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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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Our Ref.:
NY001443.0004.00014

Date:
March 2010

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.

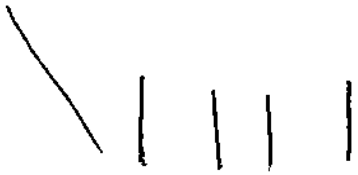
2. Landfill Gas Flare System Evaluation and Recommendations

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.

Is there a Generic HASP plus CAMP to date the SMP. Or many?

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.

Passive venting of LFG for 2-3 months, to avoid a build-up of LFG ...

Does this mean that the flare will be turned off for 8-12 weeks, i.e., 2 → 3 months. Has the impact of this been calculated?

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.

Is this OK? IPP standards

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.

why not take the opportunity to have flush mounted wells like the LFG wells since reinstalled?

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.

Not necessary if flush mounted.

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

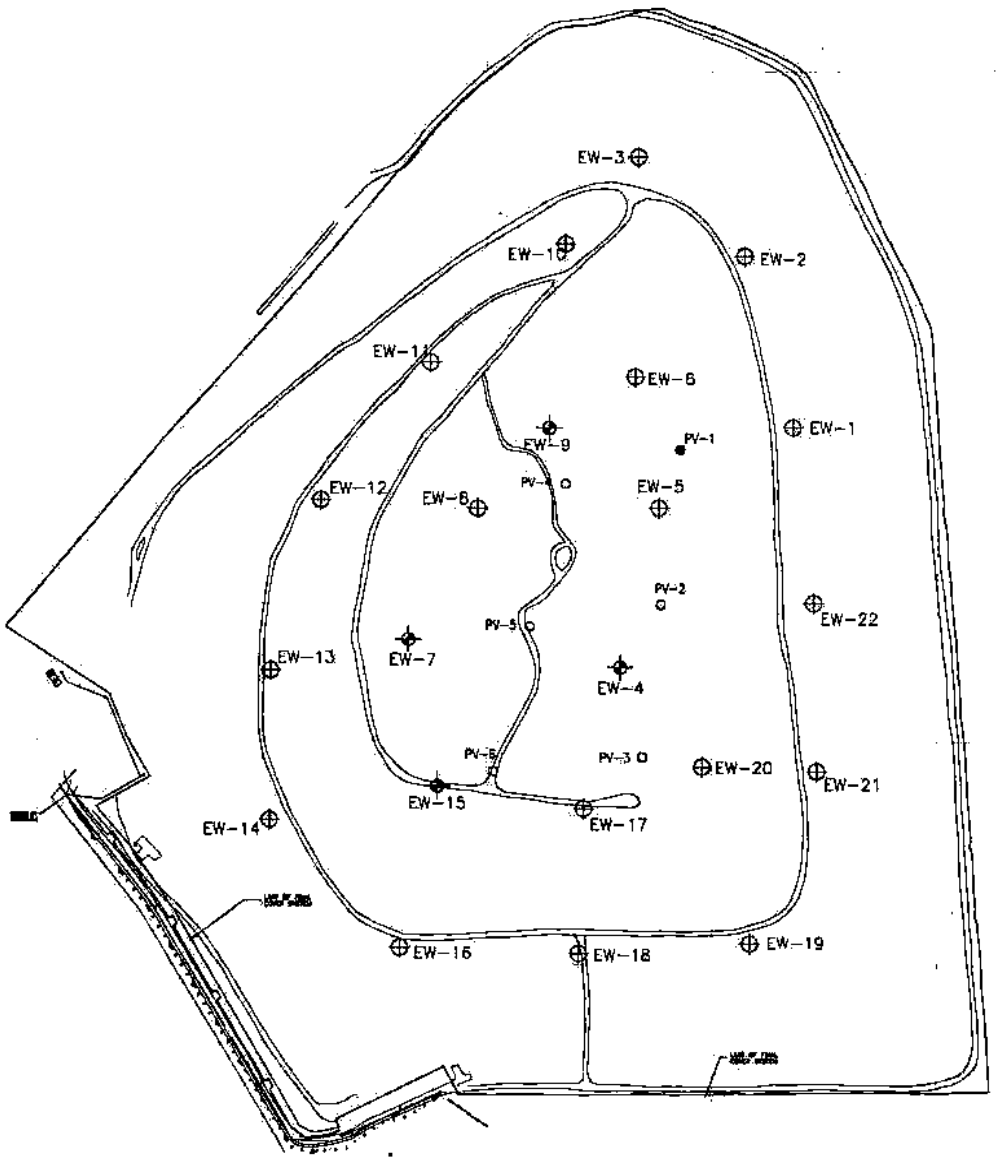
Upon completion of the LFG extraction well installation and system rebalancing, an engineering report will be prepared, by ARCADIS, to summarize the well replacement activities and results of LFG system rebalancing. In addition, this report will include all field logs generated, a table of well construction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

I don't know a generic HASP and CAMP — the SMP!



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

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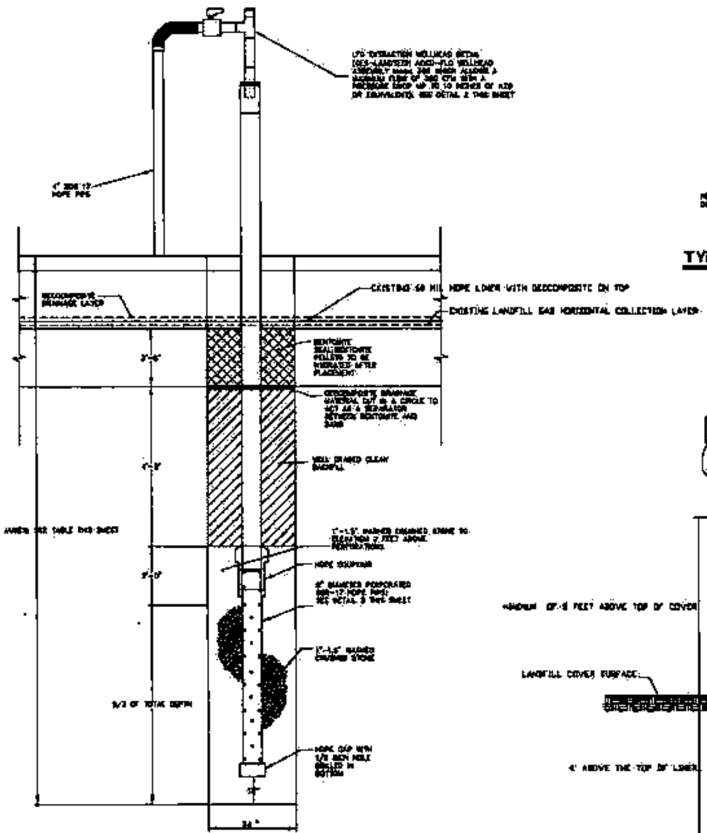
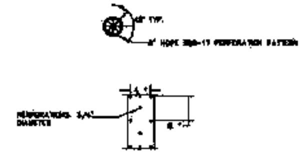
FIGURE 1



TYPICAL GAS EXTRACTION WELL (1)

NOT TO SCALE



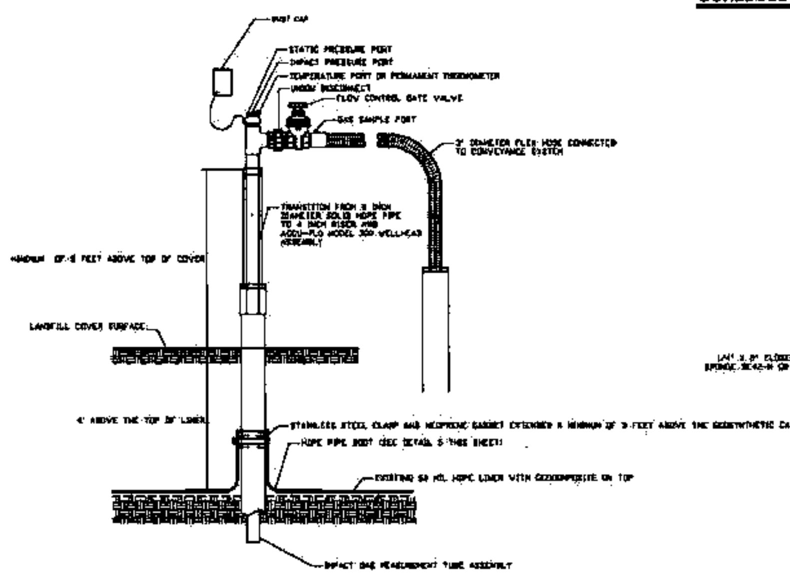
TYPICAL PIPE PERFORATIONS (2)

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	128	8	40	85	125
	EW-15	131	8	40	85	130
	EW-4	137	8	40	90	136
	EW-7	121	8	40	80	126
					Total	516

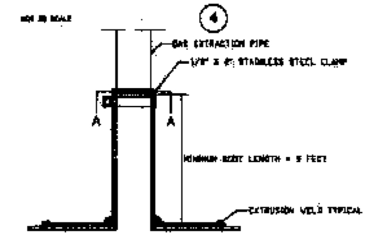
Notes:
1. Final boring depths will be determined in the field based on existing conditions
2. Wells are listed in an order of priority

LANDFILL GAS EXTRACTION WELLHEAD SCHEDULE

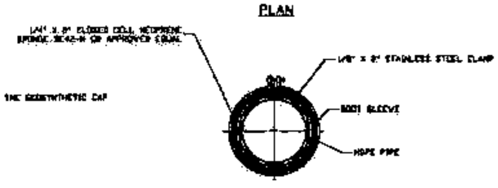


LANDFILL GAS EXTRACTION WELLHEAD ASSEMBLY (3)

NOT TO SCALE



PLAN



SECTION A-A

GEOMEMBRANE BOOT (5)

NOT TO SCALE

SCALE(S) AS INDICATED

(PE'S FULL NAME)

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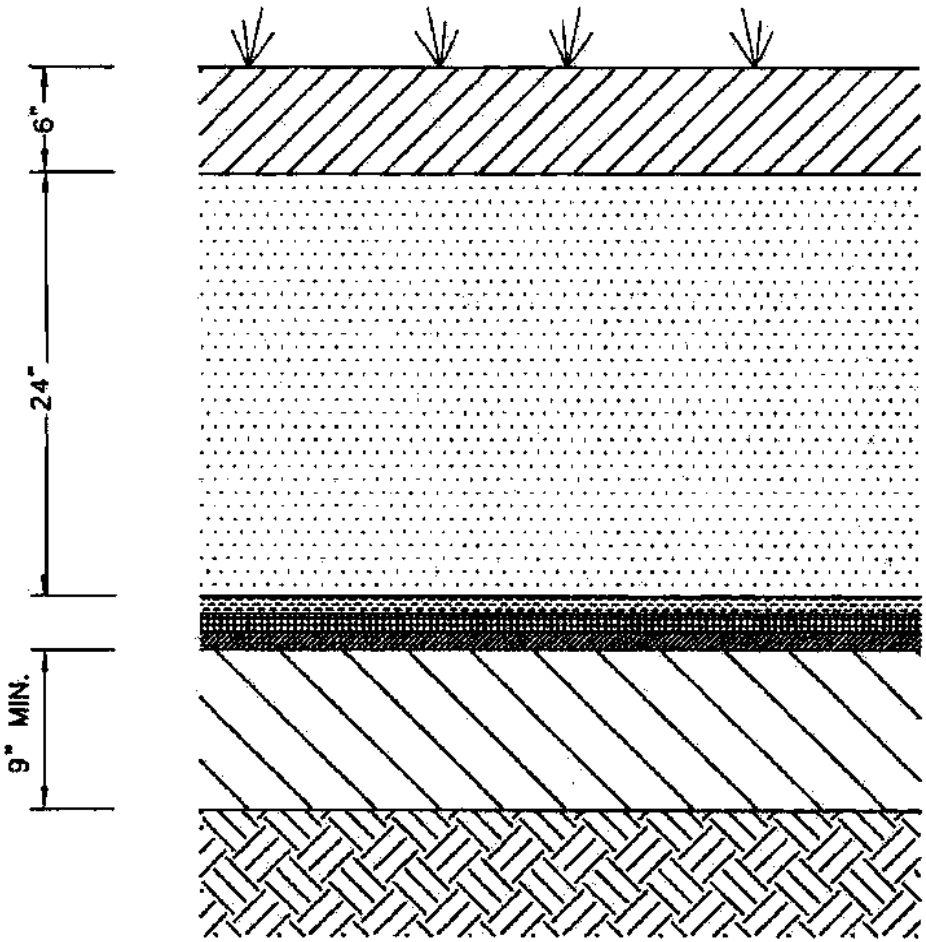
PELHAM BAY LANDFILL REPLACEMENT LANDFILL GAS EXTRACTION WELL

2



TYPICAL COVER SECTION

NOT TO SCALE

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TYPICAL COVER SOIL SECTION

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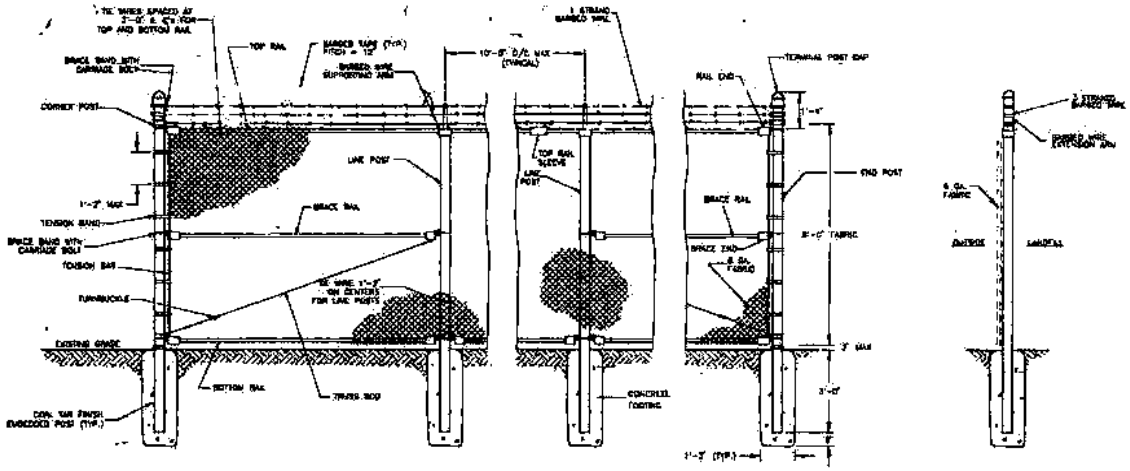
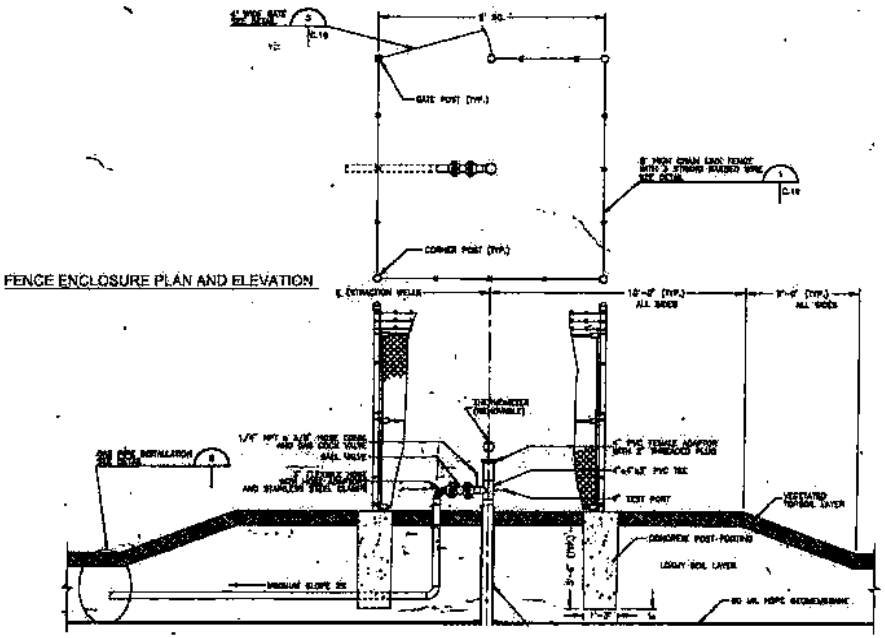
FIGURE 3

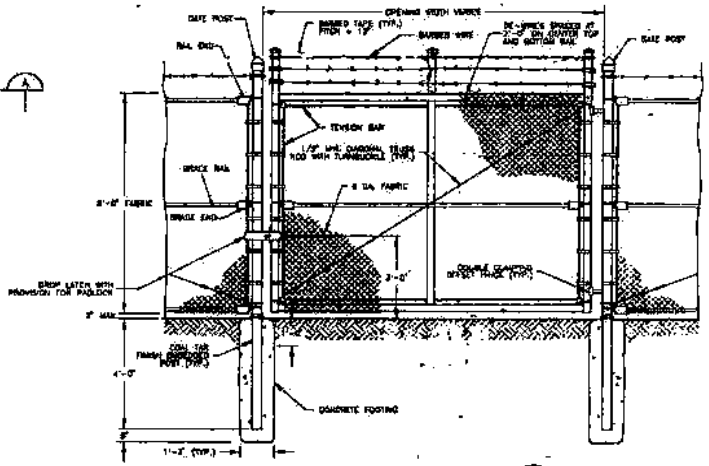


GALVANIZED STEEL CHAIN LINK FENCE

BARBED TAPE SECTION



FENCE ENCLOSURE PLAN AND ELEVATION



SINGLE GATE DETAIL

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FENCE ENCLOSURE DETAIL

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FIGURE 4