POST-CLOSURE MONITORING SAMPLING AND ANALYSIS PLAN

Brookfield Avenue Landfill

New York City
Department of Environmental Protection

Richmond County
NYSDEC Site No: 2-43-006

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Introduction

1.1 Monitoring Plan

Post-closure environmental monitoring of the Brookfield Avenue Landfill (BAL) is required by the New York State Department of Environmental Conservation (NYSDEC) to enable evaluation of the effectiveness of the remediation activities at this site. This monitoring plan was prepared based on the Rules and Regulations of the State of New York (6 NYCRR) Part 360 regulations, NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation publication, discussions with NYSDEC, and the results of the BAL Remedial Investigation (RI).

The objective of this Post-Closure Monitoring Sampling and Analysis Plan for the BAL is to ensure the integrity of the final remedial system, while detecting any adverse impacts on public health, safety, and the environment during the 30-year post closure-monitoring period.

1.2 Monitoring Plan Elements

This post-closure monitoring plan addresses the performance evaluation of the BAL cap closure system for controlling leachate and landfill gas migration. All landfill areas, approximately 132 acres, received a final cap in accordance with 6NYCRR Section 360-2.15(d). The closure construction includes a barrier wall, landfill cap, stormwater management system, leachate collection and treatment system, groundwater monitoring system, surface water monitoring system, and an active landfill gas management system, as described below. The operation and maintenance of this system is addressed in a separate document. This monitoring plan discusses the scope for monitoring:

- Groundwater elevations and quality in wells located along the perimeter of BAL, outside of the limits of the closure cap;
- Monitoring chemical characteristics of surface water and sediment;
- Leachate monitoring and reporting;
- Soil gas quality in wells located along the along the western, southern and eastern property boundaries:
- Landfill gas collection system monitoring;
- Surface emissions monitoring at the landfill.

The groundwater monitoring network includes a total of 25 shallow (upper glacial aquifer) and deep (Cretaceous aquifer) wells constructed of 2-inch diameter polyvinylchloride (PVC) pipe with a locking, protective steel casing as shown in **Figure 1** of **Appendix A**. Of the 25 wells, four are pre-existing wells that were installed during the original Remedial Investigation (RI).

The leachate collection system consists of passive collection pipes located within the landfill cells that direct the flow to on-site treatment tanks before discharge via pumps to the sanitary sewer system. As shown in **Figure 2** of **Appendix A**, the East Cell and West Cell maintain separate collection and pumping systems. Leachate is collected by 6-inch perforated, corrugated polyethylene piping in a stone-filled trench installed under the landfill cover system. There is approximately 4,000 linear feet of leachate collection pipe in the East Cell and 1,800 linear feet of collection pipe in the West Cell. Cleanout manholes are installed at each end of the collection system.

As shown on **Figure 3** of **Appendix A**, the landfill gas monitoring system consists of 32 perimeter landfill gas monitoring wells installed along the western, southern and eastern property boundaries. The landfill gas monitoring wells were installed as close to the property boundary as practicable as the property boundary is the compliance point.

The entire landfilled area is serviced by an active landfill gas collection system as shown on Figure 3 of Appendix A. As part of the closure construction, eighty-four (84) vertical gas collection wells and sixteen (16) horizontal gas collection wells were installed. Each vertical and horizontal well is equipped with a 1½-inch PVC wellhead. In general, the spacing of the vertical gas collection wells provides for a frequency of approximately one per acre. Horizontal collection wells are spaced approximately 100 feet on center.

The following **Table 1-1** presents the frequency of various post-closure monitoring activities at the site.

Table 1-1 Long-Term Post Closure Monitoring Areas and Frequency of Monitoring

Monitoring Activities	Frequency
Ground/Surface Water Monitoring System	
Sampling and analysis of groundwater wells	Quarterly
Sampling and analysis of surface water and sediment (As part of the Brookfield Avenue Landfill Operable Unit 2 Remedial Action Plan dated October 2011)	5, 10, and 20 years (After Closure)
Leachate Management System	
Sampling of effluent (Quarterly Reporting)	Monthly
Gas Management System	
Sampling and analysis of gas monitoring wells	Quarterly
Monitoring of gas extraction wells	Monthly
Surface emission monitoring	Semi-annual

1.3 Post-Closure Monitoring Plan Schedule

All post-closure monitoring sampling described in this plan will commence after NYCDEP's receipt of NYSDEC's written approval of the Final Engineering Certification Report for the BAL Closure Construction. Subsequent sampling will be conducted at the frequencies outlined above, until NYSDEC authorizes a different monitoring frequency for any or all sampling efforts.

Section 2
Environmental Monitoring Activities

This section describes the various environmental monitoring activities as required by 6NYCRR 360-2.15 (k)(7)(i). Monitoring activities include monitoring groundwater, surface water, leachate, and landfill gas. The monitoring program has been designed to assess both the performance and effectiveness of the remedy, and is consistent with the guidance offered in Section 6.2.2 Monitoring Plan of DER-10. The specific methods and procedures described herein are in accordance with standard environmental practices and are consistent with current EPA and NYSDEC guidelines and requirements. The sampling and analysis are also consistent with guidance contained in relevant regulatory documents including the Examination of Water and Wastewater (20th Edition, 1998), CERCLA Quality Assurance Manual (EPA, October 1989), the Field Methods Compendium (EPA, June 1993), and the EPA Low Stress Purging and Sampling Procedure (March 1998).

2.1 Groundwater Monitoring

The purpose of post-closure groundwater monitoring is to assess the performance and effectiveness of the remedy. The monitoring program must gather sufficient data to establish defendable trends with respect to the long-term overall groundwater quality. These trends can confirm that groundwater quality is improving, declining, or stabilizing after the completion of the remedial action. The monitoring well locations were selected based on the environmental monitoring requirements outlined in 6NYCRR 360-2.11(c).

2.1.1 Sample Locations and Rationale

Figure 1 of Appendix A displays the groundwater monitoring well locations. **Table 2-1** presents monitoring well locations and screen intervals. All monitoring wells are constructed of 2-inch diameter PVC pipe with a locking, protective steel casing.

Table 2-1 BAL Long-Term Groundwater Monitoring Well Network

Well ID	Easting (ft)	Northing (ft)	TOS (ft)	BOS (ft)	Alternate ID	Aquifer
LTMW-1	938730	145232	-17	-22	GW-10M	Upper Glacial
LTMW-2	938326	145156	-12	-22		Upper Glacial
LTMW-3	937927	145044	-17	-22		Upper Glacial
LTMW-4	937955	144643	-32	-42		Upper Glacial
LTMW-5a	937961	144235	-20	-25		Upper Glacial
LTMW-5b	937951	144225	-38	-43		Upper Glacial
LTMW-6	938032	143808	-20	-25		Upper Glacial
LTMW-7	938517	143603	-15	-20		Upper Glacial
LTMW-8	939025	143786	-20	-30		Upper Glacial
LTMW-9	940157	144451	-30	-40		Upper Glacial
LTMW-10	940627	144958	-25	-30		Upper Glacial
LTMW-11	941427	145831	-25	-30		Upper Glacial
LTMW-12	941927	146666	-25	-30		Upper Glacial
LTMW-13	941604	146942	-20	-30		Upper Glacial
LTMW-14	941164	146706	-25	-30		Upper Glacial
LTMW-15	940788	146551	-20	-25		Upper Glacial
LTMW-16	940226	146407	-22	-27		Upper Glacial
LTMW-17	939848	146309	-18	-23		Upper Glacial
LTMW-18ug	939451	146135	-22.5	-27.5	GW-13D	Upper Glacial
LTMW-18c	939466	146165	-113	-118	GW-13CS	Cretaceous
LTMW-19	939077	145889	-10	-15		Upper Glacial
LTMW-20	938747	145536	-15	-25		Upper Glacial
LTMW-21	938056	143791	-81	-86		Cretaceous
LTMW-22	940101	144427	-100	-105		Cretaceous
LTMW-23	941717	145869	-107	-112	SAC-24B	Cretaceous

Notes:

1. LTMW = Long-Term Monitoring Well.
2. Coordinates are in NAD 83, US State Plane, New York Long Island.
3. TOS = Top of Screen; BOS = Bottom of Screen; Datum = Mean Sea Level

The following describes the location and purpose of each well:

- LTMW-1 through LTMW-6 are upper glacial wells located down gradient of the landfill. As per Section 360-2.11(c), the horizontal spacing of these wells shall not exceed 500 feet and the wells shall not be further than 50 feet from the barrier wall.
- LTMW-7 through LTMW-11 are upper glacial wells located immediately south of the southern extent of waste of the East and West Cells. The locations are generally up-gradient of the landfill, although as identified during the RI, areas of localized shallow flow to the south (towards the perimeter drainage ditches) were identified. As per Section 360-2.11, the horizontal spacing of these wells shall not exceed 1,500 feet.
- LTMW-12 through LTMW-20 are upper glacial wells located down gradient of the landfill. As per Section 360-2.11(c), the horizontal spacing of these wells shall not exceed 500 feet and the wells shall not be further than 50 feet from the barrier wall.
- Monitoring wells LTMW-21 through LTMW-23 are Cretaceous wells located down gradient of the landfill. Groundwater flow in the Cretaceous aquifer is south, opposite of the shallow (upper glacial) flow direction. These monitoring wells will be located onsite, within 50 feet of the barrier wall.

2.1.2 Sampling Parameters and Monitoring Frequency

Groundwater samples shall be collected and submitted for analysis. Approved methodologies, standard operating procedures and health and safety protocols for obtaining, preserving, transporting and analyzing the samples are summarized in the following subsections. Water samples shall be submitted to a NYSDEC-approved laboratory for chemical analysis. **Tables 2-2** and **2-3** list the baseline and routine analytical parameters. Sampling and analysis will be performed quarterly for routine parameters shown in Table 2-2. Every fifth quarter, additional samples will be collected and analyzed for the baseline parameter groups listed in Table 2-3. Together with the routine parameters, the baseline parameter list covers the entire range of contaminants of concern that are relative to the performance of the remedy. The first sampling event following completion of the constructed portion of the remedy should include analysis for both the routine and baseline parameters/parameter groups.

After a minimum of eight (8) quarters of sampling, the monitoring program will be reviewed and modifications may be proposed based on the analytical results and observed trends in parameter concentrations. Modifications may include reducing the frequency of routine monitoring at select wells from quarterly to every fifth quarter, reducing the list of parameters to be analyzed in the Cretaceous wells, or other variations.

Table 2-2 Routine Parameters

Analytical Parameter	Analytical Method
Field Parameters:	
Static water level (in wells and sumps)	
Specific Conductance	9050/120.1
Temperature	170.1
pH	9040/150.1
Dissolved Oxygen	SM4500/360.1/360.2
Field Observations (colors, odors, surface sheens, etc)	
Turbidity	180.1
Leachate Indicators:	
Ammonia	350.1/350.2
Nitrate	300/352.1
Total Organic Carbon	9060/415.1
Total Dissolved Solids	160.1
Sulfate	300/375.1/9035
Alkalinity	SM2320/310.1
Chloride	300/325.1/9250
Bromide	300/320.1
Total hardness as CaCO3	SM2340B/130.1/130.2
Metals:	
Arsenic	6020/200.8
Cadmium	6020/200.8
Chromium	6020/200.8
Copper	6020/200.8
Cyanide	9010/9012/335.2/335.3
Iron	6010/6020/200.7/200.8
Lead	6010/6020/200.7/200.8
Manganese	6010/6020/200.7/200.8
Selenium	6020/200.8
Sodium	6010/6020/200.7/200.8
Zinc	6010/6020/200.7/200.8

Table 2-3 Baseline Parameters

Analytical Parameter	Analytical Method
TAL Metals	6010/6020/200.7/200.8
TCL Volatile Organic Compounds	8260/624
TCL Base-Neutral Acids (Semi-Volatile Organics)	8270/625
TCL Pesticides	8080/8081/608
TCL PCBs	8080/8082/608

2.1.3 Groundwater Level Measurement

Groundwater levels shall be measured at each monitoring well on the same day and recorded on a groundwater level measurement log. Groundwater levels shall be measured to the nearest 0.01 foot from the reference point on the top of the riser pipe or marked on the inner casing. Water level measurements will be collected using electric sounders, interface probes, pressure transducers, and/or water level recorders. Potentiometric contour map(s) of the Upper Glacial and Cretaceous flow system shall be developed based on the water level measurements.

Additionally, static water levels shall be measured each time a well is sampled and before equipment is introduced into the well. The measuring device shall be decontaminated prior to use and between each monitoring well in accordance with the methods described under Section 2.1.5. An example of a Groundwater Level Measurement Log is shown in **Appendix B**.

2.1.4 Monitoring Well Purging and Sample Collection

Monitoring wells will be purged via the low flow (low stress) method in accordance with EPA standard operating procedures (SOPs). The purpose of low flow purging is to provide a method which minimizes the amount of impact the purging process has on the groundwater chemistry during sample collection. The low flow method also minimizes the volume of water that is being purged and disposed of. This method of purging requires the sampler to place the pump intake within the screened interval and keep the drawdown at a minimum level (0.33 feet) until the water quality parameters have stabilized. The pump intake should not be placed near the bottom of the screened interval to avoid disturbing sediment that may have settled at the bottom of the well. As groundwater monitoring well purging and sampling standards are updated, the methodology for sampling on this site will be updated.

Water quality parameters and water levels must be measured during purging and prior to sample collection. The water quality indicator parameters that will be monitored for stabilization include; specific electrical conductance, dissolved oxygen, turbidity, oxidation-reduction potential, pH, and temperature. With the exception of turbidity, stabilization of the above parameters within 10 percent is required for sampling. As for turbidity, every effort should be made to reduce the turbidity to 10 Nephelometric Turbidity Units (NTUs) or less when samples are being collected for inorganic compounds, semi-volatile organic compounds and pesticides.

Stabilization of the water-quality indicator parameters is the criterion for sample collection, however, if stabilization is not occurring and the procedure is strictly followed, then samples may be collected only after a minimum of three or maximum of six casing volumes are purged. Should this situation arise, specific details recounting the day's field activities with particular attention to the well in question must be recorded in the field notebook or groundwater sampling log as shown in Appendix B.

2.1.4.1 Equipment

A list of suitable equipment for low flow purging is presented below:

- Water level indicator (with marked intervals of 0.01 foot)
- Photoionization detector (PID)

- Steel tape and weight for measuring total depth of well. Lead weight should not be used.
- Submersible or bladder pumps with adjustable rate control. Pumps should be constructed of inert materials such as stainless steel and Teflon®. Acceptable pump types include gear and helical driven, centrifugal and air-activated piston. Adjustable rate, peristaltic pumps can be used when the depth to water is 20 feet or less.
- Teflon® or Teflon® lined polyethylene tubing is preferred when sampling for organic compounds.
- Power source (i.e., generator). If a combustion type generator is used it must be placed downwind of the sampling area.
- Stop watch
- Multi-parameter meter with a flow through cell.
- Graduated cylinder
- Decontamination supplies
- Sample bottles, sample preservation supplies, sample tags or labels and chain of custody forms
- Well Construction data, field and water quality data from previous sampling events
- Well keys and well location map
- Field log book and field logging forms.
- Polyethylene sheeting for placement on the ground around the well head.
- Personal protective equipment (PPE) including nitrile gloves and safety glasses
- Tool box with hand tools including screwdriver, utility knife, tubing cutter.
- 55-gallon drums or other suitable container for purge water.
- Cooler for sample placement
- Ice for sample preservation

2.1.4.2 Purging and Sampling

The following describes the standard purging and sampling procedures for the low flow (low stress), minimal drawdown method for groundwater sample collection. As a general rule groundwater sampling must begin at the monitoring well with the least contamination. Sampling should systematically proceed with the most contaminated monitoring wells being sampled last.

Pre-Sampling Activities

1. Inspect and record the condition of each monitoring well for damage or evidence of tampering.

2. Lay out polyethylene sheeting around the base of the well to minimize the likelihood of contamination of sampling/purging equipment from the soil. Place all monitoring, purging and sampling equipment on the polyethylene sheeting.
3. Unlock the well head and record the location, time, date and appropriate field information in the field log book or groundwater sample log.
4. Remove inner casing cap.
5. Monitor the headspace of the monitoring well at the rim of the casing for volatile organic compounds (VOCs) with a PID. Record the headspace reading in the field log book or groundwater sample log.
6. Measure the depth to water using a water level meter or interface probe relative to the reference measuring point. Record the depth to water reading in the field log book or groundwater sample log. Measure the depth to water a second time to confirm the initial measurement the measurement should agree within 0.01 feet or re-measure.
7. Check the available well information or field information for the total depth of the monitoring well. Use the depth to water and the total depth of the monitoring well to calculate the volume of water in monitoring well or the volume of one casing. Record this information in the field log book or groundwater sample log.

Purging and Sampling Activities

1. Place the pump and support equipment at the wellhead and slowly lower the pump and tubing (attached) down into the monitoring well until the location of the pump intake is set at a pre-determined location within the screened interval. Refer to the available monitoring well construction details to determine the depth and length of the screen interval. Measure the depth of the pump intake while lowering the pump into place. Record the pump depth in the field log book or groundwater sampling log.
2. Measure the water level with the pump in place and record the information in the field log book or groundwater sampling log. Leave the water level indicator probe in the well for future measurements.
3. Connect the discharge line from the pump to a flow-through cell. A “T” connection is needed prior to the flow through cell to allow for the collection of water for the turbidity measurement. The discharge line from the flow through cell must be directed to a container collecting purge water.
4. Begin pumping the well at a low flow rate (0.2 to 0.5 liters per minute) and slowly increase speed. Check the water level. Maintain a steady flow rate while maintaining a drawdown of less than 0.33 feet. If drawdown is greater than 0.33 feet lower the flow rate.
5. Measure the discharge rate of the pump with a graduated cylinder and a stop watch. Measure the water level and record both measurements in the field logbook or groundwater sampling form.
6. Continue purging while monitoring the pump rate and water level. Record the water level and pump rate every three to five minutes during purging.

7. During purging, a minimum of one tubing volume (including the volume of water in the pump and flow through cell) must be purged prior to recording the water quality indicator parameters. Once one tubing volume is purged record the water quality parameter measurements in the field logbook or groundwater sampling form. Monitor and record the water quality indicator parameters every three to five minutes until all parameters stabilize. The stabilization criterion is based on three successive readings of the water quality field parameters; the following are the criteria that must be used:

Parameter	Stabilization Criteria
pH	± 0.1 pH units
Specific electrical conductance (SEC)	± 3% S/m
Oxidation-reduction potential (ORP)	± 10 millivolts
Turbidity*	± 10% NTUs (when turbidity is greater than 10 NTUs)
Dissolved Oxygen (DO)	± 0.3 milligrams per liter

*Every effort should be made to reduce the turbidity to 10 NTUs or less when samples are being collected for inorganic compounds, semi-volatile organic compounds and pesticides.

Once the criteria are met and field indicator parameters are stable, then sample collection can begin.

8. If a stabilized drawdown of 0.33 feet cannot be maintained and the water level is approaching the top of the screened interval, the flow rate is reduced or the pump is turned off (for 15 minutes) to allow for recovery. Under no circumstances should the well be pumped dry. After waiting the 15 minute recovery period commence with pumping at a lower flow rate. If the water draws down to the screened interval again turn the pump off and again allow for recovery. If two tubing volumes (including the volume of water in the pump and flow cell) are removed during purging then sampling can proceed next time the pump is turned on. Specific details recounting these field activities must be recorded in the field notebook or groundwater sampling log. This information is noted with a recommendation for a different purging and sampling procedure.
9. Maintain the same pumping rate or reduce slightly for sampling (0.2 to 0.5 liter per minute) to minimize disturbance to the water column. Disconnect the pump's tubing from the flow-through cell so that the samples are collected from the pump's discharge tubing.

   All sample containers are filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the sample container. When filling the VOC samples, a meniscus must be formed over the mouth of the vial to eliminate the formation of air bubbles and head space prior to capping.

   In the event that the groundwater is turbid (greater than 10 NTUs) a filtered metal (dissolved) sample is collected. If a filtered metal sample is required, then an in-line filter is fitted at the end of the discharge tubing and the sample is collected after the filter. The in-line filter must be pre-rinsed following manufacturer's recommendations. If there are no recommendations for rinsing a minimum of 0.5 to 1 liter of ground water from the monitoring well must pass through the filter prior to sampling.

10. Once sampling is complete carefully remove the pump from the monitoring well. Decontaminate the pump and dispose of the tubing.
11. Before locking the monitoring well, measure and record the depth to water (to 0.1 feet). Measure the total depth a second time to confirm the initial measurement; measurement must agree within 0.1 feet or re-measure.
12. Close and lock the well.

2.1.4.3 Quality Assurance Quality Control Samples

Quality Assurance Quality Control (QAQC) samples must be collected to verify that sample collection and handling procedures were performed adequately and furthermore that the sample collection was performed in such a way that the quality of the groundwater samples are not compromised.

All field quality control samples must be prepared in the same manner as the regular groundwater samples with regard to sample volume, sample container, and sample preservation. The chain of custody procedures for the QAQC samples are identical to the field groundwater samples. The following are QAQC samples which must be collected during the sampling event:

Sample Type	Frequency
Field Duplicate	1 per 20 samples
Matrix Spike/ Matrix Spike Duplicate	1 per 20 samples
Field Blank	1 per 20 samples
Trip Blank (VOC)	1 per sample cooler
Temperature Blank	1 per sample cooler

Blind Duplicate Samples

A duplicate sample is a second sample collected independently at the same location as the regular groundwater sample. Blind duplicate samples are used to evaluate sampling procedures as well as analytical precision including the variability associated with the laboratory analysis and sample collection. Blind duplicate samples are collected simultaneously or in immediate succession of the regular groundwater sample. The blind sample is collected using identical recovery techniques and treated in an identical manner during storage, transportation and analysis. Blind duplicate samples are collected at a frequency of one per every regular 20 groundwater samples. The blind duplicate sample is analyzed for the same parameters as regular groundwater sample collected from the same location.

The blind duplicate sample is given a unique ID and is submitted to the laboratory without their knowledge of the sample location. The field logbook will identify the duplicate sample locations. The sample location is not to be indicated on the sample label, chain of custody or any other documents that may accompany the samples to the laboratory. The anonymity of the sample location ensures that the laboratory cannot ascertain the associated of the duplicate sample.

Field Blanks

Field blanks are QAQC samples collected to check for cross contamination that might occur during sample collection. The field blank sample is collected by pouring deionized water into or pumped through the dedicated or field decontaminated sampling devise and transferred to the appropriate sample containers. The field blank is transported to the laboratory under the same conditions as the regular groundwater samples to the laboratory for analysis. Aside from the pumps, groundwater sampling equipment checked for cross contamination may include bailers and tubing. The field blank samples are analyzed for the same parameters as the regular groundwater samples being collected. Field blanks are collected at a frequency of one per every regular 20 groundwater samples.

Trip Blanks

Trip blanks are QAQC samples prepared by the laboratory performing the sample analysis and are provided with each shipping container. A trip blank is a volatile sample vial filled in the laboratory with organic-free, distilled water, transported to the site, handled like a sample, and returned to the laboratory for analysis. Trip blanks are used only for the laboratory analysis of VOCs only. Trip blanks are used to show whether a sample bottle was contaminated during shipment from the manufacture, while in bottle storage, in shipment to the laboratory, or during analysis at the lab.

Trip Blanks are not be held on-site longer than two calendar days. Trip blanks are not to be opened in the field. For every cooler containing water samples collected for VOC analysis, one trip blank is added to the cooler and analyzed for the presence of VOCs.

Matrix Spike/Matrix Spike Duplicate Samples

Matrix Spike/Matrix Spike Duplicate (MS/MSD) QAQC samples are duplicate samples (collected in the same manner as the blink field duplicate) that are analyzed to determine whether the sample matrix (water, soil, air, etc.) is adversely affecting the sample analysis. A spike is a known amount of analyte added to a sample. Matrix spikes are performed at a frequency of one per every regular 20 groundwater samples.

The MS/MSD sample is subjected spiked with a known amount of an analyte that is then subjected to the entire analytical procedure in order to indicate both accuracy and precision if the method for the matrix by measuring the percent recovery and the relative percent difference (RPD) of the two spiked samples. These samples are used to assess matrix interference effects on the method and to evaluate instrument performance.

Temperature Blank

A temperature blank is a vial of water that accompanies the samples that is opened and tested upon arrival at the laboratory to ensure that the temperature of the sample container is within the required preservative temperature of 4°C ± 2°.

2.1.4.4 Sample Management

Sample Container, Preservatives, and Holding Time Requirements

Sample containers are provided by the New York State Department of Health ELAP certified laboratory contracted to perform the analytical services. The selection of sample containers is based on both the media being sampled and the analytes of interest. The samples preservatives and laboratory holding times are based on media and analytes of interest.

Sample Designation and Labeling

The following procedures are used to identify and track environmental samples collected during the groundwater monitoring events. An un-removable and waterproof label is affixed to each sample container with the following information written on the label with permanent (preferably waterproof) marker or pen:

- Site name
- Sample identification
- Project number (if requested)
- Date/time
- Sampler's initials
- Sample preservation
- Analysis required

Sample IDs will be recorded as follows:

Sample Type	Sample ID
Groundwater Sample	Well ID (i.e., LTMW-1)
Field Duplicate	DUP
Matrix Spike/ Matrix Spike Duplicate	MS/MSD
Field Blank	FB-MMDDYYYY
Trip Blank	TB-# (1 per sample cooler)
Temperature Blank	Not analyzed and therefore not labeled. Not included on chain of custody.

Sample Custody

At the time of the sampling, the sampler records the sample information in the field logbook or groundwater sampling form and on the chain of custody form. The label, logbook, and chain-of-custody form entries are made in waterproof ink. The sample information recorded in the logbooks are at least as detailed as that recorded on labels, and indicate the type of sample (e.g., groundwater, soil, waste, etc.), preservation technique, and sampling location, with sufficient detail as to allow re-sampling at the same location, if necessary.

Immediately after any given sample is collected and transferred to the appropriate laboratory-supplied sample container, the sampler places the sample in a cooler containing ice for preservation. The sampler maintains the completed chain of custody until the sample coolers are prepared for shipping or hand delivery to the laboratory. The sample coolers are submitted with the chain of custody form to document the contents of the cooler and sampling event. The chain of custody form is completed, signed and dated by the sampler, and sealed inside the cooler submitted to the laboratory.

The following information will be included on the chain of custody form:

- Date and Time Sample was Collected

- Client Name
- Project Name
- Sample ID
- Sample Container Numbers and Volumes
- Sample Matrix
- Sample Preservatives
- Sample Analysis Required
- Signatures of Persons Involved in Chain-of-Custody
- Date, Time Relinquishing Sample Custody
- Sample turnaround time
- Report format

The entries on the chain-of-custody form correspond to notes in the field logbook and sample labels. Custody seals are used to detect tampering with the samples before laboratory acceptance. Custody seals are affixed to the cooler in a manner that requires seal breakage in order to open the cooler. Unauthorized seal breakage indicates sample tampering and renders the analytical results of the samples suspect. An example of the Chain-of-Custody Form is included in Appendix B.

2.1.5 Equipment Decontamination

To minimize the chance for cross contamination, non-disposable equipment used during field investigations is decontaminated after each use. Decontamination water is collected and containerized. Whenever feasible, all field sampling equipment is laboratory cleaned, wrapped, and dedicated to a particular sampling point. The field-cleaning of sampling equipment reused during a single sampling event to collect samples for analysis is avoided to the largest extent possible.

If field cleaning of aqueous sampling equipment is required, then the following 8 step decontamination procedure is followed:

1. Alconox or low-sudsing detergent scrub and potable water wash
2. Generous tap water rinse in wash tub
3. Distilled and deionized (ASTM Type II) water rinse
4. Ten percent nitric acid rinse (only if sample is to be analyzed for metals)
5. Distilled deionized (ASTM Type II) water rinse (only if sample is to be analyzed for metals)
6. Acetone (pesticide grade) rinse (only if sample is to be analyzed for organics)
7. Total air dry
8. Distilled and deionized (ASTM Type II) water rinse (only if sample is to be analyzed for organics)

It is important that contaminants are not carried from well to well via sampling equipment. To decontaminate submersible pumps the coiled lines and pump is drained of all water. The pump lines are placed in a large bucket and scrubbed with dilute non-phosphate detergent. The pump is then to be placed in a plastic over pack drum or plastic garbage can and a minimum of 20 gallons of water is flushed through it. After the flush, the outside of the pump is rinsed with distilled and deionized water.

Pump tubing cleaned in this manner is used solely for purging, and not for sample collection. New, unused, dedicated tubing is required at each groundwater sample location. If surface pumps (centrifugal, inertial life, etc.) are used, decontamination is not required because dedicated tubing is used together with a dedicated foot valve, to prevent backflow of water from the pump into the well.

2.1.6 Investigation Derived Waste

For monitoring well purge water, if there is no obvious contamination observed during drilling and well installation, if the development water does not have an observable sheen or odor, and if the PID readings of the water remain at background levels, the development/purge water may be discharged to the ground surface and allowed to percolate back to the groundwater system. In general, the water will be discharged to the ground toward the center of the landfill and not in areas where it may run off the site.

If development and purge water show signs of gross contamination, water shall be collected in U.S. Department of Transportation (DOT) approved (or equivalent) 55 gallon drums and stored at the site. These suspected fluids are analyzed to determine their toxicity characteristics and appropriate means for disposal. After the analytical results are received, the containerized fluids are disposed of in accordance with applicable local, state and federal regulations. NYSDEC will be notified before the investigation derived waste (IDW) is removed offsite for disposal.

Other IDW such as personnel protective equipment (e.g., gloves, Tyveks) are contained in plastic bags or 55 gallon drums for disposal as non-hazardous waste. Drums will be staged on pallets in a designated staging area, and the contents labeled with weather-resistant labels, markers, or crayons on the drum exterior. The sampler shall maintain a log of the drums generated, their contents, and associated analytical data. The operator shall coordinate disposal of the IDW with a qualified disposal contractor. IDW shall be handled, transported, and disposed of in accordance with applicable state, federal, and/or local hazardous waste regulations.

2.1.7 Reporting

Groundwater quality monitoring reports will be submitted to the NYSDEC quarterly within 90 days of the conclusion of the sample collection. Quarterly reports shall be prepared for, sent to and available for review at the NYCDEP and NYSDEC offices. Quarterly reports shall meet the requirements of DER-10 Section 2.2 and contain the following information:

1. A table showing the sample collection date, the analytical results, designation of upgradient wells, and location number for each environmental monitoring point sampled;

2. Tables or graphical representations comparing current water quality with historical water quality;

3. A summary of the contraventions of State water quality standards, significant increases in concentrations above existing water quality, any exceedances of groundwater protection standards, and discussion of results, and any proposed modifications to the sampling and analysis schedule; and

4. QA/QC documentation, consistent with the requirements of DER-10 Section 2.3 and 2.4.

Additionally, as stated in Section 2.1.3, potentiometric contour map(s) of the Upper Glacial and Cretaceous flow system shall be developed based on the water level measurements.

2.2 Surface Water Monitoring

Post-closure monitoring of OU2 includes monitoring of the chemical characteristics of surface water and sediment to augment monitoring conducted as part of OU1. This information is included as part of the Brookfield Avenue Landfill Operable Unit 2 Remedial Action Plan, dated October 2011. Therefore, the monitoring and maintenance requirements of OU2 are not included as part of this Manual.

2.3 Leachate Monitoring

Leachate sampling and analysis shall follow the requirements and protocols set forth by the current NYCDEP Industrial Wastewater Discharge Permit No. 10-P3149-2. The operator shall implement a self-monitoring program consisting of Monthly Self-Monitoring and Quarterly Reporting.

2.3.1 Monthly Sampling

All sampling shall take place on days representative of normal operations. Sampling shall be conducted in accordance with 40 C.F.R.§ 403.12 (g)(3), which states, in pertinent part, that grab samples must be used for pH, cyanide, total phenols, oil and grease, sulfide, and volatile organic compounds. For all other pollutants, 24-hour composite samples must be obtained through flow-proportional composite sampling techniques, unless time-proportional composite sampling or grab sampling is authorized by the Department.

Analysis and sampling type are shown in **Table 2-4** below. Sampling and analysis shall follow the M1 protocols and the aforementioned NYCDEP Industrial Wastewater Discharge Permit and/or by protocols set forth by the NYCDEP Industrial Pretreatment Program (IPP) Inspection and Permit Section. This sampling shall be performed concurrently with the quarterly post-closure groundwater monitoring events so that the QA/QC sampling and data validation performed in conjunction with the groundwater monitoring can be applied to this monitoring as well. For specific details, see the current Industrial Wastewater Discharge Permit No. 10-P3149-2.

Table 2-4 Leachate Sampling Requirements

Pollutant	Sample Location	Frequency	Sample Type
VOLATILE ORGANICS (VOC)			
Benzene	M1	Once a month	4 grab samples, taken at least 1 hour apart for 1 day. Each grab sample must be individually preserved and sent to a certified laboratory. The laboratory may then composite the grab samples.
Ethylbenzene	M1	" "	" "
Methyl-Tert-Butyl-Ether (MTBE)	M1	" "	" "
Tetrachloroethylene (Perc)	M1	" "	" "
Toluene	M1	" "	" "
Xylenes	M1	" "	" "
Carbon tetrachloride	M1	" "	" "
Chloroform	M1	" "	" "
I, I, I-trichloroethane	M1	" "	" "
SEMI-VOLATILE ORGANICS			
Naphthalene	M1	Once a month	A one-day composite sample.
1,4-dichlorobenzene	M1	" "	" "
Phenol	M1	" "	" "
1,2,4-trichlorobenzene	M1	" "	" "
PCB-1016 (Arochlor 1016)	M1	" "	" "
PCB-1242 (Arochlor 1242)	M1	" "	" "
PCB-1254 (Arochlor 1254)	M1	" "	" "
PCB-1221 (Arochlor 1221)	M1	" "	" "
PCB-1232 (Arochlor 1232)	M1	" "	" "
PCB-1248 (Arochlor 1248)	M1	" "	" "
PCB-1260 (Arochlor 1260)	M1	" "	" "

OTHER TOXIC ORGANICS OF CONCERN			
VOLATILE ORGANICS (VOC)	M1	Once a month	4 grab samples, taken at least I hour apart for I day. Each grab sample must be individually preserved and sent to a certified laboratory. The laboratory may then composite the grab samples.
SEMI-VOLATILE ORGANICS	M1		A one-day composite sample.
OTHER POLLUTANTS, PH, AND FLOW			
Cadmium	M1	Once a month	A one-day composite sample.
Chromium (Total)	M1	" "	" "
Chromium (Hexavalent)	M1	" "	" "
Copper	M1	" "	" "
Lead	M1	" "	" "
Mercury	M1	" "	" "
Molybdenum	M1	" "	" "
Nickel	M1	" "	" "
Silver	M1	" "	" "
Zinc	M1	" "	" "
Carbonaceous Biochemical Oxygen Demand (CBOD)	M1	" "	" "
Total Nitrogen	M1	" "	" "
Chloride	M1	" "	" "
Cyanide (Total)	M1	" "	4 grab samples, taken at least I hour apart for I day. Each grab sample must be individually preserved and sent to a certified laboratory. The laboratory may then composite the grab samples.
Cyanide (Amenable)	M1	" "	" "
Total Suspended Solids (TSS)	M1	" "	4 grab samples, taken at least I hour apart for I day. Each grab sample must be individually preserved and sent to a certified laboratory.
Non-Polar Material	M1	" "	" "
pH	M1	" "	Either by 4 in situ measurements or by 4 grab samples, each taken at least 1 hour apart.

2.3.2 Reporting

The operator shall submit reports to the NYCDEP using the NYSDEC's **Self-Monitoring Report Form**. Reports are due on a quarterly basis as follows:

Monitoring Period	Report Due Date
March 1 to May 31	June 30
June 1 to August 31	September 30
September 1 to November 30	December 31
December 1 to February 28	March 31

The operator must maintain a logbook on daily volume of discharge (in gallons per day). A copy of the logbook entries for the monitoring period must be submitted in each self-monitoring report.

Analytical results submitted to the NYCDEP, for any reason, shall be reported by the certified laboratory performing the analysis in a format consistent with the NYCDEP's **Analytical Report Form**. The sampling points referenced on the Analytical Report Form must be identified exactly as they are in the Permit.

2.4 Landfill Gas Monitoring

2.4.1 Perimeter Gas Monitoring Wells

As part of the closure construction, a total of thirty-four (34) permanent perimeter landfill gas monitoring wells were installed near the property boundaries along Arthur Kill Road, Richmond Avenue, and the eastern landfill property boundary as shown in Figure 3 of Appendix A. Landfill gas monitoring will be performed on a quarterly basis in conjunction with the groundwater monitoring program. Annual summary reports will be submitted to the NYSDEC describing the results of the maintenance, monitoring and/or sampling for the environmental and facility monitoring points.

The objective of the gas monitoring program is to determine the presence and extent of any subsurface landfill gas (i.e. methane) migration. In accordance with 6NYCRR 360-2.17(f), combustible gas levels cannot exceed the lower explosive limit (LEL) at or beyond the property line, and cannot exceed 25 percent of the LEL in any structure on or off the site, excluding the gas control/recovery system components. If monitoring detects explosive gas levels in excess of the LEL at the property boundary or in excess of 25 percent of the LEL within any structures, immediate and appropriate actions must be taken to ensure the safety and protection of human health. The NYSDEC must also be immediately notified. Within seven days of detection of methane in excess of regulatory levels, the NYCDEP shall submit to the NYSDEC a description of the steps taken to protect human health. Within 45 days of detection, the NYCDEP shall submit a remediation plan to the NYSDEC. This plan must describe the nature and extent of the problem and the proposed remedy. The plan must be implemented within 60 days of the date of the detection.

Based on the age of the landfill waste, the installation of a slurry wall, the shallow depth of groundwater around the perimeter of the landfill, and results of historic soil gas investigations performed during the field investigations, the potential for landfill gas migration is minimal. It is anticipated that the NYCDEP will request a data review by NYSDEC with the intent of reducing the gas monitoring frequency following completion of five (5) years of quarterly monitoring events, as allowed by 6NYCRR 360-2.15(k)(4).

2.4.1.1 Combustible Gas Indicator

A combustible gas indicator (CGI), LANDTEC GEM or similar, is required for the implementation of the landfill gas monitoring program. CGIs are used to test atmospheres for sufficient oxygen content for life support and/or the presence of any gas or vapor which, when combined with oxygen in free air, presents potential hazards due to flammable to explosive conditions. The CGI samples and analyzes the methane (CH4), carbon dioxide (CO2), and oxygen (O2) content of landfill gases.

The CGI should be calibrated before each use and checked daily during operation to assure that it is operating properly and providing accurate measurements. CGIs will be calibrated with methane in air at concentrations equivalent to 50 percent of the lower explosive limit.

2.4.2 Gas Collection System Monitoring

The operator shall measure gas concentrations of methane, carbon dioxide, and oxygen at each of the 84 vertical gas extraction wells and 16 horizontal gas collection wells shown in Figure 3 of Appendix A on a monthly basis. These measurements shall be used as an indicator of excessive extraction and richness of methane. In addition to the above constituents, the operator shall record flow, vacuum pressure, and temperature readings. If a LFG fire is suspected, carbon monoxide shall also be measured at the well heads. The landfill gas composition entering the flare shall be determined at the flare station on a monthly basis. The parameters to be determined are methane, carbon dioxide, carbon monoxide, and oxygen. The operator shall also record gas flow rate, pressure, and temperature using the control panel and indicators permanently located at the flare station. Information shall be recorded on the Inspection Checklist forms included in Appendix B.

The following instruments and equipment are required for monthly monitoring:

1. LANDTEC GEM (or equivalent) Gas Extraction Monitor
2. Colormetric Tubes (Draeger or similar)
3. Portable Combustible Gas Indicator
4. Portable Sampling Pump with Rechargeable Battery
5. One Liter Gas Sampling Bags
6. Assorted Sizes of Plastic Tubing and Rubber Stoppers

Instrumentation required for total vacuum pressure measurements and methane concentration measurements are outlined below:

- LANDTEC GEM Gas Extraction Monitor shall be used to measure LFG for percentage oxygen, methane, carbon dioxide, nitrogen (balance gas), as well as pressure, temperature, and flow. Two cylinders of calibration gas (50 percent methane by volume and 2.5 percent methane in air) shall be used to calibrate the meter. One canister shall contain 50% methane, 45% carbon dioxide, 3% nitrogen and 2% oxygen. The second canister shall be 2.5% methane with the balance gas nitrogen.
- Colormetric tubes (Draeger or similar) shall be used for measuring carbon monoxide.
- Portable combustible gas indicator with two scales, percentage methane by volume, and percentage lower explosive limit (MSA Model 62S), or equivalent. The unit shall have a water separator to protect the filaments.

- Portable sampling pump with rechargeable battery, MSA Model S, with battery charger Cat No. 56059, or equivalent. These items are useful for taking gas samples and for filling sample bags in order to send the samples to an outside laboratory.
- One liter gas sampling bags.
- Assorted sizes of plastic tubing and rubber stoppers.

2.4.2.1 Total Vacuum Pressure Measurement

Total vacuum pressure readings shall be measured at the extraction well head. The instrument utilized in measuring total vacuum pressures shall be the GEM.

The following procedure shall be employed for measuring the total vacuum pressures at the well head:

1. Prior to use ensure the GEM meter is zeroed for static and differential pressures follow GEM unit instructions.
2. Connect the hose adapters located on the GEM with plastic tubing.
3. Open the lab cock to be sampled.
4. Record the measurement (the average reading of the unit's readout variable).
5. Close the lab cock and disconnect the tubing.

2.4.2.2 Methane Concentration Measurement

Methane concentration of the landfill gas shall be measured at the connection to the gas transmission piping with a portable combustible gas indicator on the GEM, or equivalent. The following methods shall be followed for measuring the percentage of methane by volume at each gas extraction point. The total vacuum pressure at the well heads may exceed the capacity of the portable pump. If this occurs, an auxiliary pump shall be used. The following method shall be used:

1. Calibrate the GEM according to the manufacturer's recommendations.
2. Turn on the GEM, setting the range selector to Gas.
3. Briefly open and close the lab cock valve to remove moisture and/or debris build-up on the labcock.
4. Connect the GEM tubing to the orifice plate lab cock, and open the lab cock.
5. Record the average readings for methane, CO_2, O_2 and balance gas.
6. After all readings are taken, close the lab cock and disconnect the tubing.
7. Purge the GEM between well heads by letting the pump run until methane is zeroed and O_2 is around 20%.
8. Adjust value setting.

2.4.3 Surface Emission Monitoring

The applicability of 6NYCRR Part 208 applies to MSW landfills meeting the conditions listed below, as discussed in 6NYCRR 208.1.

1. The landfill has commenced construction, reconstruction or modification or accepted waste at any time since November 8, 1987, or has additional design capacity available for future waste

deposition. Activities required by or conducted pursuant to a CERCLA, RCRA, or State remedial action are not considered construction, reconstruction, or modification.

2. The landfill has a design capacity greater than or equal to 2.5 million megagrams and 2.5 million cubic meters. The landfill design capacity may be calculated in either megagrams or cubic meters for comparison with the exemption values. Any density conversions shall be documented and submitted with the report required under section 208.3(b) of this Part.

3. The landfill has a non-methane organic compound emission rate of 50 megagrams per year or more.

Since the BAL does not meet these criteria, the requirements of 6NYCRR Part 208 are not applicable. The BAL is incorporating end use plans that include both active and passive recreational uses following site capping and closure. Therefore, it is encouraged that the gas collection system be operated in accordance with the operational standards for landfill gas collection and control systems, as discussed in 6NYCRR 208.4, which require that the gas collection system be operated so that the methane concentration is less than 500 parts per million above background at the surface of the landfill.

To determine if this level is exceeded, the operator shall monitor surface concentrations of methane along the entire perimeter of the collection area and along a pattern that traverses the landfill at 30 meter-intervals (or a site-specific established spacing) and where visual observations indicate elevated concentrations of landfill gas, such as distressed vegetation and cracks or seeps in the cover. Surface emission monitoring shall be performed on a semi-annual basis using an organic vapor analyzer (OVA), flame ionization detector (FID), or similar monitoring device.

APPENDIX A

Brookfield Avenue Landfill Remediation OU1, Capital Project EP-8 Drawings

FIGURE 1

Long-Term Groundwater Monitoring Plan Monitoring Well Locations
(Sheet G-8 of Brookfield Avenue Landfill Remediation OU1,
Capital Project EP-8, 2007)

WELLS INCLUDED IN THE LONG-TERM GROUNDWATER MONITORING NETWORK FOR THE BROOKFIELD AVENUE LANDFILL

WELL ID	EASTNG (ft)	NORTHING (ft)	TOS (ft)	BOS (ft)	EXISTING WELL ID
** LTMW-1	938730	145232	-17	-22	* GW-10M
LTMW-2	938326	145156	-12	-22	
LTMW-3	937927	145044	-17	-22	
LTMW-4	937955	144643	-32	-42	
LTMW-5a	937961	144235	-20	-25	
LTMW-5b	937951	144225	-38	-43	
LTMW-6	938032	143808	-20	-25	
LTMW-7	938517	143603	-15	-20	
LTMW-8	939025	143786	-20	-30	
LTMW-9	940157	144451	-30	-40	
LTMW-10	940627	144958	-25	-30	
LTMW-11	941427	145831	-25	-30	
LTMW-12	941927	146666	-25	-30	
LTMW-13	941604	146942	-20	-30	
LTMW-14	941164	146706	-25	-30	
LTMW-15	940788	146551	-20	-25	
LTMW-16	940226	146407	-22	-27	
LTMW-17	939848	146309	-18	-23	
** LTMW-18ug	939451	146135	-22.5	-27.5	* GW-13D
** LTMW-18c	939466	146165	-113	-118	* GW-13CS
LTMW-19	939077	145889	-10	-15	
LTMW-20	938747	145536	-15	-25	
LTMW-21	938056	143791	-81	-86	
LTMW-22	940101	144427	-100	-105	
** LTMW-23	941717	145869	-107	-112	* SAC-24B

* SHALL BE REDEVELOPED USING STANDARD PRACTICES AND METHODS TO ENSURE PROPER COMMUNICATION WITH THE ACQUIFER.

** SHALL BE REDEVELOPED USING STANDARD PRACTICES AND METHODS TO ENSURE PROPER COMMUNICATION WITH THE AQUIFER. IN ADDITION, THE OUTER PROTECTIVE CASING SHALL BE REPLACED WITH NEW CASING AS PER MONITORING WELL SPECIFICATIONS.

NOTES:
1. LTMW = LONG-TERM MONITORING WELL.
2. COORDINATES ARE IN NAD 83, US STATE PLANE, NEW YORK ISLAND.
3. TOS = TOP OF SCREEN; BOS = BOTTOM OF SCREEN; DATUM = MEAN SEA LEVEL.
4. THE HORIZONTAL SPACING OF THESE WELLS SHALL NOT EXCEED 500 FEET AND THE WELLS SHALL NOT BE FURTHER THEN 50 FEET FROM THE BARRIER WALL.

NO.	DATE	DESCRIPTION	APPR'D
1	6/27/12	REVISED LONG TERM MONITORING WELL LOCATIONS	

REVISIONS

DESIGNED BY: G.HOWARD, J.LOSCHMANN
DRAWN BY: N. SWAIN, T. MORGAN
SHEET CHK'D BY: G.HOWARD
CROSS CHK'D BY: H.BOUCHER
APPROVED BY:
DATE:

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60 Crossways Park Drive West, Suite 340
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APPROVED FOR THE CITY OF NEW YORK
P.E.
PROJECT MANAGER
P.E.
ACTING CHIEF, WASTEWATER AND WATER INFRASTUCTURE AND SUPPORT

NYC Environmental Protection

CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENGINEERING DESIGN & CONSTRUCTION
BROOKFIELD AVENUE LANDFILL REMEDIATION
OPERABLE UNIT 1
CAPITAL PROJECT EP-8

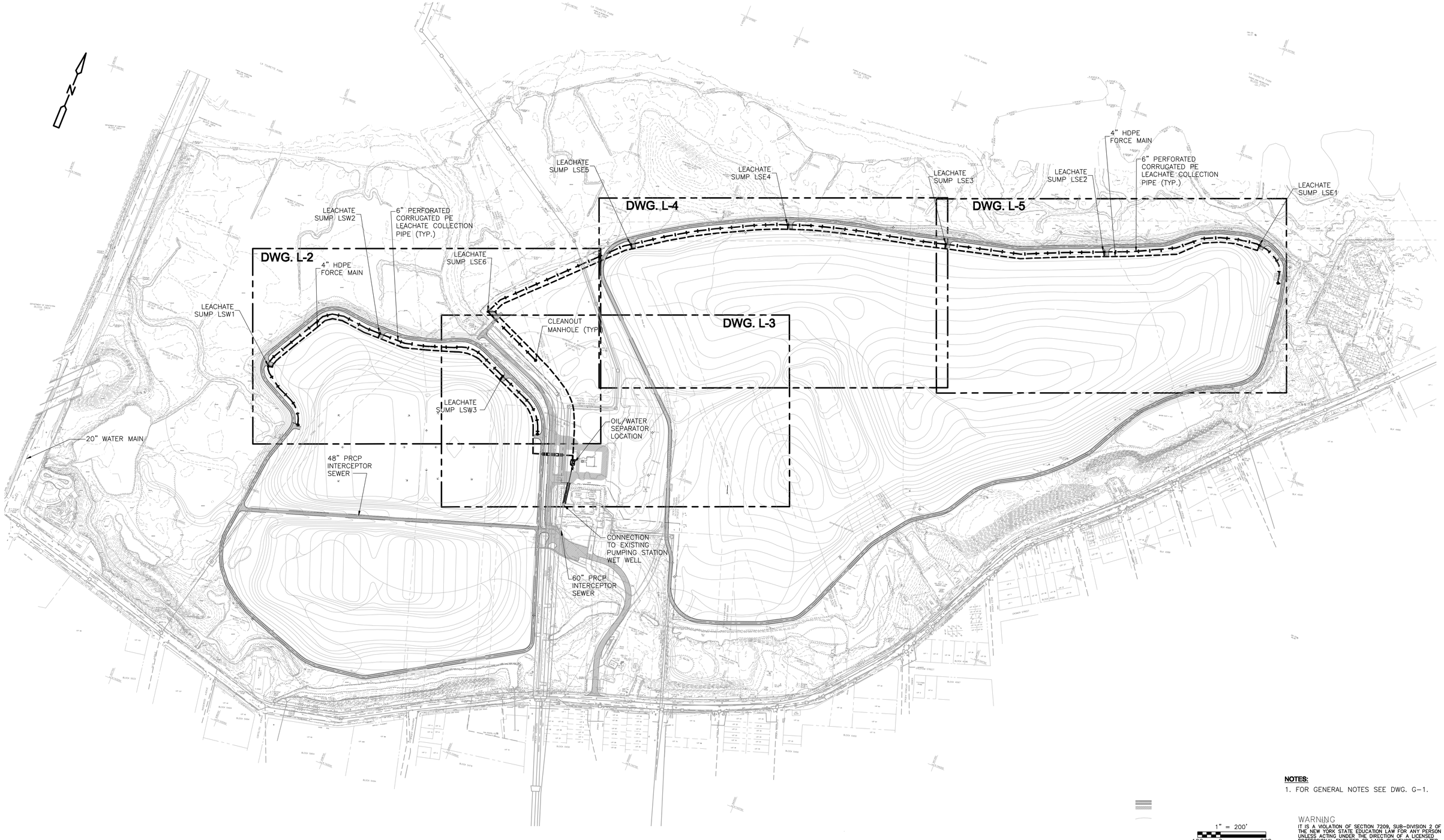
CONTRACT NO. LF-BAL-1G

LONG-TERM GROUNDWATER MONITORING PLAN
MONITORING WELL LOCATIONS

DATE: APRIL 2007
FILENAME: GSTPMW08
DWG. NO: G-8
SHEET NO:
OF
OF

FIGURE 2

Leachate Collection Overall Plan
(Sheet L-1 of Brookfield Avenue Landfill Remediation OU1,
Capital Project EP-8, 2007)



NOTES:

1. FOR GENERAL NOTES SEE DWG. G-1.

1" = 200'

100 0 200

WARNING

IT IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2 OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON UNLESS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR TO ALTER IN ANY WAY PLANS, SPECIFICATIONS, PLATES OR REPORTS TO WHICH THE SEAL OF A PROFESSIONAL ENGINEER OR LAND SURVEYOR HAS BEEN ATTACHED.

NO.	DATE	DESCRIPTION	APPR'D
		REVISIONS	

DESIGNED BY: P. GRIFFIN
DRAWN BY: B. KNITTLE
SHEET CHK'D BY: J. GAVIN
CROSS CHK'D BY: T. CHEATHAM
APPROVED BY: J. GAVIN
DATE:

CDM Camp Dresser & McKee
consulting engineering construction operations

SAVIN ENGINEERS, P.C.
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PLEASANTVILLE, NY 10570

APPROVED FOR THE CITY OF NEW YORK

PROJECT MANAGER P.E.

ACTING CHIEF, WASTEWATER AND WATER INFRASTRUCTURE AND SUPPORT P.E.

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION — DEP

CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENGINEERING DESIGN AND CONSTRUCTION
BROOKFIELD AVENUE LANDFILL REMEDIATION
OPERABLE UNIT 1
CAPITAL PROJECT EP-8

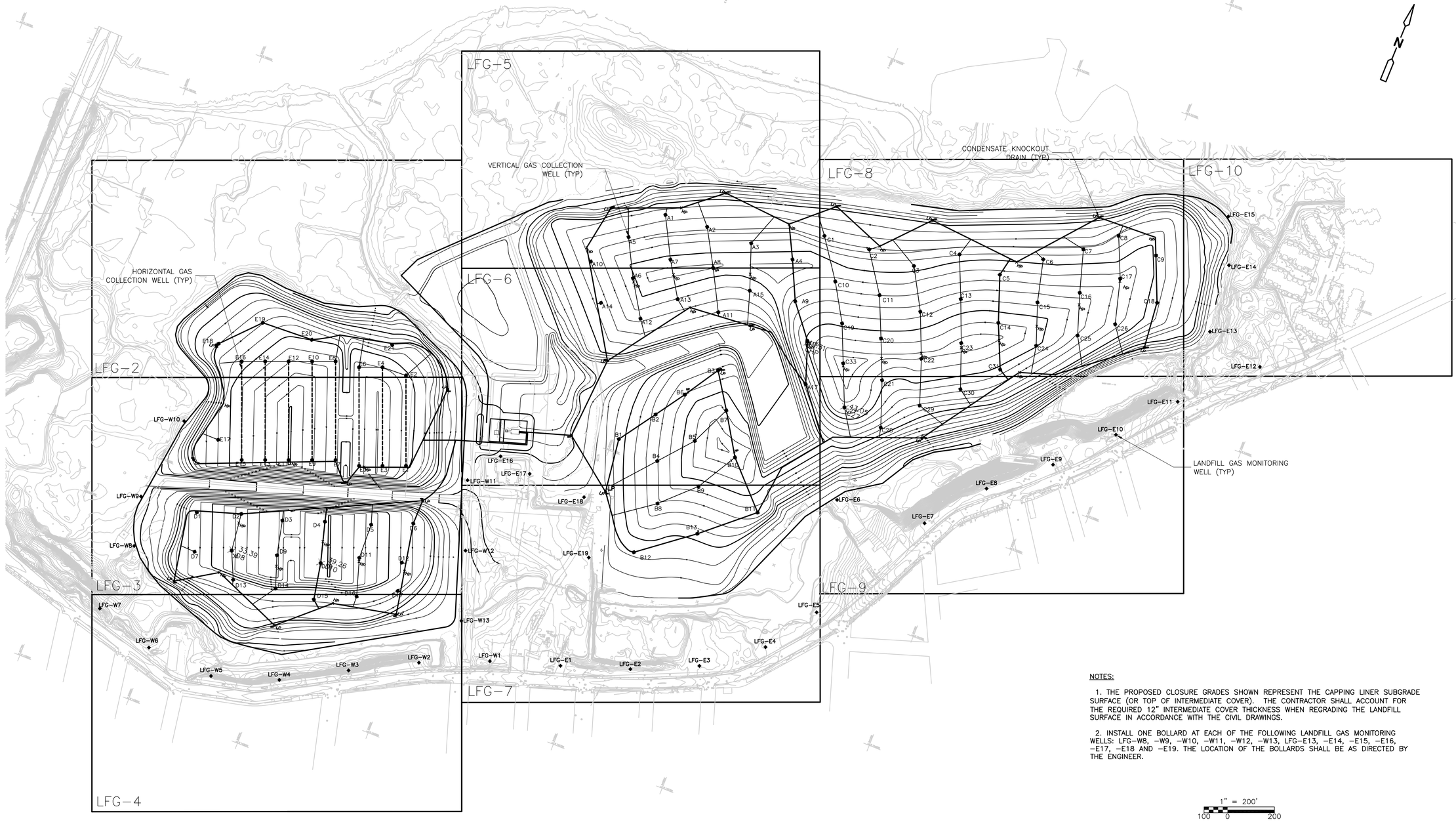
CONTRACT NO. LF-BAL-1G

LEACHATE COLLECTION OVERALL PLAN

DATE: APRIL 2007
FILENAME: L-1
DWG. NO: L-1
SHEET NO:
OF
OF

FIGURE 3

Landfill Gas Collection Key Plan
(Sheet LFG-1 of Brookfield Avenue Landfill Remediation OU1,
Capital Project EP-8, 2007)



NOTES:

1. THE PROPOSED CLOSURE GRADES SHOWN REPRESENT THE CAPPING LINER SUBGRADE SURFACE (OR TOP OF INTERMEDIATE COVER). THE CONTRACTOR SHALL ACCOUNT FOR THE REQUIRED 12" INTERMEDIATE COVER THICKNESS WHEN REGRADING THE LANDFILL SURFACE IN ACCORDANCE WITH THE CIVIL DRAWINGS.

2. INSTALL ONE BOLLARD AT EACH OF THE FOLLOWING LANDFILL GAS MONITORING WELLS: LFG-W8, -W9, -W10, -W11, -W12, -W13, LFG-E13, -E14, -E15, -E16, -E17, -E18 AND -E19. THE LOCATION OF THE BOLLARDS SHALL BE AS DIRECTED BY THE ENGINEER.

1" = 200'
100 0 200

NO.	DATE	DESCRIPTION	APPR'D
2	5/19/10	CHANGE ORDER 3 REVISIONS	
1	7/2009	CONFORMED DRAWINGS	

REVISIONS

DESIGNED BY: T. SCHAFFER
DRAWN BY: M. TOUAYL
SHEET CHK'D BY: J. RICCIO
CROSS CHK'D BY: C. KOEHLER
APPROVED BY:
DATE: APRIL 2007

CDM Camp Dresser & McKee
consulting engineering construction operations

APPROVED FOR THE CITY OF NEW YORK
PROJECT MANAGER P.E.
ACTING CHIEF, WASTEWATER AND WATER INFRASTRUCTURE AND SUPPORT P.E.

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION DEP

CITY OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF ENGINEERING DESIGN AND CONSTRUCTION
BROOKFIELD AVENUE LANDFILL REMEDIATION
OPERABLE UNIT 1
CAPITAL PROJECT EP-8

CONTRACT NO. LF-BAL-1G

LANDFILL GAS COLLECTION KEY PLAN

DATE: APRIL 2007
FILENAME: 1215-PL00
DWG. NO: LFG-1
SHEET NO:
OF OF

APPENDIX B

Sample Field Logs

Daily Record

Project Name	Date	Project No.: Task No.:
Equipment	Weather/Temperature	

Description of Work Performed
(specifiy location, nature of work, etc)

Start Time (On-Site):

End Time (Off-Site):

Summary if Delays, if any:

Visitors

GROUND WATER ELEVATION LOG

SITE: _____ ENVIRONMENTAL CONSULTING FIRM: _____

DATE: _____ FIELD PERSONNEL: _____

Monitoring Well Data			Elevation Data		
Well ID	PID Reading Time	PID Reading	Depth to water Measurement Time	Reference Point (Note 1)	Remarks

NOTE 1: Point of measurement at each well is referenced to surveyed mark on inner casing (IC) or other (O) and explained in Remarks section.

WELL NO.:

WELL PURGING/SAMPLING LOG

SITE:

GENERAL INFORMATION

Date: _____ Project: _____

Inspector(s): _____ Project No: _____

PURGING INFORMATION

Well Condition: _____

Well Type: _____

Screened Interval: _____

Lock No.: _____

Reference Point: _____

Well Depth / Diam. (ft/in): _____

Depth to Water (ft): _____

Water Column (ft /gal): _____

Min. Purge Volume (gal): _____

Purged Volume (gal): _____

Purge Date / Time: _____

Purge Method: _____

Approx. Purge Depth (ft): _____

Approx. Purge Rate (gpm): _____

DTW After Purging: _____

Purge Observations (Ullage Readings, Odor):

_____

_____

_____

_____

_____

SAMPLING INFORMATION

DTW Before Sampling: _____

Sample Date / Time(s): _____

Sample Method: _____

_____

Approx. Sample Depth (ft): _____

Sample Analysis: _____

_____

_____

Analytical Lab: _____

Sampling Observations: _____

Sample Chemistry:

	After Purge	Before Sampling
Temp.(°C):		
pH:		
Cond(ms/cm):		
Turb(NTU):		
D.O.(mg/l):		

Air Temperature / Weather Conditions: _____

Air Quality Data (ppm):

Background: _____

Well Head: _____

Purge Water: _____

Comments:

_____

_____

Meters Used:

Temperature: _____

pH: _____

Conductivity: _____

D.O.: _____

HNU: _____

GROUNDWATER SAMPLING DATA SHEET

SITE NAME: _____ **PROJECT NUMBER:** _____

DATE: _____

WEATHER: _____

FIELD PERSONNEL: _____

ITORING WELL NUMBER: _____

INITIAL DATA

Well Diameter _____ in. Gallons/Lin. Ft.: _____ Ambient PID/FID Reading: _____ ppm

Total Depth of Well: _____ ft Vol. of Water Column: _____ gallons Wellbore PID/FID Reading: _____ ppm

Depth to Water: _____ ft Min. Purge Volume: _____ gallons (3 volumes) LNAPL / DNAPL _____ ft

Height of water Column: _____ ft Depth to Top of Screen _____ ft.

PURGE DATA

Purge Method: Submersible electric pump and dedicated, disposable tubing.

Purge Interval	Time	Depth to Water (ft)	Color	Clarity	Odor	Cum. Vol. (gals)	Temp (cent.)	pH pHu	Conductivity (ms/cm)	Turbidity (NTUs)	DO (mg/l)	Eh (mv)
Initial												
1st well volume												
2nd well volume												
3rd well volume												
Post-Sampling												

urge Start Time: _____ Purge Stop Time: _____ Elapsed Time: _____ Mins. Total Volume Purged _____ Gals.

Overall Average Purge Rate _____ Gals./Min.

SAMPLING DATA

Sampling method: Stainless Steel bailer equipped with teflon check valve, teflon coated stainless steel bridle, and disposable polypropylene cord.

Start Time _____ Stop Time: _____ Elapsed Time: _____ minutes

COMMENTS:

_____

_____

_____

_____

_____

CHAIN OF CUSTODY RECORD

PROJECT NO. | SITE NAME

SAMPLERS (PRINT/SIGNATURE)

DELIVERY SERVICE:_____ AIRBILL NO.:_____

LAB_____

COOLER_____ of _____

PAGE_____ of _____

TESTS

BOTTLE TYPE AND PRESERVATIVE

LOCATION IDENTIFIER	DATE	TIME	COMP/ GRAB	SAMPLE ID	MATRIX	TOTAL NO.# OF CONTAINERS								REMARKS	SAMPLE TYPE	BEGINNING DEPTH (IN FEET)	ENDING DEPTH (IN FEET)	FIELD LOT NO.# (IRPIMS ONLY)

MATRIX CODES

AA - AMBIENT AIR; SE - SEDIMENT; SH - HAZARDOUS SOLID WASTE; SL - SLUDGE; WP - DRINKING WATER; WW - WASTE WATER; WG - GROUND WATER; SO - SOIL; DC - DRILL CUTTINGS; WL - LEACHATE; GS - SOIL GAS; WC - DRILLING WATER; WO - OCEAN WATER; WS - SURFACE WATER; WQ - WATER FIELD QC; LH - HAZARDOUS LIQUID WASTE; LF - FLOATING/FREE PRODUCT ON GW TABLE

SAMPLE TYPE CODES

TB# - TRIP BLANK; SD# - MATRIX SPIKE DUPLICATE; RB# - RINSE BLANK; FR# - FIELD REPLICATE; N# - NORMAL ENVIRONMENTAL SAMPLE; MS# - MATRIX SPIKE

(# - SEQUENTIAL NUMBER (FROM 1 TO 9) TO ACCOMMODATE MULTIPLE SAMPLES IN A SINGLE DAY)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	DATE	TIME
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LAB BY (SIGNATURE)	DATE	TIME

SPECIAL INSTRUCTIONS

Distribution: Original accompanies shipment, copy to coordinator field files

LANDFILL GAS MANAGEMENT SYSTEM

FORM FOR LANDFILL GAS COLLECTION WELLS
BROOKFIELD AVENUE LANDFILL

Inspector_____ Date_____

LOCATION	CONCENTRATION BY VOLUME			TEMP (°F)	VACUUM @ WELL HEAD (IN W.C.)	REMARKS
	Methane	CO_2	Oxygen			
Flare Inlet						
A1						
A2						
A3						
A4						
A5						
A6						
A7						
A8						
A9						
A10						
A11						
A12						
A13						
A14						
A15						
A16						
A17						
B1						
B2						
B3						
B4						
B5						
B6						
B7						
B8						
B9						
B10						
B11						
B12						
B13						
C1						
C2						
C3						
C4						
C5						
C6						
C7						

LOCATION	CONCENTRATION BY VOLUME			TEMP (°F)	VACUUM @ WELL HEAD (IN W.C.)	REMARKS
	Methane	CO_2	Oxygen			
C8						
C9						
C10						
C11						
C12						
C13						
C14						
C15						
C16						
C17						
C18						
C19						
C20						
C21						
C22						
C23						
C24						
C25						
C26						
C27						
C28						
C29						
C30						
C31						
C32						
C33						
D1						
D2						
D3						
D4						
D5						
D6						
D7						
D8						
D9						
D10						
D11						
D12						
D13						
D14						
D15						
D16						

LOCATION	CONCENTRATION BY VOLUME			TEMP (°F)	VACUUM @ WELL HEAD (IN W.C.)	REMARKS
	Methane	CO_2	Oxygen			
D17						
E1						
E2						
E3						
E4						
E5						
E6						
E7						
E8						
E9						
E10						
E11						
E12						
E13						
E14						
E15						
E16						
E17						
E18						
E19						
E20						
E21						