporting materials, and shall certify in writing that the surface on which the synthetics will be installed is acceptable. This certification of acceptance shall be given to the ENGINEER prior to commencement of HDPE synthetic membrane installation in the area under consideration.

2. Special care should be given to maintaining the integrity of the prepared re-compacted clay liner.

3. No synthetic membrane shall be placed onto an area which has become softened by precipitation or which has cracked due to desiccation. The soil surface shall be observed daily to evaluate desiccation, cracking and/or softening. The daily observations shall ascertain the effects of surface desiccation, cracking and/or softening upon integrity of the clay liner.

4. Any damage to the clay liner caused by installation activities shall be repaired at the CONTRACTOR's expense.

3.02 SYNTHETIC MEMBRANE BOOT

A. Layout Drawing:

1. The CONTRACTOR shall use synthetic membrane boot layout drawings for the installation of synthetic membrane around the extraction wells.

2. Any modification of the layout drawings shall be approved by the ENGINEER prior to synthetic membrane installation.

B. Weather Conditions:

1. Synthetic membrane placement shall not proceed at an ambient temperature below 40° F (5°C), unless otherwise authorized.

2. Synthetic membrane shall not be placed during any precipitation, in the presence of excessive moisture (e.g., fog, dew), in an area of ponded water, or in the presence of excessive winds.

C. Installation Schedule:

1. Exposure of deployed synthetic membrane panels to the surrounding environment shall be minimized to the extent possible via geocomposite and soil placement.

D. Method of Placement:

1. The CONTRACTOR shall ensure that:

a. Extreme care shall be taken while placing both the smooth and textured synthetic membranes. The material shall first be aligned with the adjacent panel prior to unrolling. Adjustments for small misalignments can be attempted, with wide mouth vice grips, as the synthetic membrane is being unrolled.

b. No synthetic membrane shall be placed in an area of ponded water or above excessively-moist or saturated subbase soils.

c. No equipment used shall damage the synthetic membrane by handling, trafficking, leakage of hydrocarbons, or other means. No vehicular traffic shall be in direct contact with the synthetic membrane.

d. No personnel working on the synthetic membrane shall smoke, wear damaging shoes, or engage in other activities which could damage the synthetic membrane.

e. The method used to unroll the panels shall not cause folds, scratches, or crimps in the synthetic membrane and shall not damage the supporting soil.

f. All elements immediately underlying the synthetic membrane must be kept clean and free of debris.

g. The method used to place the panels shall minimize wrinkles (especially differential wrinkles between adjacent panels).

h. Adequate temporary loading and/or anchoring (e.g., sand bags, tires), not likely to damage the synthetic membrane, shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

i. Direct contact with the synthetic membrane shall be minimized; i.e., the synthetic membrane in excessively high traffic areas shall be protected by geotextiles, extra synthetic membrane, or other suitable materials.

E. Damage:

1. Any field panel or portion thereof which becomes seriously damaged (torn, twisted or crimped) shall be replaced at no cost to the DEP. Less serious damage may be repaired at the ENGINEER's option and at no cost to the DEP.

2. Damaged panels or portions of damaged panels which have been rejected shall be removed from the work area.

3.03 **OVERLAPPING AND SEAMING**

A. Layout:

1. Seams shall be oriented parallel to the line of maximum slope, i.e., along, not across, the slope. Horizontal butt seams shall not be permitted on side slopes of 10 percent or greater.

2. No seams shall be located in the areas of potential stress concentrations, as so deemed by the ENGINEER.

3. Synthetic membrane panels shall be sufficiently overlain for seaming.

B. Seam Preparation:

1. Prior to any seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind and foreign material.

2. If seam overlap grinding is required, the process shall be done according to the manufacturer's instruction within one hour of the seaming operation and in a way that does not damage the synthetic membrane.

3. Seams shall be aligned with the fewest possible number of wrinkles and "fishmouths".

C. Seaming Equipment and Products:

1. Approved processes for field seaming are extrusion welding and double-wedge fusion welding. Extrusion welding shall be utilized to seam the synthetic membrane widthwise and to make detailed seams; the fusion weld may be utilized for lengthwise seams. Only apparatus of a make and model which have been specifically approved by the synthetic membrane manufacturer, and subsequently approved by the ENGINEER, shall be used. The CONTRACTOR shall submit to the ENGINEER documentation describing the apparatus and the approval granted by the synthetic membrane manufacturer.

D. Weather Conditions for Seaming:

1. Unless authorized in writing by the ENGINEER, no seaming shall be attempted at ambient temperature below 40°F for above 104°F (40°C) measured one foot above the membrane. At ambient temperatures between 40°F and 50°F, seaming shall be allowed if the synthetic membrane is preheated by either sun or hot air device, and if there is no excessive cooling resulting from the wind. At ambient temperatures above 50°F, no preheating will be required. In all cases, the synthetic membrane shall be dry and protected from wind damage.

2. If the CONTRACTOR intends to use methods which may allow seaming at ambient temperatures below 40°F, he/she shall

demonstrate that the seam so produced is equivalent to those produced under normally-approved conditions, and that the overall quality of the synthetic membrane is not adversely affected. In addition, an addendum to the contract between the DEP and the CONTRACTOR is required which specifically states that the seaming procedures do not cause any physical or chemical modification to the synthetic membrane that will generate any short or long term damage to the synthetic membrane.

E. Trial Seams:

1. Trial seams shall be made on fragment pieces of synthetic membrane to verify that seaming conditions are adequate. Such trial seams shall be made in the presence of the ENGINEER, or ENGINEER's designee, at the beginning of each seaming period, and at least once each four hours, for each seaming apparatus used that day. Also, each seamer shall make at least one trial seam each day. Trial seams shall be made under the same conditions as actual seams. The trial seams sample shall be at least 5 feet long by 1 foot wide (after seaming) with the seam centered lengthwise. Seam overlap shall be as previously indicated.

2. Two adjoining specimens, each 1.0 inch wide, shall be cut for the trial seam sample by the CONTRACTOR. The specimens shall be tested respectively in shear and peel using a field tensiometer capable of providing measurable results. If a specimen fails, the entire operation shall be repeated two additional times. If the additional specimen fails, the entire operation shall be repeated twice. If either of the additional specimens fails, the seaming apparatus or seamer shall not be accepted and shall not be used for seaming until the deficiencies are corrected and two consecutive successful trial welds are achieved.

3. After completion of the above described tests, the remaining portion of the trial seam sample may be discarded. Alternatively, the remaining portion of the trial seam can be subjected to destructive testing. If a trial seam sample fails a test, then a destructive test seam sample shall be taken from the seams completed by the seamer during the shift related to the considered trail seam. These samples shall be forwarded to the ENGINEER and, if they fail the tests, the procedure indicated in Subsection 3.03.I.1.f shall apply. The conditions of this paragraph shall be considered as met for a given seam if a destructive seam test has already been taken from the considered seam(s).

F. General Seaming Procedures:

1. The general seaming procedures used by the CONTRACTOR shall be as follows:

    a. Prior to seaming, the seam area shall be clean and free of moisture, dust, dirt, debris of any kind, and foreign material.

    b. Seaming shall extend to the outside edge of panels to be placed in the anchor trench.

    c. If required, a firm substrate shall be provided by using a flat board, a conveyor belt, or similar hard surface directly under the seam overlap to achieve proper support.

    d. If seaming operations are carried out at night, adequate illumination shall be provided.

    e. Fishmouths or wrinkles at the seam overlaps shall be cut along the ridge of the wrinkle in order to achieve a flat overlap. The cut fishmouths or wrinkles shall be seamed and any portion where the overlap is inadequate shall then be patched with an oval or round patch of the same synthetic membrane extending a minimum of 6 inches beyond the cut in all directions.

G. Seaming Process:

1. Approved processes for field seaming are extrusion welding and fusion welding. Seaming equipment shall not damage the synthetic membrane. Only the apparatus specifically approved by the ENGINEER, by make and model, shall be used.

2. Extrusion Procedures:

   a. The Geosynthetics Materials Installer shall maintain at least one spare operable seaming apparatus on site.

   b. Extrusion welding apparatus shall be equipped with gauges indicating the temperature in the apparatus and at the nozzle.

   c. Prior to beginning a seam, the extruder shall be purged until all heat-degraded extrudate has been removed from the barrel. Whenever the extruder is stopped, the barrel shall be purged of all heat-degraded extrudate.

   d. The Geosynthetics Materials Installer shall provide documentation regarding the welding rod or resin to the CQA Manager and shall certify that the welding rod or resin in compatible with the specifications, and consists of the same resin as the synthetic membrane.

   e. The edges of cross seams shall be ground to a smooth incline (top and bottom) prior to welding, and the extrudate must cover a minimum of 80 percent of the grind. Excessive grinding (width and depth) shall be cause for rejection of the Work.

3. Fusion Procedures:

   a. The Geosynthetic Materials Installer shall maintain at least one spare operable seaming apparatus on site.

   b. Fusion-welding apparatus shall be automated vehicular-mounted devices equipped with gauges giving the applicable temperatures, pressures and speed settings.

   c. The edges of cross seams shall be ground to a smooth incline (top and bottom) prior to welding, and the extrudate must cover a minimum of 80 percent of the grind. Excessive grinding (width and depth) shall be cause for rejection of Work.

d. A movable protective layer may be used directly below each synthetic membrane overlap to be seamed to prevent the buildup of moisture between the panels.

H. Non-destructive Seam Continuity Testing:

1. The CONTRACTOR shall non-destructively test all field seams over their full length using a vacuum test unit, air pressure (for double fusion seams only), or other approved method. Continuity testing shall be performed as the seaming progresses, not at the completion of all field seaming. All non-destructive testing will be observed by the CQA Manager/Inspector. The CONTRACTOR shall complete any required repairs in accordance with Subsection 3.03.J. Non-destructive testing shall be conducted at ambient temperatures appropriate for seaming. The following procedures shall apply to locations where seams cannot be non-destructively tested:

a. All such seams shall be cap-stripped with the same synthetic membrane.

b. If the seam is accessible to testing equipment prior to final installation, the seam shall be non-destructively tested prior to final installation.

c. If the seam cannot be tested prior to final installation, the seaming and stripping operations shall be observed by the ENGINEER for uniformity and completeness.

2. Vacuum Testing:

a. The equipment shall be comprised of the following:

1) Energize the vacuum box assembly consisting of a rigid housing, a transparent viewing window, a soft neoprene gasket attached to the bottom, porthole or valve assembly, and a vacuum gauge;

2) Steel vacuum tank and pump assembly equipped with a pressure controller and pipe connections;

3) A rubber pressure/vacuum hose with fittings and connections;

4) A bucket and wide paint brush; and,

5) A soapy solution.

b. The following procedures shall be followed:

1) Energize the vacuum pump and reduce the tank pressure to approximately 10 inches of mercury; i.e., 5 psi gauge.

2) Wet a strip of synthetic membrane with soapy solution on an area approximately 6 inches larger in each dimension than the vacuum box being utilized.

3) Place the box over the wetted area.

4) Close the bleed valve and open the vacuum valve.

5) Ensure that a leak tight seal is created.

6) For a period of not less than 30 seconds, examine the synthetic membrane through the viewing window for the presence of soap bubbles.

7) If no bubble appears after 30 seconds, close the vacuum valve and open the bleed valve, move the box over the next adjoining area with a minimum 3 inch overlap, and repeat the process.

8) All areas where soap bubbles appear shall be marked and repaired in accordance with Subsection 3.03 and retested.

3. Air Pressure Testing (For Double Fusion Seams Only):

a. The following procedures are applicable to those processes which produce a double seam with an enclosed space.

1) The equipment shall consist of the following:

2) An air pump (manual or motor driven), equipped with a pressure gauge, capable of generating and sustaining a pressure between 25 to 30 psi, mounted on a cushion to protect the synthetic membrane.

3) A rubber hose with fittings and connections.

4) A sharp hollow needle, or other approved pressure feed device.

c. The following procedures shall be followed:

1) Seal both ends of the seam to be tested.

2) Insert needle, or other approved pressure feed device, into the tunnel created by the fusion weld.

3) Insert a protective cushion between the air pump and the synthetic membrane.

4) Energize the air pump to a pressure between 25 and 30 psi, close valve, and sustain the pressure for not less than 5 minutes.

5) If loss of pressure exceeds 3 psi, or does not stabilize, locate faulty area and repair in accordance with Subsection 3.03.J.

6) Remove needle, or other approved pressure feed device, and seal repair in accordance with Subsection 3.03.J.

I. Destructive Testing:

1. Destructive seams tests shall be performed at selected locations. The purpose of these tests is to evaluate seam strength. Seam strength testing shall be done as the seaming progresses, not at the completion of all field seaming.

a. Location and Frequency

1) Destructive test samples shall be collected at a minimum average frequency of one test location per 500 feet of seam length. Samples, in addition to the minimum average frequency, shall be taken by the CONTRACTOR at locations selected by the ENGINEER. Test locations shall be determined during seaming, and may be prompted by suspicion of excess crystallinity, contamination, offset welds, or any other potential cause of imperfect welding. The CONTRACTOR shall not be informed in advance of the locations where the seam samples will be taken. The ENGINEER, at the recommendation of the ENGINEER,

reserves the right to increase the frequency in accordance with actual performance results of samples taken.

b. Sampling Procedure

1) Samples shall be cut by the CONTRACTOR at locations designated by the ENGINEER as the seaming progresses in order to obtain laboratory test results before the synthetic membrane is covered by another material. Each sample shall be numbered and the sample number and location identified on the panel layout drawing. All holes in the synthetic membrane resulting from the destructive seam sampling shall be immediately repaired in accordance with the repair procedures described in Subsection 3.03.J. The continuity of the new seams in the repaired area shall be tested according to Subsection 3.03.J.

c. Size of Samples

1) The samples shall be at least 12 inches wide by 42 inches long with the seam centered lengthwise. One 1-inch wide strip shall be cut from each end of the sample, and these shall be tested in the field. The remaining sample shall be cut into three equal parts and distributed as follows:

a) One portion to the CONTRACTOR for laboratory testing, 12 inches x 12 inches.

b) One portion for the ENGINEER's Laboratory for testing, 12 inches x 18 inches.

c) One portion to the OWNER for archive storage, 12 inches x 12 inches.

d. Field Testing

1) The two, 1-inch wide strips shall be tested in the field, in the presence of the ENGINEER or designated representative, by hand or tensiometer capable of providing measurable results, for peel and shear respectively, and shall not fail in the seam. If any field test sample fails to pass, then the procedures outlined in Subsection 3.03 I.1.f shall be followed.

e. Laboratory Testing

1) Testing by the CONTRACTOR shall include “Seam Strength” and “Peel Adhesion” (ASTM D-4437 with 1-inch wide strip, tested at 2 inches per minute). Both tracks of double fusion seams shall be tested. The minimum acceptable values to be obtained in these tests are those indicated in Table 02714-1. At least 5 specimens shall be tested for each test method. To be acceptable, 4 out of 5 samples shall pass shear and peel testing. Specimens shall be selected alternately by test from the sample (i.e, peel, shear, peel, shear, etc.). The CONTRACTOR shall provide the ENGINEER test results no more than 48 hours after the samples are received at the laboratory.

f. Procedures for Destructive Test Failure

1) The following procedures shall apply whenever a sample fails the destructive test, whether the test conducted by the ENGINEER's Laboratory, the CONTRACTOR's Laboratory, or by field tensiometer. The CONTRACTOR shall have two options:

a) The CONTRACTOR can reconstruct the seam between any two passed test locations.

b) The CONTRACTOR can trace the welding path a minimum of 10 feet in each direction from the failed test and take a small sample for an additional field test at each location. If these additional samples pass the tests, the full laboratory samples shall be taken. If these laboratory samples pass the tests, then the seam shall be reconstructed between these locations. If either sample fails, then the process shall be repeated to establish the zone in which the seam should be reconstructed. In any case, all acceptable seams must be bounded by two locations from which samples passing laboratory destructive tests have been taken. In cases exceeding 150 feet of reconstructed seam, a sample taken from within the reconstructed zone must pass destructive testing. Whenever a sample fails, additional testing may be required for seams that

were seamed by the same seamer and/or seaming apparatus, or seamed during the same time shift.

J. Defects and Repairs

1. Identification:

a. All seams and non-seam areas of the synthetic membrane will be examined by the ENGINEER for identification of defects, holes, blisters, undispersed raw materials and any sign of contamination by foreign matter.

b. The surface of the synthetic membrane shall be clean at the time of examination. The synthetic membrane surface shall be broomed or washed by the CONTRACTOR if the amount of dust or mud inhibits examination.

c. The CONTRACTOR shall ensure that this examination of the synthetic membrane precedes any seaming of that section.

2. Evaluation:

a. Each suspect location, both in seam and non-seam areas, shall be non-destructively tested using the methods described in Subsection 3.03 H as appropriate. Each location which fails the non-destructive testing shall be marked by the ENGINEER and repaired by the CONTRACTOR. Work shall not proceed with any materials which will cover locations which have been repaired until laboratory test results with passing values are available.

3. Repair Procedures:

a. Any portion of the synthetic membrane exhibiting a flaw, or failing a destructive or non-destructive test, shall be repaired by the CONTRACTOR. Several procedures exist for the repair of these areas. The final decision as to the appropriate repair procedure shall be agreed upon between the ENGINEER, OWNER and the CONTRACTOR. The procedures available include:

1) Patching, used to repair large holes, tears, undispersed raw materials, and contamination by foreign matter.

2) Grinding and rewelding, used to repair small sections, at the discretion of the ENGINEER, of extruded seams.

3) Spot welding or seaming, used to repair small sections of extruded seams.

4) Cap strips used to repair large lengths of failed seams.

5) Removing bad seam and replacing with a strip of new material welded into place used with large lengths of fusion seams.

b. An addition, the following provisions shall be satisfied:

1) Surfaces of the synthetic membrane which are to be repaired shall be ground no more than one hour prior to the repair.

2) All surfaces must be clean and dry at the time of repair.

3) All seaming equipment used in repairing procedures must be approved.

4) The repair procedures, materials, and techniques shall be approved in advance of the specific repair by the ENGINEER, the DEP and the CONTRACTOR.

5) The patches or caps shall extend approximately 9 inches beyond the edge of the defect. All corners of caps or patches shall be rounded with a radius of at least 3 inches.

6) The synthetic membrane below large caps should be appropriately cut to avoid water or gas collection between the two sheets.

4. Verification of Repairs:

a. Each repair shall be numbered and logged.

b. Each repair shall be non-destructively tested using the methods described in Subsection 3.03 H as appropriate. Repairs which pass the non-destructive test shall be taken as an indication of an adequate repair.

c. Large caps may be of sufficient extent to require destructive test sampling, at the discretion of the ENGINEER. Failed tests

indicate that the repair shall be redone and retested until a passing test results.

5. Large Wrinkles:

a. When seaming of the synthetic membrane is complete (or when seaming of a large area of the synthetic membrane is complete) and prior to placing overlying materials, the ENGINEER shall identify all excessive liner wrinkles. The CONTRACTOR shall cut and re-seam all wrinkles so identified. The seam thus produced shall be tested like any other seam.

3.04 MATERIALS IN CONTACT WITH THE SYNTHETIC MEMBRANE

A. The following provisions require the CONTRACTOR to take all necessary precautions so that the installation of these materials does not damage the synthetic membrane. Installation on rough surfaces shall be carefully performed to minimize damage. If approved, additional loosely placed geotextile sections may be used by the CONTRACTOR as protection for the synthetic membrane.

B. Geocomposite material shall be placed directly above the synthetic membrane. Care shall be taken not to drag the geocomposite across the synthetic membrane. Soil materials placed above the geosynthetics shall be installed with care.

C. Equipment shall not be driven directly on the synthetic membrane. Unless otherwise specified by the ENGINEER, all operational equipment utilized to place overlying soil materials shall adhere to the following soil thicknesses:

Maximum Allowable Equipment Ground Pressure (psi)	Soil Thickness Above Geosynthetics (feet)
<5	1.0
<10	1.5
<20	2.0
>20	3.0

D. Placement shall be such as to prevent wrinkles, snags and tears. Placement shall be in the presence of the appropriate CQA personnel.

E. The CONTRACTOR shall be responsible for the placement of the synthetic membrane without wrinkles, folds or extraneous materials that would inhibit the synthetic membrane complete and intimate contact with the underlying re-compacted clay liner.

3.05 **LINER SYSTEM ACCEPTANCE**

A. The CONTRACTOR shall retain all ownership and responsibility for the geosynthetics in the liner system until acceptance by the DEP.

B. The geosynthetic liner system shall be accepted by the DEP when:

1. The installation is complete.

2. All documentation of the installation is complete, including the ENGINEER's Certification Report.

3. Verification of the adequacy of all field seams and repairs, including associated testing, is complete.

4. Written certification documents, including the Record Drawings, sealed by a registered professional engineer, have been received by the DEP from the CONTRACTOR.

Table 02713-1

REQUIRED PROPERTY VALUES FOR TEXTURED HDPE SYNTHETIC MEMBRANE

PROPERTIES	QUALIFIERS	SPECIFIED VALUES	TEST METHOD
Thickness	Average minimum	60 mils	ASTM D-5994
Density	minimum	0.940 g/cm3	ASTM D792 Method A or ASTM D-1505
Melt Index	maximum	1.0g/10 minutes	ASTM D-1238 Condition E
Tensile Strength at yield	minimum	126 ppi	ASTM D-638
Tensile Strength at break	minimum	75 ppi	ASTM D-638
Elongation at yield	minimum	12%	ASTM D-638
Elongation at break	minimum	100%	ASTM D-638
Tear Resistance	minimum	39 lb.	ASTM D-1004
Puncture Resistance	minimum	70 lb.	ASTM D-4833 or FTMS 101 Method 2065
Carbon Black Content	range	2-3%	ASTM D-1603
Carbon Black Dispersion	N/A	A1, A2, B1	ASTM D-3015
Dimensional Stability (each direction)	change	±2%	ASTM D-1204 212 °F, 15 min.
Seam Strengths:			
Peel Strength (fusion)	minimum	88 ppi	ASTM D-4437
Peel Strength (extrusion)	minimum	63 ppi	ASTM D-4437
Shear Strength(fusion & ext.)	minimum	113ppi	ASTM D-4437

Table 02713-2

REQUIRED PROPERTY VALUES FOR SMOOTH HDPE SYNTHETIC MEMBRANE

PROPERTIES	QUALIFIERS	SPECIFIED VALUES	TEST METHOD
Thickness	minimum	60 mils	ASTM D-5199
Density	minimum	0.940 g/cc	ASTM D792 Method A or ASTM D-1505
Melt Index	maximum	0.3g/10 minutes	ASTM D-1238 Condition E
Tensile Strength at yield	minimum	126ppi	ASTM D-638
Tensile Strength at break	minimum	228ppi	ASTM D-638
Elongation at yield	minimum	12%	ASTM D-638
Elongation at break	minimum	560%	ASTM D-638
Tear Resistance	minimum	39 lb.	ASTM D-1004
Puncture Resistance	minimum	70 lb.	FTMS 101 Method 2065
Carbon Black Content	range	2-3%	ASTM D-1603
Carbon Black Dispersion	N/A	A1, A2, B1	ASTM D-3015
Dimensional Stability (each direction)	change	±2%	ASTM D-1204 212 °F, 15 min.
Seam Strengths:			
Peel Strength (fusion)	minimum	98 ppi	ASTM D-4437
Peel Strength (extrusion)	minimum	70 ppi	ASTM D-4437
Shear Strength (fusion & ext.)	minimum	126 ppi	ASTM D-4437

END OF SECTION

02936
SEEDING

PART 1 - GENERAL

1.01 **WORK INCLUDED**

A. The Work covered by this Section consists of furnishing all equipment, tools, materials, and labor necessary for establishing temporary and permanent vegetative cover, e.g., seeding, fertilizing, and mulching, on all areas disturbed at the site.

1.02 **RELATED WORK**

A. Section 01300 SUBMITTALS

B. Section 02290 EROSION AND SEDIMENT CONTROL

1.03 **REFERENCES**

A. The following publications of the issues listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

1. U.S. DEPARTMENT OF AGRICULTURE (USDA)
Federal Seed Act of 9 August 1939 (53 Stat. 1275)

1.04 **GENERAL REQUIREMENTS**

A. The specified seed varieties and quantities shall be uniformly distributed over the disturbed area in such a manner that will produce an even stand of grass over the entire area seeded. The CONTRACTOR shall notify the ENGINEEER at least ten (10) days prior to seeding operations.

1.05 **SOIL TEST**

A. The CONTRACTOR shall perform agricultural soil tests to determine lime and fertilizer requirements for permanent seeding. Soil tests shall be performed by a recognized commercial laboratory. Test reports shall be submitted to the ENGINEER or their representative in accordance with Part 1.06 of this Section.

1.06 **SUBMITTALS**

A. In accordance with Section 01300 - SUBMITTALS, the CONTRACTOR shall submit the following items:

1. Certificates of Compliance or Reports:

a. Seed;

b. Fertilizer;
b. Lime; and,
d. Agricultural Soil Test Report.

1.07 **DELIVERY, STORAGE, AND HANDLING**

A. Delivery:

1. During delivery, seed shall be protected from any drying or contamination by detrimental material.

2. Seeding material shall be inspected upon arrival at the site; unacceptable material shall be immediately removed from the site by the CONTRACTOR.

3. Fertilizer shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance with City of New York and federal laws and regulations.

4. Pesticides and herbicides shall be delivered to the site in the original unopened containers. Containers without labels, USEPA registration numbers, and the manufacturer's registered uses will be rejected by the ENGINEER.

B. Storage:

1. Seed and fertilizer shall be stored in cool, dry locations away from contaminants.

2. Pesticides and herbicides shall not be stored with other landscaping materials and shall be handled and stored in accordance with the manufacturer's directions.

3. Materials shall be stored in areas designated or approved by the ENGINEER.

PART 2 - MATERIALS

2.01 **MATERIALS**

A. Seed shall be of the latest season's crop and shall be delivered in original sealed packages bearing the producer's guaranteed analysis for percentages of mixtures, purity, germination, weed-seed content, and inert material. Labels shall conform to USDA Federal Seed Act, Rules & Regulations and applicable City of New York seed laws. Wet, moldy, or otherwise damaged seed will be rejected.

B. Fertilizer shall be controlled-release, commercial grade, granular free flowing, uniform in composition, delivered in fully labeled sealed containers, and shall conform to applicable

City of New York and federal regulations. Fertilizer shall bear the manufacturer's guaranteed statement of analysis.

C. Natural limestone shall contain not less than 85% of total carbonates and ground to such fineness that not less than 90% passes a No. 20-mesh sieve and not less than 50% a 100-mesh sieve.

D. Soil Conditions

The soil shall meet the following minimum conditions for permanent vegetative establishment:

1. Soil pH shall be between 6.0 and 8.0
2. Soluble salts shall be less than 500 part per million(ppm)
3. The soil shall contain less than 40% clay, but adequate fine-grained materials to maintain moisture.
4. Soil shall contain 3.75% minimum and 20% maximum organic matter by weight.
5. Soil must contain sufficient pore space to permit adequate root penetration.
6. If these conditions cannot be met by soils on site, adding topsoil or soil amendments is required after approval by the ENGINEER.

E. Mulch

1. Straw Mulch shall be unrotted stalks from oats, wheat or rye that are free from noxious weeds, mold, or other objectionable material. The straw mulch shall contain at least 50 percent by weight of the material to be ten (10) inches or longer. Straw shall be in an air-dry condition and suitable for placing with blower equipment.

2. Hydro-Mulch Overspray Tackifier shall be the same as, or equal to, a recycled slick paper (containing wood cellulose and kaolinite clay), shall not contain any growth or germination-inhibiting factors, and shall be dyed an appropriate color to facilitate visual metering during application. Slick paper composition on air-dry weight basis: 8 percent moisture maximum, pH 4.5 - 6.5. When added to water, it shall form a homogenous slurry specifically for use in hydraulic mulching equipment. This material when sprayed on the straw mulch becomes a tackifier/binder and provides a stable bed for seed germination.

E. Water shall be of a quality suitable for irrigation.

F. Chemical Treatment Material shall be USEPA-registered and approved herbicides and pesticides. These materials shall comply with all applicable State of Ohio and federal laws and regulations.

PART 3 - EXECUTION

3.01 DATES FOR SEEDING

A. Seeding shall be performed upon completion of final grading activities for Work associated extraction well replacement.

1. From March 1 to May 31 or August 1 to September 30, permanent seeding shall occur in accordance with Table 02936-1.

2. From October 1 through November 20, the CONTRACTOR shall prepare the seedbed, add the required amounts of lime and fertilizer, and mulch and anchor. After November 20, and before March 15, the CONTRACTOR shall conduct permanent seeding with a 50 percent increase of the rates outlined in Table 02936-1.

3. From November 20 through March 15, when soil conditions permit, the CONTRACTOR shall prepare the seedbed, lime and fertilize, apply the selected permanent seed mixture, and mulch and anchor. The CONTRACTOR shall conduct seeding with a 50 percent increase of the rates specified in Table 02936-1.

3.02 PREPARATION OF SEEDBED

A. Tillage

1. The soil shall be tilled to a depth of at least 3 inches by plowing, disking, harrowing, or rototilling. When drought, excessive moisture, or other unsatisfactory conditions prevail, the Work shall be stopped. The soil surface shall be leveled to meet finish grade requirements before seeding. Seedbed preparation shall be performed on the contour to reduce soil loss.

B. Application of Fertilizer and Lime

1. Fertilizer shall be incorporated into the soil to a depth of 3 inches during seedbed preparation.

C. Fertilizer and Lime Rate

1. Fertilizer and Lime shall be applied at the rate determined by the results of the CONTRACTOR's Agricultural Soil Test. The following rates are provided as a comparison to the Agricultural Soil Test results.

a. For temporary seeding, the fertilizer shall be applied at a rate of 12-15 pounds per 1000 square feet or 500-600 pounds per acre of 10-10-10 or 12-12-12 analysis or equivalent.

b. For permanent seeding, the fertilizer shall be applied at a rate of 12 pounds per 1000 square feet or 500 pounds per acre of 10-10-10 or 12-12-12 analysis or equivalent.

3.03 **PLANTING SEED**

A. Prior to seeding, any previously prepared seedbed areas compacted or damaged by interim rains, traffic, or other cause, shall be reworked to restore the ground condition previously specified. Seed shall be planted at the rate specified herein.

B. Seed planting shall be accomplished by:

1. Broadcast Seeding: The CONTRACTOR shall broadcast seed by hand or with approved gravity or cyclone types of spreading equipment. Broadcast seeding shall be covered to an average depth of ¼ to ½-inch. Completed seeding shall be mixed into soil with a harrow or rake and compacted with a cultipacker-type roller providing 60 to 90 pounds weight per linear foot of roller, or by equivalent approved hand rolling or compacting methods. Broadcast seeding will not be permitted when wind velocity is such as to prevent uniform seed distribution. Do not sow immediately following rain or when ground is too dry.

2. Drill Seeding: The CONTRACTOR shall plant seed with a Brillon-type grass seed drill equipped with seeding mechanisms, agitator, double disk furrow openers and packer wheels. The seed drill shall plant, cover and compact the seedbed in the same operation. The distance between drill rows shall not be more than 3 to 4 inches apart with planting depth of $^{1}/_{4}$ - $^{1}/_{2}$-inch. Drill seeding is recommended over broadcast for large areas of seeding.

3. Hydroseeding: If hydroseeding is used and the seed and fertilizer is mixed, they shall be mixed on site and the seeding shall be immediate and without interruption.

4. Mulching: The CONTRACTOR shall perform mulching on the same day as planting seed.

    a. Applying Mulch: Straw mulch shall be spread uniformly in a continuous blanket over the seeded areas, using a minimum of 2 tons per acre, or as directed by the ENGINEER. The mulch shall be spread in such manner as to prevent bunching.

b. Securing Mulch: Immediately following (the same day) the spreading of the mulch, the material shall be anchored securely to the soil by use of the Hydro-Mulch Overspray Tackifier material. The material shall be applied by a hydroseed blower, or as approved by the ENGINEER. The material shall be applied in a raining technique to prevent bunching and displacement of the straw mulch.

3.04 PROTECTION AND CLEANUP

After seeding and mulching operations have been completed, barricades and approved warning signs shall be erected by the CONTRACTOR as required to provide protection against traffic and trespass. Excess material from seeding and mulching operations, and all debris, shall be cleaned up and disposed off-site by the CONTRACTOR, unless otherwise directed by the ENGINEER.

3.05 ESTABLISHMENT AND MAINTENANCE PERIOD

A. Establishment Period

The CONTRACTOR is responsible for the establishment and maintenance of permanent seeding for a minimum period of one year from the date of the establishment of vegetative coverage. Establishment of vegetative coverage is defined as follows:

1. Vegetative growth over 90 percent of the seeded surface.

2. Growth of the vegetation shall have reached a minimum blade length of at least 6 inches; and,

3. No bare spots greater than 10 square feet can be observed.

B. Maintenance Period

The CONTRACTOR shall be responsible for maintenance of temporary and permanent seeding until receiving the Certificate of Final Acceptance. Maintenance activities performed by the CONTRACTOR shall include:

1. The CONTRACTOR shall repair and seed patches of dead vegetation which are the result of improper seeding practices or the lack of protection.

2. Eroded or damaged areas shall be repaired and reseeded by the CONTRACTOR. Typical repairs include, but are limited to, replacement of lost topsoil, application of required fertilizers, preparation of the seedbed, seeding, and mulching. Watering of seeding is not required.

Table 02936-1

Seeding Requirements

SEEDING MIXTURES	RATE PER ACRE
Asclepias Syriaca (Milkweed)	3.0 lbs.
Cassis Fasciculate (Partridge Pea)	0.5 lbs.
Euthamia Graminifolia (lance-leaf Goldenrod)	0.25 lbs.
Solidago Rugosa (Rough-stemmed Goldenrod)	0.25 lbs.
Aster Pilosus (white Heath Aster)	0.25 lbs.
Solidago Canadensis (Canadian Goldenrod)	0.25 lbs.
Andropogon Gerardii (Big Bluestem)	5.0 lbs.
Schizachyrium Scoparius (Little Bluestem)	4.5 lbs.
Sorghastrom Nutans (Indiangrass)	3.5 lbs.
Panicum Virgatum (Switchgrass)	1.5 lbs.
Rudbeckia Hirta (Black-eyed Susan)	0.25lbs.

END OF SECTION

E -2 E -2 E -2 E -2 E -1 E -1

N 29000
N 28500
N 28000
N 27500
N 27000

EW-9
PV-1
PV-4
PV-2
PV-5
EW-7
EW-4
PV-6
PV-3
EW-15

LIMIT OF FINAL COVER SYSTEM

LIMIT OF FINAL COVER SYSTEM

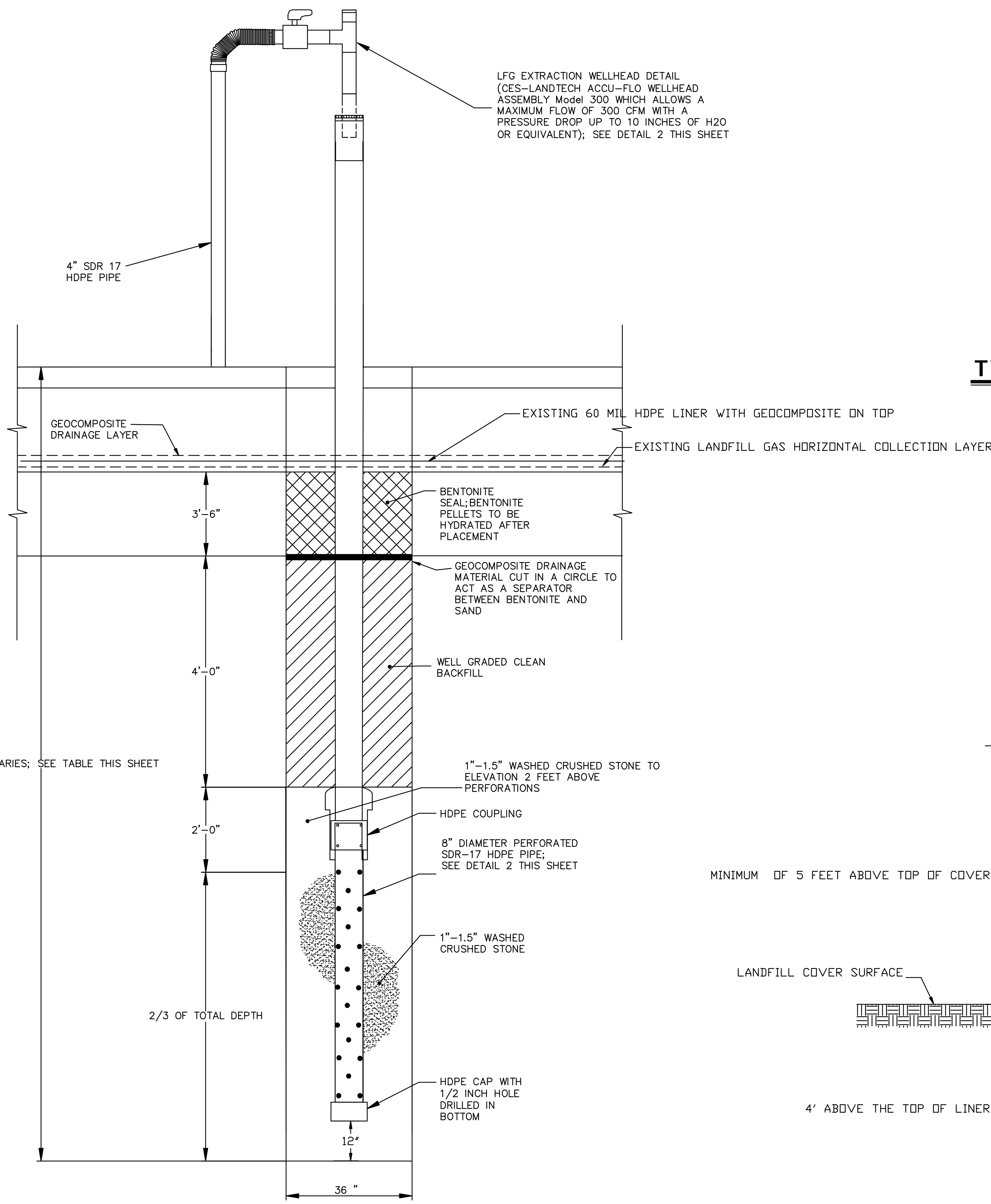
EW-6
WELLS TO BE REPLACED

NYDEP
PELHAM BAY, NEW YORK

LOCATION OF LANDFILL GAS EXTRACTION WELLS SCHEDULED TO BE REPLACED

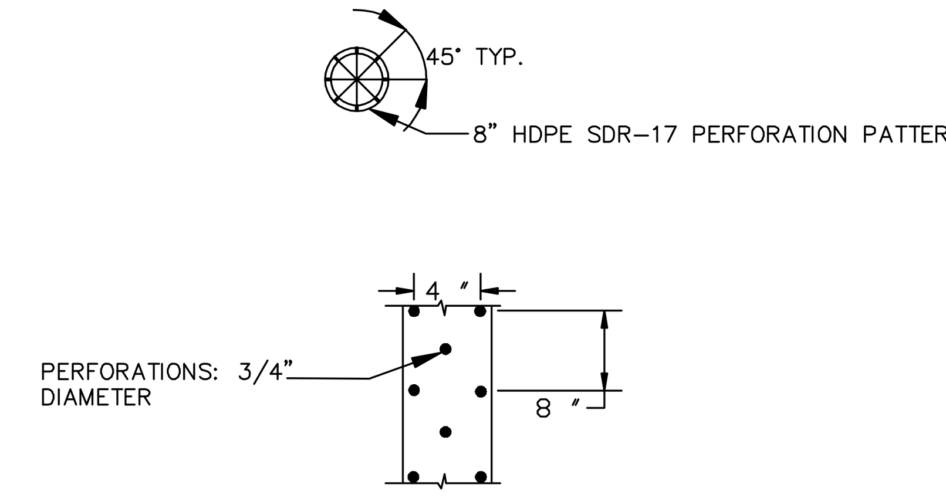
ARCADIS

FIGURE
1



TYPICAL GAS EXTRACTION WELL (1)

NOT TO SCALE



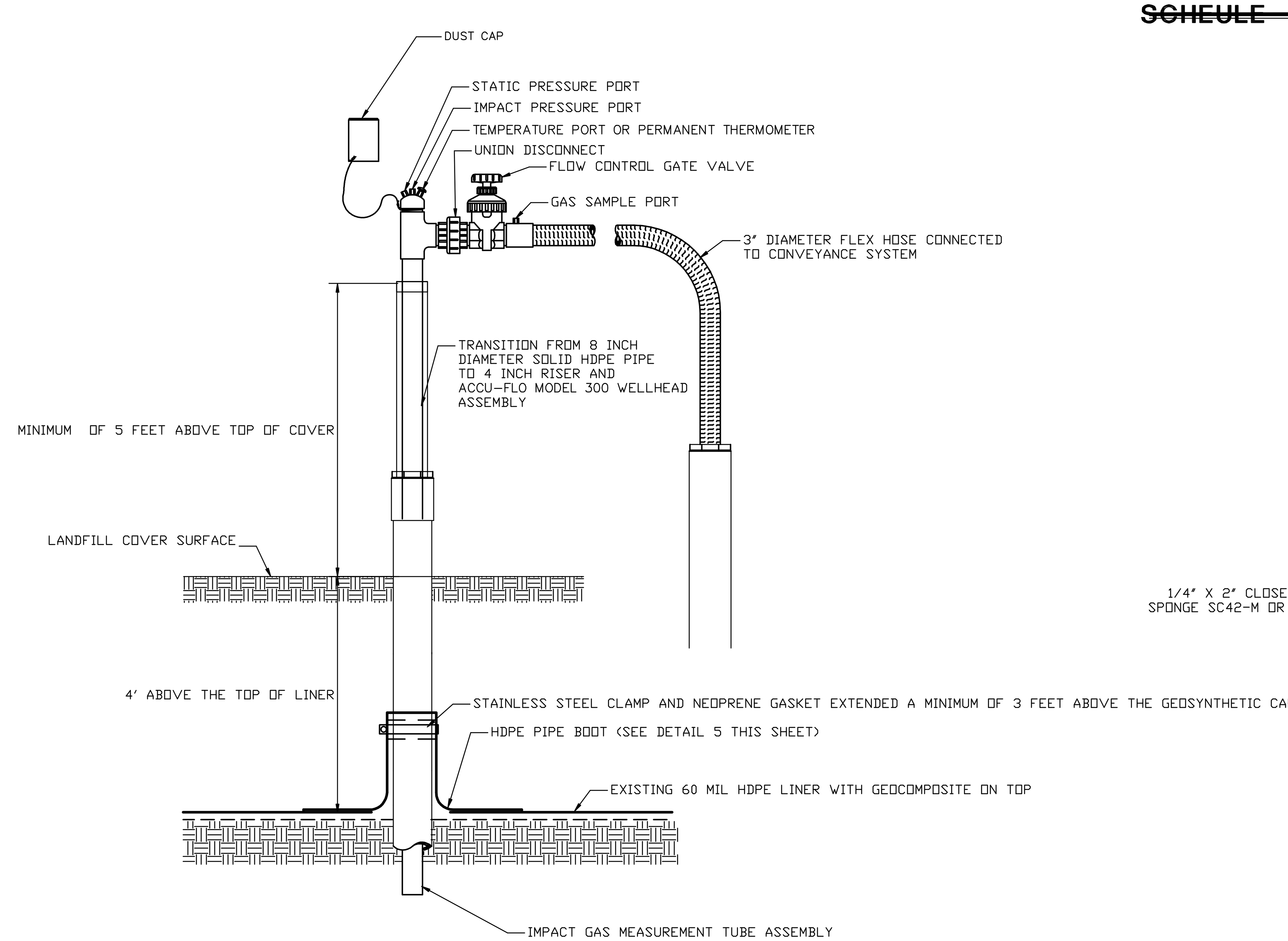
TYPICAL PIPE PERFORATIONS (2)

NOT TO SCALE

Phase	Well ID	Approximate Elevation of Landfill Surface (Bronx Dataum)	Approximate Transition Length Of SDR-17 HDPE Pipe (Transition from 8 inch Diameter to 4 Inch Diameter) (Ft)	Approximate Length Of 8 Inch SDR-17 HDPE Riser in feet (Approx. 1/3 of Well Depth)	Approximate Length Of 8Inch Diameter SDR-17 HDPE Perforated Screen (Ft)	Approximate Boring length in ft below top of landfill cover (36 inch diameter)
Phase 1 Replacement Wells	EW-9	126	6	40	79	125
	EW-15	131	6	40	84	130
	EW-4	137	6	40	90	136
	EW-7	131	6	40	79	125
					Total	516

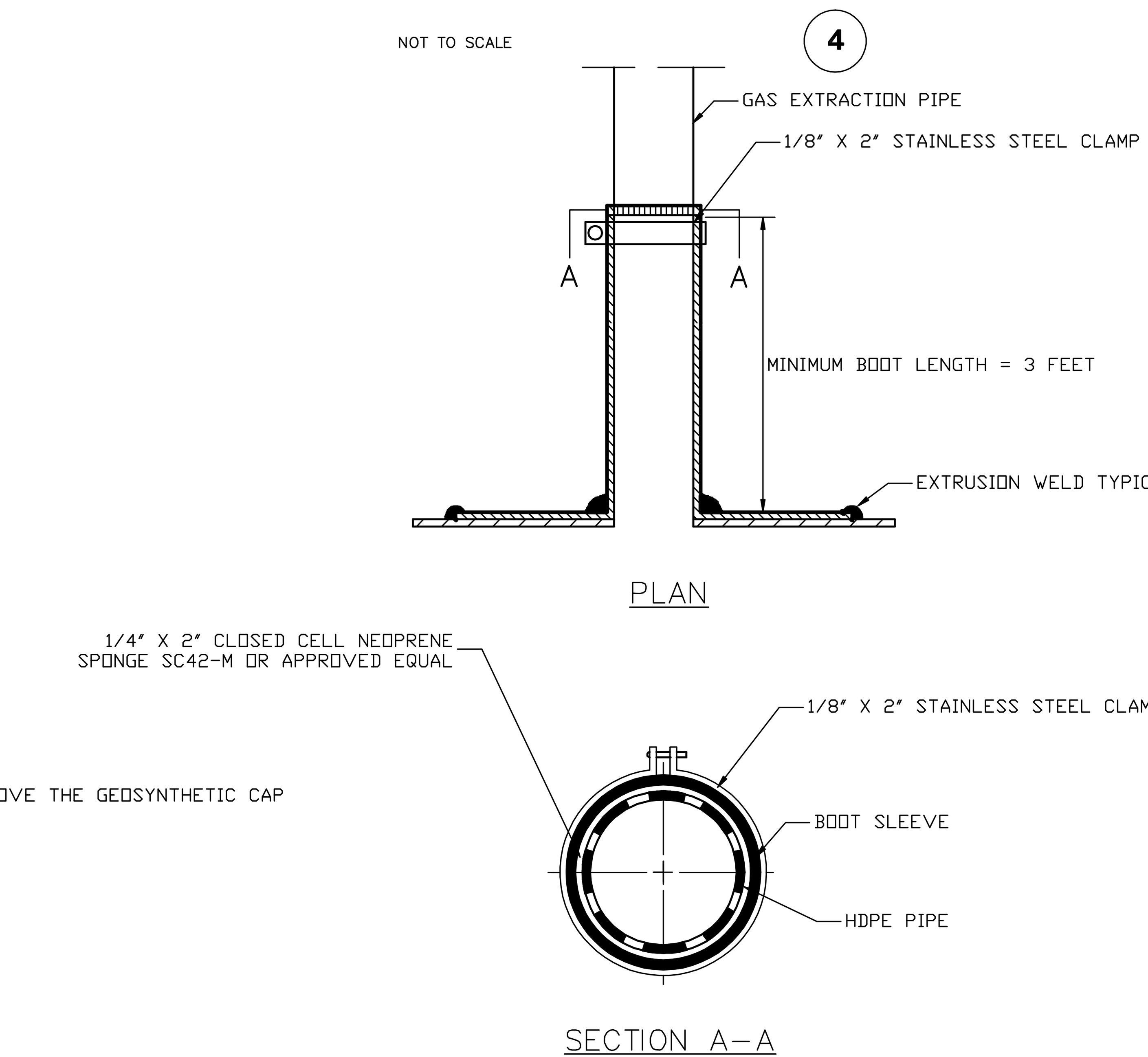
Notes:
1. Final boring depths will be determined in the field based on existing conditions.
2. Wells are listed in an order of priority.

LANDFILL GAS EXTRACTION WELLHEAD ~~SCHEULE~~



LANDFILL GAS EXTRACTION WELLHEAD ASSEMBLY (3)

NOT TO SCALE



GEOMEMBRANE BOOT (5)

NOT TO SCALE

SCALE(S) AS INDICATED

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name (PE'S FULL NAME)
Professional Engineer's No. (PE NUM)
State (ST) | Date Signed | Project Mgr. (MGR)
Designed by (DSN) | Drawn by (DFT) | Checked by (CHK)

ARCADIS

ARCADIS OF NEW YORK, INC.

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION • BRONX NEW YORK CITY

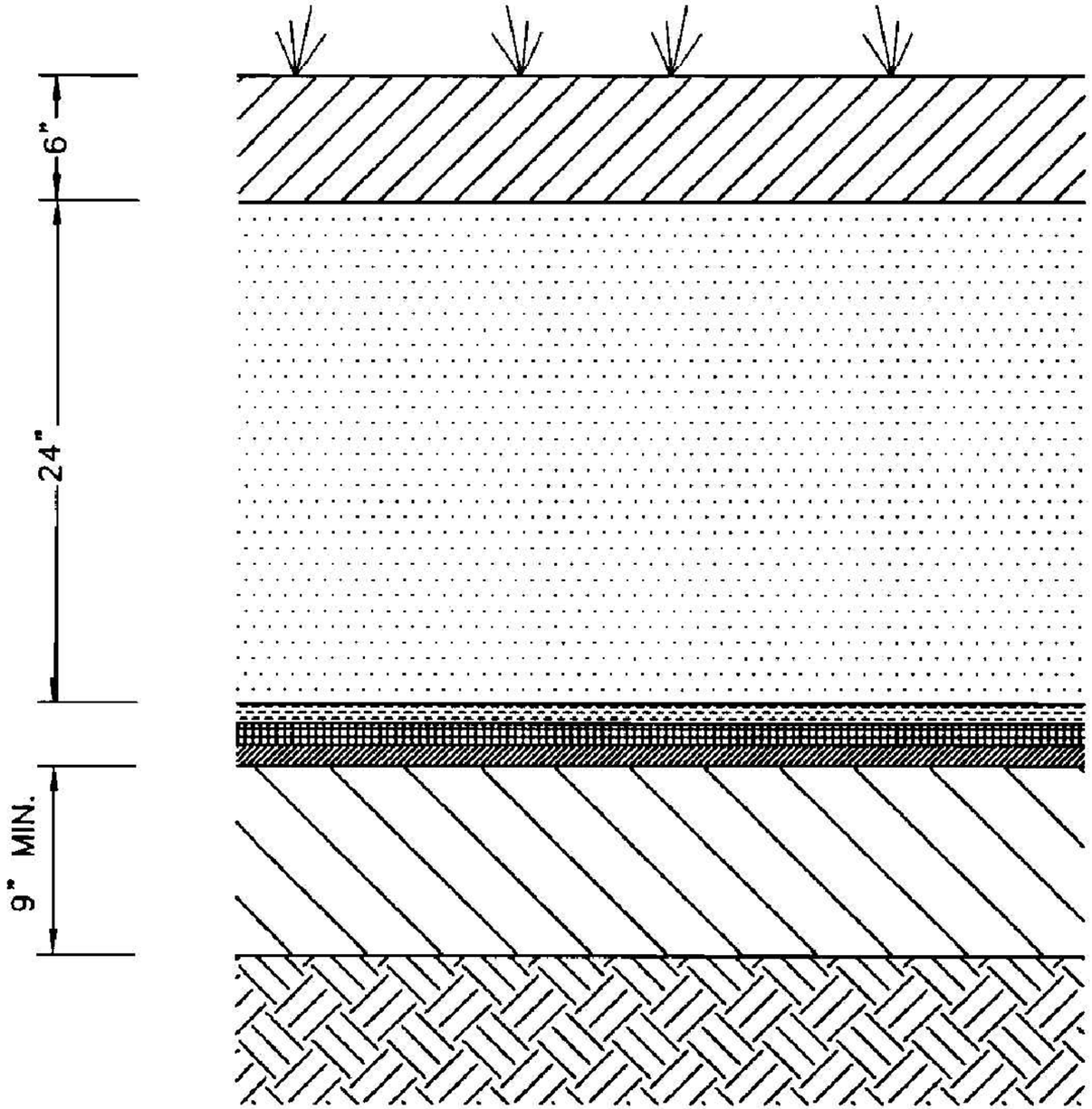
PELHAM BAY LANDFILL REPLACEMENT LANDFILL GAS EXTRACTION WELL

ARCADIS Project No. 12345678.0000.12345

Date (DATE)

ARCADIS
ADDRESS LINE1
ADDRESS LINE2
CITY, STATE
TEL. XXX.XXX.XXXX

2



VEGETATED TOPSOIL LAYER

LOAMY SOIL LAYER

GEOCOMPOSITE

60mil HDPE GEOMEMBRANE

RANDOM SOIL CLASS II

WASTE OR RANDOM SOIL CLASS I

TYPICAL COVER SECTION

NOT TO SCALE

NYDEP
PELHAM BAY, NEW YORK

TYPICAL COVER SOIL SECTION

ARCADIS

FIGURE
3

ATTACHMENT 1

DRAFT CONTRACT DOCUMENTS

PROJECT SUBCONTRACT AGREEMENT

This Project Subcontract Agreement is made and entered into by and between Severn Trent Environmental Services, Inc. (hereinafter referred to as the "Contractor") located at _____ and _____ located at _____ (hereinafter referred to as "Subcontractor").

WHEREAS, the Contractor has entered into a certain contract to provide specified services or equipment (such contract is referred to hereunder as the "Client Contract") with the owner of systems or facilities that requires such services or equipment or with other contractors performing work at such systems or facilities (each referred to hereunder as a "Client"); and

WHEREAS, the Subcontractor has agreed to perform a portion of the work required under the Client Contract as set forth below;

NOW, THEREFORE, in consideration of the mutual covenants and promises contained herein, the Contractor and Subcontractor hereby agree as follows:

START DATE: _____

COMPLETION DATE: _____

DESCRIPTION OF SERVICES AND COMPENSATION:

Subcontractor agrees to provide the Services as set forth in Attachment 1 – Scope of Work, Compensation and Payment Terms

SAFETY:

Subcontractor agrees to comply with the Contractor's Workplace Safety Requirements as set forth in Attachment 2, as well as any other specific safety regulations required by Client as identified in Attachment 1 and any safety measures that Contractor or Client may from time to time establish. Any misrepresentation by Subcontractor regarding safety performance shall constitute a material breach and default of this Agreement.

INSURANCE:

Subcontractor shall procure and maintain throughout the term of this Agreement, insurance complying with the Minimum Subcontractor Insurance Requirements as set forth in Attachment 3. Prior to commencing any services under this Agreement, Subcontractor shall submit to Contractor a certificate of insurance evidencing such compliance, along with copies of any required endorsements. If any of the insurance policies expire during the term of this Agreement, Subcontractor shall provide Contractor with a certificate of insurance confirming renewal of such policies not less than ten (10) days prior to the expiration date of coverage.

In the event that the Client requires the Subcontractor to provide more than the Minimum Subcontractor Insurance, such requirements will be identified in Attachment 1 and Subcontractor shall procure and maintain such insurance at its sole expense.

BONDS:

To the extent required by the Client, Subcontractor, at its expense, shall secure and at all times maintain performance and payment bonds in an amount and form acceptable to Contractor and Client as identified in Attachment 1.

CORPORATE RESPONSIBILITY:

Subcontractor shall, from the effective date of this Agreement and as a condition of this Agreement, comply with all standards of commercial integrity and business ethics as are embodied in all applicable federal, state, and local laws, regulations, orders, decrees or settlements, whether civil or criminal, including but not limited to all such requirements pertaining to equal employment opportunity, the environment, labor, human rights, occupational health and safety and public integrity. In addition, Subcontractor shall take all reasonable steps to establish health and safety and environmental management systems to meet or exceed those applicable standards and to consider Contractor's recommendations, if any, regarding same. Any persistent violation or a single egregious violation of this provision shall constitute a breach of this Agreement.

THE STANDARD TERMS AND CONDITIONS on the following pages and the above-referenced attachments are agreed to be part of this Subcontract Agreement.

IN WITNESS WHEREOF, the parties have duly executed this Agreement effective this _____day of _____, 200_____.

CONTRACTOR:
SEVERN TRENT _____, INC.

BY: _____
(Name and Title)

Address for Notices:

_____

_____

_____

SUBCONTRACTOR:
_____

BY: _____
(Name and Title)

Address for Notices:

_____

_____

_____

STANDARD TERMS AND CONDITIONS OF MASTER SUBCONTRACT AGREEMENT

Definitions As used herein, the following terms shall have the following meanings:

--*"Agreement"* means these terms and conditions and any additional terms and conditions attached hereto and/or expressly incorporated herein, directly or by reference;
-- **"***Completion Date*" means the date designated in this Agreement for the completion of the Services. The Completion Date may be changed only pursuant to a duly authorized change order;
-- "*Client Contract*" has the meaning set forth in the recitals to this Agreement. The Client Contract includes any and all drawings, plans, specifications, amendments, addenda attached and/or incorporated by reference thereto, all of which may be made part of this Agreement and incorporated herein as if set forth herein in full;
--"*Contract Price*" means the compensation to be paid by the Contractor to the Subcontractor in accordance with this Agreement for services rendered thereto;
--*"Contractor"* has the meaning set forth in the recitals to this Agreement;
--"*Client"* has the meaning set forth in the recitals to this Agreement;
--*"Retainage"* means such portion of each progress payment made by the Contractor to the Subcontractor on account of the Contract Price, if any is so indicated in Attachment 1, to be withheld as security to assure the faithful completion of the Services and performance of Subcontractor's obligations;
-- "*Services*" means the services to be provided by the Subcontractor as described in Attachment 1, which Services shall be performed pursuant to the terms and conditions of this Agreement;
--*"Subcontractor"* has the meaning set forth in the recitals to this Agreement;
--*"Start Date"* means the date designated in this Agreement for the start of the Services. The Start Date may be changed only by the Contractor upon written notice to the Subcontractor;
Other terms not expressly defined above have the meaning so given to them by this Agreement.

Construction of Agreement. Whenever the context requires, the gender of all words used in this Agreement includes the masculine, feminine, and neuter. All references to articles and sections refer to articles and sections of this Agreement, and all references to exhibits or attachments are to exhibits and attachments attached to this for all purposes. Captions, headings, cover pages, tables of contents and footnote instructions contained in this Agreement are inserted only to facilitate reference and for convenience and in no way define, limit or describe the scope, intent or meaning of any provisions of this Agreement. Words and abbreviations that have well known technical or trade meanings are used in this Agreement in accordance with such recognized meanings. The layout (if any) of mechanical and electrical systems, equipment, fixtures, piping ductwork, conduit, specialty items and accessories indicated on any drawings furnished to the Subcontractor is diagrammatic and all variations in alignment, elevation and detail required to avoid interferences and satisfy architectural or structural limitations are not necessarily shown.

Representations and Warranties. Subcontractor hereby represents, warrants and covenants that: (a) Subcontractor is a legal entity, duly organized, validly existing and in good standing under the laws of its state and country of organization and has all requisite power and authority, rights and franchises to own and operate its properties, to carry on its business as now conducted and as proposed to be conducted, and to enter into and perform this Agreement; (b) the execution delivery and performance of this Agreement has been duly authorized and approved by all necessary corporate or similar action on its part; (c) the execution, delivery and performance of this Agreement will not conflict with, or result in any violation of, or constitute a default or a condition which upon notice or lapse of time, or both, would constitute a default, under the organizational documents of the Subcontractor nor under any judgment, order, writ, injunction, decree, rule, regulation, permit, license, note, agreement, mortgage, deed, contract or other instruments that apply to, or which bind, the Subcontractor; (d) this Agreement has been duly executed by the Subcontractor and is a legally valid and binding obligation of the Subcontractor, enforceable against the Subcontractor in accordance with its terms, except as such enforceability may be limited by bankruptcy, insolvency, reorganization, moratorium or similar laws affecting creditors' rights generally, by general principles of equity and by the exercise of judicial discretion; (e) there are no actions, suits, proceedings or governmental investigations pending, or, to its best knowledge, threatened, against it, or judgments, decrees, orders, rulings, writs or injunctions outstanding against it, that would in each such case have a material adverse effect upon the Subcontractor's ability to execute this Agreement or otherwise to consummate and perform its respective obligations hereunder; (f) Subcontractor is familiar with all existing laws, rules and regulations, including without limitation, all applicable environmental and health and safety laws and regulations and all local laws and regulations in the country and location where the work is performed that relate to and/or may affect Subcontractor's obligations hereunder; (g) Subcontractor has or will acquire all appropriate licenses and permits, if any, required to perform the Services under this Agreement; and (h) Subcontractor carefully reviewed the terms of this Agreement , and is, or shall be, satisfied with its ability to perform its obligations hereunder.

Confidentiality. Subcontractor acknowledges that, in the course of the dealings hereunder, it may acquire information about the Contractor or Contractor's Client, their business activities, business prospects and operations, their technical information and their trade secrets, their patented and un-patented inventions, their drawings, blueprints, flow sheets, designs, engineering information, construction information, financial information, operation criteria, customers, subcontractors, and other information of similar nature (whether or not same is reduced to a tangible medium), all of which are proprietary and highly confidential ("Confidential Information"). Subcontractor shall hold all Confidential Information in strict confidence and shall not reveal the same except for information (a) which may be disclosed pursuant to the terms of this Agreement; (b) generally known to the public; (c) known prior to negotiations leading to this Agreement; (d) independently acquired outside the scope of this Agreement; or (e) lawfully disclosed by or to a third party or tribunal. The Confidential Information shall be safeguarded by Subcontractor to the same extent that it safeguards its own most confidential materials or data relating to its own business. Subcontractor shall not use the Confidential Information for its own benefit or the benefit of a third party without the express written consent of the Contractor. The provisions of this subparagraph shall survive the termination of this Agreement for a period of ten (10) years thereafter.

Quality of Work and Materials. All Services to be provided hereunder shall be performed by qualified personnel in accordance with industry standards and in strict compliance with all applicable laws, the terms and conditions of this Agreement and/or Client Contract, if applicable. Subcontractor acknowledges that the Contractor and the Client are relying on the Subcontractor to use the effort, skill, diligence and quality control/quality assurance measures expected of a first class, qualified professional firm performing services of a similar nature to the Services to be performed by the Subcontractor. Any materials furnished by the Subcontractor shall be new, current, of merchantable quality and in compliance with any technical standards or specifications incorporated into this Agreement. When certain materials

are specified by a reference standard, Subcontractor may select, with the written permission of the Contractor, any suitable commercially acceptable material meeting the standard.

Subcontractor Conduct and Responsibility when Providing Services. (a) Prior to furnishing any Services, Subcontractor shall obtain and provide the Contractor with the performance and/or payment bonds, if any are required, and proof of insurance in accordance with the terms hereof; (b) Subcontractor shall be responsible for the safety, efficiency and adequacy of its employees and any vehicles and/or machinery, equipment or materials furnished by Subcontractor during the performance of Services and for damages which may result from defective or improper maintenance or operation of any such vehicles and/or machinery, equipment or materials; (c) The Contractor and/or the Client may direct Subcontractor to prevent access to, or remove from any location in which Services are provided any individual or employee of Subcontractor: (i) who is consuming alcoholic beverages and/or has consumed alcoholic beverages and is then under the influence of alcohol; (ii) who has been, or is, engaged in the use of any illegal drug, narcotic or controlled substance and is then under the influence of such illegal drug, narcotic or controlled substance; or (iii) who, in the reasonable opinion of the Contractor and/or the Client, hinders the progress of, or interferes with, any work performed on site; (d) Subcontractor shall handle and take care of all materials and/or equipment furnished by Subcontractor in the performance of the Services and shall be responsible for the security and condition of the same. After completion of the Services, Subcontractor shall carefully remove all materials and/or equipment furnished or used by it; and (e) Subcontractor shall be responsible for the collection, removal and disposal of all waste materials in accordance with applicable law, and all paper, cartons and other debris caused by the performance of the Services by Subcontractor.

Change in Law. Changes in current laws, regulations and ordinances including, without limitation, all applicable environmental and health and safety laws, rules and regulations shall result in a change in scope and may require a modification of the Contract Price, but only to the extent that same is allowed under the Client Contract.

Change or Field Orders. The Contractor may add or delete, modify, alter, or accelerate the schedule for the Services, including without limitation, order changes to the Services, or require the Subcontractor to perform additional services, but only through a duly executed change or field order. All change orders and field orders shall be in writing and require the signature and acceptance by Subcontractor prior to becoming effective. Any adjustments to the Contract Price and/or the Completion Date shall be made strictly in accordance with this Agreement.

Claim for Extra Work. (a) If Subcontractor is of the opinion that any service which it has been ordered to perform is beyond the scope of the Services which it is contractually required to perform, then Subcontractor shall: (i) not suspend the performance of the Services but promptly comply with the Contractor's order or directive and proceed diligently with the performance of the Services in accordance with the Contractor's instructions, and (ii) notify the Contractor in writing within five (5) working days of such order or directive of its reasons for its opinion and request a final determination thereon by the Contractor; and (iii) provide the Contractor in a timely manner with any and all information necessary for the Contractor to pursue a like claim against the Client for an adjustment similar to the adjustment requested by the Subcontractor; (b) If the Contractor shall finally determine that the services required to be performed are within the scope of the Services which the Subcontractor is contractually required to perform without an adjustment, then Subcontractor, in order to reserve its right to claim compensation for any such additional work, must notify the Contractor in writing within five (5) working days after receiving notice of the Contractor's final determination that it is performing such additional services under protest; and (c) In addition to the foregoing, Subcontractor shall submit to the Contractor within twenty (20) days after it has performed such alleged additional services, a detailed statement of all the additional compensation it expects to receive. Under all circumstances, the parties agree that any

adjustments to the Contract Price and/or the Completion Date shall be made strictly in accordance with this Agreement.

Change in Contract Price and Time. The Contract Price will not be revised for any reason, except as and to the extent expressly provided in change or field orders. (a) The amount by which the Contract Price is to be increased or decreased by any change or field order shall be reasonably determined by the Contractor through one or more of the following methods: (1) by accepting an amount agreed upon by the Contractor and the Subcontractor; (2) by applying the applicable unit prices and alternate prices, if any; (3) by receiving from Subcontractor a detailed breakdown satisfactory to the Contractor, including actual time slips and invoices, itemizing the direct cost of additional labor and additional materials necessary to perform the additional services under the change or field order; (4) by receiving from Subcontractor a true copy of his bid work sheets to determine the Contract Price allocable to any eliminated Service. (Should Subcontractor fail to furnish the Contractor with such bid work sheets, then the Contractor shall determine the amount of the reduction. The determination of the Contractor shall be final and binding unless erroneously or fraudulently arrived at); or (5) by adding to the Contract Price only the amount of the premium portion of overtime pay resulting from an acceleration of the Services. Where the changed scope of services involve both an increase and a reduction in any Services to be provided hereunder, the Contract Price shall only be increased to the extent that the cost of the increase exceeds the cost of the reduction; (b) The compensation specified in any change or field order or any adjustment to the Contract Price occasioned by any change or field order shall constitute an accord and satisfaction chargeable against both parties herein; (c) No time extension shall be granted to the Subcontractor by reason of the issuance of any change or field order unless it is expressly stated therein; (d) The Completion Date will not be revised for any reason by the Subcontractor except upon the occurrence of an event of Force Majeure or unless otherwise agreed to in a change or field order. The Completion Date may, however, be accelerated by the Contractor and the Subcontractor shall be compensated for its overtime in accordance with the provisions of (a)(5) above. The Completion Date may also be delayed at the sole but reasonable discretion of the Contractor upon the furnishing of a written notice to the Subcontractor; (e) Notwithstanding the generality of any of the foregoing provisions contained in this Section, under no circumstances shall the Contract Price or the Completion Date be adjusted on account of or as a result of any occurrence or transaction arising out of or from the negligence, wrongful willful act or wrongful failure to act on the part of the Subcontractor.

Changed Site Conditions. Subcontractor shall promptly, and before such conditions are disturbed, notify the Contractor in writing of: (1) subsurface or latent physical conditions differing materially from those indicated in this Agreement, or (2) unanticipated physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in this Agreement. The Contractor shall promptly investigate the conditions, and if it confirms Subcontractor's claim, all changes in Contract Price and Completion Date shall be made in accordance with a change order. No claim of the Subcontractor for changed conditions shall be allowed unless Subcontractor has given the notice required under this Section and unless Contractor is able to negotiate for a similar relief from the Client.

Indemnity. From and after the date hereof, Subcontractor and Subcontractor’s subcontractors, agents and assigns shall reimburse, indemnify and hold harmless the Contractor, its directors, officers, shareholders and affiliates (each such entity and its successors and assigns is referred to herein as an “Indemnified Party”), against and in respect of: (a) any and all damages, losses, settlement payments, deficiencies, liabilities, costs and expenses, including without limitation, attorney’s fees suffered, sustained, incurred or required to be paid by any Indemnified Party because of, or that result from, relate to or arise out of (i) the untruth, inaccuracy or breach of any representation, statement or warranty, or the failure to fulfill any agreement or covenant of the Subcontractor contained in this Agreement or contained in any certificate or other writing furnished to any Indemnified Party by or on behalf of the Subcontractor pursuant to this Agreement; and (ii) bodily injury, disease or death to any person, including Subcontractor’s employees,

or damage to property, to the extent caused by the willful or negligent acts or omissions of Subcontractor, Subcontractor's employees or any of Subcontractor's lower-tier subcontractors or suppliers.

Use or Occupancy Prior to Acceptance. If before final acceptance of the Services, the Contractor and/or the Client desire to use, occupy or operate any materials and/or equipment furnished or rehabilitated by the Subcontractor, the Contractor and/or the Client shall have the right to do so, and Subcontractor shall in no way interfere with or object to such use or occupancy. Prior to final acceptance of the Services, the Contractor and/or the Client may elect to accept individual units or portions of materials and/or equipment furnished or rehabilitated by the Subcontractor provided same has been completed in accordance with all of Subcontractor's contractual obligations. Otherwise, such use, occupancy or operation (1) shall not constitute acceptance of space, systems, materials or equipment, or affect the start of any guarantee period and (2) shall not affect the obligations of Subcontractor with respect to any portion of the Services which is not furnished in conformance with this Agreement. Subcontractor shall continue to perform the Services in a manner which shall not unreasonably interfere with such use, occupancy and operation by the Contractor and/or the Client. Any such use, occupancy or operation by the Contractor and/or the Client shall not give rise to any claim for additional compensation by Subcontractor.

Title to Equipment and/or Materials. Title to any and all materials and/or equipment furnished hereunder shall at all times belong to and remain with the Contractor, unless such title has passed to the Client pursuant to the terms of the Client Contract.

Ownership of Documents. All tracing, specifications, computations, notes and other original documents as instruments of service shall become the property of the Contractor and/or the Client, provided however that the Subcontractor shall be entitled to keep copies of same for its records.

Contract Schedule. (a) The Subcontractor shall commence the Services on the Start Date and shall complete the Services on or prior to the Completion Date. Any progress schedule identified or produced in accordance with the terms of this Agreement (hereinafter the "Progress Schedule") shall be followed by the Subcontractor (as same may be modified from time to time in accordance with the provisions of this Agreement), and shall be used by the Contractor to evaluate the progress of the Services; (b) If, in the reasonable opinion of the Contractor and/or the Client, it appears that the Subcontractor will be unable to complete the Services prior to the Completion Date, or if the Subcontractor falls behind the Progress Schedule then in effect, the Subcontractor shall take whatever steps as may be necessary to improve its progress and shall, if requested by the Contractor, submit operational plans to demonstrate the manner in which lost time may be regained. It is the responsibility of the Subcontractor to maintain the Progress Schedule and to complete the Services prior to the Completion Date so as not to delay the progress of work performed by the Contractor, if any, and others. If the Subcontractor falls behind the Progress Schedule, or if it appears that the Services will be difficult for the Subcontractor to complete prior to the Completion Date, it shall be the responsibility of the Subcontractor to increase the number of men, the number of shifts, the days of work and/or, to the extent permitted by law, to institute or increase overtime operations, all without additional cost to the Contractor.

Time is of the Essence. Subcontractor specifically acknowledges that **TIME IS OF THE ESSENCE** with regard to the prompt and diligent completion of the Services prior to the Completion Date. Accordingly, if the Subcontractor shall fail to complete all Services prior to the Completion date, the Contractor may, at its option, withhold from any sums otherwise due and owing to the Subcontractor hereunder, so much of the balance thereof as the Contractor shall deem necessary to secure the Contractor against any costs, expenses, or damages which may be incurred by the Contractor as a result of said failure, but any such withholding shall not be deemed to be a waiver of any additional rights that the Contractor may have under applicable law or under this Agreement

Force Majeure. Notwithstanding any provision to the contrary contained herein, but only to the extent permissible under the Client Contract and/or required under applicable law, Subcontractor shall be entitled to a time extension if a delay in the completion of the Services arises from unforeseeable causes beyond the control and without the fault or negligence of the Subcontractor, including but not restricted to, acts of God, acts of the public enemy, acts of the government in either its sovereign or contractual capacity, acts of another contractor in the performance of a contract with the Government, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, unusually severe weather, or similarly excusable delays of subcontractors or suppliers arising from unforeseeable causes beyond the control and without the fault or negligence of the Subcontractor; and the Subcontractor, within three (3) days from the beginning of any such delay, notifies the Contractor in writing of the causes of delay.

Contract Price and Payment Terms. (a) For the timely performance and completion of the Services in accordance with the terms of this Agreement, the Contractor shall pay the Subcontractor the Contract Price at such times, in such portions, and in such manner as described below or as otherwise provided in this Agreement; (b) To the extent that payment terms set forth in Attachment 1 provide for progress payments, such progress payments shall be made by the Contractor to the Subcontractor on a monthly basis (or in accordance with the relevant payment schedule provided in Attachment 1) in proportionate degree to the amount/value of Services completed during each payment period, less the stipulated amount of Retainage, if such Retainage is to be withheld pursuant to this Agreement (c) Each payment shall be made within a period of thirty (30) days following the Contractor's receipt of invoices/requisitions from the Subcontractor in form and content reasonably acceptable to the Contractor, or as required under the Client Contract, which invoices/requisitions may be required to include proof of payment to or waiver of liens from lower-tier subcontractors and/or suppliers; (d) The final payment which shall include all amounts held in Retainage shall not be due and payable until such time as the Services performed by the Subcontractor have been inspected and accepted pursuant to the terms of this Agreement; (d) Subcontractor understands and agrees that it will accept payment in full for the Services performed under this Agreement at the Contract Price specified herein regardless of whether the final quantities of labor and/or materials are more or less than the estimated quantities used either for the purpose of determining the lowest bid submitted for the Services or for the purpose of deriving the Contract Price. Subcontractor further agrees that the Contractor will not be held responsible even if said estimated quantities shall be found to be not even approximately correct and the Subcontractor shall have and make no claim for damages because of any difference between the quantities of the various classes or items of work actually done or materials actually delivered, and the estimated quantities of same.

Withholding of Payments. If the Subcontractor fails to perform in a timely manner a material obligation under this Agreement, the Contractor may withhold a reasonable portion of the Contract Price to cover the cost of correcting or resolving the lack of performance. If or when the lack of performance is resolved, the Contractor shall pay the withheld amounts to the Subcontractor.

Payment of Taxes. The Subcontractor agrees to comply with and assume all responsibility for the payment of any and all taxes, assessments and fees of every kind and character relating to the Services, including all federal, state and municipal taxes, importation or other taxes and duties, and withholdings and contributions, whether measured by the salaries or wages of any its employees or otherwise, including, but not limited to, unemployment and workmen's compensation acts and all sales and uses taxes, which taxes, withholdings and contributions are all specifically included as part of the Contract Price. The Subcontractor agrees to furnish to the Contractor or the Client documentary evidence of such payment whenever so requested by the Contractor or the Client.

Liens. Subcontractor shall not file nor permit to be filed by any laborer, materialman, subcontractor, mechanic or other similarly situated person, any lien upon any part of the Services, the site(s) on which the Services are provided, or the funds allocated to the Services. If, notwithstanding the requirements of this provision, any mechanic's lien or other claim shall be filed for or on account of the Services

performed, or if any restraining notices or judgment(s) related to Subcontractor performance of the Services shall be filed against the Contractor and/or the Client, then the Subcontractor, within three (3) days after notification thereof, shall discharge such lien, restraining notice or judgment or otherwise make provisions in lieu thereof satisfactory to the Contractor and the Client.

Required Inspections and Tests. If the terms of this Agreement, or any laws, rules, ordinances or regulations, require that any portion of the Services be inspected or tested prior to acceptance, Subcontractor shall give the Contractor timely notice of readiness of the Services for inspection or testing and the date fixed for such inspection or testing. Subcontractor shall bear all costs of such inspection and testing. In addition, whenever, in the opinion of the Contractor, it is desirable to require special inspection or testing of the Services or its individual components, the Contractor shall have the authority to do so at its cost and expense provided that if such special inspection or testing reveals a failure of any portion of the Services to comply with this Agreement, Subcontractor shall bear all costs thereof. In the event that any item fails inspection or testing, the Contractor may require inspection or testing of any or all of the other items of the Services at Subcontractor's cost and expense.

Uncovering of Services. If any portion of the Services shall be covered or concealed contrary to the request of the Contractor, such portion of the Services shall, if required by the Contractor, be uncovered for examination, inspection or testing. Any examination, testing or inspection shall not relieve Subcontractor of its responsibility to maintain quality control over the Services.

Correction of Services. Any Services not approved by the Contractor shall immediately be reconstructed, made good, replaced or corrected by Subcontractor, including all work of other subcontractors destroyed or damaged by such correction, reconstruction or replacement. Rejected materials and/or equipment shall be removed immediately. Acceptance of materials and workmanship by the Contractor or the Client shall not relieve Subcontractor from the obligation to replace all portions of the Services which are not in full compliance with this Agreement.

Warranties and Guarantees. (a) Subcontractor guarantees to the Contractor and the Client that the Services provided and materials and/or equipment furnished shall be free from defects in material or workmanship, shall be of merchantable quality and shall conform to the provisions of this Agreement (and any standards and specifications set forth herein). Subcontractor further acknowledges that it has reason to know that the Contractor requires the materials, equipment and services provided hereunder to be fit for a particular purpose and that the Contractor relies on the skill and judgment of the Subcontractor in selecting and furnishing proper goods and services necessary to render such materials, equipment and services suitable and fit for their intended purposes in all respects. As such, the Subcontractor warrants that each of the materials, equipment and services furnished by the Subcontractor is fit for the Contractor's and the Client's intended purposes in all respects; (b) The Subcontractor agrees to make good, repair or replace, at no cost for labor and/or materials and to the satisfaction of the Contractor and the Client, any defective component of the materials, equipment and services furnished for a period of one (1) year from the date in which final payment is due to the Subcontractor pursuant to the terms of this Agreement. If the Subcontractor fails to commence the repair or replacement of any such defect within three (3) business days after notification by the Contractor, or fails to diligently pursue or complete such repair or replacement within a reasonable time after commencement, the Contractor may proceed to repair such defect or repair such component by whatever method it may deem expedient, and may charge the cost thereof against any payment due the Subcontractor. If the expense of completing such repair or replacement and any additional administrative expenses incurred by the Contractor as a result thereof shall exceed any unpaid balance due to the Subcontractor, the Subcontractor shall pay the difference to the Contractor within ten (10) days after notice; (c) The rights and remedies afforded the Contractor and/or the Client hereunder are in addition to and not in lieu of and do not in any way affect, change, alter, modify, vary or prejudice any right, remedy or recourse which the Contractor and/or the Client may have under other provisions of this Agreement or pursuant to law; (d) Subcontractor hereby assigns to the

Contractor and the Client all of its rights, warranties, or guarantees afforded to it by any of its subcontractors, manufacturers, or suppliers. The assignment of such guarantees or warranties shall not limit the obligation of the Subcontractor hereunder.

Default and Termination for Cause. If Subcontractor shall violate any substantial provision of this Agreement, or any material adverse change shall take place in the financial condition of Subcontractor, or should any of the Subcontractor's representations made hereunder prove to be incorrect or misleading ("Event of Default"); then the Contractor may serve written notice upon Subcontractor and upon Subcontractor's surety, if any, terminating or partially terminating this Agreement at a specified date. Upon such notice to Subcontractor, title to any or all Subcontractor's materials, work in progress, dies and tolls, whether on site or offsite, which are necessary or useful in completing the Services shall vest in the Contractor and/or the Client and the Contractor and/or Client may take possession of and utilize the same for completion of the Services. The Contractor may finish the Services by whatever method it shall deem expedient and Subcontractor shall not be entitled to receive any further payments until the Services are fully performed and accepted. Upon final completion of the Services and acceptance by the Contractor and the Client, the Contractor shall cause the Subcontractor to be paid the balance remaining, if any, after deducting from the amount otherwise payable to the Subcontractor hereunder all costs and expenses of the Contractor arising out of or resulting from the termination or partial termination of this Agreement and including all other set-offs available to the Contractor pursuant to this Agreement. In the event the sum due shall be in favor of the Contractor, Subcontractor shall pay to the Contractor such sum upon demand. Immediately upon termination in accordance with the provisions of this Section, each and every subcontract and purchase order entered into by Subcontractor shall, at the Contractor's option, be automatically assigned to the Contractor, and Subcontractor shall not agree to any provision in a subcontract or purchase order that would prohibit such assignment. In the event that it shall be determined that a termination under this paragraph, otherwise in good faith, was wrongful or not justified, the sole right, remedy and recourse of Subcontractor against the Contractor shall be for money damages not to exceed actual expenses incurred reasonable overhead and expectation of profit on the Services performed, less amount previously paid. Subcontractor, upon the date that such termination shall take effect, shall give prompt written notice to the unions, if any, having jurisdiction over Subcontractor's employees that it consents to the performance of the Services by others. Subcontractor expressly authorizes the Contractor to notify the unions of such consent in the name of Subcontractor. Any failure, neglect or refusal of Subcontractor to issue such notice shall subject Subcontractor to all damages sustained by the Contractor thereby.

Termination for Convenience of the Contractor. Contractor, at any time, may terminate this Agreement in whole or in part for its own convenience. Any such termination shall be effected by delivering to Subcontractor a notice of termination specifying the extent to which performance of the Services is terminated and the date upon which such termination becomes effective. Upon receipt of the notice of termination, Subcontractor shall follow the directions of the Contractor with regard to the continuation or termination of the Services. In the event of a termination pursuant to this Section, Subcontractor shall be paid by the Contractor only the apportioned Contract Price for Services rendered, plus the fair and reasonable value of materials stored on site and under order for which Subcontractor is responsible for payment, less any sums properly deductible by the Contractor, except that payment is conditioned upon Contractor's receipt of such payment from the Client and in no event shall Subcontractor be entitled to compensation in excess of the total unpaid Contract Price.

Suspension of Work. The Contractor, in writing, may at any time and for any reason direct Subcontractor to suspend the performance of the Services for a reasonable specified period of time. Subcontractor shall resume the performance of the Services upon the date specified in such direction or upon such other dates as the Contractor may thereafter specify in writing. The Completion Date may be delayed by a period of time equal to the period during which the performance of the services shall have been suspended.

Independent Contractor. Subcontractor, in performing its obligations to the Contractor hereunder, is acting as an independent contractor. Subcontractor is not an agent of the Contractor and has no authority to represent or bind the Contractor as to any matters, except as expressly authorized herein.

Lower-Tier Subcontractors. Prior to the commencement of the Services, Subcontractor must submit to Contractor a list of all proposed lower-tier subcontractors. Contractor may, in its sole discretion, reject any proposed lower-tier subcontractor. Contractor's rejection of any proposed lower-tier subcontractor shall not constitute grounds for an extension of the Completion Date. Contractor's approval of any lower-tier subcontractor shall not in any way relieve Subcontractor of responsibility for the Services. Subcontractor shall at all times be responsible for the performance of any lower-tier subcontractors and shall ensure their compliance with the terms of this Agreement. Subcontractor shall require any lower-tier subcontractors to comply with the workplace safety requirements and insurance requirements of this Agreement.

Liquidated Damages. If the Client Contract provides for liquidated damages for delay beyond the scheduled completion date and such damages are assessed against the Contractor, then the Contractor may assess liquidated damages against the Subcontractor in proportion to Subcontractor's share of responsibility for such delay. Any such assessment against Subcontractor shall in no way limit Subcontractor's liability to Contractor for any damages caused by Subcontractor's delay.

Entire Agreement. This Agreement constitutes the full understanding between the parties hereto with reference to the subject matter hereof and supersede all prior agreements, whether written or oral, with respect to the subject matter of this Agreement. No other statements, oral or written shall vary or modify the written terms hereof, and neither party shall claim any amendment, modification or release from any provision hereof by mutual agreement, acknowledgement or acceptance of purchase order forms, or otherwise, unless such agreement is in writing and signed by the other party, and specifically states that it is an amendment to this Agreement.

Binding Nature and Restriction on Assignment. This Agreement shall be binding on the parties hereto and their respective successors and permitted assigns. Neither party may, or shall have the power to, assign this Agreement or any of its rights and obligations hereunder without the prior written consent of the other.

Waiver. The duties and obligations imposed by this Agreement and the rights and remedies available hereunder to either party shall be in addition to and not a limitation of any duties, obligations, rights and remedies otherwise imposed or available by law. No action or failure to act by either party including, but not limited to, the making of any payment or permitting a party to continue with the performance of its obligations, shall constitute a waiver of any right or duty afforded under this Agreement, nor shall any such action or failure to act constitute an approval or acquiescence in any breach hereunder, except as may be specifically agreed in writing.

Notices. Wherever under this Agreement one party is required or permitted to give notice to the other party, such notice shall be in writing and shall be delivered personally, sent by facsimile transmission, sent by nationally recognized express courier or sent by certified, registered, first class mail, postage prepaid, but not by electronic mail. Any such notice shall be deemed given when actually received, when so delivered personally, by facsimile transmission or by express courier, or if mailed, on the fifth day after its mailing, postage prepaid to the recipient party.

Dispute Resolution. (a) For work performed within the United States of America, this Contract and performance under it shall be governed by and construed in accordance with the laws of the State of _____. Venue for any action under this Contract shall be in the state court in _____County, _____.

(b) For work performed outside of the United States of America, this Contract and performance under it shall be governed and construed in accordance with the laws of the State of New York, USA. The English language shall be the official text of this Contract. Any dispute, claim or controversy arising out of or relating to this Contract or the breach, termination, enforcement, interpretation or validity thereof, including the determination of the scope or applicability of this agreement to arbitrate, shall be determined by arbitration in New York, New York, USA, or other location agreed by the parties, before a sole arbitrator, conducted in the English language and accordance with the ICC Arbitration Rules as currently in force, administered by the ICC. Judgment on the arbitration award may be entered in and enforced by any court of competent jurisdiction. The arbitrator shall, in the arbitration award, allocate all of the costs of the arbitration, including the fees of the arbitrator and the reasonable attorneys' fees of the prevailing party, against the party who did not prevail. The provisions of this subparagraph (b) shall only apply in connection with work performed outside the United States.

Severability. Each and every provision of law and government regulation required by law to be inserted in this Agreement shall be deemed to be inserted and this Agreement shall read and shall be enforced as though so included herein, and if through mistake or otherwise any such provision is not inserted or is not correctly inserted, then upon the application of either party, this Agreement shall be deemed to be amended to make such insertion or correction. If this Agreement contains any unlawful provision, the same shall be deemed of no effect and shall, upon the application of either party, be deemed stricken from this Agreement without affecting the binding force of the remainder.

Survival. Termination or expiration of this Agreement shall not release either party from any liabilities or obligations set forth in this Agreement which (i) the parties have expressly agreed shall survive any such termination or expiration or (ii) remain to be performed or by their nature would be intended to be applicable following such termination or expiration.

Third Party Beneficiaries. (a) The Client shall have the same relative rights, options and privileges under this Agreement against the Subcontractor as are secured to the Contractor under this Agreement, and the Client shall have the right to exercise the same relative rights, options and privileges toward the Subcontractor in the same manner as the Contractor may exercise like rights, options and privileges against the Subcontractor; (b) This Agreement is entered into between Contractor and Subcontractor; and, with the exception of the Client's rights to enforce this Agreement against the Subcontractor as enumerated in (a) above, this Agreement shall not be deemed to create any rights in third parties, including suppliers, or customers of a party, or to create any obligations of a party to any such third parties.

Counterparts. This Agreement may be executed in several counterparts, all of whom taken together shall constitute one single agreement between the parties hereto.

Approval By Client. Subcontractor agrees that this Agreement may be subject to the approval of the Client and, if so, shall be binding upon the Contractor only in the event that such approval is obtained.

ATTACHMENT 1

SCOPE OF WORK, COMPENSATION AND PAYMENT TERMS

1 DESCRIPTION OF SERVICES AND SCOPE OF WORK

Subcontractor shall provide the labor, materials and equipment to [**FILL-IN]**.

[DETAILED SCOPE OF WORK AND SPECIFICATIONS TO BE FILLED-IN IN ACCORDANCE WITH CONTRACT REQUIREMENTS]

2 CONTRACT PRICE: $

3 MEASUREMENT AND PAYMENT TERMS

[**TO BE FILLED-IN]**

4 SPECIAL REQUIREMENTS

[DESCRIBE IF ANY]

The following sections of the Client Contract are incorporated by reference herein:

[LIST OR DESCRIBE ANY FLOW-DOWN PROVISIONS]

ATTACHMENT 2

WORKPLACE SAFETY REQUIREMENTS

Provisions Relating to Safety and the OSHA Regulations. The Subcontractor is required to perform the Services in a safe manner. The Subcontractor shall seek to avoid injury, loss or damage to persons or property by taking all reasonably prudent steps to protect: (a) its employees and other persons at the worksite; (b) materials and equipment stored at the worksite or at off-site locations for use in the performance of the Services; and (c) all property and structures located at the worksite and adjacent to work areas, whether or not said property or structures are part of the project worksite or involved in the performance of the Services. The Subcontractor shall comply with all applicable rules, regulations, orders and other lawful requirements and standards established to promote worker safety and health at the worksite, including compliance with all applicable provisions of the Occupational Safety and Health Act of 1970 ("OSHA"). The Subcontractor shall be responsible for establishing and implementing a safety program complying with all safety measures, policies and standards required by any governmental authorities having jurisdiction, those required by the Contractor and those required by the Client Contract. The Subcontractor shall indemnify the Contractor for any fines, or penalties imposed on the Contractor as a result of safety or health violations to the extent that any such fines or penalties are the result of the Subcontractor's failure to comply with applicable safety or health requirements, rules, regulations, orders or other lawful requirement.

Providing a safe, injury-free work environment should at all times be the Subcontractor's **NUMBER ONE** priority and responsibility. The following safety requirements are mandatory for all personnel on any assignment. They are not intended to be all-inclusive and may need to be supplemented to meet specific project conditions, additional Client requirements or as otherwise agreed.

The Subcontractor agrees in the performance of this Agreement to understand, comply with and enforce the following requirements.

1. Subcontractor shall comply with and enforce ALL applicable Federal, State, Local or other regulatory agency safety rules including but not limited to the OSHA, including all amendments thereto, and all applicable hazardous substance and waste management laws and shall provide their employees with appropriate health, safety and environmental training as required by local, state or federal regulations.

2. Subcontractor shall comply with Contractor's site-specific health and safety plan and any requirements contained therein including, but not limited to work permit systems for confined space entry, hot work, lockout / tagout and other work as appropriate for the project worksite. Subcontractor shall develop its own worksite specific plan that is in compliance with Contractor's plan.

3. Subcontractor will provide their employees with appropriate, functional safety equipment and personal protective equipment and will ensure that such equipment is used properly.

4. Subcontractor shall comply with Contractor's Substance Abuse Policy.

5. Subcontractor may be pre-qualified by Contractor, subject to periodic review, based upon certain information requested by and submitted to Contractor concerning Subcontractor's health and safety program, safety performance and other criteria established by Contractor. If Subcontractor has not

been pre-qualified by Contractor, Contractor may require Subcontractor to complete safety training prior to commencement of the Services. Such requirement will be at Contractor's sole discretion and Subcontractor shall not be reimbursed by Contractor for any time, expense or other cost related to such training.

6. Subcontractor shall comply with Contractor's established minimum requirements:

   A. American National Standards Institute ("ANSI") approved hard hats.

   B. ANSI-approved safety eyewear.

   C. Leather safety footwear with minimum of 6" ankle foot support. No sneakers or walking shoes will be allowed.

   D. Full body harness with two shock absorbing lanyards shall be used for fall protection for those employees working at heights greater than ten (10) feet, but only if other means of fall prevention are not practical in Contractor's reasonable judgment.

   E. New Employee Orientations and Weekly Safety meetings shall be conducted specific to the hazard exposure in such phase of work.

   F. Approved lockout / tagout procedures shall be used wherever employees could be harmed by an accidental system or equipment start-up.

   G. All electric tools will be grounded or double insulated.

   H. Only trained, authorized, or licensed personnel will operate or service equipment. Equipment will be operated in accordance with manufacturer's recommendations. Proof of training, license and/or certification must be available to be presented upon request.

   I. Work areas shall be maintained clean and orderly at all times. Good housekeeping is essential at all times.

   J. The use, possession or sale of alcohol or regulated drugs is prohibited. Violators will be removed from the project.

   K. Subcontractor shall designate a Safety Supervisor for all subcontract work prior to the start of Contract work.

   L. Possession of firearms is strictly prohibited.

   M. All construction/services work areas must be properly identified and protected with barriers, barricades and appropriate signs.

   N. Operators of any motor vehicle shall follow and obey all traffic rules and shall not operate a vehicle in a reckless or dangerous manner.

   O. No flammable liquid, gas or material of any kind is to be stored in unmarked or unauthorized safety containers.

P. Subcontractor is responsible for ensuring that Subcontractor's employees, lower-tier subcontractors and suppliers are properly trained to handle or use any and all chemical materials required for the Services and that all materials are handled properly and in accordance with all laws and regulations. M.S.D.S. sheets must be on the worksite and available upon request for all chemicals to be used by Subcontractor on the project site.

7. All incidents, injuries, illnesses or damage to property shall be immediately reported to Contractor's representative or designee and shall provide Contractor with copies of any regulatory, administrative or statutory reports relating to any accident, occupational injury or illness occurring in connection with the project.

8. Subcontractor shall immediately report to Contractor any incidents that result in possible infractions of environmental laws, rules or regulations, including but not limited to any spill, discharge, release or escape of any irritant or contaminant, including smoke, vapors, fumes, acids, alkalis, toxic chemicals, and/or waste materials. Containment and cleanup of any such spill, discharge, release or escape shall be the sole responsibility of the Subcontractor. Subcontractor shall provide copies of any regulatory, administrative or statutory reports concerning environmental infractions or incidents occurring in connection with this project to Contractor.

9. Subcontractor shall immediately inform Contractor of any inspection(s) conducted or to be conducted by regulatory agencies when working at a project location and shall inform Contractor of the results of such inspection(s).

10. Contractor's Site Managers/Supervisors shall have the authority to suspend any activity being conducted that could endanger the safety and health of any person until that unsafe or hazardous condition is corrected by the Subcontractor.

11. Violation of any of these requirements may result in termination of the Agreement.

SUBCONTRACT AGREEMENT
ATTACHMENT 3

Minimum Subcontractor Insurance Requirements

Prior to commencing any work under this Agreement, Subcontractor, at its sole cost and expense, shall procure and maintain the necessary insurance coverage and shall meet all insurance requirements as set forth in this attachment, as well as any additional insurance requirements identified herein or attached hereto. If the Client Contract requires Subcontractor to maintain higher limits than those stated below, the higher limits shall apply.

1. Form of Coverage and Minimum Limits

Form of Coverage	Minimum Limits
Worker's Compensation	Statutory requirements in state in which work is performed
Employer's Liability	$500,000 per accident $500,000 each disease – each employee

- Policy shall include a waiver of subrogation

Note: If Subcontractor has no employees or is not required by law to maintain Worker's Compensation insurance for the principals of the business, Subcontractor must provide evidence of accident and health insurance covering work-related injuries for any person performing Services on the project.

Commercial General Liability	$1,000,000 per occurrence $2,000,000 aggregate

- The Commercial General Liability policy shall include Severn Trent Environmental Services, Inc., its parent, subsidiaries, affiliated companies and their respective officers, directors and employees as additional insured. Subcontractor shall provide a copy of the additional insured endorsement, which is subject to Contractor's approval.
- Coverage under the Commercial General Liability policy shall be on an occurrence basis and shall include the following, either within the policy form or by endorsement if required to effect coverage:
  - contractual liability coverage
  - completed operations coverage
  - separation of insureds provision
  - personal and advertising injury coverage
  - no exclusion for explosion, collapse or underground property damage hazards (XCU coverage)
  - Broad form property damage coverage
- Policy shall include a waiver of subrogation

Form of Coverage **Minimum Limits**

- Coverage under the policy shall be primary to any potentially applicable insurance maintained by Contractor or its affiliates

Business Automobile Liability
Bodily injury and property damage –
Combined Single Limit $1,000,000

- Policy shall include a waiver of subrogation
- If Subcontractor's services or work involves transportation of hazardous substances or hazardous materials as defined by the Motor Carrier Act of 1980, Subcontractor's Business Auto Liability policy shall include the MCS90 endorsement with applicable limits in compliance with the financial responsibility requirements of the Motor Carrier Act.

Contractor's Pollution Liability $1,000,000 each claim and aggregate

- Coverage shall be on a claims-made basis
- Coverage shall include bodily injury, property damage, clean-up costs and expenses caused by pollution conditions resulting from Subcontractor's activities at the project location.
- The Contractor's Pollution Liability policy shall include Severn Trent Environmental Services, Inc., its parent, subsidiaries, affiliated companies and their respective officers, directors and employees as additional insured. Subcontractor shall provide a copy of the additional insured endorsement, which is subject to Contractor's approval

2. Insurance Companies

Insurance companies providing the coverage required by this Agreement shall be licensed to do business in the state in which the Services are performed and shall have an A.M. Best rating of no less than A- VIII.

3. Deductibles and Self-Insured Retentions

Subcontractor shall be solely responsible for any and all deductibles and/or self-insured retentions imposed under the insurance policies required by the Subcontractor hereunder.

4. Changes in Coverage

Contractor shall have the right to reasonably amend, or add to the insurance requirements, limits, minimums and standards set forth herein and Subcontractor shall be compensated for the reasonable costs of such changes in coverage to the extent that Subcontractor can demonstrate and provide details of such costs to the Contractor's satisfaction.

In the event that Subcontractor's limits under any of the required insurance policies are reduced to the extent that the minimum limits required in Section 1 above would not be available to pay claims, Subcontractor shall immediately notify Contractor or cause the

insurance company to notify Contractor and Subcontractor shall take immediate action to increase the policy limits such that the minimum limits required by this Agreement are available to settle claims.

5. Requirements of Lower-tier Subcontractors

All lower-tier subcontractors shall be subject to all of the insurance requirements contained herein. Subcontractor shall for ensuring the compliance of all lower-tier subcontractors and shall provide evidence of insurance in the form of an insurance certificate and copies of any required endorsements.

6. Failure to Obtain or Maintain Insurance

Subcontractor's failure to obtain and/or maintain throughout the term of this Agreement any insurance as required under this Agreement, including without limitation, insurance in the amounts, types and coverage issued by insurance companies meeting the requirements hereof, shall constitute a default.

If, in Contractor's good judgment, the Subcontractor, or any person acting by, through, or under the Subcontractor, has not obtained or maintained any insurance as required under this Agreement, Contractor, in addition to any other remedies available to it, including without limitation, those available under this Agreement, may order Subcontractor to stop and cause to be stopped all work under this Agreement and take such precautions as Contractor reasonably thinks is necessary to protect itself from the risks associated with such failure to obtain or maintain such insurance.

7. Notices of Claims

In the event of any potentially insurable injury, damage or loss, Subcontractor shall provide prompt and adequate notice to any insurance company providing potentially applicable coverage, with simultaneous notice to the Contractor. Such notice shall expressly state that it is being provided on both the Subcontractor's behalf and on the behalf of Severn Trent Environmental Services, Inc., its parent, subsidiaries, affiliated companies and their respective officers, directors and employees as additional insured. If the terms of the Client Contract require additional parties to be named as additional insured, such notice shall also expressly state that it is being provided on behalf of those additional insureds. Subcontractor shall be liable to Contractor and any other parties required to be additional insured if it fails to provide such notice. The foregoing shall not limit the Contractor's right to provide notice to insurance company or companies.

8. Insurance Certificates and Copies of Endorsements

Prior to commencing any work under this Agreement, Subcontractor shall deliver to Contractor a certificate of insurance, in a form acceptable to the Contractor, evidencing the existence and amounts of coverage required hereunder, including any required endorsements. The certificate shall include the following cancellation notice provision:

"Should any of the above described policies be cancelled or set for non-renewal before the expiration date thereof, the issuing insurer will mail 30 days written notice to the Certificate Holder named herein."

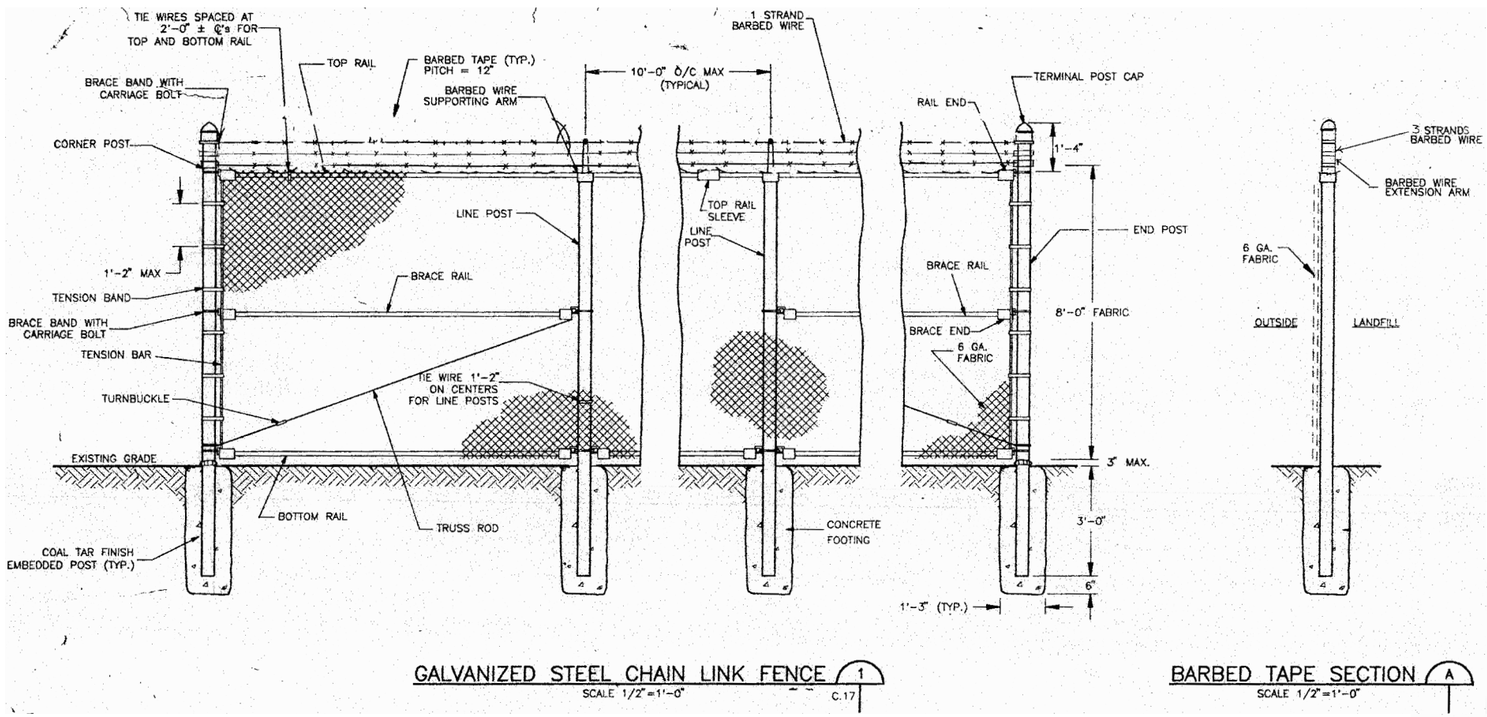
Copies of additional insured endorsements and any other endorsements that place into effect the coverage required herein shall be provided to Contractor along with the insurance certificate. All required endorsements are subject to Contractor's approval.

In the event that any insurance policy required under this Agreement expires during the term of the Agreement, Subcontractor shall deliver to Contractor no later than 10 days following the expiration of such policy a certificate of insurance including any new or renewal policies. Subcontractor shall deliver to Contractor copies of all required endorsement no later than 45 days following the effective date of any new or renewal policies.

Any failure on the part of the Contractor to review, request or receive any insurance documentation shall in no way limit or waive any of the requirements imposed upon the Subcontractor by any provision of this Agreement.

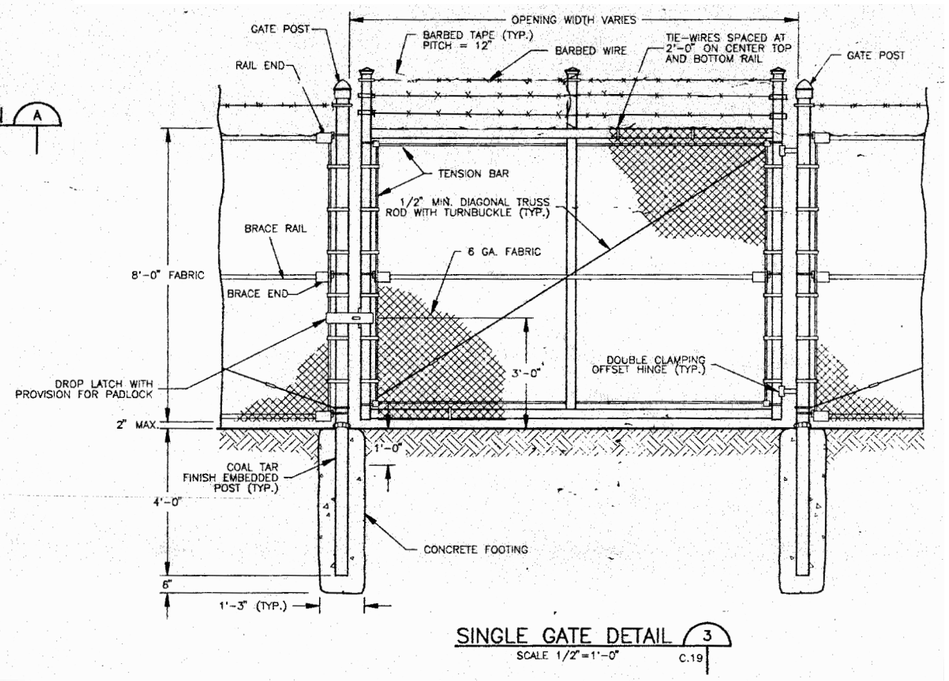
ATTACHMENT 2

FENCE ENCLOSURE DETAILS

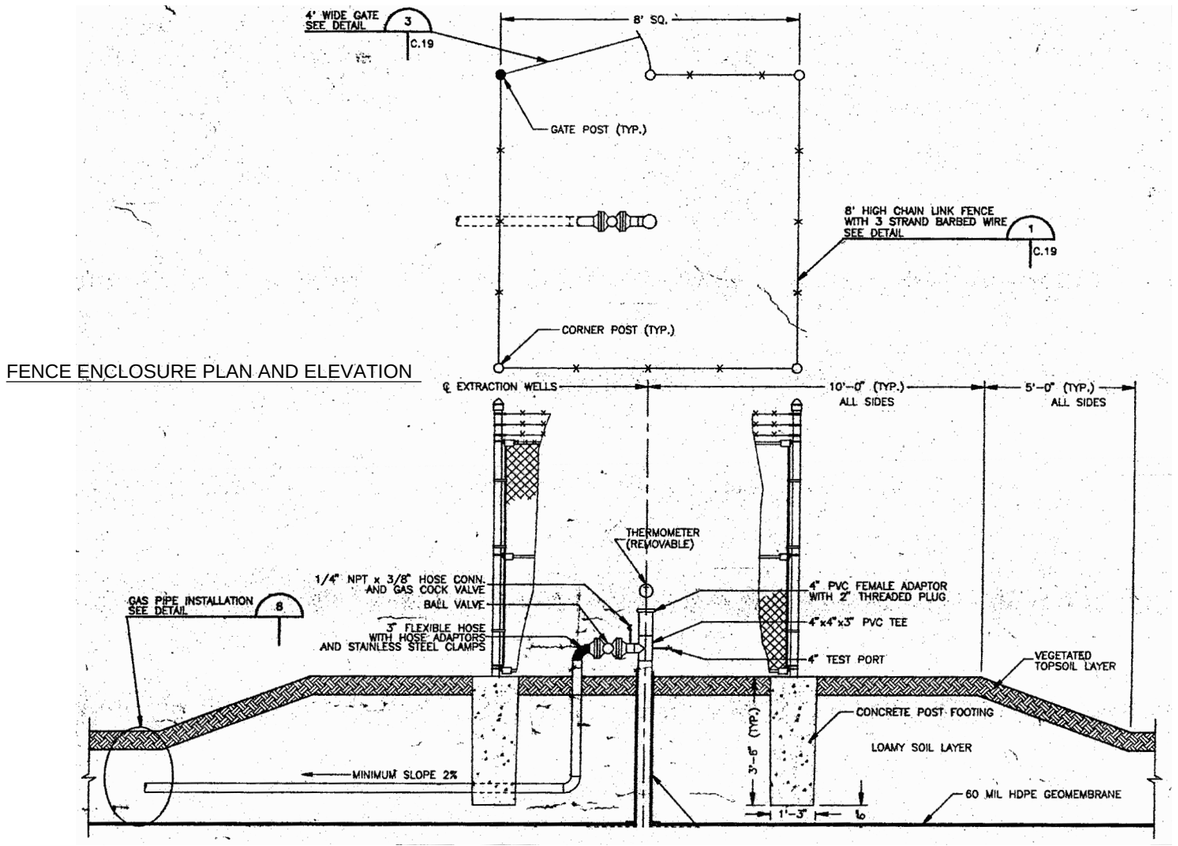


GALVANIZED STEEL CHAIN LINK FENCE 1
SCALE 1/2"=1'-0"
C.17

BARBED TAPE SECTION A
SCALE 1/2"=1'-0"



SINGLE GATE DETAIL 3
SCALE 1/2"=1'-0"
C.19



FENCE ENCLOSURE PLAN AND ELEVATION

NYDEP
PELHAM BAY, NEW YORK

FENCE ENCLOSURE DETAIL

ARCADIS

ATTACHMENT 2

ATTACHMENT 3

BID FORM

Attachment 3. Bid Form for Gas Extraction Well Replacement
At The Pelham Bay Landfill
Bronx County, New York

	Circle One	
Is Bidder VENDEX Approved?	Y	N
If Yes, provide proof		
Is Bidder a WBE?	Y	N
If Yes, provide proof		
Is Bidder a MBE?	Y	N
If Yes, provide proof		

Quantity	Description	Rate	Units	Total
1	Mobilization/Demobilization		LS	$ -
Site Preparation				
4	Removal of Existing Chain Link Fence and Disposal		each	$ -
4	Excavate and Stage Cover Soils to Expose Geomembrane Liner (Area to be determined by CONTRACTOR and sufficient size to accommodate all equipment and work required)		each	$ -
4	Construct Stabilized Drilling Platform		each	$ -
1	Soil Erosion and Sediment Controls		LS	$ -
1	Construct Decontamination Pad		LS	$ -
1	Staging Areas/Temporary Construction Roads		LS	$ -
4	Remove Liner for Borehole Advancement		each	$ -
4	Remove Existing Wellhead and Temporarily Cap Landfill Gas Conveyance Pipes.		each	$ -
1	Air Monitoring (including CAMP)		/ month	$ -
1	Vapor/Odor Control		/ month	$ -
4	Well Permit		each	$ -
Well Installation				
516	36" Diameter Borehole Drilling		/ foot	$ -
526	8" HDPE Well Installation (all materials and labor)		/ foot	$ -
4	Well Head Materials		each	$ -
4	Well Head Installation		each	$ -
135	Drill Cuttings / Material Handling		/ cubic yard	$ -
200	Transport and Disposal - Drill Cuttings		/ ton	$ -

Attachment 3. Bid Form for Gas Extraction Well Replacement
At The Pelham Bay Landfill
Bronx County, New York

			Circle One	
_____	Standby/Venting Time	_____	/ hour	$ -
1	Survey	_____	LS	$ -
1	Miscellaneous Costs (Provide Details)	_____	LS	$ -
Restoration				
4	HDPE Liner Repair and Boot Installation w/ CQA Testing	_____	each	$ -
4	Landfill Gas Conveyance Pipe Reconnection	_____	each	$ -
4	Soil Cover Restoration	_____	each	$ -
4	Chain Link Fence - Furnish and Install	_____	each	$ -
TOTAL				**$ -**

ARCADIS

Appendix B

Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP)

(TO BE SUBMITTED UNDER SEPARATE COVER)