Pennsylvania Avenue Landfill
Brooklyn, New York
NYSDEC Site No. 224002

Annual Post-Closure Operation, Maintenance and Monitoring Report
January 2015 through December 2015

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New York City Department of Environmental Protection
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Section 1- Introduction

This Post-Closure Annual Summary Report (Report) has been prepared by the New York City Department of Environmental Protection (NYCDEP) to fulfill the reporting requirements contained in the Pennsylvania Avenue Landfill (PAL) Operation and Maintenance (O&M) Manual, the PAL Monitoring Plan, and 6NYCRR Part 360. This Report documents the operation, maintenance and monitoring activities performed during the PAL seventh annual post-closure reporting period from January 1 through December 31, 2015.

Section 2 - Site Background

The PAL inactive hazardous waste disposal site (Site) is located on 110 acres at the southern end of Pennsylvania Avenue in Brooklyn, New York. It is bounded by the Belt Parkway, Jamaica Bay, Hendrix Creek and Fresh Creek. A site location map is provided in Figure 1.

In 1956, the Site was opened to receive residential and commercial wastes, including construction and demolition (C&D) residuals and waste oil. In 1962, land-filling activities shifted to the Fountain Avenue Landfill (FAL). The PAL was reopened for disposal of C&D wastes in 1968. It is reported that, between 1974 and 1980, illegal dumping of hazardous wastes occurred at the Site. Disposal of all wastes stopped by 1980, and the Site was added to the Registry of Inactive Hazardous Waste Disposal Sites requiring surveillance. In 1983, the Site was reclassified to a Class 3, which is a site considered not to pose a significant threat, and for which action can be deferred. After an oil inventory and product recovery feasibility study conducted in 1984, the Site was reclassified to a Class 2, a site which poses a significant threat to public health or the environment.

On December 16, 1985, and again on April 17, 1990, the New York State Department of Environmental Conservation (NYSDEC) executed Orders on Consent with the New York City Department of Sanitation (DOS) to close and remediate the Site. On April 7, 1992, the DEP entered into a Consent Order with the NYSDEC to perform a remedial program at the Site.

In response to this, DEP conducted a Remedial Investigation/Feasibility Study (RI/FS) to determine the nature and extent of contamination. The Final RI/FS, dated May 1994, revealed that certain areas and media at the Site required remediation; a summary of these results follows:

- Surface soil and sediment samples exhibited varying levels of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals, pesticides and PCBs contamination.
- It was determined that a floating product (i.e., separate-phase petroleum) plume beneath the Site contaminated the groundwater in the leachate mound and the surface water in Fresh Creek. Tests indicated that the waste oils with the capacity to migrate to the shoreline had already done so, and the remaining oils are stationary. In addition to the VOC and SVOC levels associated with residual petroleum contamination, the waste oil contained PCB levels that classify it as a hazardous waste.

- Groundwater in the leachate mound (U wells – fill aquifer) was somewhat contaminated with VOCs, SVOCs and PCBs, and it was more so in the areas where it was in contact with the floating oil plume. The shallow and deep Upper Glacial Aquifer (S & D wells) did not require remediation because they did not exhibit significant levels of contamination.

By the Order on Consent, Interim Remedial Measures (IRMs) were implemented. An interim cover was placed to prevent casual contact with exposed waste and minimize emissions. Rip-rap was installed for shoreline protection. Construction of a passive waste oil interceptor trench was completed in January 1994. The purpose of the trench is to capture waste oil before it reaches Fresh Creek; however, to date actual oil migration to the trench has been minimal.

The goals for the remediation program were set to eliminate or minimize the threats to the public health and the environment, by addressing the contamination of subsurface soils and waste disposal areas; by protecting surface waters through eradication of run-off and erosion from contaminated substrates and the migration of leachate into surrounding waters; by minimizing the impact of contaminated groundwater; by reducing soil and sediment contamination levels and removing the possibility of human or animal contact; and, by controlling and containing landfill gas emissions.

The Final Feasibility Study Report, dated September 1994, detailed the selection process and the remedial alternative chosen. The option selected included a 6NYCRR Part 360 cap, leachate collection along Fresh Creek, limited sediment excavation, active gas control, and long term monitoring of site media.

The Record of Decision (ROD), dated February 1995, presented the remedial action. In accordance with the ROD, the Site was remediated under construction Contracts Nos. LF-PAL-G2/E2 and LF-PAL-G3. The main elements of this action included:

- Remediation of approximately 30,000 cubic yards of sediment along the Fresh Creek shoreline.
- Installation of a groundwater/leachate (GW/L) management system consisting of a 750-feet-long interceptor trench, two pumping stations, a force-main and an enclosed leachate pre-treatment system with subsequent disposal to the 26th Ward Wastewater Treatment Plant (WWTP).
- Regrading of the Site to provide proper drainage and minimize erosion.
- Installation of a stormwater collection, conveyance and outfall system.
- Installation of an actively vented impermeable final cover consisting, from top to bottom, of a vegetated top soil layer (6” minimum), a soil barrier protection layer (12”), a Type 2 cover double-sided geocomposite drainage layer or a Type 1 cover cushion geotextile, an LLPDE geomembrane liner (40 mil thick), and a sub-base grading fill layer.
- Planting of warm season grasses and approximately 13,000 shrubs and trees
- Installation of an active landfill gas (LFG) collection system and flaring station.

The ROD called for a pre-approved Post-Closure Monitoring, Sampling and Analysis Plan (the Monitoring Plan, the Plan) to commence within one month of DEP’s receipt of NYSDEC’s written approval of the Final Engineering Report (FER) for the Site. The FER acceptance letter was dated

March 26, 2009, and the first monitoring round was initiated within a month of its receipt and performed in accordance with the Monitoring Plan requirements. Subsequently, the ground-water portion of the Monitoring Plan was revised to allow the low-flow purging and sampling method to be used to collect groundwater samples for the analysis of both the inorganic and organic parameters. These revised Monitoring Plan requirements were utilized commencing with the second Post-Closure monitoring event. Based on the results of one year of quarterly post-closure monitoring, the frequency of ground water monitoring was reduced from quarterly to annually in rotating calendar quarters (i.e., once every five quarters), and the list of parameters required to be monitored was reduced. The 2011 annual monitoring round was performed during the first quarter of 2011, the 2012 annual monitoring round was performed during the second quarter of 2012, the 2013 annual monitoring round was performed during the third quarter of 2013, and the 2014 annual monitoring round was performed during the fourth quarter. The next monitoring round will be performed during the first quarter of 2016. Soil gas quality readings are taken from the five gas monitoring wells located beyond the perimeter of the cap, parallel to the Belt Parkway quarterly.

Prior to approval of the FER, a preliminary groundwater sampling and analysis round was conducted in July 2007. Since their installation in May 2008, the perimeter soil gas wells are monitored as needed, and at least quarterly as mandated by the Monitoring Plan.

In July 2012, the NYSDEC changed the classification of the PAL site from a Class 2 to a Class 4 site on the Registry of Inactive Hazardous Waste Disposal Sites since it was properly remediated and requires site management.

Section 3 – Annual Summary

This Report covers the sixth annual post-closure reporting period from January 1 through December 31, 2015.

3.1 Groundwater/Leachate Management System

The groundwater/leachate (GW/L) management system represents one of the components of the selected remedy in the Site's ROD**.** The ROD stipulated the construction of an active leachate collection trench in the area of the waste oil outbreak along Fresh Creek and pumping the leachate to an on-site facility for pre-treatment prior to discharge to the 26th Ward WWTP.

The GW/L collection, pre-treatment and disposal system was designed to prevent migration of GW/L containing oil and dissolved contaminants to Fresh Creek and to produce a treated effluent acceptable for discharge. The main components of the GW/L management system consist of a stone-filled interceptor trench with two pump stations; a 3-inch diameter HDPE leachate force main carrier pipe in a 6-inch diameter HDPE casing pipe; a pre-treatment facility and a 4-inch diameter HDPE pretreated leachate force main pipe ultimately discharging to a junction manhole at the 26th Ward WWTP. The GW/L pre-treatment facility was designed to treat up to 30 gpm. The facility's components include oil-water separation with citric acid conditioning, bag filtration and carbon adsorption.

The effluent was originally regulated under DEP's Industrial Wastewater Discharge (IWD) Permit No. 07-P3145-2, effective from August 27, 2007 to August 26, 2012. Based on the historical sampling data indicating that the groundwater/leachate quality in the interceptor trench met the plant's Industrial Pre-Treatment Permit discharge limits prior to pre-treatment, the DEP received approval in 2011 to install diversion piping within the PAL GW/L Pre-Treatment Plant to divert the influent directly to the plant effluent piping. Figure 2 shows the current Pre-Treatment System Schematic, which includes the diversion-related modifications. The programmable logic control (PLC) was also reprogrammed to accommodate this second mode of operation. The facility has operated in Pre-Treatment Plant Diversion Mode since November 1, 2011. The Pre-Treatment Plant equipment within the building has been, and shall continue to be properly maintained so that if the GW/L water quality degrades, the Pre-Treatment Plant can be put back into operation in accordance with the PAL O&M Manual.

A new IWD Permit No. 11-P3145-1, reflecting the relocated M-1 sampling location was issued on November 11, 2011 and expires on November 10, 2016. Monthly M-1 sampling continues to be performed under the new permit and is reported quarterly in the Self Monitoring Reports submitted to the IIPS. Appendix B of the 2015 Quarterly Reports contains the results of the laboratory analyses as well as the Self-Monitoring Reports.

Examination of the M-1 sampling data for the 2015 annual reporting period, summarized in Table 1, indicates that the concentration of each detected parameter in the M-1 samples is lower than its respective IWD permit discharge limit. To document that operation of interceptor trench collection system is still warranted, the M-1 sample results were also compared to the NYSDEC 6NYCRR Part 703 standards and guidance values for Class SA (Saline) surface waters. Based on that comparison, in 2015, the concentrations of chlorobenzene and the total dichlorobenzenes in the interceptor trench water frequently exceeded the 5-ug/L guidance value for protection of saltwater fish propagation. In addition, the lead concentrations of the interceptor trench water continued to periodically exceed the 8-ug/L standard for protection of saltwater fish propagation. Therefore, operation of the interceptor trench collection system is still warranted.

Although the system is in diversion mode, the interceptor trench continues to be inspected daily for the presence of product (separate-phase petroleum) and to verify water levels. There was no indication of separate-phase petroleum in the trench or off-site leachate migration during this annual reporting period.

During this annual reporting period, 7,935,528 gallons were discharged to the WWTP from the interceptor trench. The system had one interruption, from January 26th to 29th, when the pump stations and the GW/L pre-treatment plant underwent a controlled shutdown in preparation for predicted blizzard conditions. The interceptor trench was monitored and there was no off-site leachate discharge. The following table summarizes the flow data for the twelve-month period.

	Total Flow (Gallons)	Average Flow (GPM)	Average Daily Flow (GPD)	Maximum Daily Flow (GPD)	Number of days in service	Percent of time in service
Jan-15	787,015	19.3	27,859	33,250	28.3	91.1%
Feb-15	756,000	18.8	27,000	27,000	28	100%
Mar-15	805,540	18.0	25,985	28,940	31	100%
Apr-15	689,960	16.0	22,999	26,610	30	100%
May-15	622,260	13.9	20,073	23,480	31	100%
Jun-15	584,620	13.5	19,487	21,600	30	100%
Jul-15	605,873	13.6	19,544	21,040	31	100%
Aug-15	584,867	13.1	18,867	27,070	31	100%
Sep-15	573,120	13.3	19,104	20,440	30	100%
Oct-15	643,960	14.4	20,773	24,760	31	100%
Nov-15	590,210	13.7	19,674	25,660	30	100%
Dec-15	692,103	15.5	22,326	30,230	31	100%
Average	661,294	**15.2**	**21,906**	NA	N**A**	**99.2%**
Maximum	805,540	**23.1**	NA	**33,250**	NA	NA
Total	**7,935,528**	NA	NA	NA	**362**	NA

Inspection and monitoring of the GW/L pre-treatment system was conducted following the O&M Manual procedures. Daily Operations, bi-weekly (GWL-1), monthly (GWL-2), quarterly (GWL-3), and annual (GWL-5) inspections were performed. Another form, DP-1, "Description of Deficiencies and Problems," was used to highlight specific problems requiring timely attention. While many of the deficiencies caused by the impact of the Hurricane Sandy surge were addressed previously, certain repairs were performed during the fourth quarter under a hurricane damage priority repair work order. These repairs included removing sand and road material from the Pump Station No.1 valve vault, and, although the product storage tank is not utilized, it was placed back on its base following the repairs to the embankment and Road D. Other equipment components exposed to the Hurricane Sandy surge that are currently operational will continue to be monitored and assessed over time and may be replaced in the future, if necessary.

No separate-phase petroleum has ever been detected at the leachate pump stations. However, as a precautionary measure, the replacement of the scavenger pumps was examined but determined not to be necessary at this time. The pump stations will continue to be inspected on a daily basis and the water quality will continue to be sampled on a monthly basis in accordance with the Discharge Permit requirements. Should separate-phase petroleum be observed, mitigation measures will be taken at that time to ensure they are appropriate to the actual conditions encountered. The replacement of the OWS influent filter casing and the petroscreen coalescer baskets has been placed on hold since the treatment system can be placed back on line without these items, thereby, allowing for their replacement when and if the pre-treatment system is placed back on-line. At the commencement of the diversion mode operation, the pre-treatment plant equipment and piping that was being circumvented, was power-washed and prepared in accordance with manufacturer's recommendations to remain in a standby condition. The equipment continues to be inspected as

required to ensure that they remain in good operating condition and ready to return to service if needed. Copies of the inspection reports were provided in Appendix A of the 2015 Quarterly Reports.

3.2 Landfill Gas Management System

The landfill gas (LFG) management system represents one of the elements of the selected remedy in the Site's ROD. The ROD required the selected remedy "to ensure full collection and control of landfill gas". This system must also meet the requirements of 6NYCRR Part 360 to limit off-site gas migration to the lower explosive limit (LEL) at the property line (i.e., 5% gas in air) and 25% of the LEL in structures (i.e., 1.25% gas in air). The LFG management system operates in accordance with an Air Facility Registration Certificate # 2-6105-00762/00001 issued by the NYSDEC.

The system features 46 gas extraction wells (EWs), a below grade polyethylene collection header piping network with isolation valves, two 375-scfm centrifugal blowers (Blower 301 and Blower 302), condensate collection system, an enclosed flare system, process instrumentation and controls, a PLC management system, a fire alarm system and an emergency condition alarm autodialer phone system. A plan of the overall LFG management system is shown on Figure 3 illustrating the location of the extraction wells, header pipe and flare facility. All 46 gas EWs were inspected and monitored for gas content (percent CH_4, CO_2 and O_2), temperature and vacuum pressure each month. Deficiencies such as missing signage, track cleaning or sampling port repair are corrected at the time of the inspection, work orders are issued for other work. The LFG-3 inspection reports are included in Appendix C of the 2015 Quarterly Reports.

The four main headers that convey the landfill gas are connected to a condensate drain line at their low point located adjacent to the flare station. This condensate drain line and the condensate drain lines from the two blower demisters (knock out pots) empty into the 2,500 gallon condensate tank located at the flare station. At the end of the 2015 annual post-closure period, the condensate tank contained 280 gallons.

Main piping on the vacuum side of the blowers contains an 8-inch butterfly valve with an electric actuator. This automatically adjusts the valve position according to the vacuum transmitter readings in order to control the landfill vacuum. This is followed by an 8-inch electro-pneumatic butterfly valve which operates with a compressed nitrogen cylinder. This valve automatically closes in the event of a system failure or shutdown. The gas flare system is designed to operate with one blower in service and one as redundant standby. Although designed to collect up to 375 scfm of landfill gas, the system averaged 83.1 scfm during the 2015 annual post-closure period. Process gas temperature and pressure readings from the vacuum and discharge side are recorded daily in the LFG-1 inspection log. The monthly summary report of the LFG-1 daily inspections is included in Appendix C of the 2015 Quarterly Reports.

Landfill gas is discharged from the blowers through an 8-inch header and flame arrestor into the enclosed flare. The flare pilot is fired using natural gas from the utility company. The natural gas is also used as auxiliary fuel to supplement the recovery of landfill gas. During the 2015 annual post-closure period, 203,035 SCF of natural gas was consumed for the pilot and to help bring

system to temperature after start ups, and during the fourth quarter to supplement the landfill gas. The flare support system includes a purge air blower, two manual and two automatic dampers, temperature control with three thermocouples. The flare operation is on automatic control using the middle thermocouple at a target temperature of 1,500 ^{o}F.

During the 2015 annual post-closure period, the landfill gas flaring system processed 36,113,480 SCF of landfill gas. The flare ran for 82.5% of the time. A controlled shutdown to protect equipment from predicted blizzard conditions, system evaluation by the manufacturer and the electrician, FDNY Annual Inspections on March 18th and November 5th, LEL sensor replacement and FDNY follow up inspection, Autodialer phone line failure, routine equipment inspection, replacement, calibration and maintenance, severe weather conditions, frozen equipment, poor gas quality, and condensate issues accounted for 1,538.1 hours or 17.5% of the 2015 annual post-closure period. In an effort to alleviate condensate issues, condensate withdrawal events from the headers were conducted on January 13th, February 5th, 10th, 26th, April 8th, May 13th July 16th, August 18th , October 26th, November 30th, December 1st, 15th, 21st, 27th and 30th. Although there is no increase in the condensate tank inventory, condensate displacement results in improved operations. The landfill gas flare flow meter was calibrated on November 2nd. During calibration it was determined that the meter could not be zeroed, and is therefore unreliable. The manufacturer's representative is working on a replacement. Flow and process gas content data is summarized in the table that follows.

Pennsylvania Avenue Landfill			
Flare Operation - 2015			
Month	**CH_4** (% by Volume)	**Time in service (Hours)**	**Flow (SCF)**
January-15	17.76%	459.5	3,129,819
February-15	18.98%	554.0	3,069,514
March-15	18.01%	284.0	1,739,612
April-15	17.17%	651.3	3,234,777
May-15	17.32%	734.0	3,042,293
June-15	18.06%	720.0	3,014,885
July-15	16.2%	744.0	3,400,805
August-15	15.4%	710.0	3,255,131
September-15	15.0%	720.0	3,286,667
October-15	17.9%	446.0	2,069,427
November-15	17.5%	648.6	3,599,547
December-15	16.3%	574.5	3,271,003
Average	**17.1%**		**3,009,457**
Total		**7,245.9**	**36,113,480**

Bi-weekly (LFG-2) and quarterly (LFG-4) inspections were conducted, and copies are included in Appendix C of the 2015 Quarterly Reports. The system was evaluated by the manufacturer on March 11th; and as result, the vacuum transmitter, the PLC operator's interface screen, and the

stack flame detector were replaced. In addition, the Blower Station LEL sensor and both blower soft starts were replaced, and all three Flare Station phone lines were replaced by the provider. Deficiencies identified at the flare and blower station during scheduled inspections, and still pending are the LFG flow meter and the condensate monitoring system float and probe. Equipment components exposed to the Hurricane Sandy surge that are currently operational but not designated for replacement will continue to be monitored and assessed over time and may be replaced in the future, if necessary. There were no other significant deficiencies pending at the end of this annual reporting period.

3.3 Final Cover System

The landfill final cover system (FCS) prevents stormwater infiltration into the landfill and landfill gas migration into the atmosphere. The ROD stipulated the construction of a 6NYCRR Part 360 landfill cap. According to the O&M Manual, the cover is comprised of a vegetative topsoil layer with a minimum thickness of 6 inches; a 12-inch thick soil barrier protection layer; a Type 2 cover system double-sided geocomposite drainage layer (areas with less than 5% slope); a Type 1 cover system cushion geotextile layer (areas with slopes greater than 5%); a 40-mil thick LLDPE (linear low density polyethylene) geomembrane liner; and 6-inch thick Type II cover soil.

The O&M Manual requires the final cover system be inspected on a monthly basis and after each major rainfall event equal to or exceeding the 2-year 24-hour precipitation event (3.5 inches in 24 hours). The surface of the landfill was divided into 17 inspection zones. All 17 inspection zones are shown in Figure 4 which is utilized to identify the system components. This figure is also utilized to identify the components of the stormwater and ancillary systems. A record of the final cover system inspection is summarized on a Monthly Checklist Form FCS-1, with deficiencies noted on the Deficiency and Problems Form (DP-1). The monthly inspection reports can be found in Appendix D of the 2015 Quarterly Reports. The final cover system is inspected for surface cracking, vegetative growth, vector penetration, settlement, erosion, slope stability, seepage, and vandalism. The inspection is performed by walking up and down the side slopes and across each zone several times. The deficiencies encountered, are erosion in inspection Zone 4 stabilized by vegetative cover, and ponding in inspection Zones 1, 2, 5, 8, and 16. The repairs of the erosion on the water side perimeter of Zone 9 caused by Hurricane Sandy was addressed under the priority repair work order substantially completed during this reporting period. Invasive species mowing of approximately seven acres was conducted under the direction of DEP BEPA.

3.4 Stormwater Management System

The stormwater management system (SWM) is an integral part of the capping and closure system required under the 6NYCRR Part 360 regulations to protect the landfill final cover system. The system was designed to collect, transport and discharge stormwater to the surface waters surrounding the PAL in order to prevent stormwater ponding and erosion damage to the final cover system.

The stormwater management system consists of several components which require monitoring, inspection, and periodic maintenance. The system has been divided into three subsystems (SWM-1, SWM-2 and SWM-3) for ease of inspection and reporting. These subsystems include:

- SWM-1: Geocomposite drain pipes and stormwater drainage swales,
- SWM-2: Outlets, culverts, rip rap inlet and outlet protection and revetment area, and
- SWM-3: HDPE downchute pipes, manholes, pipe trenches and energy dissipation structures.

The O&M Manual requires that the stormwater management systems SWM-1, SWM-2 and SWM-3 be inspected on a monthly basis and after each major rainfall event equal to or exceeding the 2-year 24-hour precipitation event (3.5 inches in 24 hours). A record of the inspection is summarized on Monthly Checklist Forms SWM-1, SWM-2, SWM-3 and DP-1 (for SWM-1, SWM-2 and SWM-3) for each system in accordance with the requirements of the O&M Manual. A Deficiency and Problems Form DP-1 is completed to summarize the items marked not satisfactory (NS) in the stormwater system checklist forms.

Deficiencies identified during the 2015 annual post-closure period do not necessarily affect the efficient performance of this system. Inspection of the System during and after storm events, indicate that it is working properly. The swales and culverts were mowed, weed-wacked, and excessive vegetative growth and debris was removed when observed during inspections. The monthly inspection reports and DP-1 Forms can be found in Appendix D of the 2015 Quarterly Reports.

3.5 Ancillary Systems

The ancillary systems (ANS) are those support systems at the PAL that are used for site access and security. The ancillary systems include five (5) access roads (A, B, C, D and E) and two (2) nature trails (East & West), along with fences, gates, and locks. The roadways are integral in providing access to perform required inspection, monitoring and maintenance activities. In addition, since the selected remedy resulted in leaving waste on-site, the security fences and gates provide important institutional controls to prevent site access to unauthorized individuals.

The O&M Manual requires that the ANS be inspected on a monthly basis. A record of the inspection is summarized on Monthly Checklist Forms ANS-1 and DP-1 (for ANS-1) in accordance with the requirements of the O&M Manual. The instructions for the checklists further require inspections after each major rainfall event equal to or exceeding the 2-year 24-hour precipitation event (3.5 inches in 24 hours). These are incorporated into the monthly inspections reports found in Appendix D of the 2015 Quarterly Reports.

Damage and wear are inherent in unpaved roads. Potholes on the access roads are recurring and are filled in as part of routine maintenance. The annual road repairs were performed during the third quarter. The damage caused by Hurricane Sandy to Road D and the embankment, was repaired under the priority Hurricane Sandy repair work which was substantially completed during this reporting period.

Holes in the perimeter fence are repaired as soon as possible after they are found during each monthly inspection and/or the weekly inspections conducted during fair weather. Locks are inspected and lubricated quarterly and as needed. Safety inspections are performed monthly.

Damaged and missing “No Trespassing”, “Confined Space” and “Hazard” signs were also replaced.

3.6 Post-Closure Environmental Monitoring

The Monitoring Plan for the PAL went into effect when the FER was approved by NYSDEC at the end of March 2009. The Plan addresses the performance evaluation of the effectiveness of the cap and/or landfill gas collection system in controlling leachate and landfill gas migration. It requires monitoring of the groundwater elevation and quality at ten wells (HP wells) located around the perimeter, outside the limits of the closure cap, and soil gas quality in five perimeter gas monitoring wells located outside the limits of the cap parallel to the Belt Parkway. Additionally, monitoring for landfill gas is performed on a monthly basis inside the GW/L pre-treatment facility building, as per 6NYCRR Part 360 requirements.

3.6.1 Groundwater Monitoring Program

In the NYSDEC letter of March 2, 2011 to DEP, the NYSDEC approved the DEP's request to reduce the frequency of groundwater monitoring from quarterly to annually, in rotating quarters (i.e., once every five quarters), and to reduce the frequency of monitoring for pesticides and PCBs to once every five years. In accordance with this post-closure schedule, groundwater monitoring was not required to be performed during this annual reporting period since the 2014 groundwater monitoring round was performed in the fourth quarter. Therefore, the next groundwater monitoring round will be performed during the first quarter of 2016 (i.e., five quarters later).

3.6.2 Gas Monitoring Program

Perimeter soil gas readings at the five perimeter gas monitoring wells were taken quarterly, on March 4th, June 9th, September 11th and December 15th, and to confirm the absence of off-site gas migration after intermittent extended flare outages on October 5th, 6th, 7th, 8th, 26th and 27th, November 2nd, and December 17th and 21st. Figure 5 shows the locations of the perimeter gas wells. Table 2 contains a summary of the perimeter gas monitoring well results during the 2015 annual post-closure period.

Methane readings were consistently 0.0% at GMW-2, GMW-3 and GMW-5; 0.0% and twice 0.1% at GMW-1; and at GMW-4 methane readings were 0.0% seven times, 0.5% once, 0.3% once, 0.2% twice, and 0.1% twice. Accordingly, methane levels at all five gas monitoring wells were less than the lower explosive limit (i.e., 5% gas in air) at the property line and thus meet the 6NYCRR Part 360 requirements.

Methane readings within the GW/L pre-treatment facility building were obtained on a monthly basis and were consistently 0.0% throughout the facility. These readings were taken on January 12th, February 19th, March 3rd, April 8th, May 6th, June 2nd, July 1st, August 10th, September 8th, October 19th, November 3rd and December 7th. The data is summarized in Table 3 of this Report. Accordingly, methane levels within the building were less than 25% of the LEL (i.e., 1.25% gas in air) and therefore meet 6NYCRR Part 360 requirements.

On March 9th and September 17th, landfill surface gas readings were taken, with no detections observed throughout the landfill. Sample locations are shown in Figure 6, and results are included in Appendix E of the First and Third Quarter 2015 Reports, respectively.

Based on the results of the post-closure landfill-gas monitoring performed during this annual reporting period, methane levels measured were less than the 6NYCRR Part 360 limits, and indicate that landfill gas being generated by the PAL is being contained by the collection and treatment system and preventing off-site methane migration. It is expected that landfill gas concentrations will continue to decrease over time as the landfill ages.

Section 4 – Conclusions and Recommendations

Based on the results of the post-closure activities performed during this annual reporting period, the PAL engineering controls and associated institutional controls are in place, performing properly and remain effective. The PAL remedy continues to be protective of public health and the environment and is compliant with the PAL ROD. The activities associated with the O&M Manual and the Post-Closure Monitoring Plan (as approved by the NYSDEC) continue to be implemented.

Routine system maintenance and repair of each of the remediation systems should continue in compliance with the requirements of the PAL O&M Manual. In general, it is recommended that areas of the Site affected by Hurricane Sandy should be restored to their existing condition prior to the storm event.

Specific conclusions and recommendations for each of the remediation systems are identified in the following paragraphs.

4.1 Groundwater/Leachate Management System

The GW/L management system continued to be operational and prevent off-site leachate migration during this annual reporting period. Since November 1, 2011, the GW/L management system has been operating in plant diversion mode. In this mode, the treatment system processes are being circumvented since the quality of the interceptor trench water being collected meets the permit discharge limits without pre-treatment. During this reporting period, the untreated discharge continued to meet the required permit limits. The interceptor trench discharge monthly monitoring for permit-required parameters will be continued in accordance with the permit requirements. Should it be necessary in the future for the treatment processes to be brought back online, it would be recommended that monthly influent/effluent water quality sampling be reinstated.

While the Monthly M-1 sample results during this reporting period continue to meet the required permit discharge limits without pre-treatment, the concentrations of certain parameters in the influent continue to exceed the NYSDEC limits for saline surface water. Therefore, operation of the interceptor trench is still warranted.

As previously recommended in prior Post-Closure Reports, since no separate-phase petroleum has ever been detected at the leachate pump stations, the replacement of the scavenger pumps was examined and determined not to be necessary. The pump stations should continue to be inspected on a daily basis and the water quality should continue to be sampled on a monthly basis in accordance with the Discharge Permit requirements. Should separate-phase petroleum be observed, mitigation measures should be taken at that time to ensure they are appropriate to the actual conditions encountered. Based on the results of the monitoring and inspection activities performed during this reporting period, this recommendation remains in effect.

The remaining recommended operational equipment components that were impacted by the Hurricane Sandy surge and designated for replacement should be replaced. Other equipment components exposed to the Hurricane Sandy surge that are currently operational but not designated for replacement should continue to be monitored and assessed over time and may be replaced in the future, if necessary.

In general, it is recommended that individual pieces of equipment that are not in use be maintained in good working condition and ready to be placed back on-line, if necessary. The interceptor trench pump stations and related equipment will continue to be operated and maintained. If deficiencies are noted they will be repaired and/or replaced in a timely manner to minimize system down time. Specifically, the recommended corrective actions listed in Form DP-1, Leachate Pre-Treatment System, Descriptions of Deficiencies and Problems, in Appendix A of the quarterly reports should be implemented.

4.2 Landfill Gas Management System

The LFG management system continues to be operational and prevent off-site gas migration. As the landfill ages, the methane quality and quantity of gas generated by the landfill will continue to decline. The LFG management system should continue to be operated to maximize methane quality at the flare in order to minimize the use of supplemental gas. The recommendations made by the DEP oversight consultant to improve system performance should continue to be implemented. The LFG management system performance should continue to be monitored to determine if adjustments and/or modifications to the system are necessary as the landfill gas quality and quantity diminishes in the future.

The remaining recommended operational equipment components that were impacted by the Hurricane Sandy surge and designated for replacement should be replaced. Other equipment components exposed to the Hurricane Sandy surge that are currently operational but not designated for replacement should continue to be monitored and assessed over time and may be replaced in the future, if necessary. In addition, the recommended corrective actions listed in Form DP-1, Landfill Gas System, Descriptions of Deficiencies and Problems, in Appendix C of the quarterly reports should be implemented.

4.3 Final Cover System

Overall the landfill final cover system is in good condition and protecting landfill cap beneath it as intended. Conditions found were typical of those encountered during the landfill post-closure period, with only a few deficiencies noted. In general, it is recommended that routine maintenance continue to be performed to prevent problem areas from expanding and worsening. This would include filling ruts caused by erosion, reseeding areas where necessary and maintaining landfill surface slope to promote stormwater runoff. The perimeter areas of the final cover system affected by Hurricane Sandy should be restored to their existing condition prior to the storm event. In addition, the recommended corrective actions listed in Form DP-1, FCS-1, Descriptions of Deficiencies and Problems, in Appendix D of the quarterly reports should be implemented.

4.4 Stormwater Management System

The stormwater management system continues to convey stormwater runoff to its outfall locations. Conditions found were typical of those encountered during the landfill post-closure period, with a few deficiencies noted. In general, it is recommended that silt and vegetation in drainage swales continue to be periodically removed and sediment be removed from other portions of the drainage system. The recommended corrective actions listed in Form DP-1 (SWM-1, SWM-2 SWM-3), Descriptions of Deficiencies and Problems, in Appendix D of the quarterly reports should be implemented as deemed appropriate.

4.5 Ancillary Systems

The roads and nature trails of the ancillary systems continue to provide access throughout the Site while the fencing and gates continue to allow for controlled site access. Conditions found were typical of those encountered during the landfill post-closure period, with a few deficiencies noted. In general, it is recommended that routine maintenance continue to be performed to prevent problem areas from expanding and worsening. This would include filling ruts and depressions in roads and trails and repairing site fencing and gates when necessary. Areas of the ancillary systems affected by Hurricane Sandy should be restored to their existing condition prior to the storm event. In addition, the recommended corrective actions listed in Form DP-1, ANS-1, Descriptions of Deficiencies and Problems, in Appendix D of the quarterly reports should be implemented.

4.6 Post-Closure Environmental Monitoring

In accordance with the post-closure groundwater monitoring schedule (i.e., once every five quarters), groundwater monitoring was not required to be performed during this annual reporting period.

Based on the results of the post-closure landfill-gas monitoring performed during this annual reporting period, methane levels measured met the 6NYCRR Part 360 requirements indicating that the landfill gas being generated by the PAL is being contained by the collection and treatment system and preventing off-site methane migration. It is expected that landfill gas concentrations will continue to decrease over time as the landfill ages.

Recommendations for post-closure monitoring are to continue to perform the environmental monitoring in accordance with the modified Monitoring Plan (approved by the NYSDEC in March 2011) reflecting the reduction in the frequency of groundwater monitoring to annually, in rotating quarters (i.e., once every five quarters) and the reduction in the frequency of monitoring for pesticides and PCBs to once every five years to coincide with the five-year review periods. The next groundwater monitoring round will be performed during the first quarter of 2016. This schedule has been approved by NYSDEC so that monitoring will not be conducted in consecutive quarters and annual monitoring will be performed once in each calendar quarter during each five year reporting period.

Figures

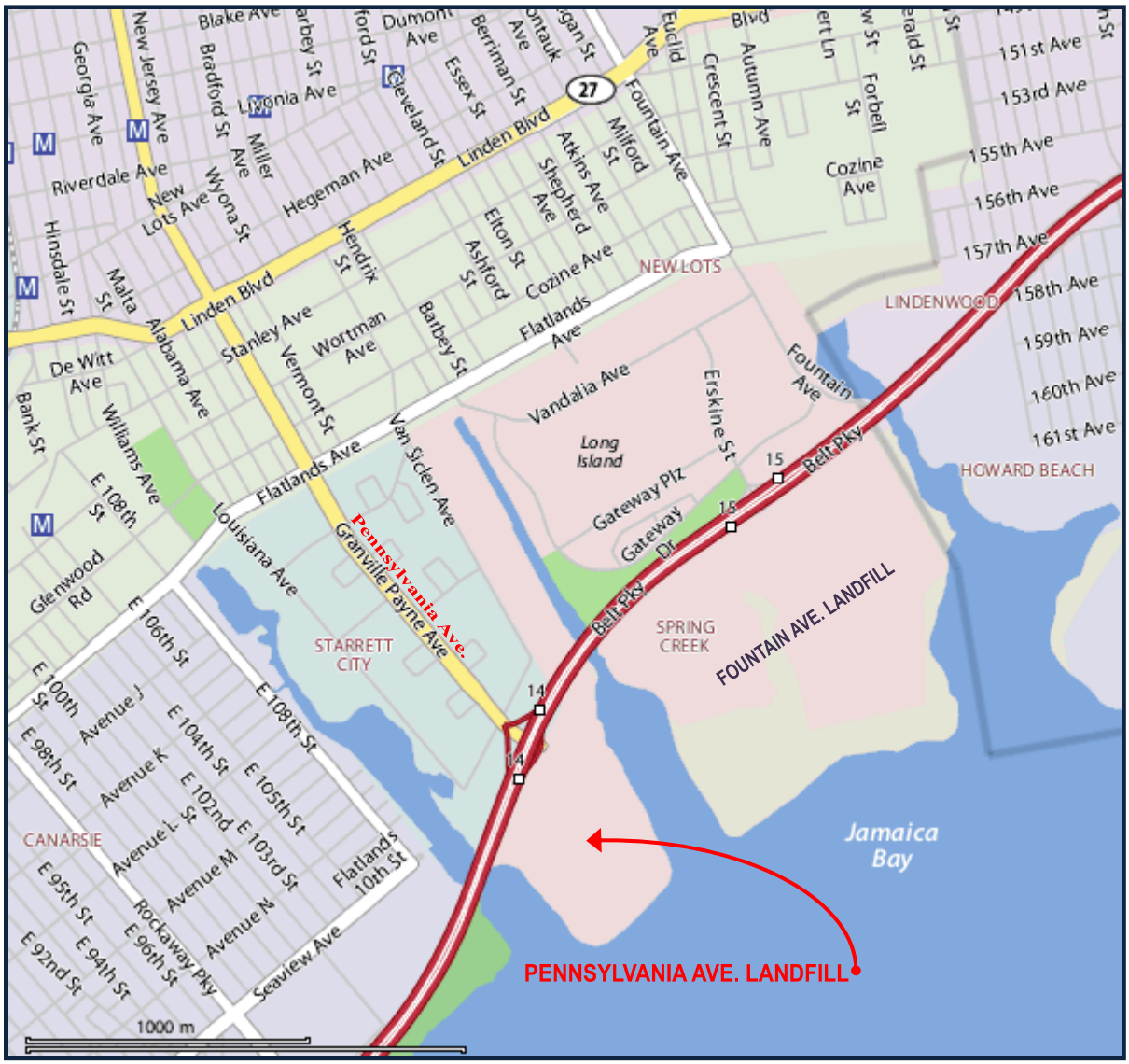

FIGURE 1
SITE LOCATION MAP

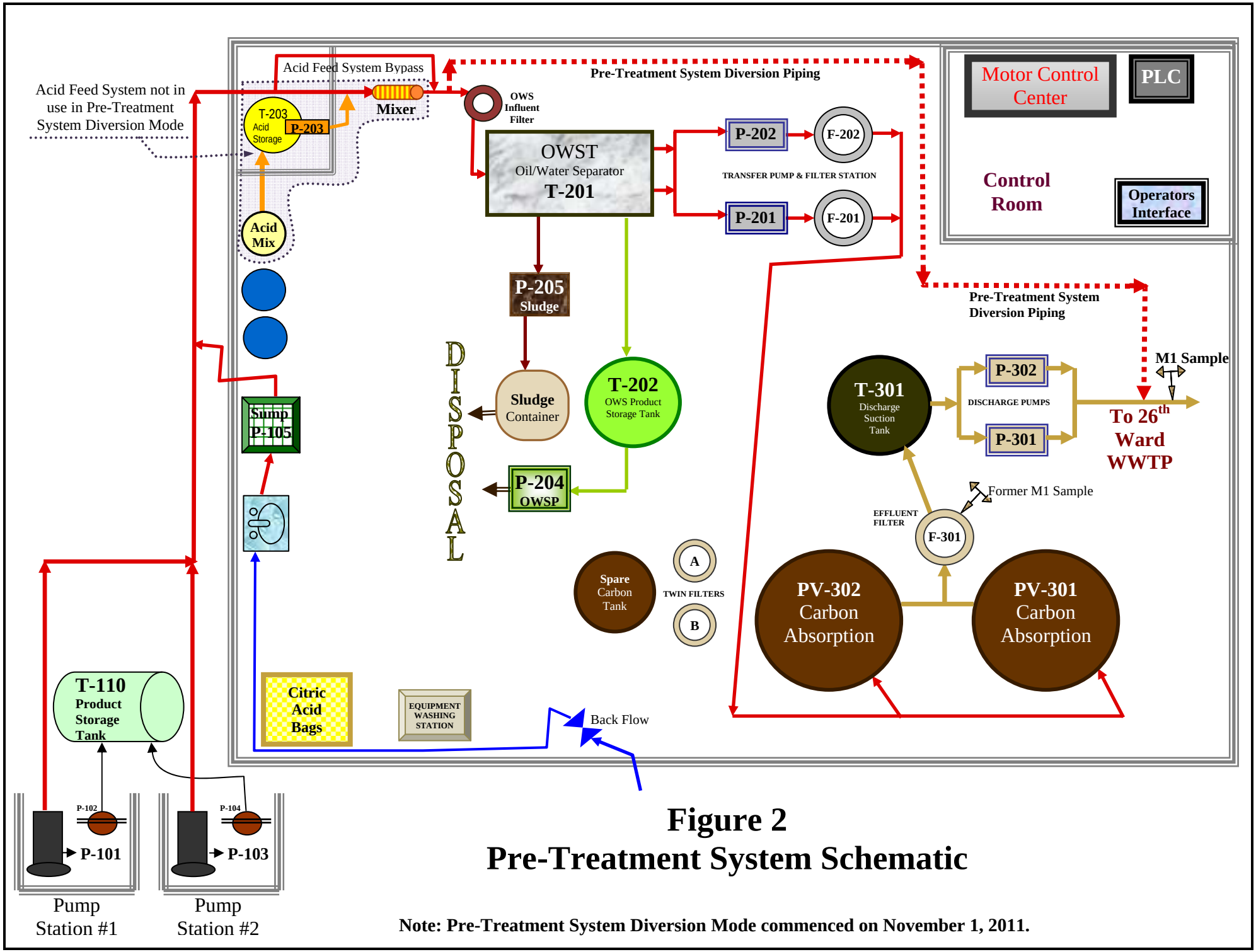

Figure 2
Pre-Treatment System Schematic

Note: Pre-Treatment System Diversion Mode commenced on November 1, 2011.

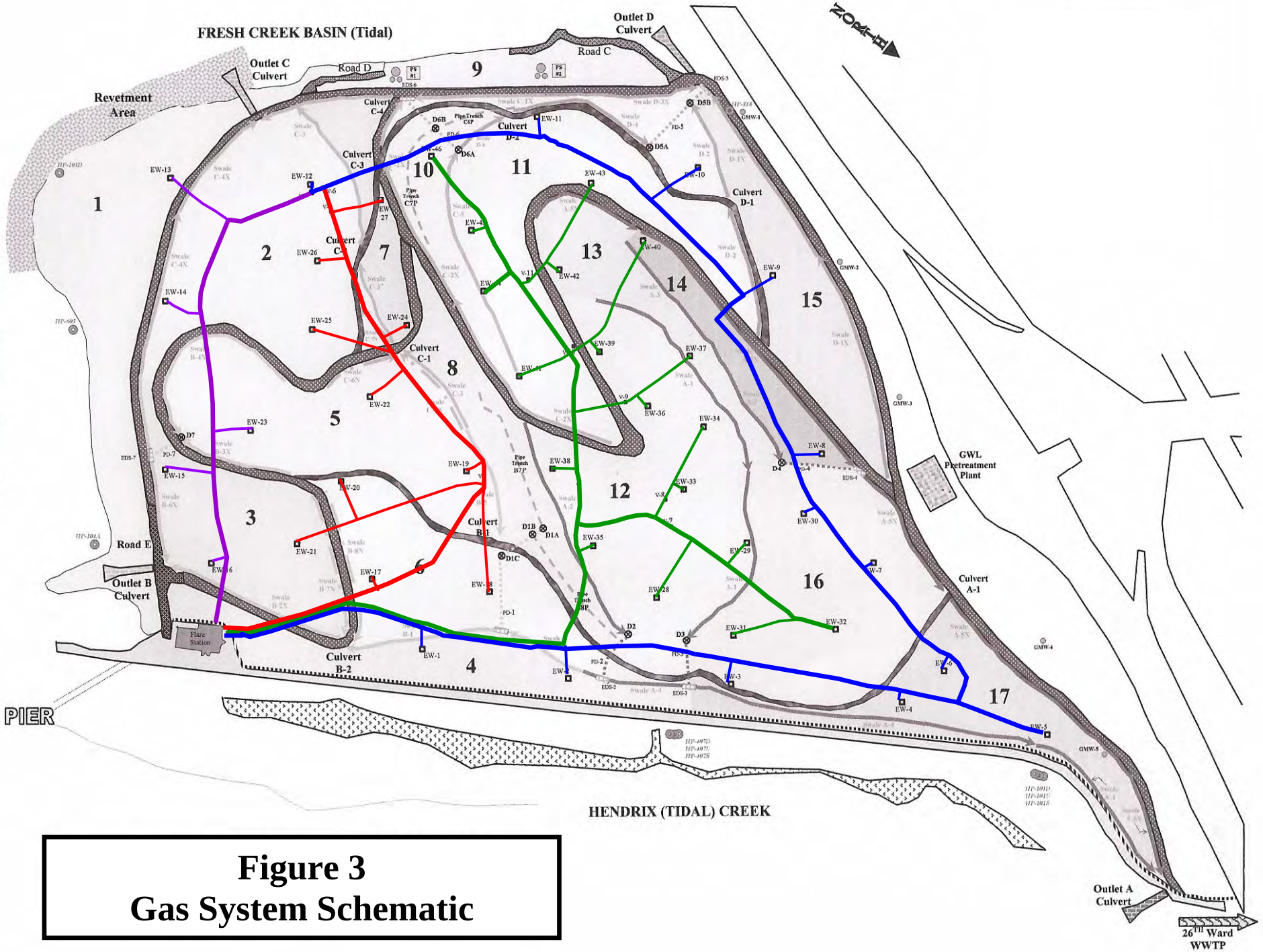

Figure 3
Gas System Schematic

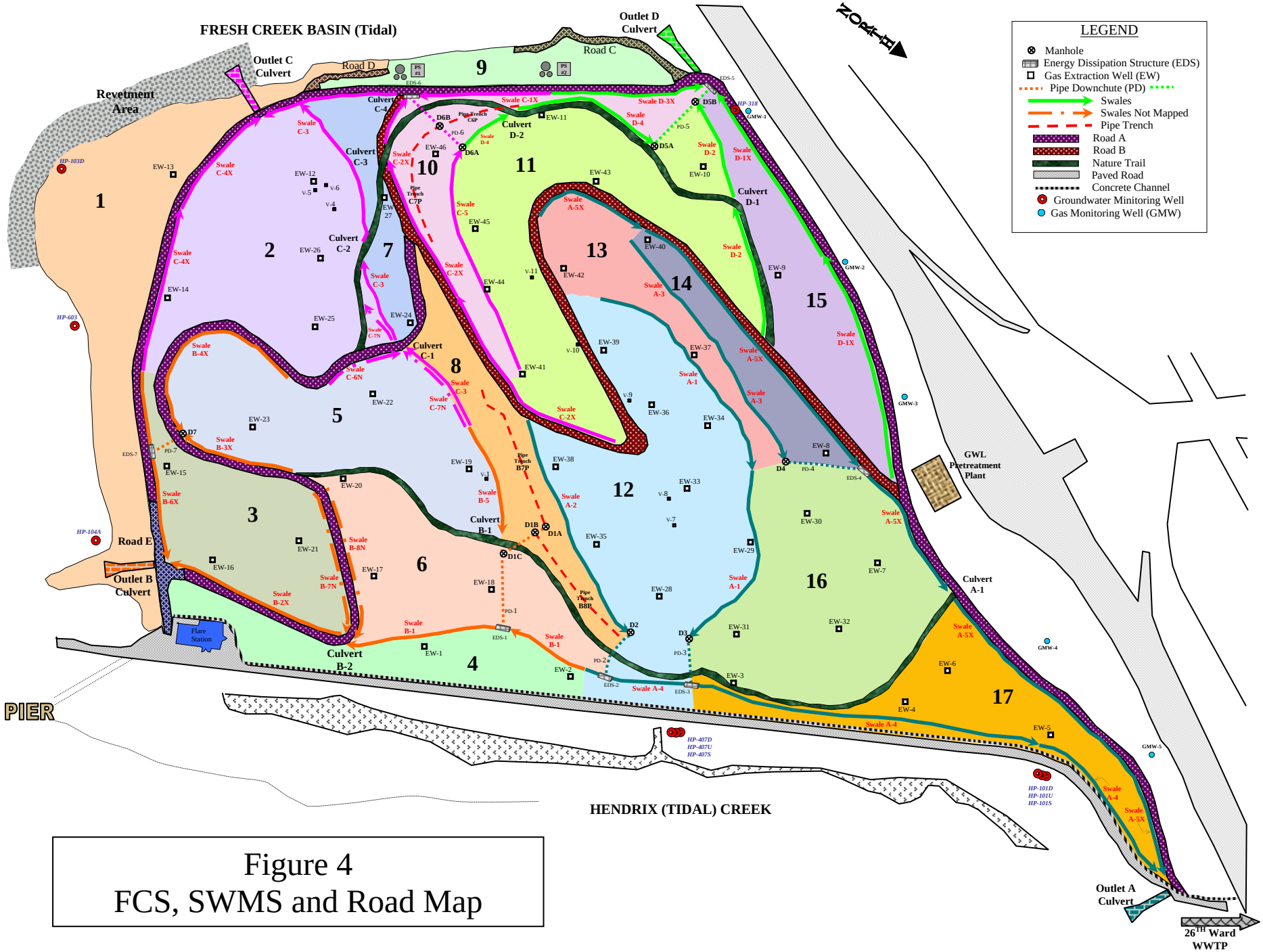

Figure 4
FCS, SWMS and Road Map

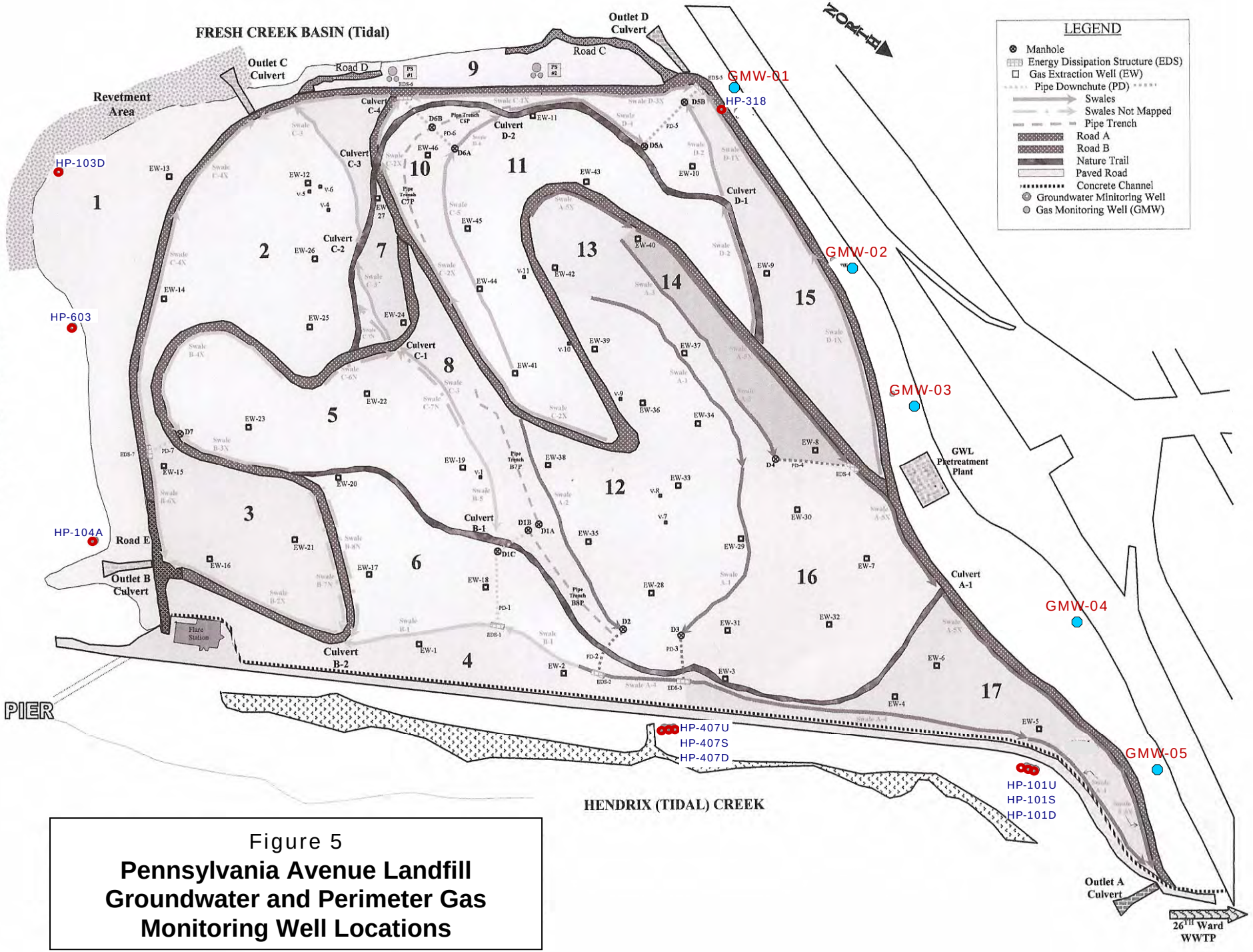

Figure 5

Pennsylvania Avenue Landfill Groundwater and Perimeter Gas Monitoring Well Locations

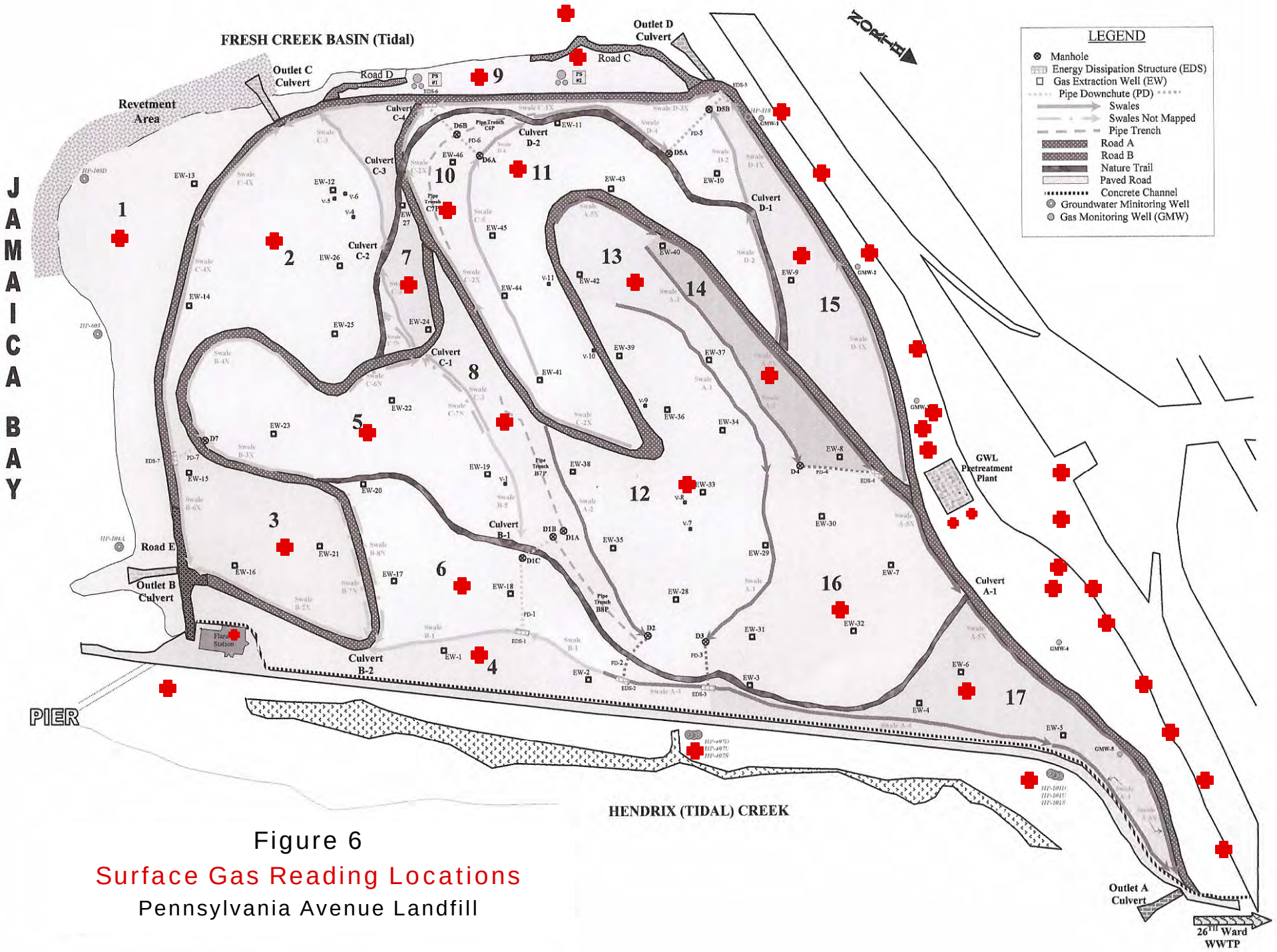

Figure 6

Surface Gas Reading Locations

Pennsylvania Avenue Landfill

Tables

Table 1 - Parameters Detected in the Groundwater Leachate Pre-Treatment System Discharge

Analyte	Units	Permit Max. Conc.	Permit Daily Limit	Permit Monthly Limit	TOGS SA Fish Propagation Standards	M1 Discharge Sample Results 01/12/15	02/19/15	03/03/15	04/08/15	05/06/15	06/02/15	07/01/15	08/10/15	09/08/15	10/19/15	11/03/15	12/07/15
Lead	ug/L	2000			8		**19**	**17**		**29**	**21**	**17**	**13**		**8.1**		**9.4**
Zinc	mg/L	5.0			0.066	0.028	0.022	0.035	0.03	0.037		0.045	0.02				0.024
Carbonaceous Biological Oxygen Demand	mg/L							9			6						
Chloride	mg/L					1,270 D	9.7	1,770 D	1,010 D	1,990 D	1,420 D	1,040 D	1,490 D	1,630 D	5,280 D	2,940 D	5,070 D
Nitrate as N	mg/L					0.42	0.64	0.21	0.65	0.11	0.1	1.23	1.41 D	2.32 D	0.13	1.41 D	0.13
Nitrogen, Kjeldahl, Total	mg/L					42.0 D	53.2 D	63.1 D	38.5 D	56.9 D	27.9 DS	35.7 D	42.0 D	37.9 D	44.4 D	38.5 D	44.1 D
Nitrogen, Total	mg/L					42.4	53.8	63.3	39.1	57	28	36.9	43.4	40.2	44.5	39.9	44.2
Suspended Solids (Residue, Non-Filterable)	mg/L	350				17	13	27	22	28	41	16	15	19	27	20	29
Suspended Solids (Residue, Non-Filterable)	mg/L	↓				12	16	31	18	20	18	29	20	25	35	18	26
Suspended Solids (Residue, Non-Filterable)	mg/L	↓				20	16	26	14	21	14	24	23		30	18	23
Suspended Solids (Residue, Non-Filterable)	mg/L	↓				13	24	22	17	19	21	14	15		41	11	28
pH (*Lab pH Qualifier* H)																	
pH Grab 1 (Field/Lab)	SU	5.0 - 11.0				6.91 / 6.9	6.96 / 7.0	7.76 / 6.9	7.65 / 6.9	7.30 / 6.9	7.2 / 6.9	7.25 / 7.0	7.27 / 6.9	6.90 / 7.0	7.55 / 6.8	7.22 / 7.3	6.80 / 6.0
pH Grab 2 (Field/Lab)	SU	Standard Units				6.96 / 6.9	6.92 / 7.0	7.66 / 6.9	7.55 / 6.9	7.16 / 6.9	7.0 / 6.9	7.24 / 6.9	7.22 / 7.0	6.89 / 7.0	7.41 / 6.8	7.04 / 7.2	6.84 / 6.2
pH Grab 3 (Field/Lab)	SU					6.86 / 6.9	6.89 / 7.0	7.51 / 7.0	7.45 / 6.9	7.12 / 5.9	6.7 / 6.9	7.20 / 7.0	7.19 / 6.9	6.89 / 7.1	7.33 / 6.8	6.98 / 7.2	6.81 / 6.3
pH Grab 4 (Field/Lab)	SU					6.81 / 6.9	6.81 / 7.0	7.32 / 7.0	7.39 / 6.9	7.10 / 7.0	6.5 / 6.9	7.14 / 6.9	7.18 / 7.1	6.89 / 7.1	7.18 / 6.8	6.95 / 7.2	6.81 / 6.4
PCBs																	
Aroclor 1016	µg/L	1 (Total PCBs)										0.087					
VOCs																	
1,2-Dichlorobenzene	µg/L					2.8	3	2.6	2.1	2	1	1.7		1			1
1,3-Dichlorobenzene	µg/L						1.1				1.1			1.7			
1,4-Dichlorobenzene	µg/L					3.6	3.9	3.8	3.2	3.1	2.9	2.9	1.8	1.6	1.8	1.6	1.7
Sum of Dichlorobenzenes	µg/L				5 (GV)	***6.4***	***8***	***6.4***	***5.3***	***5.1***	***5***	*4.6*	*1.8*	*4.3*	*1.8*	*1.6*	*2.7*
2-Butanone	µg/L									18							
Acetone	µg/L							9.7 cS						8.2			
Benzene	µg/L		134	57	190 (GV)	1.3	1.4	2.1	1.2	1							
Chlorobenzene	µg/L				5 (GV)	**27**	**27**	**35**	**23**	**22**		**17**	**7.3**	3.3	**9.3**		**11**
Ethylbenzene	µg/L		380	142	4.5 (GV)			1.4									
m,p-Xylene	µg/L							1.2									
Xylene (total)	µg/L		74	28				1.2									
SVOs																	
Acenaphthene	µg/L						1										
Bis(2-ethylhexyl)phthalate	µg/L										1						
Di-n-butyl phthalate	µg/L														2.0 B		
N-Nitrosodiphenylamine	µg/L					5.9	5.9	5.6	5.1	5.4	4.7	5.2	4.6	2.4	3.5	3.7	4.2

Qualifiers:

D = Result for dilution

B = Found in blank

c = Calibration acceptability criteria exceeded for this sample

S = Recovery exceeded control limit for this sample

H = Received/analyzed outside of analytical holding time

GV = Guidance Value only, not a standard

Table 2
Summary of Perimeter Gas Monitoring Well Results
Pennsylvania Avenue Landfill, Brooklyn, NY

Quarterly Monitoring Round	Date	GMW-1	GMW-2	GMW-3	GMW-4	GMW-5
		Methane (% by volume)				
1Q15	4-Mar	0.0	0.0	0.0	0.5	0.0
2Q15	9-Jun	0.0	0.0	0.0	0.2	0.0
3Q15	11-Sep	0.1	0.0	0.0	0.0	0.0
4Q15	5-Oct	0.0	0.0	0.0	0.0	0.0
	6-Oct	0.0	0.0	0.0	0.0	0.0
	7-Oct	0.0	0.0	0.0	0.0	0.0
	8-Oct	0.1	0.0	0.0	0.1	0.0
	26-Oct	0.0	0.0	0.0	0.1	0.0
	27-Oct	0.0	0.0	0.0	0.3	0.0
	2-Nov	0.0	0.0	0.0	0.2	0.0
	15-Dec	0.0	0.0	0.0	0.0	0.0
	17-Dec	0.0	0.0	0.0	0.0	0.0
	21-Dec	0.0	0.0	0.0	0.0	0.0
		Carbon Dioxide (% by volume)				
1Q15	4-Mar	2.4	1.3	0.8	5.1	0.7
2Q15	9-Jun	3.6	2.7	2.8	17.0	1.7
3Q15	11-Sep	6.5	6.1	3.2	2.3	1.3
4Q15	5-Oct	3.7	3.3	3.2	2.1	1.1
	6-Oct	4.3	1.9	3.5	2.7	2.1
	7-Oct	3.3	2.1	3.6	2.8	2.1
	8-Oct	5.1	3.8	3.5	2.9	1.8
	26-Oct	3.4	2.2	3.1	3.7	1.9
	27-Oct	0.7	2.1	2.6	12.8	3.1
	2-Nov	2.1	0.3	3.5	12.2	2.9
	15-Dec	2.3	1.7	3.8	12.6	3.6
	17-Dec	1.1	1.5	3.6	8.4	1.4
	21-Dec	4.6	3.2	4.7	13.3	3.8
		Oxygen (% by volume)				
1Q15	4-Mar	12.1	18.0	18.8	12.8	19.2
2Q15	9-Jun	8.6	8.8	14.9	2.5	18.4
3Q15	11-Sep	6.0	8.0	18.5	18.4	20.5
4Q15	5-Oct	12.9	18.4	18.1	17.5	20.6
	6-Oct	11.4	19.5	17.7	15.3	18.1
	7-Oct	13.6	19.2	17.4	18.1	14.5
	8-Oct	10.9	19.0	18.1	16.2	17.6
	26-Oct	14.1	19.3	18.9	15.5	17.8
	27-Oct	19.2	19.2	18.9	9.6	16.7
	2-Nov	19.6	20.1	18.2	10.1	17.0
	15-Dec	13.7	19.4	17.2	7.8	12.8
	17-Dec	17.4	19.7	17.6	13.0	20.1
	21-Dec	8.1	18.6	18.1	7.2	14.5

Note: Monitoring performed to confirm the absence of off-site gas migration after intermittent extended flare outage. The quarterly rounds were conducted on March 4th, June 9th, September 11th and December 15th.

Table 3:
Summary of Gas Monitoring Results within the Groundwater/Leachate Pre-Treatment Building

Pennsylvania Avenue Landfill
Brooklyn, NY

	Date	Leachate Treatment Building Methane (% by Volume)
1Q15	1/12/15	0.0
	2/19/15	0.0
	3/3/15	0.0
1Q15	4/8/15	0.0
	5/6/15	0.0
	6/2/15	0.0
1Q15	7/1/15	0.0
	8/10/15	0.0
	9/8/15	0.0
1Q15	10/19/15	0.0
	11/3/15	0.0
	12/7/15	0.0