NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF ENGINEERING DESIGN AND CONSTRUCTION

FOUNTAIN AVENUE LANDFILL REMEDIATION

CONTRACT LF-FAL-G4, G1

FINAL ENGINEERING REPORT

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Prepared for:
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Bureau of Engineering Design and Construction
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Submitted to:
New York State Department of Environmental Conservation
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CERTIFICATION

I, C. Duane Seaman, certify that I am currently a registered professional engineer, and I certify that the Remedial Work Plan (or Remedial Design) was implemented and that all construction activities were completed in substantial conformance with the Department-approved Remedial Design.

The data submitted to the Department demonstrates that the remediation requirements set forth in the Remedial Design and any other relevant provisions of ECL 27-1419 have been or will be achieved in accordance with the time frames, if any, established in the design.

C. Duane Seaman, P.E.
Project Manager

9/8/2011
Date

Seal of New York State PE

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1.0 INTRODUCTION

The purpose of this report is to describe the construction and inspection of the remediation of the Fountain Avenue Landfill (the "site", or "landfill") located in Brooklyn, New York, performed under the City of New York Contract LF-FAL-G4: Remediation of the Fountain Avenue Landfill (herein, referred as the "Contract"). The remediation of the landfill was based on the remedy chosen in the Record of Decision (ROD) issued by the New York State Department of Environmental Conservation (NYSDEC), dated February 1995.

As a prerequisite to the landfill remediation, a marine pier was constructed at the site under separate contract LF-FAL-G1. The pier was used as the primary means of importing all soil and stone fill materials into the site during the landfill remediation. While the pier was just one component of the many required to complete the remediation, it is discussed separately because of the separate contract and different contractor.

This report also provides a New York State Licensed Professional Engineer's certification that the remediation of the landfill was conducted and completed in accordance with the relevant Contract Drawings and Specifications, including some minor revisions which do not significantly affect the intent of the design.

This final engineering report has been prepared to meet the requirements for preparation of a final engineering report as described in NYSDEC Solid Waste Regulations 6 NYCRR Part 360-2.8 and Part 360-2.13, effective December 31, 1988.

The following entities were involved with the remediation of the landfill:

- Owner of the Landfill: The landfill's owner is the New York City Department of Environmental Protection (NYCDEP).

- Regulatory Agency: NYSDEC was involved with the review and approval, of the Contract Drawings and Specifications, as well as contributing partial payment for the remediation of the landfill.

- Professional Engineer: URS Corporation, Inc. (URS) was the Owner's Design Engineer, Resident Engineer, and Quality Assurance Inspector. Also, URS is providing the New York State Licensed Professional Engineer's certification that the remediation of the landfill was conducted and completed in accordance with the relevant Contract Drawings and Specifications, including some minor revisions which do not significantly affect the intent of the design.

- General Contractor: Modern Continental Corporation, Inc. ("MCC", or the "Contractor") was the general contractor that was contracted by the NYCDEP to construct the remediation components as described in the Contract Drawings and Specifications.

The Fountain Avenue Landfill is located in the Borough of Brooklyn, Kings County, City of New York. The landfill is bounded on the northwest side by the Belt Parkway, Hendrix Creek to the southwest, Jamaica Bay to the southeast, and to the Old Mill Creek to the northeast. The landfill property encompasses approximately 297 acres.

1.1 Site History

The Fountain Avenue landfill received municipal and industrial waste from February 1961 to December 1985. Landfill operations were conducted under the responsibility of the New York City Department of Sanitation. Solid waste disposed of at the site generally consisted of garbage, rubbish, street dirt, commercial waste, construction and demolition debris, incinerator ash and residue. The method of disposal included filling wastes into tidal wetlands which had been enclosed by dredged sand berms. From 1961 to the early 1970s, the landfill site increased in size from 150 to 297 acres. In 1974, FAL received 22% of New York City's solid waste; by late 1978, 5,000 to 6,000 tons of waste were received per day; and by 1984, the site received approximately 35% of the City's total solid waste disposal, or 9,500 tons per day. An estimated 29 million cubic yards of waste have been disposed at the landfill.

In addition to solid waste, waste oil was used for control of roadway dust. The waste oils used for dust control are alleged to have contained hazardous substances. FAL was permitted by New York State Department of Environmental Conservation (NYSDEC) to receive asbestos-containing waste for disposal. Prior to burial, this waste was required to be containerized, or double-bagged, and then was unloaded by hand at a designated area and immediately covered. An inspection of the asbestos disposal area by SCS Engineers in March 1984 found many of the black plastic disposal bags to be ruptured and the depth of cover material inadequate or nonexistent in some areas.

Between 1974 and 1980 waste oil, sludges, and plating materials were disposed at New York City (NYC) landfills, including Fountain Avenue Landfill. The quantities and locations of hazardous wastes which may have been disposed are unknown. The following waste materials were reported to have been illegally dumped at the landfill in liquid form: acetone, alcohols, acids, alkyl phenols, benzene, chlorides, cyanide, dichlorobenzene, dioctylphthalate, ethylbenzene, fuel oil, industrial oil, lacquer, lubricating oil, mercaptans, metals, naphthalene, sewage sludge, toluene, wastewater, and xylenes.

1.2 Site Conditions Prior To Landfill Closure

The landfill consists primarily of two flat-topped mounds of fill at elevations of approximately 75 and 130 feet above Jamaica Bay. The mounds are bisected by a valley which is oriented north-south and which is 40 to 60 feet lower in elevation. Soil cover above the refuse is generally thin (<6 inches). An Interim Remedial Measure (IRM) was performed in 1993 to cover all exposed refuse areas with soil. Stressed vegetation is evident throughout the site.

The vegetation consists of phragmites, lower lying grasses and sparsely situated trees and shrubs. Wildlife observed at the site included shore birds, hawks, pheasant, rabbits, wild dogs, and rodents.

Leachate seeps were observed at many locations across the landfill. Areas of greenish-brown ponded leachate were noted in several locations of the site. A large pond of leachate on the southeastern perimeter beach along Jamaica Bay discharged a brownish-black stream into Jamaica Bay. Ponded leachate along the Belt Parkway in the western corner of the landfill drained into Hendrix Creek.

Surface water and leachate runoff was observed flowing northward down the valley that separates the two fill mounds into a paved parking area near the support facilities and into a drainage grating in the parking area. The surface water/leachate drainage discharges via a 24-inch diameter corrugated pipe into Old Mill Creek at a point 600 feet south of the access gate. Two other grated drainage inlets, one near the NYCDOS storage Butler Building and one near the previously removed waste drum storage area, also drain to the same 24-inch corrugated pipe. Also, a 12-inch diameter concrete drainage pipe that discharges into Old Mill Creek was observed near the landfill entrance gate.

Vehicle access to the landfill is via the north corner of the site, at the southern end of Fountain Avenue. The main entrance gate is kept locked and site access is controlled through security provided by guards on duty 24 hours a day. Site security patrols are performed along the site perimeter roads. The guard service utilizes a trailer near the main entrance gate.

The several acres adjacent to the entry gate, used during closure as the support area and project offices contained an existing Butler building that was sporadically used by the NYCDOS as a storage facility. An above ground heating oil storage tank with oil was located near the southwest corner of this building, a former drum storage area, with no drums present was located to the, east, and operations-related fencing remained on the site.

Several office and storage trailers, a locker room building and underground storage tanks which were once present on the site were demolished as part of a scheduled interim remedial measure. The foundations for all the demolished buildings still exist on the landfill.

1.3 Remedial Construction History

Contract bid documents for the Landfill remediation construction were entitled "*Remedial Action For Fountain Avenue Landfill, Contract LF-FAL-G4,* dated October 2000, prepared by URS Corporation. The NYCDEP awarded the construction contract to Modern Continental Corporation, Inc. (MCC) of Cambridge, MA, the lowest responsible bidder, in a contract amount of $141,597,705.00. The Notice to Proceed was issued on March 27, 2002, which notified MCC to fully complete the work on or before March 24, 2009 (2,550 consecutive calendar days).

The MCC commenced work on March 27, 2002 and was substantially complete with Milestone 1 (Landfill Capping work excluding woody planting and watering milestones) on July 31, 2008, 852 days past the originally scheduled Milestone Completion date of March 31, 2006. The Milestone 1 delays were predominantly related to the Contractor's difficulty obtaining sufficient quantities of suitable fill and difficulty executing erosion control as required in the contract.

1.4 Fountain Avenue Landfill Pier

The Fountain Avenue Landfill Pier was constructed under contract LF-FAL-G1 solely for use in the closure of the Fountain Avenue Landfill. All fill, riprap, roadstone, topsoil and other bulk materials were delivered to the site via the pier, with minor exceptions.

The Contractor awarded the project, WMS Construction, Inc, failed to complete the pier, but having completed only eight of nine bents (spans) of the access ramp portion of the pier. WMS defaulted on the remaining contract. MCC was awarded a change order near the start of their work to finish the ramp and connect it to a floating barge/pier. The pier was completed in its new configuration by MCC between May 13, 2002 and August 2, 2002 and entered into use by MCC on August 5, 2002.

In general, the pier consists of a pile supported precast reinforced concrete deck, overlain by with a cast in place concrete deck for stiffening purposes. It is designed to accommodate HS 20, 30% impact, AASHTO loads, and 150 PSF live load.

1.5 Components of the Remedial Construction Contract

The Contract LF-PAL-G4 consisted of the major items of work summarized in this section and in subsequent sections of this report and specified in detail on the Drawings and Specifications of the Contract.

The major components of the Contract performed by MCC included the following work:

- Site Preparation: Surveying and construction layout services; Erosion and Sediment Control measures' which were maintained throughout the duration of the contract; Landfill grading and excavation to included waste regrading; completion of the pier; grading fill, type I and type II cover soils placement for liner placement.
- Landfill Gas Management: Construction of a landfill gas (LFG) collection system, including 265 vertical extraction wells placed into the landfill mass and LFG surface header piping for the conveyance of the LFG to the blower and flare facility.
- Low Permeability Layer: Installation of 40 mil Linear Low Density Polyethylene (LLDPE) geomembrane, including geosynthetics above the geomembrane liner. The geosynthetic layers were placed directly above an approved subgrade layer.

- Liner Protection Layer (Barrier Protection Soil): Installation of a minimum 12-inch compacted barrier protection layer over the geosynthetics cap.
- Topsoil and Seeding: Installation of a 6" minimum and up to a 3.0' layer of topsoil with seeding and erosion control to establish a permanent vegetative layer.
- Planting: The installation and maintenance of the plantings required under the contract (NOT PART OF THIS CERTIFICATION REPORT).
- Drainage Control Features: Construction of drainage channels and diversion swales including culverts and outfalls.
- LFG Blower and Flare Facility: Installation of a landfill gas blower and flare facility that destroys the LFG that is directed to the flare via the LFG collection piping.

All work under the Contract was completed by the MCC workforce, which included the following major subcontractors:

Subcontractors	Activity Performed
Chenango Contracting	Geosynthetics Installation
VIP landscaping	Landscaping
Moretrench	Well Drilling
A. Maranda Inc.	Gas Collection and Flare Station
Michael Security	Field Unarmed Guard
Kleinberg	Electrical Work
World Wide Safety Consultants LC	Environmental Health and Safety Services
Testwell Laboratories, Inc.	Soil Testing
Chemtech	Chemical lab
EEA	Hazardous Area Monitoring
Donjon Marine, Inc.	Remove and Dispose of Temporary Dolphin Piles in Jamaica Bay
Evergreen	Geotechnical Testing of Soil Material
Material Testing Laboratory, Inc.	Soil Testing
Accord Pipe Fab. Inc.	Fabrication of Stainless Steel Pipe & Fittings for Flare System
Certified Testing Labs, Inc.	Soil Testing
Spearin, Preston & B	Flare Stack Pile Install
Municipal Land Survey, P.C.	On-Site Surveying and Quantity Calculations
SCS Field Service	Flare Start Up Services
L.A.B. Validation	Data Validation
Niagara Boundary & Mapp. Serv.	Survey
Smith Control System Inc.	Installation and Controls for Flare System Change Order
TRC Environmental Corporation	Flare Emission Testing

1.6 Existing Documents

The following documents describe the construction, quality control and basis of the design of the remediation contract:

- *INFORMATION FOR BIDDERS, STANDARD CONSTRUCTION CONTRACT, AND SPECIFICATIONS FOR FURNISHING ALL LABOR AND MATERIAL NECESSARY FOR: Contract LF-FAL-G4, Remedial Action for Fountain Avenue Landfill, Borough of Brooklyn – New York*, October 23, 2000, URS Corporation, Mack Centre II, Paramus, NJ.

- *Remediation of Fountain Avenue Landfill, Capital Project EP-8, Contract No. LF-FAL-G4, NYSDEC Site 224002*, October 2000, URS Corporation (Drawing Set).

- Record of Decision, February 1995 – Prepared by NYSDEC.

- Remedial Investigation Report, May 1994 – Prepared by URS Consultants, now URS Corporation.

- Feasibility Study Report, September 1994 – Prepared by URS Consultants, now URS Corporation.

- Pennsylvania and Fountain Avenue Landfills Geotechnical Investigation Report, July 1996 – Prepared by URS Consultants, now URS Corporation.

2.0 SITE PREPARATION

The primary objective with respect to site preparation activities involved the clearing and rough grading of the landfill. These subgrade preparation tasks were designed to prepare the surface to receive the low permeability geosynthetic layer. The site preparation activities were divided into a progression of steps including erosion and sediment control, clearing and grubbing, rough grading and subgrade preparation to include existing waste excavation and regrading.

2.1 Erosion and Sedimentation Control

Prior to commencing construction activities, supplemental flow restriction was constructed prior to and during storm events to mitigate developing flows and prevent offsite migration of sediment. Typically, hay bales and silt fence were spiked across developing flow channels in order to filter and to slow the open channel flow development. Silt fence was installed around the entire perimeter of the landfill and maintained for the duration of the contract.

Photographs of the installation of sediment control basins and silt fence are included in Appendix K.

2.2 Clearing and Grubbing

Site preparation began with the clearing of trees, brush, shrubs, other vegetation, rubbish and debris; grubbing of stumps, buried logs, root mats and organic materials within the Contract Limits of Work, and in accordance with the Contract Specifications. All trees and shrubs within the limit of the work were removed, unless designated to remain. Earthwork operations did not start in areas where clearing and grubbing was not complete, with the exception of stumps and large roots that were removed concurrent with excavation. Trees, brush and woody vegetation removed during clearing activities were chipped on site and placed in deep fills in thin layers to facilitate compaction of cover soils. Waste tires were consolidated and removed from the site to an approved disposal facility.

Photographs of the clearing and grubbing activities are included in Appendix K.

2.3 Waste Excavation and Regrading

Prior to performing waste excavation and regrading work, the landfill area was surveyed to establish pre-construction topography. The pre-construction topography was used to redesign the preparatory grades to incorporate any changes in the landfill topography resulting from the landfill settlement. Waste excavation and regrading activities included excavation of waste and regrading necessary to establish the appropriate landfill side slope dimensions and proposed grades for the construction of the subgrade for the landfill capping system. Channels required for drainage features were also reflected in the subgrade design, as

well as establishing the locations of the main surface features (access roads, sediment basin, and drainage structures). All excavated material from the site was relocated to areas within the limit of geomembrane as shown on the approved plans. No material was removed from the site. After material was relocated, all exposed waste was covered with soil from onsite borrow or from approved offsite sources in accordance with the plans and specifications.

Photographs of the waste excavation and regrading activities are included in Appendix K.

3.0 FOUNTAIN AVE PIER CONSTRUCTION

An integral part of the Remediation of the Fountain Avenue Landfill was the construction of a new off loading pier into Jamaica Bay. The ROD required that all materials be brought to the site via barge. This ocean borne method of delivery required the construction of an off-loading facility. In the FS the final solution was determined to be a concrete pier extending from the shore into the shipping channel several hundred feet from shore. The major components of the pier where;

a) Site re-grading to allow for a shore connection point. This area was located on the southern end of the site closest to the shipping channel.
b) Installation of a steel sheet pile landing area to connect the pier with the shore.
c) The installation of steel pipe piles to support the Bends and the decking.
d) The casting in place of the concrete Bends to support the concrete decking.
e) The installation of the pre cast concrete deck panels, and guard rails.

3.1 Installation of Steel Sheeting

Before installation of the steel sheeting commenced, the Contractor was required to re-develop the road network leading to the landing location so the heavy trucks could enter and exit the area. Once the area was cleared and grubbed, the contractor excavated the perimeter berm down to the loading ramp pad elevation, removing existing construction debris to open the area for pile driving. The debris was disposed of on site and covered with a layer of soil.

The Contractor submitted a steel sheeting design signed by a professional engineer licensed to practice in New York State. The sheeting was installed to the limits specified in the approved sheeting design. The 3/8" sheets installed were made of A-36 steel in accordance with ASTM A 328

Photographs of the sheet pile landing are included in Appendix K.

3.2 Installation of Pipe Piles

The Contractor submitted a pipe pile design signed by a professional engineer licensed to practice in New York State. The piles were laid out in the configuration shown in the plans and three of the initial piles were driven and load tested for 48 hours.

Table 3.1
Pipe Pile Load Testing

14" PIPE PILE	60 TON DESIGN LOAD	120 TON TEST LOAD
18" PIPE PILE	120 TON DESIGN LOAD	240 TON TEST LOAD
24" PIPE PILE	180 TON DESIGN LOAD	360 TON TEST LOAD

The results of the shoreline testing was that the 14" and 18" piles passed the testing but the 24" pile was short (316 vs 360 Tons). The contractor proposed to test a second pile using a different firm (one recommended) and at Bend # 7 the pile was tested and passed with 480 tons.

Each pile was filled with 4000 psi concrete and cut off at the pre determined elevation.

The Contractor did not complete the placement of all the piles due to his default part way thru the contract.

Photographs of the Pipe Piles installation are included in Appendix K.

3.3 Construction of the Concrete Bends

The Contractor started construction of the Bends from the shoreline at Bend #18 and worked outward to bend # 10. Each Bend was individually formed on top of the piles driven for it. Prior to forming each bend the required # 11 re-bar was placed and tied to the pile rebar or formed into the Bend forms. During the re bar tying and form construction the work was inspected on a full time basis.

Due to the design of the bends after bend #10, the forms would be in the water during high tide. This required the contractor to adjust his construction technique to work off hours (work with the tide) in order to form the bend and pour the concrete. This is the point were the contractor was unable to perform and work was stopped at bend # 10.

All concrete for the Bends was tested by the DEP and passed the 4000 PSI requirement.

Concrete Test results are in the Appendix B.

Photographs of the Bends installation are included in Appendix K.

3.4 Installation of the Concrete Deck Panel

The Contractor was required to Precast the deck panels and submitted a Mix Design from New Jersey Precast Corp. for a 28 day 5000 psi mix which was approved on April 30 2001.

New Jersey Precast prepared 33 panels between April 30 2001 and June 15 2001. Each was tested and passed the concrete strength requirement and the panels were pre-stressed in accordance with the specifications.

The Shop Inspection Reports are in Appendix B

WMS installed the panels needed to complete the pier to Bend #10 and the rest were stockpiled on shore. MCC in the follow up work used the additional ones needed to complete the re designed pier to bend #9. The panels were inspected as they were installed.

Photographs of the Pre Cast panels' installation are included in Appendix K.

3.5 Contractor Default and Alternative Design

During the course of the construction it became clear that the contractor WMS was not able to manage the construction of such a large and complex project as the pier. Despite efforts by the NYCDEP to assist the contractor WMS defaulted on their contract date. The DEP was required to secure the site, process all outstanding payments and develop an alternative solution.

The DEP working closely with Modern Continental Construction Company developed an alternative off loading facility that completed only 9 of the bends and then attached a 300' by 100' Barge to the end of the last bend via a Mabry to serve as a off loading facility. The solution worked thru out the G-4 Project and was safely removed.

4.0 SHORELINE REVETMENT CONSTRUCTION

An integral part of the Remediation of the Fountain Avenue Landfill was the shoreline revetment construction along the south shoreline of the landfill that abuts Jamaica Bay as well as a small part of Hendrix Creek and Spring Creek. The revetment construction was installed to the lines and grades as indicated on the plans and specifications and serves as a permanent barrier to erosion of the landfill in the area.

4.1 Dewatering

Dewatering activities were performed by the Contractor for the excavation and backfill operations using a system of well pumps and associated piping installed along the perimeter of the excavation. The effluent was discharged to the top of the landfill. The contractor focused on low tide construction timeframe to limit de watering.

4.2 Excavation

Excavation operations followed the dewatering efforts to the line and grades specified in the contract. Excavated material was relocated to the landfill and used as grading fill. The work proceeded from Spring Creek area to past the pier and then to Hendrix Creek.

4.3 Geotextile and Revetment Stone Backfill

Upon successful completion of the excavation operations, a layer of geotextile was placed on the subgrade underneath the stone backfill layers.

The material used for backfill of the excavation was in general conformance with the Contract Specifications. All backfill used on the project was tested and approved per the QA/QC requirement of the Specifications prior to use at the Fountain Avenue Landfill. URS and Modern Continental went to the quarry at Clinton Point and to the loading facility at Tilcon New York, Inc. to visually inspect the operations. 9,851.28 cy of underlayment stone and 20,685.60 cy of armor stone were delivered via barge to the onsite pier.

In general, the backfill material was placed as two separate layers. The first layer of underlayment stone was placed directly over the geotextile to the lines and grades in the plans and specifications. The underlayment stone was quarry processed, rough, angular material graded with a median diameter of approximately 6”. Armor stone was then placed over the underlayment stone to complete the revetment. The armor stone was also quarry processed rough angular material with a median diameter of approximately 18".

4.4 Quality Assurance/Quality Control Installation of Backfill

Quality control and quality assurance testing of materials proposed for use as revetment underlayment and armor stone are included in Appendix C. Quality assurance during the backfill placement consisted of full-time observation by the Engineer to verify that all underlayment and armor stones were placed to the lines and grade as indicated on the approved plans and specifications and material placed met size requirements. The Contract Specifications required no compaction testing for the placement of this material.

There is no frequency testing for riprap required during construction. As the construction progressed, the only time new tests were required were if a new source of riprap needed acceptance or if the material changes and did not conform to specifications. Table 4-1 shows the source testing requirements for QC and QA.

Table 4-1
Quality Control / Quality Assurance – Laboratory Minimum Testing Requirements

Property	Test Method	Requirement
Specific Gravity	COE C.D.-C-107	Dry unit weight 165 lbs/cu ft or greater
Absorption	COE C.D.-C-107	Less than 1 percent
Soundness	COE C.D.-C-137	Less than 5 percent loss
Freezing and Thawing	COE C.D.-C-144	Less than 12 percent loss in 12 cycles
Abrasion Analysis	COE C.D.-C-145	Less than 20 percent loss for 500 revolutions
Wetting and Drying	Spec D-12.1 part 2.2 B.3	No major progressive cracking
Expansive Breakdown	COE C.D-C-148	No deterioration except minor crumbs from surface
Drop Test	Spec D-12.1 Part 2.2 B.4	No breakage or cracking

For NYSDOTSS items, certifications were submitted instead of actual laboratory test results which attest that the riprap meets all NYSDOTSS requirements for riprap.

QA Geotechnical Inspectors visually and periodically inspected the material delivered to the site to ensure consistency. If changes in the material occurred, the QA Site Manager rejected any work performed by Modern Continental using the new material until the pre-construction QA and QC procedures were executed and approved by the QA Site Manager.

Refer to Appendix C for the NYSDOTSS testing of Riprap.

Photographs of the stone revetment construction are included in Appendix K.

5.0 TYPE I (GENERAL) GRADING FILL

Type I grading fill was used along with grading activities to bring the existing irregular natural grades of the site to uniform slopes and contours for placement of subsequent uniform thickness cap layers. This was to be followed by select Type II grading fill (Type II cover soil) in order to achieve the final cover subgrade directly below the geomembrane. Depths of type I grading fill varied in order to achieve the design contours throughout the landfill.

5.1 Material Source – Type I (General) Grading Fill

The material used for the Type I grading fill was non-hazardous soil that was in general conformance with the Contract Specifications All grading fill used on the project was tested for hazardous waste characteristics, including ignitability, reactivity, corrosivity and TCLP (Toxicity Characteristic Leaching Procedure) to verify that contaminants would not leach out of the soil. They were also tested for physical properties to meet the structural requirements of the specifications. Soils were approved per the QA/QC requirements of the Specifications prior to being imported for use at the Fountain Avenue Landfill.

The 1,170,580 cy of Type I grading fill was imported from fifteen sites, including construction sites, mining pits and dredge sites. All Type I grading fill material was delivered to the Fountain Avenue Landfill pier via barge transportation, except for the "Peardegat" source, which was supplied locally from a NYCDEP site and transported by the Contractor via truck.

NYCDEP and URS inspected the borrow sites and loading facilities prior to general acceptance and procurement. Source testing was performed on each sources of Type I grading fill. Table 5-1 shows the source testing requirement.

Table 5-1
Source - Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One per source
Standard Proctor Density	ASTM D-698	One per source
Organic Content	ASTM D-2974	One per source
Atterberg Limits	ASTM D-4318	One per source
Chemical Analysis	Per Specifications	One per source
Water (Moisture) Content	ASTM D-2216	One per source

The general requirements for Type I grading fill are shown in Table 5-2.

Table 5-2
Type I Grading Fill Requirements

Property	Criteria
Organic Content (%)	<15%
Plastic Index (slope > 5%)	<12
Plastic Index (slope < 5%)	<50
Standard Proctor Test	Max Density(pcf)
Standard Proctor Test	Opt. Moisture (%)
Moisture (as received) (%)	<OW +7%
Max Particle Size (in)	<12"
TCLP	Chemical Testing

Refer to Appendix D for Source testing of Type I Grading Fill.

5.2 Installation – Type I Grading Fill

The Type I grading fill was offloaded from the barges at the pier by clamshell excavator and placed directly into off-road 30 yard capacity dump-trucks. It was then driven directly to the point of use, or stockpiled to accommodate the work flow.

Type I grading fill was installed to varying thickness as required achieving the dimensions and contours as shown on the Contract Drawings. Fill placement and compaction was limited to lift thickness of 1', so thicker areas were built up using multiple lifts. Each fill layer was compacted using a smooth drum vibratory roller prior to the placement of subsequent lifts.

5.3 Quality Control /Quality Assurance During Installation

Quality control and quality assurance during construction of the Type I grading fill layer consisted of Contractor and Owner laboratory and field-testing and full-time inspection by owner's representative.

All QC laboratory and field testing was performed by the approved independent chemical laboratory and approved independent geotechnical laboratory, employed by MCC. Chemical analyses were provided by Chemtech, Inc., located in Mountainside, New Jersey. Geotechnical analyses were provided by A&L Laboratories, Inc., located in Richmond, Virginia. For the Duraport source, shared with the PAL project, Chemical analyses were provided by Accredited Laboratories, Inc., located in Carteret, New Jersey. The Geotechnical analyses were provided by Testwell Laboratories, Inc., located in Ossining, New York. In accordance with Table 5-3 below, periodic quality control was performed by the contractor.

Table 5-3
Quality Control – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 5,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 5,000 yd^3
Organic Content	ASTM D-2974	One test every 5,000 yd^3
Atterberg Limits	ASTM D-4318	One test every 5,000 yd^3
Field-Moisture Density	ASTM D-2922	Nine tests per Acre
Chemical Analysis	Per Specifications	One test every 3,000 yd^3
Water (Moisture) Content	ASTM D-2216	One test every 5,000 yd^3

All QA laboratory and field testing was performed by the approved independent chemical laboratory and geotechnical laboratory, employed by URS. Chemical analyses were provided by Veritech Laboratory, a division of Hampton-Clarke, Inc., located in Fairfield, New Jersey. Geotechnical analysis was performed by URS Soil Testing Laboratory in Totowa, NJ. QA testing was performed in accordance with Table 5-4 below, periodic quality assurance (QA) inspection and testing was performed by URS to verify the QC testing.

Table 5-4
Quality Assurance – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 20,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 20,000 yd^3
Organic Content	ASTM D-2974	One test every 20,000 yd^3
Atterberg Limits	ASTM D-4318	One test every 20,000 yd^3
Field-Moisture Density	ASTM D-2922	Four tests per Acre
Chemical Analysis	Per Specifications	One test every 60,000 yd^3
Water (Moisture) Content	ASTM D-2216	One test every 20,000 yd^3

The Type I grading fill was compacted to an in-place minimum density of 90 percent of the maximum dry density, as determined by ASTM D-698. In addition, QA Geotechnical Inspectors visually and periodically inspected the material delivered to the site to ensure consistency. If changes in the material occurred, the QA Site Manager rejected any work performed by MCC using the new material until the pre-construction QA and QC testing procedures were executed and approved by the QA Site Manager. Any material that was not meeting the criteria was not shipped to the site.

Refer to Tables 5-5 and 5-6 for range of summary results of frequency testing.

Table 5-5a
Type I Grading Fill QA & QC Geophysical Tests Results Summary

Criteria	Organic Content (%)	Plastic Index (slope >5%)	Standard Proctor Test		Max. Particle Size (in)
			Max. Density (pcf)	Opt. Moisture (%)	
Specification Requirements	<15%	<12			<12"
Fill Source:	Range of Values (Minimum - Maximum):				
LIE	1.5 - 57	NP-NP	124 - 131	7.4 - 11.0	1 -2
Allocco	1.22 - 9.52	NP - 20.4	100.9 - 138.7	5.1 - 13.9	0.75 - 6
Bayonne / BET - Duraport	1.7 - 6.19	NP -17.8	102.6 -124.1	9.5 - 19	1 - 3
NY Recycling	2.7 - 3.9	NP - NP	117.8 - 122.3	9.3 - 11.9	1 - 3
LIE 2 - (ramp)	1.4 - 2.5	NP - NP	120.4 - 126.1	9.7 - 11.1	
Slattery (BQE)	1.0 - 4.3	NP - NP	111.5 - 134.8	6.4 - 12.6	2 - 2
LIE 2 (stockpile)					
Slattery (LIC)	1.2 - 5.6	NP - NP	101 - 129.6	8.2 - 14.1	
Bruckner	0.7 - 3.2	NP - NP	123 - 133.1	7.4 - 10.7	
Cryders Lane	2.8 - 3.1	NP - NP	101 - 110.8	12.3 - 18.8	
MTA	3 - 5.1	NP - NP	115.7 - 126.5	9.1 - 11.8	
FEDEX - Maspeth	4.2 - 7.5	NP - NP	121.5 - 121.9	9.5 - 10.6	2 -2
Wantagh Pkwy	0.7 - 4.38	NP - NP	102.5 - 131.7	7.1 - 15.3	0.375 - 3
Stony Creek	1.4 - 2.6	NP - NP	114.6 - 130.9	9.4 - 11.9	
Calverton		NP - NP			
Paerdegat	0.4 -4.3	NP - NP	102.8 - 121.6	10.4 - 16.5	0.75 - 3

Table 5-5b (dredged material used as fill)
Type I Grading Fill QA & QC Geophysical Tests Results Summary

	Unconfined Compressive Strength
General Requirements	> 10 psi
Fill Source:	Range of Values (Minimum - Maximum):
Flushing Bay	20.4 - 152.4
KVK	17.67 - 184.7
Kinder Morgan	55.6 - 301.0

Table 5-6a (first four sources)
Type I Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	LIE		Allocco		BET-Bayonne-Duraport		NY Recycling	
		Min.	Max	Min.	Max	Min.	Max	Min.	Max
Ignitability	non-ign<2.2mm/sec<ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign
Corrosivity	2 < pH <12.5	8.8	10.6	5.3	10.8	5.21	10.8	8.4	10.6
Reactivity (Cyanide)	<250 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
Reactivity (Sulfide)	<500 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Arsenic	5.0 mg/L	ND	ND	0.0404	0.0581	ND	0.0504	ND	ND
TCLP Barium	100.0 mg/L	0.15	0.28	0.0398	0.751	ND	0.62	0.153	1.34
TCLP Benzene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Cadmium	1.0 mg/L	ND	ND	0.0041	0.0513	ND	0.057	ND	ND
TCLP Carbon tetrachloride	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlordane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlorobenzene	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chloroform	6.0 mg/L	ND	ND	ND	ND	ND	ND	ND	0.01
TCLP Chromium	5.0 mg/L	ND	0.017	0.0071	0.118	ND	0.325	ND	0.0121
TCLP o-Cresol (2-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP m-Cresol (3-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	0.002	ND	ND
TCLP p-Cresol (4-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	0.002	ND	ND
TCLP 2,4'-D	10.0 mg/L	ND	0.00054	ND	ND	ND	ND	ND	ND
TCLP 1,4-Dichlorobenzene	7.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,2-Dichloroethane	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,1-Dichloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4-Dinitrotoluene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Endrin	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Heptachlor	0.008 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachlorobenzene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloro-1,3-butadiene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloroethane	3.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Lead	5.0 mg/L	ND	0.0412	0.0214	1.24	ND	0.287	ND	0.137
TCLP Lindane (G-BHC)	0.4 mg/L	ND	ND	0.0398	0.0735	ND	ND	ND	ND
TCLP Mercury	0.2 mg/L	ND	ND	0.002	0.0423	ND	ND	ND	ND
TCLP Methoxychlor	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methylethylketone	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Nitrobenzene	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pentachlorophenol	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pyridine	5.0 mg/L	ND	0.005	ND	ND	ND	ND	ND	ND
TCLP Selenium	1.0 mg/L	ND	0.0312	0.009	0.0515	ND	0.0353	ND	0.0302
TCLP Silver	5.0 mg/L	ND	ND	0.037	0.037	ND	0.0681	ND	ND
TCLP Tetrachloroethylene	0.7 mg/L	ND	ND	0.02	0.02	ND	0.095	ND	ND
TCLP Toxaphene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Trichloroethylene	0.5 mg/L	ND	ND	ND	ND	ND	0.069	ND	ND
TCLP 2,4,5-Trichlorophenol	400.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,6-Trichlorophenol	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-TP	1.0 mg/L	ND	0.00027	ND	ND	ND	ND	ND	ND
TCLP Vinyl Chloride	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
PCBs, Total	10 mg/kg	ND	0.0039	0.0042	39	ND	1.3	ND	1.9
Sulfides	5000 mg/kg	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia	200 mg/kg	ND	ND	10.8	126	ND	160	ND	ND
Asbestos Fiber	1% (by weight)[3]	ND	ND	1	2	ND	ND	ND	ND

Table 5-6b (sources 5 through 8)
Type I Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	LIE 2 - Ramp		Slattery - BQE		LIE 2 - Stockpile		Slattery - LIC	
		min.	max	min.	max	min.	max	min.	max
Ignitability	non-ign<2.2mm/sec<ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign
Corrosivity	2 < pH <12.5	5.2	6.2	5.4	10.6	4.6	5.4	6	9.2
Reactivity (Cyanide)	<250 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
Reactivity (Sulfide)	<500 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Arsenic	5.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Barium	100.0 mg/L	0.13	0.296	0.0816	0.617	0.0469	0.588	0.121	0.495
TCLP Benzene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Cadmium	1.0 mg/L	ND	ND	ND	0.0124	ND	ND	ND	0.0146
TCLP Carbon tetrachloride	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlordane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlorobenzene	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chloroform	6.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chromium	5.0 mg/L	ND	ND	ND	0.108	ND	ND	ND	0.0176
TCLP o-Cresol (2-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP m-Cresol (3-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	0.003
TCLP p-Cresol (4-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	0.003
TCLP 2,4'-D	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,4-Dichlorobenzene	7.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,2-Dichloroethane	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,1-Dichloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4-Dinitrotoluene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Endrin	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Heptachlor	0.008 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachlorobenzene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloro-1,3-butadiene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloroethane	3.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Lead	5.0 mg/L	ND	0.052	ND	0.858	ND	ND	ND	0.424
TCLP Lindane (G-BHC)	0.4 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Mercury	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methoxychlor	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methylethylketone	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Nitrobenzene	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pentachlorophenol	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pyridine	5.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Selenium	1.0 mg/L	ND	ND	ND	0.0328	ND	0.0352	ND	0.0376
TCLP Silver	5.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Tetrachloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Toxaphene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Trichloroethylene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-Trichlorophenol	400.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,6-Trichlorophenol	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-TP	1.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Vinyl Chloride	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
PCBs, Total	10 mg/kg	ND	ND	ND	0.33	ND	ND	ND	0.12
Sulfides	5000 mg/kg	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia	200 mg/kg	ND	ND	ND	ND	ND	ND	ND	ND
Asbestos Fiber	1% (by weight)[3]	ND	ND	ND	ND	ND	ND	ND	ND

Table 5-6c (sources 9 through12)
Type I Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	Bruckner		Cryders Lane		MTA		FEDEX - Maspeth	
		min.	max	min.	max	min.	max	min.	max
Ignitability	non-ign<2.2mm/sec<ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign
Corrosivity	2 < pH <12.5	6	9	6.4	6.5	7.4	8.6	8.8	9.2
Reactivity (Cyanide)	<250 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
Reactivity (Sulfide)	<500 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Arsenic	5.0 mg/L	ND	0.044	ND	ND	ND	0.0453	ND	ND
TCLP Barium	100.0 mg/L	0.364	0.652	0.155	0.158	0.0535	0.461	ND	0.394
TCLP Benzene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Cadmium	1.0 mg/L	ND	0.0052	ND	ND	ND	ND	ND	ND
TCLP Carbon tetrachloride	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlordane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlorobenzene	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chloroform	6.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chromium	5.0 mg/L	ND	0.0208	0.015	0.0187	ND	0.0069	ND	ND
TCLP o-Cresol (2-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP m-Cresol (3-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP p-Cresol (4-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4'-D	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,4-Dichlorobenzene	7.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,2-Dichloroethane	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,1-Dichloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4-Dinitrotoluene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Endrin	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Heptachlor	0.008 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachlorobenzene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloro-1,3-butadiene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloroethane	3.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Lead	5.0 mg/L	ND	0.442	ND	ND	0.0499	0.113	ND	ND
TCLP Lindane (G-BHC)	0.4 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Mercury	0.2 mg/L	ND	0.0042	ND	ND	ND	ND	ND	ND
TCLP Methoxychlor	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methylethylketone	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Nitrobenzene	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pentachlorophenol	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pyridine	5.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Selenium	1.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Silver	5.0 mg/L	ND	0.0268	ND	ND	ND	ND	ND	ND
TCLP Tetrachloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Toxaphene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Trichloroethylene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-Trichlorophenol	400.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,6-Trichlorophenol	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-TP	1.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Vinyl Chloride	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
PCBs, Total	10 mg/kg	ND	0.077	0.069	0.075	0.048	3.3	ND	ND
Sulfides	5000 mg/kg	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia	200 mg/kg	ND	2.18	ND	2.57	ND	ND	ND	ND
Asbestos Fiber	1% (by weight)[3]	ND	ND	ND	ND	ND	ND	ND	ND

Table 5-6d (sources 13 through 16)
Type I Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	Wantagh Pkwy		Stony Creek		KVK		Paerdegat	
		min.	max	min.	max	min.	max	min.	max
Ignitability	non-ign<2.2mm/sec<ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign
Corrosivity	2 < pH <12.5	8.4	10.2	9	11.1	7.09	9.09	7.2	11
Reactivity (Cyanide)	<250 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
Reactivity (Sulfide)	<500 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Arsenic	5.0 mg/L	ND	0.0549	ND	ND	ND	ND	ND	ND
TCLP Barium	100.0 mg/L	0.224	1.53	0.191	0.507	0.276	1.29	ND	1.4
TCLP Benzene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Cadmium	1.0 mg/L	ND	0.0195	ND	ND	ND	ND	ND	ND
TCLP Carbon tetrachloride	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlordane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlorobenzene	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chloroform	6.0 mg/L	ND	ND	ND	ND	ND	ND	ND	0.0059
TCLP Chromium	5.0 mg/L	ND	0.111	ND	0.354	ND	ND	ND	ND
TCLP o-Cresol (2-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP m-Cresol (3-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP p-Cresol (4-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4'-D	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,4-Dichlorobenzene	7.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,2-Dichloroethane	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,1-Dichloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4-Dinitrotoluene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Endrin	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Heptachlor	0.008 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachlorobenzene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloro-1,3-butadiene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloroethane	3.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Lead	5.0 mg/L	ND	0.277	ND	0.278	ND	ND	0.18	6.7
TCLP Lindane (G-BHC)	0.4 mg/L	ND	0.0767	ND	ND	ND	ND	ND	ND
TCLP Mercury	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methoxychlor	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methylethylketone	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Nitrobenzene	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pentachlorophenol	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pyridine	5.0 mg/L	ND	ND	ND	0.001	ND	ND	ND	ND
TCLP Selenium	1.0 mg/L	ND	0.0459	ND	0.0562	ND	ND	ND	ND
TCLP Silver	5.0 mg/L	ND	0.0819	ND	0.0093	ND	ND	ND	ND
TCLP Tetrachloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	0.054
TCLP Toxaphene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Trichloroethylene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-Trichlorophenol	400.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,6-Trichlorophenol	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-TP	1.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Vinyl Chloride	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND
PCBs, Total	10 mg/kg	ND	0.9	ND	ND	ND	0.407	ND	ND
Sulfides	5000 mg/kg	ND	ND	ND	ND	78.2	1390	ND	940
Ammonia	200 mg/kg	ND	41	ND	13	ND	3.85	5.8	130
Asbestos Fiber	1% (by weight)[3]	ND	ND	ND	ND	ND	ND	ND	0.01

Table 5-6e (sources 17 through 19)
Type I Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	Flushing Bay		Calverton		Kinder-Morgan	
		min.	max	min.	max	min.	max
Ignitability	non-ign<2.2mm/sec<ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign
Corrosivity	2 < pH <12.5	7.15	8.02	7.18	7.48	7.36	7.9
Reactivity (Cyanide)	<250 ppm reactive	ND	ND	ND	ND	ND	ND
Reactivity (Sulfide)	<500 ppm reactive	ND	312	ND	ND	ND	ND
TCLP Arsenic	5.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Barium	100.0 mg/L	ND	0.262	0.346	0.58	ND	0.565
TCLP Benzene	0.5 mg/L	ND	ND	ND	ND	ND	0.12
TCLP Cadmium	1.0 mg/L	ND	ND	0.095	0.099	ND	ND
TCLP Carbon tetrachloride	0.5 mg/L	ND	ND	ND	ND	ND	ND
TCLP Chlordane	0.03 mg/L	ND	ND	ND	ND	ND	ND
TCLP Chlorobenzene	100.0 mg/L	ND	ND	ND	ND	ND	0.125
TCLP Chloroform	6.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Chromium	5.0 mg/L	ND	0.255	ND	0.071	ND	ND
TCLP o-Cresol (2-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP m-Cresol (3-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP p-Cresol (4-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP 2,4'-D	10.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP 1,4-Dichlorobenzene	7.5 mg/L	ND	ND	ND	ND	ND	ND
TCLP 1,2-Dichloroethane	0.5 mg/L	ND	ND	ND	ND	ND	ND
TCLP 1,1-Dichloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	0.104
TCLP 2,4-Dinitrotoluene	0.13 mg/L	ND	ND	ND	ND	ND	ND
TCLP Endrin	0.02 mg/L	ND	ND	ND	ND	ND	ND
TCLP Heptachlor	0.008 mg/L	ND	ND	ND	ND	ND	ND
TCLP Hexachlorobenzene	0.13 mg/L	ND	ND	ND	ND	ND	ND
TCLP Hexachloro-1,3-butadiene	0.5 mg/L	ND	ND	ND	ND	ND	ND
TCLP Hexachloroethane	3.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Lead	5.0 mg/L	ND	1.14	ND	0.246	ND	ND
TCLP Lindane (G-BHC)	0.4 mg/L	ND	ND	ND	ND	ND	ND
TCLP Mercury	0.2 mg/L	ND	ND	ND	ND	ND	ND
TCLP Methoxychlor	10.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Methylethylketone	200.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Nitrobenzene	2.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Pentachlorophenol	100.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Pyridine	5.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Selenium	1.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Silver	5.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Tetrachloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND
TCLP Toxaphene	0.5 mg/L	ND	ND	ND	ND	ND	ND
TCLP Trichloroethylene	0.5 mg/L	ND	0.06	ND	ND	ND	0.118
TCLP 2,4,5-Trichlorophenol	400.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP 2,4,6-Trichlorophenol	2.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-TP	1.0 mg/L	ND	ND	ND	ND	ND	ND
TCLP Vinyl Chloride	0.2 mg/L	ND	ND	ND	ND	ND	ND
PCBs, Total	10 mg/kg	0.158	2.89	0.846	4.94	ND	ND
Sulfides	5000 mg/kg	146	2736	ND	ND	57	459.1
Ammonia	200 mg/kg	1.06	9.92	52.5	64.2	2.15	3.02
Asbestos Fiber	1% (by weight)[3]	ND	ND	ND	ND	ND	ND

Refer to Appendix D for all geotechnical, chemical, and field test results.

For field moisture-density testing (IPD), test data sheets are also copied in Appendix D. No summary table of the results is provided because for any out-of-specification test result, soil was recompacted and moisture-adjusted until the results met specification.

Photographs of the Type I grading fill installation are included in Appendix K.

6.0 TYPE II GRADING FILL

Type II grading fill was used as bedding for the geomembrane and was placed as a six (6) inch thick layer above the regraded waste or type I grading fill, and directly below the geomembrane. Type II grading fill meets the specifications for general (type I) grading fill plus the additional requirement of having a maximum particle size of 1" diameter.

6.1 Material Source – Type II Grading Fill

The material used for the Type II grading fill was non- hazardous soil that was in general conformance with the Contract Specifications. The Type II grading fill used on the project was tested for hazardous waste characteristics, including ignitability, reactivity, corrosivity, and TCLP (Toxicity Characteristic Leaching Procedure) to verify that contaminants would not leach out of the soil. They were also tested for physical properties to meet the structural requirements of the Specifications. Soils were approved per the QA/QC requirements of the Specifications prior to being imported for use at the Fountain Avenue Landfill.

The 311,628cy of Type II grading fill was imported from several sites: five quarries from Tilcon New York, Inc. located in Tomkin's Cove, New York, Haverstraw, New York, and at Clinton Point (New Hamburg, New York), from Stony Creek Industries, Oceanside New York and Amboy Aggregate New Jersey. All Type II material was delivered to the Fountain Avenue Landfill pier via barge transportation

NYCDEP and URS inspected the borrow sites and loading facilities prior to general acceptance and procurement. Source testing was performed on all 4 sources. Table 6-1 shows the source testing requirement.

Table 6-1
Source - Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One per source
Standard Proctor Density	ASTM D-698	One per source
Organic Content	ASTM D-2974	One per source
Atterberg Limits	ASTM D-4318	One per source
Chemical Analysis	Per Specifications	One per source
Water (Moisture) Content	ASTM D-2216	One per source

The general specifications for Type II grading fill are shown in Table 6-2.

Table 6-2
Type II Grading Fill Requirements

Property	Criteria
Organic Content (%)	<15%
Plastic Index (slope > 5%)	<12
Plastic Index (slope < 5%)	<50
Standard Proctor Test	Max Density(pcf)
Standard Proctor Test	Opt. Moisture (%)
Moisture (as received) (%)	<OW +7%
Max Particle Size (in)	<1"
Chemical Testing	TCLP Haz.. Waste Characteristics

Refer to Appendix E for all Source testing results.

6.2 Installation – Type II Grading Fill

The Type II grading fill was stockpiled and then transported with earthmoving equipment such as excavators and pay loaders into articulated trucks for transport and placement onto approved locations.

Type II grading fill was installed with a minimum thickness of six (6) inches as specified and required per the Contract Drawings. Material was compacted in place using a smooth drum vibratory roller.

6.3 Quality Assurance/Quality Control During Installation

Quality assurance and quality control during construction of the Type II grading fill consisted of full-time observation in addition to laboratory and field-testing.

All QC laboratory and field testing was performed by the approved independent chemical laboratory and approved independent geotechnical laboratory, employed by MCC. Chemical analyses were provided by Accredited Laboratories, Inc., located in Carteret, New Jersey and by Chemtech, of Mountainside, New Jersey. Geotechnical analyses were provided by Testwell Laboratories, Inc., located in Ossining, New York. In accordance with Table 6-3 below, periodic quality control was performed by the contractor. Field testing consisted of in-place moisture-density testing using nuclear density test meter. Testwell Laboratories, and later Certified Testing Laboratories of The Bronx, New York provided these onsite testing services to MCC.

Table 6-3
Quality Control – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 5,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 5,000 yd^3
Organic Content	ASTM D-2974	One test every 5,000 yd^3
Atterberg Limits	ASTM D-4318	One test every 5,000 yd^3
Field-Moisture Density	ASTM D-2922	Nine tests per Acre
Chemical Analysis	Per Specifications	One test every 3,000 yd^3
Water (Moisture) Content	ASTM D-2216	One test every 5,000 yd^3

All QA laboratory and field testing was performed by the approved independent chemical laboratory and geotechnical laboratory, employed by URS. Chemical analyses were provided by Veritech Laboratory, a division of Hampton-Clarke, Inc., located in Fairfield, New Jersey. Geotechnical analysis was performed by URS Soil Testing Laboratory in Totowa, NJ. Field Moisture-Density tests were performed by one of URS' full time onsite inspector's with appropriate equipment and method training for this task. In accordance with Table 6-4 below, periodic quality assurance (QA) inspection and testing was performed by URS to verify the QC testing.

Table 6-4
Quality Assurance – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 20,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 20,000 yd^3
Organic Content	ASTM D-2974	One test every 20,000 yd^3
Atterberg Limits	ASTM D-4318	One test every 20,000 yd^3
Field-Moisture Density	ASTM D-2922	Four tests per Acre
Chemical Analysis	Per Specifications	One test every 60,000 yd^3
Water (Moisture) Content	ASTM D-2216	One test every 20,000 yd^3

The Type II grading fill was compacted to an in-place minimum density of 90 percent of the maximum dry density, as determined by ASTM D-698. In addition, QA Geotechnical Inspectors visually and periodically inspected the material delivered to the site to ensure consistency. If changes in the material occurred, the QA Site Manager rejected any work performed by MCC using the new material until the pre-construction QA and QC procedures were executed and approved by the QA Site Manager.

Refer to Tables 6-5 and 6-6 for summary test results.

Table 6-5
Type II Grading Fill QC Geophysical Tests Results Summary

General Requirements	Criteria	Amboy		Tilcon		Clinton Point		Tompkins Cove		Stony Creek	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Organic Content (%)	<15%	0.10	3.90	0.30	0.80	0.21	0.64	0.08	2.70	2.10	3.90
Plastic Index (slope > 5%)	<12	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Plastic Index (slope < 5%)	<50	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
Standard Proctor Test	Max. Density (pcf)	99.90	102.20	131.40	135.70	107.70	126.90	113.80	137.30	113.20	124.50
	Opt. Moisture (%)	15.9	17.2	7.9	11.6	1.0	5.4	3.1	13.7	10.1	13.4
Max. Particle Size (in)	<1"	0	3/8	0.75	1	0.75	1	0.75	1	0.75	

Table 6-6
Type II Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	Amboy		Tilcon		Stony Creek		Clinton Point		Tompkins Cove	
		Min	Max	Min	Max	Min.	Max	Min.	Max	Min.	Max
Ignitability	non-ign <2.2mm/sec<ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign	non-ign
Corrosivity	2 < pH <12.5	7.4	9	8.4	9.7	7.9	11	8.6	9.7	8.4	9.3
Reactivity (Cyanide)	<250 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Reactivity (Sulfide)	<500 ppm reactive	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Arsenic	5.0 mg/L	ND	ND	0.0311	0.0347	0.052	0.102	ND	ND	0.0311	0.0347
TCLP Barium	100.0 mg/L	0.0627	0.355	0.0411	0.298	0.11	0.575	0.0465	0.169	0.0411	0.298
TCLP Benzene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Cadmium	1.0 mg/L	ND	ND	0.0042	0.0046	0.0113	0.0113	ND	ND	ND	ND
TCLP Carbon tetrachloride	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlordane	0.03 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chlorobenzene	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chloroform	6.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Chromium	5.0 mg/L	ND	ND	0.006	0.556	0.0133	0.0514	0.006	0.006	0.0076	0.556
TCLP o-Cresol (2-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP m-Cresol (3-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP p-Cresol (4-Methylphenol)	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4'-D	10.0 mg/L	ND	ND	ND	ND	0.0002	0.0002	ND	ND	ND	ND
TCLP 1,4-Dichlorobenzene	7.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,2-Dichloroethane	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 1,1-Dichloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4-Dinitrotoluene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Endrin	0.02 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Heptachlor	0.008 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachlorobenzene	0.13 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloro-1,3-butadiene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Hexachloroethane	3.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Lead	5.0 mg/L	0.0242	0.0268	0.0279	0.0842	0.0192	0.369	0.021	0.0697	0.0279	0.0842
TCLP Lindane (G-BHC)	0.4 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Mercury	0.2 mg/L	ND	ND	ND	ND	0.00029	0.0031	ND	ND	ND	ND
TCLP Methoxychlor	10.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Methylethylketone	200.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Nitrobenzene	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pentachlorophenol	100.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Pyridine	5.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 6-6 (continued)
Type II Grading Fill QC Chemical Tests Results Summary

Waste Characteristics	Criteria	Amboy		Tilcon		Stony Creek		Clinton Point		Tompkins Cove	
		Min	Max	Min	Max	Min.	Max	Min.	Max	Min.	Max
TCLP Selenium	1.0 mg/L	0.0392	0.0392	0.0138	0.035	0.0596	0.068	0.014	0.0322	0.0138	0.035
TCLP Silver	5.0 mg/L	ND	ND	0.0104	0.0158	ND	ND	0.0114	0.0114	0.0123	0.0158
TCLP Tetrachloroethylene	0.7 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Toxaphene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Trichloroethylene	0.5 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-Trichlorophenol	400.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,6-Trichlorophenol	2.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP 2,4,5-TP	1.0 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TCLP Vinyl Chloride	0.2 mg/L	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCBs, Total	10 mg/kg	ND	ND	0.053	0.053	0.013	1.2	ND	ND	0.053	0.053
Sulfides	5000 mg/kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia	200 mg/kg	ND	ND	ND	ND	2.92	14	16	36	ND	ND
Asbestos Fiber	1% (by weight)[3]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Refer to Appendix E for all field, chemical and geotechnical testing.

Photographs of the Type II grading fill installation are included in Appendix K.

7.0 LLDPE GEOMEMBRANE

The Contract Specifications and Drawings required the installation of a co-extruded, light reflective white Linear Low Density Polyethylene (LLDPE) Geomembrane layer of the Final Cover System. Two types of LLDPE Geomembrane cover systems were installed: 40-mil Smooth LLDPE Geomembrane and 40-mil Textured LLDPE Geomembrane.

7.1 Manufacturer – LLDPE Geomembrane

The manufacturer of the LLDPE geomembrane was Poly-Flex, Inc. of Grand Prairie, Texas. Poly-Flex, Inc. was responsible for the production of the materials and for quality control during production including certification that its materials conformed to the Contract Specifications. Poly-Flex, Inc. was required to submit certification that the LLDPE geomembrane was formulated and manufactured from 100% virgin raw material, specifically compounded for use in hydraulic structures, and only first quality plastics and elastomers were used. In addition, Poly-Flex, Inc. was required to submit written certification that each lot of material met or exceeded the Technical Specifications.

33 tests were submitted by Chevron Philips, the resin manufacturer, and Poly-Flex each for both the raw material (resin) used to fabricate the geomembrane, and for the individual finished rolls of geomembrane. All tests confirm that each lot of material met the Technical Specifications.

Certificate of Analysis sheets from Chevron Philips and Railcar Resin Report sheets from Poly-Flex are located in Appendix F.

Test data for the 3,540,849 sq ft of smooth and 8,181,370 sq ft of textured LLDPE geomembrane used on the project were reviewed approved per the QA/QC requirements of the Specifications prior to the material being imported for placement at the Fountain Avenue Landfill. The manufacturer submitted certified test results that attested to the compliance of the geomembrane based on Table 7-2 properties shown below.

Table 7-2
Specifications for Geomembrane

Property	Test Method	LLDPE Values
Thickness	ASTM D-5199 (Smooth) ASTM D-5994 (Textured)	40 mils
Density (finished sheet)	ASTM D-792 or ASTM D-1505	0.915 – 0.940 g/cm^3 0.915 – 0.927 g/cm^3
Carbon Black Content	ASTM D-1603	2.0 – 3.0 %
Carbon Black Dispersion	ASTM D-5596	Cat. 1 or 2
Min Tensile Properties (machine Direction): (c)Tensile Strength at break (d) Elongation at break (2" G.L.)	ASTM D-638 Type IV	 ≥ 152 Smooth lbs/in width ≥ 60 Textured lbs/in width ≥ 800 Smooth % ≥ 250 Textured %
Tear Resistance	ASTM D-1004 Die C	≥ 22 lbs
Puncture Resistance	ASTM D-4833	≥ 44 lbs
Low Temperature Impact	ASTM D-746 procedure B	≤ -70 °C
Dimensional Stability	ASTM D-1204 212°F, for 1 hour	±3.0 % change max
Environmental Stress Crack	ASTM D-1693	≥ 1500 hours
Roll Width*	----	15 ft
Roll Length*	----	400 ft
Field Seam Requirements: (a) Shear (b) Peel Adhesion	 ASTM D-4437 ASTM D-4437	 ≥ 56 lbs/in width ≥ 45 lbs/in width

*Poly-Flex standard manufacturing procedure was revised prior to the commencement of this project to change the standard 40 mil LLDPE roll dimensions to 23 ft width and 750 ft length, versus the 15 ft by 400 ft called for in the specifications. This was viewed as a design improvement because it substantially reduces field seaming and thus did not violate the specification.

Poly-Flex provided "Certification Sheet" (s) with these physical test data for all geomembrane rolls. The certification sheets are presented in Appendix F and a summary is shown in table 7-3.

Table 7-3
QC Summary Results For Geomembrane Rolls

Test	Thickness	Carbon Black	Tear	Puncture	Tensile @Break (smooth)	Elong @Break (smooth)	Tensile @Break (textured)	Elong @Break (textured)	Carb.Blk Dispers	Density
Specification	36 / 40	2.0 - 3.0	≥22	≥44	≥152	≥800	≥60	≥250		.915-.940
Units	mils (min/avg)	%	lbs	lbs	lb/in width	%	lb/in width	%	cat 1 or 2	gm/cc
Minimum	36/40	2	23	72	166	860	62	391	1	0.933
Maximum	39/48	2.8	33	97	222	1261	163	720	2	0.937
No.of Tests	1296	1296	1296	1296	331	331	965	965	1296	1296

During the manufacturing process, representatives of URS and the NYCDEP visited the manufacturing plant to observe the manufacturing process to verify that testing was conducted in accordance with the contract specifications.

Test data was provided for each roll. This frequency of testing meets and exceeds the minimum industry guidelines for liner manufacturing.

7.2 Installation – LLDPE Geomembrane

The geosynthetics on this project were installed by Chenango Contracting, Inc. (Chenango) of Johnson City, New York. As a subcontractor to MCC, Chenango was responsible for on-site management of the LLDPE geomembrane, including handling, storage, placement, and installation in accordance with the approved LLDPE geomembrane panel layout.

All geomembrane rolls were inspected as they were unwound during installation, for unmixed or poorly dispersed ingredients, thin spots, the presence of contaminants or foreign particles, pinholes, tears, punctures, blisters, and any other defects. Any defects and impurities were removed or repaired before the membrane was installed on the landfill.

7.3 Quality Assurance/Quality Control During Installation

Quality Control (QC) during LLDPE geomembrane installation was performed by Chenango. QC periodic testing was performed for every 500 feet of liner seam length, as well as continuous seam testing. URS performed Quality Assurance (QA) by periodic testing of seams and by reviewing manufacturer's test result submittals. The Contract allowed the Owner's Engineer (URS) to test any portion of the geomembrane at any time. Table 7-1 also shows the field peel and shear values for the destructive seam test requirements for the geomembrane during installation.

Refer to Appendix A for copies of the QA Geosynthetic Daily Inspection Reports.

Refer to Appendix F for all QA and QC testing results of geomembrane.

7.3.1 Placement – LLDPE Geomembrane

When the Type II sub-base was approved by Chenango and URS (see subgrade approval forms APP 2), the LLDPE geomembrane panels were deployed to the intended location by Chenango using earth moving equipment and laborers.

The respective limits of smooth and textured LLDPE geomembrane were determined as per the Contract Drawings and existing field conditions. Only textured LLDPE geomembrane was used on slopes at or exceeding 10 percent.

In general, seams were oriented parallel to the line of maximum slope, (i.e., oriented along, not across the slope). Seams on slopes exceeding 15 percent were not permitted to be at more than 30 degrees from parallel with the direction of the slope. Cross-slope seams were kept to a minimum and in no case were within five feet of adjacent panel cross-slope seams.

The LLDPE geomembrane panels were carefully placed at the proper location and each panel was overlapped at a minimum of three (3) inches, as required for proper seaming. Each LLDPE geomembrane was inspected by URS and Chenango personnel for any defects as it was placed, and assigned its corresponding panel number. The LLDPE geomembrane panels were installed in a relaxed condition free of tension or stress.

7.3.2 Trial Seams (Start-Ups) – LLDPE Geomembrane

LLDPE geomembrane trial seams, also known as qualifying seams or start-ups, were an integral aspect of the QA/QC procedures. The purpose of these trail seams was to serve as a daily pre-qualifying experience for personnel, equipment and procedures for field fabricating seams on the geomembrane material under the same climatic conditions as the actual field seams. The test strips were made on narrow pieces of excess geomembrane with a minimum length of three (3) feet.

The goal of the start-ups was to reproduce all aspects of the production field seaming activities intended to be performed in the immediately upcoming work sessions in order to determine equipment and operator proficiency. For the double hot-wedge fusion welding process, URS required that start-ups be performed every four (4) hours, whenever personnel or equipment changed, and when climatic conditions reflected wide changes in geomembrane temperature (based on changes in ambient air temperature).

The start-ups were destructively tested for peel and shear as soon as the seam cooled using a field tensiometer. A minimum of six (6) one-inch wide specimens cut out of each test weld were subjected to shear and peel adhesion testing at the site (i.e., three specimens for peel, and three specimens for shear testing.) If all specimens passed, the technician was approved to weld. If any one of the test specimens failed, a new test strip was fabricated by varying the temperature, speed or pressure, as applicable. If additional specimens failed, the seaming apparatus and technician were not allowed to seam until the deficiencies were corrected and successful start-ups were achieved.

Refer to Appendix F for Trial seam results.

7.3.3 LLDPE Geomembrane Field Seaming and Joining

The field seaming of the deployed LLDPE geomembrane panels is an integral aspect of the proper functioning of the LLDPE geomembrane as the low permeability barrier of the final cover system.

Prior to field seaming, the contact surfaces of the panels to be seamed were wiped clean to remove all dirt, dust, moisture and other foreign materials. The lap joints were formed by lapping the edges of the panels at a minimum of three (3) inches. Any portion of the LLDPE geomembrane damaged during installation was removed or repaired using an additional piece of LLDPE geomembrane, as per the Technical Specifications.

All penetrations, such as pipes, monitoring wells and gas extraction wells, were "booted" with 40-mil LLDPE geomembrane in accordance with the Contract Drawings and Specifications.

URS maintained a Pipe Boot/Special Connection Log which is presented in Appendix F.

7.3.4 Non-Destructive Testing of Field Seams – LLDPE Geomembrane

The primary purpose of the non-destructive seam testing was to ensure continuity along the entire seam length. Non-destructive testing was performed by Chenango and witnessed by URS to validate 100% of the seams.

For this project, all field seams were non-destructively tested over their full length using either vacuum box or pressurized air-channel testing. Air lance testing was not permitted as stated in the Contract Specifications.

Refer to Appendix F for the non-destructive test methods and results used for the LLDPE geomembrane.

7.3.5 Destructive Testing of Field Seams – LLDPE Geomembrane

Samples from the production of field-fabricated geomembrane seams for destructive testing were taken at a minimum frequency of one destructive test sample for every 500 linear feet of field seam, as specified in the Contract Specifications. Destructive testing of the geomembrane seams was performed by cutting out and removing a portion of the completed production field seam, and then further dividing the sample into specimens for testing in accordance with ASTM D 4437 – Practice for Determining the Integrity of Field Seams used in Joining Flexible Polymetric Sheet Geomembranes.

Field cutouts were conducted on the field seams. For every 500 linear feet of field seam (including seams created for repairs), and as directed by URS, a short section (3 feet long) of the fabricated seam was cut from the installed geomembrane and distributed as follows:

- One portion field tested on site by the Contractor (MCC) for peel adhesion and shear strength;
- One portion for laboratory tensile testing by MCC's independent QC testing laboratory;
- One portion to URS for testing by the independent QA testing laboratory, Shaw EMCON/OWT, Inc. of Tuxedo, New York;
- One portion to URS for NYCDEP's archive storage.

Modern Continental and URS conducted 1199 destructive tests each for a total of 2,398 tests. All tests confirm that the geomembrane placed met the Technical Specifications.

Refer to Appendix F for the results of all testing of the LLDPE geomembrane.

Photographs of the installation of the LLDPE geomembrane are included in Appendix K.

8.0 GEOCOMPOSITE

The geosynthetic drainage system, referred to as geocomposite, is a layer of 3 synthetics together designed to provide a plane of high void space which permits a high degree of in-plane flow (transmissivity). The geocomposite consists of a geonet with layers of geotextile fabric above and below. The filter geotextile is heat bonded to the top and bottom of the geonet. Note that while the specification requires that the geotextile component comply with the "filter fabric" parameters, the geocomposite was supplied complete, with fabric attached to the geonet by Polyflex and is not the same fabric or manufacturer supplied under the "filter geotextile" pay item.

8.1 Manufacturer – Geocomposite

The manufacturer of the 7,974,462.28 sq ft of geocomposite used in the cover was Poly-Flex, Inc. of Grand Prairie, Texas. The material used for the geocomposite was manufactured from appropriate polymers and compounding ingredients that was in general conformance with the Contract Specifications. The geocomposite used on the project was tested and approved per the QA/QC requirements of the Specifications prior to being imported for use at the Fountain Avenue Landfill.

The Manufacturer was required to provide evidence of the geonet and geotextile physical properties compliance with the specification. No minimum number of tests was specified and no periodic testing was required, but Chenango Contracting (the installer) supplied manufacturer's data for every roll. Table 8-1 shows test properties, methods, specified allowable values and submitted test results for the geonet part of the composite. The full data sheets are in Appendix F.

Table 8-1
Geonet - Typical Testing Results

Property	Test Method	Specification	Submittal (Range)
Manufacture / Material		Extruded Polyethylene	Extruded Polyethylene
Weight (lbs/sf)	ASTM D-3776	≥0.16	0.143 – 0.236
Tensile strength at Break (lb)	ASTM D-5035	≥575	636 – 984
Elongation at Break (%)	ASTM D-638	≥200	See note below
Polymer Melt Index (g/10 min)	ASTM D-1238 Condition E	0.1 – 1.0	0.24 – 0.74
Polymer Density (g/ccm)	ASTM D-1505	≥0.94	0.947 – 0.96
Carbon Black Content (%)	ASTM D-1603	2% - 3%	2 - 3
Thickness at strand Intersection (in)	ASTM D-5199	0.20 min	0.2

When checking table 8-1 against the Specifications, note that referenced test method ASTM D-638 was changed to D-5035 and non-testing of elongation was addressed in Contract Addendum 2.

Table 8-2 shows a data summary for the geotextile portion of the geocomposite. The full data sheets are in Appendix F.

Table 8-2
Geotextile - Typical Testing Results

Property	Test Method	Specification	Submittal(range)
Fabric Weight (oz/sy)	ASTM D-5261	6	6.10 – 8.42
Burst Strength (psi)	ASTM D-3786	225	315 - 466
Tear Strength (lb)	ASTM D-4533	60	65 - 119
Grab Tensile strength (lb)	ASTM D-4632	160	160 - 225
Grab Elong at Break (%)	ASTM D-4632	50	50 - 93
Permittivity (1/sec)	ASTM D-4491	1.3	1.4 – 2.6
Apparent opening size (sieve no.)	ASTM D-4751	70 min	70-140
Puncture strength (lb)	ASTM D-4833	75	95 - 139

The Contractor (MCC) was to prequalify the geocomposite by providing hydraulic transmissivity test result from an independent laboratory test using site BPL fill as the upper boundary and geomembrane as the lower. Table 8-3 presents the transmissivity test result.

Table 8-3
Geocomposite Transmissivity Testing Results

Property	Test Method	Frequency / Value	Submittal
Transmissivity:	ASTM D-4716	One per source	
Case A: Hydraulic Gradient of 0.1	(Compressive stress 350 psf min.)	$T \geq 5 \times 10^{-4}$ sq m/s	5.34×10^{-4}
Case B: Hydraulic Gradient of 0.3	(Compressive stress 350 psf min.)	$T \geq 5 \times 10^{-5}$ sq m/s	35.2×10^{-5}

In addition to the single transmissivity test required by the specification, Poly-flex provided periodic transmissivities for individual roll samples. These transmissivities were tested between metal compression plates only, without the use of the BPL soil and geomembrane boundary conditions. The testing frequency was approximately one test per every 15 to 20 rolls of geocomposite. These test results are with the roll data in Appendix F.

8.2 Installation – Geocomposite

The geosynthetic drainage system (geocomposite) within the final cover system was installed by Chenango Contracting (Chenango) for MCC after the underlying geomembrane was installed and accepted. Prior to installation of the geocomposite, the underlying geomembrane was cleaned and free of dirt, dust, or any other objectionable materials, which could inhibit the ability of the drainage system to transmit water. During placement, the geocomposite were inspected by URS on both sides for imperfections, damage, or defects. All necessary precautions were taken to prevent damage to the underlying layers of geosynthetics. Field personnel were prohibited from using sharp tools, cigarettes, solvents, or any other materials which could cause damage to the geocomposite and/or underlying geosynthetics.

The geocomposite was installed as indicated on the Contract Drawings. The geocomposite was secured and then rolled downslope perpendicular to the grading contour lines in such a way as to keep the sheet in tension under self-weight only. Adjacent rolls were overlapped by at least six (6) inches while horizontal overlaps (seams parallel to grading contour lines) were not permitted on slopes exceeding 12 percent unless approved by URS, and unless the manufacturer's recommendations of additional permanent reinforcement for horizontal overlaps were incorporated.

Overlaps were secured by tying (the geonet) and sewing (the geotextile). The geonet was tied by using white plastic fasteners (white for easy inspection). Metallic tying devices were not permitted as per Contract Specifications. The geonet overlaps were tied every five (5) feet down the slope, every two (2) feet across the slope, and every six (6) inches in anchor trenches.

The geotextile component of the geocomposite was stitched using a handheld sewing machine and a polymeric thread with chemical resistance properties equal to or exceeding those of the geotextile.

The Contract Specifications required the Contractor to cover the geocomposites and geotextiles to be within the two weeks after installation. In many instances MCC failed to comply with this requirement. In such cases the exposed areas were checked by URS for damage and for clogging due to run-on of fines from eroded soil areas. Where clogging or damage was found, those areas were marked in the field by URS and were replaced by Chenango. In addition, the longest-exposed section of geocomposite was sampled, and the sample analyzed for weakening due to ultraviolet exposure. The strength of the sample remained above the Specification value so removal was not necessary.

8.3 Quality Assurance/Quality Control During Installation

The Contract Specifications do not require a minimum number of QC tests by the Contractor during installation, but allow the Engineer to test QA samples at will.

URS obtained samples of the geonet and geotextile components from MCC and forwarded them to an independent laboratory (EMCON/OWT) for testing to verify conformance with the Contract Specifications. Samples were taken across the entire width of the roll and did not include the first three (3) feet of the roll's long dimension. Samples were three (3) feet long times the roll width. URS examined all results from the laboratory testing for conformance. See Table 8-4 for QA Transmissivity test results. See Table 8-5 for QA summary results for the geonet.

Refer to Appendix F for the physical laboratory testing results and locations.

Any gaps or tears which developed in the geonet were repaired by MCC, by placing a patch extending two (2) feet beyond the edges of the gap or tear. The patch was secured to the original geonet by spot gluing, spot welding to geonet or tying every six (6) inches. Photographs of the installation of the geocomposite are included in Appendix K.

Table 8-4
QA Transmissivity Test Results for Geocomposite

Test Description	Transmissivity	Transmissivity
Specification	≥5X10E-04 for i=0.1	≥5X10E-05 for i=0.3
Units	sq.m/s	sq.m/s
Minimum	5.5x10E-04	5X10E-04
Maximum	35.4x10E-04	36x10E-04
No. of Tests	13	13

Table 8-5
QA Summary Results for Geonet

Test Description	Thickness	Mass/ Area	Carbon Black	Ultimate Tensile Strength	Density	Melt Index
Specification	0.2	0.16	3-Feb	575	≥0.94	≥800
Units	inch	lbs/sq.ft	%	lbs/ft	gm/cc	g/10 min
Minimum	0.2	0.143	2	636	0.947	0.24
Maximum	0.2	0.236	3	984	0.96	0.74
No. of Tests	6	6	6	6	6	6

9.0 GEOTEXTILE

The geotextile component of the final cover drainage layer consisted of three types of geotextiles: cushion, filter and separation geotextile. The geotextiles discussed in this section are from different sources than the geotextile portion of the geocomposite (chapter 8) and quantities discussed in this chapter are not inclusive of any geocomposite component.

9.1 Manufacturer – Geotextile

The manufacturer of the 475,882 sq yards of cushion, and 27,436 sq yards of filter geotextile used onsite was TNS Advanced Tech/Nevown, Inc. of Greer, South Carolina. The 121,120 sq yards of separation geotextile used onsite was manufactured by Synthetic industries, Inc. of Chattanooga, Tennessee. Geotextile consisted of a non-woven, needle-punched polypropylene polymer. The material used for the geotextile was manufactured from polymers formulated with to enhance the geotextiles' resistance to environmental degradation including ultraviolet exposure.

Table 9-1 shows the specifications for the geotextiles and properties of the materials submitted. Submittals for the geotextiles are in Appendix F.

Table 9-1
Geotextile – Minimum Physical Requirements

Property	Test Method	Cushion		Filter		Separation	
		Specified	Submitted	Specified	Submitted	Specified	Submitted
Burst Strength	ASTM D-3786	750 psi	750	NA	Not given	225	330
Grab Strength	ASTM D-4632	390 lbs	390	160	160	NA	170
Tear Strength	ASTM D-4533	150 lbs	150	60	60	NA	70
Grab Elongat. @ Break	ASTM D-4632	NA	50%	50	50	NA	50
Apparent opening size test	ASTM D-4751	NA	#100 sieve	#70 sieve	70	NA	#70 sieve
Puncture strength	ASTM D-4833	180 lbs	180	75	75	90	110
Permittivity	ASTM D-4491	0.4 sec^{-1}	0.4	1.3	1.3	1.3	1.3
Mass per unit area	ASTM D-5261	16 oz/yd^2	16	6	6.0	6	6.0

9.2 Installation – Geotextile

The geotextiles were installed by MCC at the locations shown on the Contract Drawings. All bedding geotextile seams within drainage channels, and geotextile seams within the final cover system drainage layer, consisted of adjacent panels sewn securely together.

The geotextiles were installed to the lines and grades as shown on the Contract Drawings. The geotextiles were rolled down the slope in such a manner as to continually keep the sheet in tension of self-weight. The geotextiles were securely anchored in anchor trenches as required and temporarily weighted with sandbags as needed. A minimum buried flap of geotextile of two (2) feet by the length of the anchor was required for anchor trenches. Geotextiles were not exposed to precipitation prior to installation and was not exposed to direct sunlight for more than 24 hours prior to placement.

Geotextiles used with the final cover system were seamed by stitching methods as recommended by the manufacturer and approved by URS. Any deviations from the seam procedures were approved on a case-by-case basis after review by URS. Sewing was done using nylon thread with chemical resistance properties equal to those of the geotextile for this application. All sewn seams were continuous and spot seaming was not permitted for sewn seams. Seams were oriented down slopes perpendicular to grading contours unless otherwise specified by URS. Data submittal for the nylon thread is in Appendix F.

9.3 Quality Assurance/Quality Control During Installation – Geotextile

The Contract Specifications do not require a minimum number of QC tests by the Contractor during installation, but allow the Engineer to test QA samples at will.

URS obtained 37 samples of the geotextiles from MCC and forwarded them to an independent laboratory (EMCON/OWT) for testing to verify conformance with the Contract Specifications. Samples were taken across the entire width of the rolls and did not include the first three (3) feet of the roll's long dimension. Samples were three (3) feet long times the roll width. URS examined all results from the laboratory testing for conformance. See Table 9-2 for QA summary results.

Refer to Appendix F for the physical laboratory testing results and locations.

Table 9-2QA
Summary Results for Geotextile

Test	Grab Tensile	Mullen Burst	Puncture	AOS	Permittivity	Grab Elongation	Tear
Specification	160	225	90	70	1.3	50	60
Units	lb	psi	lb	sieve	1/sec	%	lb
Minimum	160	315	95	70	1.4	50	65
Maximum	255	466	139	140	2.6	93	119
No. of Tests	37	37	37	37	37	37	37

URS examined the geotextile rolls upon delivery to the site and reported any deviation from the Contract Specifications to MCC. In these instances, MCC performed the necessary repairs and replaced any damaged products delivered to the site, as directed by URS.

Any holes or tears which developed in the geotextile were repaired by MCC, by placing a fabric patch of the same geotextile was seamed into place no closer than three (3) inches from any edge of the patch. Prior to repair, MCC completely removed any soil or other material which penetrated a damaged geotextile. Tears, holes, or other damage to the fabric were repaired to the satisfaction of URS and the NYCDEP.

Photographs of the installation of the geotextile are included in Appendix K.

10.0 BARRIER PROTECTION LAYER

The Barrier Protection Layer (BPL) was placed over the geosynthetics to anchor them and protect them from weathering, surface traffic (human and animal), impacts, and minimize frost action, root penetration, burrowing animals and other damage. The BPL material also had a special requirement that the permeability be less than$1X10^{-5}$cm/sec to control the rate of rainwater infiltration reaching the geosynthetic drainage layer. A minimum of twelve (12) inch thickness of compacted BPL soil was placed directly on top of the geosynthetic layer (geonet and LLDPE geomembrane).

10.1 Material Source – Barrier Protection Layer

The soil material used for the BPL construction was environmentally clean in accordance with NYSDEC TAGM HWR-94-4046 (Technical and Administrative Guidance Memorandum) and was in general conformance with the Contract Specifications. The barrier protection soil used on the project was tested and approved per the QA/QC requirements of the Specifications prior to being imported for use at the Fountain Avenue Landfill. Approximately 822,743 cubic yards of material were delivered and placed as BPL over the geosynthetics.

The BPL soil was imported from a borrow site at Clifton Park, New York. NYCDEP and URS inspected the borrow site and loading facility prior to general acceptance and procurement. Source testing was performed. All BPL soil material was delivered to the Fountain Avenue Landfill pier via barge transportation.

Table 10-1 shows the source testing requirement.

Table 10-1
Source - Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One per source
Standard Proctor Density	ASTM D-698	One per source
Organic Content	ASTM D-2974	One per source
Atterberg Limits	ASTM D-4318	One per source
Chemical Analysis	Per Specifications	One per source
Water (Moisture) Content	ASTM D-2216	One per source
Soil Classification	ASTM D-2487	One per source

The general requirements for BPL are shown in Table 10-2.

Table 10-2
BPL Requirements

Property	Criteria
Organic Content (%)	<5%
Plastic Index (slope > 5%)	<12
Plastic Index (slope < 5%)	<50
Standard Proctor Test	Max Density(pcf)
Standard Proctor Test	Opt. Moisture (%)
Moisture (as received) (%)	<OW +7%
Max Particle Size (in)	<3"
Chemical Testing	TCL & TAL NYS TAGM 94-4046
USC	SM,GM,SC or GC
Fines Content	20% - 40%
Clay Content (hydrometer) (%)	<10%
Hydraulic Conductivity	< $1x10^{-5}$ cm/sec

Refer to Appendix G for Source testing results.

10.2 Installation – Barrier Protection Layer

Appropriate care and procedures were used in the placement of the BPL over the LLDPE geomembrane material and composite to avoid wrinkling or over-stressing the geocomposites. BPL soil was installed with a minimum lift thickness of twelve (12) inches.

The BPL soil was generally stockpiled near the lower edge of exposed liner in working BPL fill areas and then pushed over the liner with low ground pressure (LGP) bulldozers riding on the layer of BPL as it was placed. Fill was placed from lower elevations to higher as required by the Specifications, except where impractical and approved otherwise. Temporary roads constructed of additional BPL material up to four feet thick were also built over the liner where needed to allow articulated off-road dump trucks to access approved areas for fill placement without undue stress on the underlying geosynthetics. These thicker roadway areas were later graded down to the required 12 inch thickness using laser-level-guided dozers with surveyed liner elevations. Thickness was confirmed periodically by hand digging test holes.

During the course of the BPL installation, it was found that the pH of the material was changing after the material was onsite. The pH values of soil which previously was within specifications was rising to levels above specification limits and judged by DEP to be unacceptable. Retesting of onsite BPL material confirmed this to be a consistently occurring problem which generally was occurring in soils placed on the lower slopes around the

perimeter of the landfill. Trial additions and disking-in of sulfur to the soil was tested and found to reduce the pH. Sulfur was applied to the affected areas.

10.3 Quality Assurance/Quality Control During Installation

Quality assurance and quality control during construction of the BPL consisted of full-time observation in addition to laboratory and field-testing. The contractor used his GPS system to control the depth of material.

The thickness of the BPL was also verified by hand digging four test holes, as directed by URS. After measurements were made, the holes were backfilled with BPL soil, and hand tamped. URS observed the digging and backfilling of test holes to ensure that MCC exercised care not to damage the underlying geosynthetic materials.

All QC laboratory and field testing was performed by MCC's approved independent chemical laboratory and approved independent geotechnical laboratory,. Chemical analyses were provided by Accredited Laboratories, Inc., located in Carteret, New Jersey, and Chemtech, in Mountainside New Jersey. Geotechnical analyses were provided by Testwell Laboratories, Inc., located in Ossining, New York. Field moisture density testing (IPD) onsite testing using nuclear density test meter was performed by Testwell, and later by Certified Testing Laboratories, Inc of The Bronx, New York. Periodic quality control was performed by the contractor in accordance with Table 10-3 below.

Table 10-3
Quality Control – Field and Laboratory Minimum Testing Requirements for BPL

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 2,500 yd^3
Standard Proctor Density	ASTM D-698	One test every 5,000 yd^3
Soil Classification	ASTM D-2487	One test every 5,000 yd^3
Organic Content	ASTM D-2974	One test every 5,000 yd^3
Visual Identification	ASTM D-2488	One test every 1,000 yd^3
Atterberg Limits	ASTM D4318	One test every 1,000 yd^3
Field-Moisture Density	ASTM D-2922	Nine tests per Acre
Chemical Analysis	Per Specifications	One test every 3,000 yd^3

All QA laboratory and field testing was performed by the approved independent chemical laboratory and geotechnical laboratory, employed by URS. Chemical analyses were provided by Veritech Laboratory, a division of Hampton-Clarke, Inc., located in Fairfield, New Jersey. Geotechnical analysis was performed by URS Soil Testing Laboratory in Totowa, NJ.

QA field moisture-density (IPD) was performed by a URS onsite inspector trained in the use of the nuclear density meter. In accordance with Table 10-4 below, periodic quality assurance (QA) inspection and testing was performed by URS to verify the QC testing.

Table 10-4
Quality Assurance – Field and Laboratory Minimum Testing Requirements for BPL

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 10,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 20,000 yd^3
Soil Classification	ASTM D-2487	One test every 5,000 yd^3
Organic Content	ASTM D-2974	One test every 5,000 yd^3
Visual Identification	ASTM D-2488	One test every 2,000 yd^3
Atterberg Limits	ASTM D4318	One test every 2,000 yd^3
Field-Moisture Density	ASTM D-2922	Four tests per Acre
Chemical Analysis	Per Specifications	One test every 60,000 yd^3

The BPL was compacted to a minimum density of 90 percent of the maximum dry density with the optimum moisture based on the Standard Proctor Test, as determined by ASTM D-698. The moisture and density of the BPL were measured in the field to a 6-inch depth by a nuclear densometer. Field density and moisture tests on the BPL were performed at approximately 100-foot intervals. These field density tests are also referred to as IPD (in place density) elsewhere in this report

Refer to table 10-5 for geophysical results and table10-6 for chemical results summaries of BPL testing. For field testing (IPD), test data sheets are copied in Appendix G. No summary table is provided because if there were for any out of range test result, the soil would be recompacted until the required density was obtained.

The moisture content (as received) was not performed since the material was processed, placed and compacted on site. After compaction the moisture content was measured by the troxler density gauge and compared to the proctor test results as to achieving 90% density. Any material that was excessively wet was store piled to dry.

Table 10-5
BPL QC Geotechnical Test Results Summary

Property	Criteria	Range of Values	No. of Tests
Organic Content (%)	<5%	0.8 – 3.0%	203
Plastic Index (slope > 5%) Plastic Index (slope < 5%)	<12 <50	0 – 6.2	1015
Standard Proctor Test	Max Density(pcf)	102.9 – 127.3	203
Standard Proctor Test	Opt. Moisture (%)	1.3 – 20.3	203
Moisture (as received) (%)	<OW +7%	NA	NA
Max Particle Size (in)	< 3”	0.08 - 3	406
USC	GM, SM, GC or SC	SM, GM	406
Fines Content	20% - 40%	11.2 – 57.2	406
Clay Content (hydrometer) (%)	<10%	1.9 – 17.8	406
Hydraulic Conductivity (permeability)	< $1x10^{-5}$ cm/sec	$1.4 X 10^{-5}$ - $4.4 X 10^{-4}$	203

For the chemical testing summarized below in tables 10-6a through 10-6d, each sample was analyzed for all contaminants, so the number of samples tested is always the same for each contaminant shown. There were 369 samples tested for the Barrier Protection Layer material which was accepted and delivered to the Fountain Avenue Landfill project.

Table 10-6a
BPL Chemical Test Results Summary
Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total VOCs	10.0 mg/kg	0.001	0.0653
Acetone	0.2 mg/kg	0.0014	0.057
Benzene	0.06 mg/kg	ND	ND
Bromodichloromethane	*	ND	ND
Bromoform	*	ND	ND
Bromomethane	*	ND	ND
2-Butanone	0.3 mg/kg	ND	0.013
Carbon Disulfide	2.7 mg/kg	0.0018	0.01
Carbon Tetrachloride	0.6 mg/kg	ND	ND
Chlorobenzene	1.7 mg/kg	ND	ND
Chloroethane	1.9 mg/kg	ND	ND
Chloroform	0.3 mg/kg	0.0026	0.0042
Chloromethane	*	ND	ND
Cis-1,3-Dichloropropene	*	ND	ND
Dibromochloromethane	*	ND	ND
1,1-Dichloroethane	0.2 mg/kg	ND	ND
1,2-Dichloroethane	0.1 mg/kg	ND	ND
1,1-Dichloroethene	0.4 mg/kg	ND	ND
1,2-Dichloroethene (total)	*	ND	ND
1,2-Dichloropropane	*	ND	ND
1,3-Dichloropropene (trans)	*	ND	ND
Ethylbenzene	5.5 mg/kg	ND	ND
2-Hexanone	*	0.0096	0.0096
Methylene Chloride	0.1 mg/kg	0.001	0.033
4-Methyl-2-Pentanone	1.0 mg/kg	ND	ND
Styrene	*	ND	ND
Tetrachloroethene	1.4 mg/kg	0.0022	0.0082
1,1,1-Trichloroethane	0.8 mg/kg	ND	ND
1,1,2-Trichloroethane	*	ND	ND
1,1,2,2-Tetrachloroethane	0.6 mg/kg	ND	ND
Toluene	1.5 mg/kg	0.0013	0.003
Trichloroethene	0.7 mg/kg	ND	ND
Vinyl Chloride	0.2 mg/kg	ND	ND
Xylenes (total)	1.2 mg/kg	0.0017	0.0038

* Contaminants with an"*" do not have individual limits in the NYSDEC's TAGM 4046. The total of all TCL volatile organic compounds, however, shall not exceed the maximum allowable concentration listed above as Total VOCs.

Table 10-6b
BPL Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total SVOCs	500 mg/kg	0.034	1.5
Total CPAHs	10.0 mg/kg	ND	0.344
Acenaphthene	50.0 mg/kg	ND	ND
Acenaphthylene	41.0 mg/kg	0.056	0.056
Anthracene	50.0 mg/kg	ND	ND
Benzo(g,h,I)perylene	50.0 mg/kg	0.043	0.043
bis(2-ethylexyl)phthalate	50.0 mg/kg	0.034	0.27
bis-(2-Chloroethyl)ether	0.58 mg/kg	ND	ND
bis-(2-Chloroethoxy)methane	50.0 mg/kg	ND	ND
4-Bromophenylphenylether	50.0 mg/kg	ND	ND
Butylbenzylphthalate	50.0 mg/kg	0.041	0.047
Carbazole	32.0 mg/kg	ND	ND
4-Chloroaniline	0.220 or MDL	ND	ND
4-Chloro-3-methylphenol	0.240 or MDL	ND	ND
2-Chlorophenol	0.8 mg/kg	ND	ND
4 Chlorophenylphenylether	50.0 mg/kg	ND	ND
2 Chloronapthalene	50.0 mg/kg	ND	ND
2,4-Dinitrotoluene	50.0 mg/kg	ND	ND
Dibenzofuran	6.2 mg/kg	ND	ND
1,2-Dichlorobenzene	50.0 mg/kg	ND	ND
1,3-Dichlorobenzene	50.0 mg/kg	ND	ND
1,4-Dichlorobenzene	50.0 mg/kg	ND	ND
3,3'-Dichlorobenzidine	1.4 mg/kg	ND	ND
2,4-Dichlorophenol	0.4 mg/kg	ND	ND
4,6 Dinitro-2-methylphenol	50.0 mg/kg	ND	ND
2,4-Dimethylphenol	50.0 mg/kg	ND	ND
2,4-Dinitrophenol	0.200 or MDL	ND	ND
2,6-Dinitrotoluene	1.0 mg/kg	ND	ND
Diethylphthalate	7.1 mg/kg	0.059	0.74
Dimethylphthalate	2.0 mg/kg	ND	ND
Di-n-butylphthalate	8.1 mg/kg	0.056	1.5
Di-n-octyphthalate	50.0 mg/kg	0.081	0.081
Fluoranthene	50.0 mg/kg	0.087	0.23
Fluorene	50.0 mg/kg	ND	ND
Hexachlorobenzene	0.41 mg/kg	ND	ND

Table 10-6b(continued-page 2)
BPL Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Hexachlorobutadiene	8.2 mg/kg	ND	ND
Hexachloroethane	46.0 mg/kg	ND	ND
Hexachlorocycpentadiene	50.0 mg/kg	ND	ND
Isophorone	4.4 mg/kg	ND	ND
2-Methylnaphthalene	36.4 mg/kg	0.044	0.17
2-Methylphenol	0.100 or MDL	ND	ND
4-Methylphenol	0.9 mg/kg	0.056	0.056
Naphthalene	13.0 mg/kg	0.34	0.77
Nitrobenzene	0.200 or MDL	ND	ND
2-Nitroaniline	0.430 or MDL	ND	ND
4 Nitroaniline	50.0 mg/kg	ND	ND
2-Nitrophenol	0.330 or MDL	ND	ND
4-Nitrophenol	0.100 or MDL	ND	ND
3-Nitroaniline	0.500 or MDL	ND	ND
N-Nitroso-di-n-propylamine	0.091 mg/kg	ND	ND
N-Nitrosodiphenylamine	50.0 mg/kg	ND	ND
2,2'-oxybis(1-Chloropropane)	50.0 mg/kg	ND	ND
Pentachlorophenol	1.0 or MDL	ND	ND
Phenanthrene	50.0 mg/kg	0.091	0.2
Phenol	0.03 or MDL	ND	ND
Pyrene	50.0 mg/kg	0.083	0.19
1,2,4-Trichlorobenzene	50.0 mg/kg	ND	ND
2,4,5-Trichlorophenol	0.1 mg/kg	ND	ND
2,4,6-Trichlorophenol	50.0 mg/kg	ND	ND

Table 10-6c
BPL Chemical Test Results Summary
Pesticides and PCB's

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total Pesticides	10 ppm	ND	ND
Aldrin	0.041 mg/kg	ND	ND
alpha-BHC	0.11 mg/kg	ND	ND
Endrine aldehyde	*	ND	ND
Alpha-chlordane	*	ND	ND
beta-BHC	0.2 mg/kg	ND	ND
delta-BHC	0.3 mg/kg	ND	ND
4,4'-DDD	2.9 mg/kg	ND	ND
4,4'-DDE	2.1 mg/kg	ND	ND
4,4'-DDT	2.1 mg/kg	ND	ND
Dieldrin	0.044 mg/kg	ND	ND
Endosulfan I	0.9 mg/kg	ND	ND
Endosulfan II	0.9 mg/kg	ND	ND
Endosulfan Sulfate	1.0 mg/kg	ND	ND
Endrin	0.10 mg.kg	ND	ND
Endrin ketone	N/A	ND	ND
gamma-BHC (Lindane)	0.06 mg/kg	ND	ND
gamma-chlordane	0.54 mg/kg	ND	ND
Heptachlor	0.10 mg/kg	ND	ND
Heptachlor epoxide	0.02 mg/kg	ND	ND
Methoxychlor	*	ND	ND
Total PCBs	1.0 mg/kg	ND	ND
Toxaphene	*	ND	ND

* Contaminants marked with an "*" do not have individual limits in NYSDEC's TAGM 4046; however, the total pesticides and PCB concentrations shell be less than the maximum allowable concentrations listed above as Total Pesticides and Total PCB's, respectively.

Table 10-6d
BPL Chemical Test Results Summary
Heavy Metals, Asbestos and Conventionals

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Aluminum	33,000 mg/kg	1150	33000
Antimony	10 mg/kg	0.45	10
Arsenic	10 mg/kg	0.373	10
Barium	300 mg/kg	4.49	300
Beryllium	1 mg/kg	0.019	1
Cadmium	5 mg/kg	0.055	5
Chromium	160 mg/kg	1.49	160
Cobalt	60 mg/kg	0.952	60
Copper	115 mg/kg	2.23	115
Cyanide	4 mg/kg	ND	4
Iron	30000 mg/kg	2920	30000
Lead	400 mg/kg	0.97	400
Manganese	1300 mg/kg	63.5	1300
Mercury	0.6 mg/kg	0.006	0.6
Nickel	75 mg/kg	2.01	75
Selenium	2 mg/kg	0.369	2
Silver	200 mg/kg	0.101	200
Thallium	20 mg/kg	0.394	20
Vanadium	150 mg/kg	3.26	150
Zinc	100 mg/kg	7.5	100
Asbestos Fiber Content	1% (by weight)	ND	ND
pH	5.5-7.5	5	7.8
Sulfides	50000 mg/kg	6.68	50000
Ammonia	40 mg/kg	2.1	40

Refer to Appendix G for all field, chemical and geotechnical test results for BPL.

Photographs of the installation of the BPL are included in Appendix K.

11.0 GENERAL FILL / WETLANDS SAND

General fill was used to construct drainage swales, berms, roadway embankments, as backfill and for mass areas throughout the landfill as per the Specifications. Depths of general fill varied as required per the Contract Drawings. General fill refers to fill used above and outside the cover, thus it was required to meet the same environmental testing requirements as BPL, except for the permeability testing.

Wetlands sand was used to construct the base layer and planting islands in the low-lying area between the toe of the northwest landfill slope and the Belt Parkway. During the work additional plan drawings were generated showing construction details of the wetland design. The approved design was added as a change order requiring 16,228 cy of wetlands sand to construct per the Contract and change order Drawings

11.1 Material Source – General Fill

The general fill used for the Fountain Avenue Landfill construction was environmentally clean in accordance with NYSDEC TAGM HWR-94-4046 (Technical and Administrative Guidance Memorandum) and was in general conformance with the Contract Specifications. The general fill used on the project was tested and approved per the QA/QC requirements of the Specifications prior to being imported for use at the landfill. All general fill material was delivered to the Fountain Avenue Landfill pier via barge transportation.

The 211,027 cy of general fill used onsite was imported from the same borrow site at Clifton Park, New York as the BPL. NYCDEP and URS inspected the borrow site and loading facilities prior to general acceptance and procurement. Source testing was performed. Table 11-1 shows the source testing requirement.

Table 11-1
Minimum Laboratory Source –Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One per source
Standard Proctor Density	ASTM D-698	One per source
Organic Content	ASTM D-2974	One per source
Atterberg Limits	ASTM D-4318	One per source
Chemical Analysis	SW-846 TCL, TAL	One per source
Water (Moisture) Content	ASTM D-2216	One per source

The general requirements for general fill are shown in Table 11-2.

Table 11-2
General Fill Requirements

Property	Criteria
Organic Content (%)	<15%
Plastic Index (slope > 20%)	<12
Plastic Index (slope < 20%)	<50
Standard Proctor Test	Max Density (pcf)
Standard Proctor Test	Opt. Moisture (%)
Moisture (as received) (%)	<OW +7%
Max Particle Size (in)	<3"
Chemical Testing	TCL & TAL NYS TAGM 94-4046
USC	SM or SC
Fines Content	20% - 40%

Refer to Appendix H for Source testing results.

11.2 Installation – General Fill

General fill was moved about and placed on top of the BPL and geosynthetics layers by building temporary and permanent roadways to protect those layers from the wheeled off-road trucks used. Temporary roads were removed by low ground pressure (LGP) dozers after use. Permanent roads were finished with the specification roadbase surfacing. General fill was installed as shown on the Contract Drawings. MCC used a GPS position locating system along with surveying and laser guidance system mounted to dozer blades to achieve the correct grades and slopes.

The general fill was stockpiled onsite and then loaded with excavators and payloaders, into articulated trucks for transport and placement onto approved locations in order to construct roads and swales. The material was spread in 1' lifts to the line and grades required. Both the QA and QC inspectors performed IPD testing as the material was placed.

11.3 Quality Assurance/Quality Control During Installation – General Fill

Quality assurance and quality control during construction of the general fill layer consisted of full-time observation in addition to laboratory and field-testing.

All QC laboratory and field testing was performed by the approved independent chemical laboratory and approved independent geotechnical laboratory, employed by MCC.

Chemical analyses were provided by Accredited Laboratories, Inc., located in Carteret, New Jersey and Chemtech, of Mountainside, New Jersey. Geotechnical analyses were provided by Testwell Laboratories, Inc., located in Ossining, New York. Periodic quality control was performed by the contractor in accordance with Table 11-3 below.

Table 11-3
Quality Control – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422 (latest revision)	One test every 5,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 5,000 yd^3
Atterberg Limits	ASTM D-4318	One test every 5,000 yd^3
Moisture Content	ASTM D-2216 (latest revision)	One test every 5,000 yd^3
Chemical Analysis (TAL metals & TCL organics)	SW-846	One test every 3,000 yd^3
Organic Content	ASTM D-2974 (latest revision)	One test every 5,000 yd^3
Field-Moisture Density	ASTM D-2922	Minimum of 3 tests every 200 linear feet every compacted lift

All QA laboratory and field testing was performed by the approved independent chemical laboratory and geotechnical laboratory, employed by URS. Chemical analyses were provided by Veritech Laboratory, a division of Hampton-Clarke, Inc., located in Fairfield, New Jersey. Geotechnical analysis was performed by URS Soil Testing Laboratory in Totowa, NJ. Field moisture-density measurements were made by one of URS' onsite inspectors trained in the use of the nuclear density meter. Periodic quality assurance (QA) inspection and testing was performed by URS in accordance with Table 11-4 below to verify the QC testing.

Table 11-4
Quality Assurance – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422 (latest revision)	One test every 20,000 yd^3
Standard Proctor Density	ASTM D-698	One test every 20,000 yd^3
Atterberg Limits	ASTM D-4318	One test every 20,000 yd^3
Field-Moisture Density	ASTM D-2922	Minimum of 3 tests every 200 linear feet every compacted lift
Chemical Analysis (TAL metals & TCL organics)	USEPA SW-846	One test every 60,000 yd^3

The general fill was compacted to an in-place minimum density of 95 percent of the maximum dry density, as determined by ASTM D-698. In addition, QA Geotechnical Inspectors visually and periodically inspected the material delivered to the site to ensure consistency. The moisture and density of the General Fill were measured in the field to a 6-inch depth by a nuclear densometer. Field density and moisture tests on the BPL were performed at approximately 100-foot intervals. These field density tests are also referred to as IPD (in place density) elsewhere in this report.

If changes in the material occurred, the QA Site Manager rejected any work performed by MCC using the new material until the pre-approval QA and QC procedures were executed and approved by the QA Site Manager.

The General Fill used on this site was comprised of piles of BPL material that did not meet the permeability requirements on all the piles prior to classification as BPL or General Fill. Therefore the range of Geophysical results are the same as the BPL material.

Tables 11-5 thru 11-6 below summarize the range of values of test results for the geophysical and chemical testing of the general fill.

Table 11-5
General Fill Geophysical QC Test Results Summary

Property	Criteria	Range of Values
Organic Content (%)	<5%	0.8 – 3.0%
Plastic Index (slope > 5%) Plastic Index (slope < 5%)	<12 <50	0 – 6.2
Standard Proctor Test	Max Density(pcf)	102.9 – 127.3
Standard Proctor Test	Opt. Moisture (%)	1.3 – 20.3
Max Particle Size (in)	< 3"	0.08 - 3
USC	GM, SM, GC or SC	SM, GM
Fines Content	20% - 40%	11.2 – 57.2
Clay Content (hydrometer) (%)	<10%	1.9 – 17.8

For the chemical testing summarized below in tables 10-6a through 10-6d, each sample was analyzed for all contaminants, so the number of samples tested is always the same for each contaminant shown. There were 83 samples tested for the General Fill material which was accepted and delivered to the Fountain Avenue Landfill project.

Table 11-6a
General Fill Chemical Test Results Summary
Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total VOCs	10.0 mg/kg	0.001	0.067
Acetone	0.2 mg/kg	0.0047	0.057
Benzene	0.06 mg/kg	ND	ND
Bromodichloromethane	*	ND	ND
Bromoform	*	ND	ND
Bromomethane	*	ND	ND
2-Butanone	0.3 mg/kg	ND	ND
Carbon Disulfide	2.7 mg/kg	0.0017	0.01
Carbon Tetrachloride	0.6 mg/kg	ND	ND
Chlorobenzene	1.7 mg/kg	ND	ND
Chloroethane	1.9 mg/kg	ND	ND
Chloroform	0.3 mg/kg	0.001	0.0042
Chloromethane	*	ND	ND
Cis-1,3-Dichloropropene	*	ND	ND
Dibromochloromethane	*	ND	ND
1,1-Dichloroethane	0.2 mg/kg	ND	ND
1,2-Dichloroethane	0.1 mg/kg	ND	ND
1,1-Dichloroethene	0.4 mg/kg	ND	ND
1,2-Dichloroethene (total)	*	ND	ND
1,2-Dichloropropane	*	ND	ND
1,3-Dichloropropene (trans)	*	ND	ND
Ethylbenzene	5.5 mg/kg	ND	ND
2-Hexanone	*	ND	ND
Methylene Chloride	0.1 mg/kg	0.001	0.014
4-Methyl-2-Pentanone	1.0 mg/kg	ND	ND
Styrene	*	ND	ND
Tetrachloroethene	1.4 mg/kg	ND	ND
1,1,1-Trichloroethane	0.8 mg/kg	ND	ND
1,1,2-Trichloroethane	*	ND	ND
1,1,2,2-Tetrachloroethane	0.6 mg/kg	ND	ND
Toluene	1.5 mg/kg	0.0012	0.003
Trichloroethene	0.7 mg/kg	ND	ND
Vinyl Chloride	0.2 mg/kg	ND	ND
Xylenes (total)	1.2 mg/kg	0.0013	0.0038

* Contaminants with an"*" do not have individual limits in the NYSDEC's TAGM 4046. The total of all TCL volatile organic compounds, however, shall not exceed the maximum allowable concentration listed above as Total VOCs.

Table 11-6b
General Fill Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total SVOCs	500 mg/kg	0.041	0.49
Total CPAHs	10.0 mg/kg	ND	ND
Acenaphthene	50.0 mg/kg	ND	ND
Acenaphthylene	41.0 mg/kg	ND	ND
Anthracene	50.0 mg/kg	ND	ND
Benzo(g,h,I)perylene	50.0 mg/kg	ND	ND
bis(2-ethylexyl)phthalate	50.0 mg/kg	0.041	0.49
bis-(2-Chloroethyl)ether	0.58 mg/kg	ND	ND
bis-(2-Chloroethoxy)methane	50.0 mg/kg	ND	ND
4-Bromophenylphenylether	50.0 mg/kg	ND	ND
Butylbenzylphthalate	50.0 mg/kg	ND	ND
Carbazole	32.0 mg/kg	ND	ND
4-Chloroaniline	0.220 or MDL	ND	ND
4-Chloro-3-methylphenol	0.240 or MDL	ND	ND
2-Chlorophenol	0.8 mg/kg	ND	ND
4 Chlorophenylphenylether	50.0 mg/kg	ND	ND
2 Chloronapthalene	50.0 mg/kg	ND	ND
2,4-Dinitrotoluene	50.0 mg/kg	ND	ND
Dibenzofuran	6.2 mg/kg	ND	ND
1,2-Dichlorobenzene	50.0 mg/kg	ND	ND
1,3-Dichlorobenzene	50.0 mg/kg	ND	ND
1,4-Dichlorobenzene	50.0 mg/kg	ND	ND
3,3'-Dichlorobenzidine	1.4 mg/kg	ND	ND
2,4-Dichlorophenol	0.4 mg/kg	ND	ND
4,6 Dinitro-2-methylphenol	50.0 mg/kg	ND	ND
2,4-Dimethylphenol	50.0 mg/kg	ND	ND
2,4-Dinitrophenol	0.200 or MDL	ND	ND
2,6-Dinitrotoluene	1.0 mg/kg	ND	ND
Diethylphthalate	7.1 mg/kg	0.061	0.12
Dimethylphthalate	2.0 mg/kg	ND	ND
Di-n-butylphthalate	8.1 mg/kg	0.056	0.39
Di-n-octyphthalate	50.0 mg/kg	ND	ND
Fluoranthene	50.0 mg/kg	ND	ND
Fluorene	50.0 mg/kg	ND	ND
Hexachlorobenzene	0.41 mg/kg	ND	ND

Table 11-6b(continued-page 2)
General Fill Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Hexachlorobutadiene	8.2 mg/kg	ND	ND
Hexachloroethane	46.0 mg/kg	ND	ND
Hexachlorocycpentadiene	50.0 mg/kg	ND	ND
Isophorone	4.4 mg/kg	ND	ND
2-Methylnaphthalene	36.4 mg/kg	ND	ND
2-Methylphenol	0.100 or MDL	ND	ND
4-Methylphenol	0.9 mg/kg	ND	ND
Naphthalene	13.0 mg/kg	ND	ND
Nitrobenzene	0.200 or MDL	ND	ND
2-Nitroaniline	0.430 or MDL	ND	ND
4 Nitroaniline	50.0 mg/kg	ND	ND
2-Nitrophenol	0.330 or MDL	ND	ND
4-Nitrophenol	0.100 or MDL	ND	ND
3-Nitroaniline	0.500 or MDL	ND	ND
N-Nitroso-di-n-propylamine	0.091 mg/kg	ND	ND
N-Nitrosodiphenylamine	50.0 mg/kg	ND	ND
2,2'-oxybis(1-Chloropropane)	50.0 mg/kg	ND	ND
Pentachlorophenol	1.0 or MDL	ND	ND
Phenanthrene	50.0 mg/kg	ND	ND
Phenol	0.03 or MDL	ND	ND
Pyrene	50.0 mg/kg	ND	ND
1,2,4-Trichlorobenzene	50.0 mg/kg	ND	ND
2,4,5-Trichlorophenol	0.1 mg/kg	ND	ND
2,4,6-Trichlorophenol	50.0 mg/kg	ND	ND

Table 11-6c
General Fill Chemical Test Results Summary
Pesticides and PCB's

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total Pesticides	10 ppm	0.018	0.09
Aldrin	0.041 mg/kg	ND	ND
alpha-BHC	0.11 mg/kg	ND	ND
Endrine aldehyde	*	ND	ND
Alpha-chlordane	*	ND	ND
beta-BHC	0.2 mg/kg	ND	ND
delta-BHC	0.3 mg/kg	ND	ND
4,4'-DDD	2.9 mg/kg	ND	ND
4,4'-DDE	2.1 mg/kg	ND	ND
4,4'-DDT	2.1 mg/kg	ND	ND
Dieldrin	0.044 mg/kg	ND	ND
Endosulfan I	0.9 mg/kg	ND	ND
Endosulfan II	0.9 mg/kg	ND	ND
Endosulfan Sulfate	1.0 mg/kg	ND	ND
Endrin	0.10 mg.kg	ND	ND
Endrin ketone	N/A	ND	ND
gamma-BHC (Lindane)	0.06 mg/kg	ND	ND
gamma-chlordane	0.54 mg/kg	ND	ND
Heptachlor	0.10 mg/kg	ND	ND
Heptachlor epoxide	0.02 mg/kg	ND	ND
Methoxychlor	*	ND	ND
Total PCBs	1.0 mg/kg	0.018	0.09
Toxaphene	*	ND	ND

* Contaminants marked with an "*" do not have individual limits in NYSDEC's TAGM 4046; however, the total pesticides and PCB concentrations shell be less than the maximum allowable concentrations listed above as Total Pesticides and Total PCB's, respectively.

Table 11-6d
General Fill Chemical Test Results Summary
Heavy Metals, Asbestos and Conventionals

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Aluminum	33000 mg/kg	1900	13800
Antimony	10 mg/kg	0.45	8.08
Arsenic	10 mg/kg	0.45	5.26
Barium	300 mg/kg	5.78	52
Berylium	1 mg/kg	0.019	0.63
Cadmium	5 mg/kg	0.099	2.01
Chromium	160 mg/kg	0.592	14.1
Cobalt	60 mg/kg	0.682	8.8
Copper	115 mg/kg	3.36	20.1
Cyanide	4 mg/kg	ND	ND
Iron	30000 mg/kg	1690	19600
Lead	400 mg/kg	0.97	10.8
Manganese	1300 mg/kg	27	476
Mercury	0.6 mg/kg	0.006	0.24
Nickel	75 mg/kg	1.21	16.4
Selenium	2 mg/kg	0.345	1.68
Silver	200 mg/kg	0.101	2.53
Thallium	20 mg/kg	0.509	5.2
Vanadium	150 mg/kg	2	23.5
Zinc	100 mg/kg	4.91	53.8
Asbestos Fiber Content	1% (by weight)	-	-
pH	5.5-7.5	5.2	7.5
Sulfides	50000 mg/kg	6.68	6.68
Ammonia	40 mg/kg	0.0027	9.38

Refer to Appendix H for all geotechnical chemical and test results.

For field moisture-density testing (IPD), test data sheets are also copied in Appendix H. No summary table of the results is provided because for any out-of-specification test result, soil was recompacted and moisture-adjusted until the results met specification.

Photographs of the installation of the general fill are included in Appendix K.

11.4 Material Source – Wetlands Sand

As with the other fill types used above or outside the geomembrane liner, the wetlands sand used for the Fountain Avenue Landfill construction was tested to be environmentally clean in accordance with NYSDEC TAGM HWR-94-4046 (Technical and Administrative Guidance Memorandum) and was in general conformance with the Contract Specifications. The sand specification was similar to that of the topsoil (see Section 12) with lesser percentages of organic content, silt and clay. The 16,230 cy used onsite was supplied by TFC (Thomas F Corbett) of Salem, New Jersey (Sand source was Continental Aggregates, working with TFC). TFC was previously approved for topsoil supply to this project. Geophysical / agricultural testing was the same tests used for topsoil evaluation, but with a reduced and modified criteria list for comparison. Supplier prequalification testing consisted of testing the first pile produced (first QC frequency test). The test parameters and acceptance criteria are shown in table 11-7 in section 11.6 below.

11.5 Installation – Wetlands Sand

Sand was moved about and placed on top of the 40 mil geosynthetic liner in the wetlands area by building temporary roadways to protect the liner from the wheeled off-road trucks used. Temporary filled areas were then graded to the dimensions and planting islands as required on the drawings by excavator, low ground pressure (LGP) dozers and by hand.

11.6 Quality Assurance / Quality Control During Installation – Wetlands Sand

Quality assurance and quality control during construction of the wetlands consisted of full-time observation in addition to laboratory and field-testing.

All QC laboratory and field testing was performed by the approved independent chemical laboratory and approved independent geotechnical laboratory, employed by MCC. Chemical analyses were provided by Chemtech, of Mountainside, New Jersey. Geotechnical / agricultural analyses were provided by A&L Eastern Laboratories, Inc., located in Richmond, Virginia. Periodic quality control was performed by the contractor in accordance with Tables 11-7 below.

Table 11-7
Quality Control – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 2,500 yd^3
pH	See Note 1 Below	One test every 2,500 yd^3
Organic Content	See Note 1 Below	One test every 2,500 yd^3
Soluble salts	See Note 1 Below	One test every 2,500 yd^3
Macro/Micro Nutrients	See Note 1 Below	One test every 2,500 yd^3
Nitrogen (inorganic and TKN)	NEC-67(see 2 below)	One test every 2,500 yd^3
Chemical Analysis (TAL metals & TCL organics)	USEPA SW-846	One test every 3,000 yd^3 See note 3 below

NOTES:

1. These soil tests were conducted in accordance with Soil Testing Procedure for the Northeastern United States, 2nd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin #493, 12/95.
2. Method is referenced in the Northeast Coordinating Committee on Soil Testing NEC-67
3. Requirement was every 3,000 yd^3 but actual practice was 2,500 yd^3 (every pile tested)

All QA laboratory and field testing was performed by the approved independent chemical laboratory and geotechnical laboratory, employed by URS. Chemical analyses were provided by Veritech Laboratory, a division of Hampton-Clarke, Inc., located in Fairfield, New Jersey. Geotechnical / agricultural analysis was performed by Rutgers Soil Testing Laboratory in New Brunswick, NJ. Field moisture-density measurements were made by one of URS' onsite inspectors trained in the use of the nuclear density meter. Periodic quality assurance (QA) inspection and testing was performed by URS in accordance with Table 11-8 below to verify the QC testing.

Table 11-8
Quality Assurance – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 2,500 yd^3
pH	See Note 1 Below	One test every 2,500 yd^3
Organic Content	See Note 1 Below	One test every 2,500 yd^3
Soluble salts	See Note 1 Below	One test every 2,500 yd^3
Macro/Micro Nutrients	See Note 1 Below	One test every 2,500 yd^3
Nitrogen (inorganic and TKN)	NEC-67(see 2 below)	One test every 2,500 yd^3
Chemical Analysis (TAL metals & TCL organics)	USEPA SW-846	One test every 3,000 yd^3

NOTES:

1. These soil tests were conducted in accordance with Soil Testing Procedure for the Northeastern United States, 2nd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin #493, 12/95.
2. Method is referenced in the Northeast Coordinating Committee on Soil Testing NEC-67
3. Requirement was every 3,000 yd^3 but actual practice was 2,500 yd^3 (every pile tested) Tables 11-9 thru 11-10 below show the geophysical and chemical summary results for wetlands sand.

Refer to Appendix H for all field, chemical and geotechnical test results.

Photographs of the installation of the wetlands sand are included in Appendix K.

Table 11-9
Wetland Sand Geophysical QC Test Results Summary

Property	Criteria	Range of Results	
		Minimum	Maximum
Organic Content	0% - 1%	0.5	0.7
Gravel Content	≤10%	1.3	3.0
Sand Content	>85%	85.9	91.7
Sand Sieve Analysis			
Very Coarse(%)	None	5.7	10.7
Coarse(%)	None	12.9	36.2
Medium(%)	None	37.0	41.7
% medium or larger	None	55.8	82.8
Fine(%)	None	15.7	42.3
Very Fine(%)	None	1.5	2.6
Silt Content	0 - 5%	1.0	7.8
Clay Content	0 - 5%	2.0	9.8
USDA Classification			
Max Grain Size	≤ 1.5''	0.3	0.8
pH	5 -7	4.8	5.1
Soluble Salts	0 - 0.4 mmhos/cm	0.0	0.1
Nitrogen Total (TKN)	None	0.0	0.1
Nitrate Content	None	1.0	1.0
Macronutrients			
Phosphorus (P)	None	4.0	8.0
Potassium (K)	None	16.0	40.0
Magnesium (Mg)	None	30.0	60.0
Calcium (Ca)	None	80.0	200.0
Total (Mg+K+Ca)	None	136.0	300.0
Micronutrients			
Zinc (Zn)	None	0.1	0.9
Copper (Cu)	None	0.2	0.4
Manganese (Mn)	None	1.0	3.0
Boron (B)	None	0.1	0.1

For the chemical testing summarized below in tables 11-10a through 11-10d, each sample was analyzed for all contaminants, so the number of samples tested is always the same for each contaminant shown. There were six samples tested for the wetland sand material which was accepted and delivered to the Fountain Avenue Landfill project.

Table 11-10a
Wetland Sand Chemical Test Results Summary
Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total VOCs	10.0 mg/kg	0.0036	0.0036
Acetone	0.2 mg/kg	ND	ND
Benzene	0.06 mg/kg	ND	ND
Bromodichloromethane	*	ND	ND
Bromoform	*	ND	ND
Bromomethane	*	ND	ND
2-Butanone	0.3 mg/kg	ND	ND
Carbon Disulfide	2.7 mg/kg	ND	ND
Carbon Tetrachloride	0.6 mg/kg	ND	ND
Chlorobenzene	1.7 mg/kg	ND	ND
Chloroethane	1.9 mg/kg	ND	ND
Chloroform	0.3 mg/kg	ND	ND
Chloromethane	*	ND	ND
Cis-1,3-Dichloropropene	*	ND	ND
Dibromochloromethane	*	ND	ND
1,1-Dichloroethane	0.2 mg/kg	ND	ND
1,2-Dichloroethane	0.1 mg/kg	ND	ND
1,1-Dichloroethene	0.4 mg/kg	ND	ND
1,2-Dichloroethene (total)	*	ND	ND
1,2-Dichloropropane	*	ND	ND
1,3-Dichloropropene (trans)	*	ND	ND
Ethylbenzene	5.5 mg/kg	ND	ND
2-Hexanone	*	ND	ND
Methylene Chloride	0.1 mg/kg	0.0036	0.0036
4-Methyl-2-Pentanone	1.0 mg/kg	ND	ND
Styrene	*	ND	ND
Tetrachloroethene	1.4 mg/kg	ND	ND
1,1,1-Trichloroethane	0.8 mg/kg	ND	ND
1,1,2-Trichloroethane	*	ND	ND
1,1,2,2-Tetrachloroethane	0.6 mg/kg	ND	ND
Toluene	1.5 mg/kg	ND	ND
Trichloroethene	0.7 mg/kg	ND	ND
Vinyl Chloride	0.2 mg/kg	ND	ND
Xylenes (total)	1.2 mg/kg	ND	ND

* Contaminants with an"*" do not have individual limits in the NYSDEC's TAGM 4046. The total of all TCL volatile organic compounds, however, shall not exceed the maximum allowable concentration listed above as Total VOCs.

Table 11-10b
Wetland Sand Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total SVOCs	500 mg/kg	ND	ND
Total CPAHs	10.0 mg/kg	ND	ND
Acenaphthene	50.0 mg/kg	ND	ND
Acenaphthylene	41.0 mg/kg	ND	ND
Anthracene	50.0 mg/kg	ND	ND
Benzo(g,h,I)perylene	50.0 mg/kg	ND	ND
bis(2-ethylexyl)phthalate	50.0 mg/kg	ND	ND
bis-(2-Chloroethyl)ether	0.58 mg/kg	ND	ND
bis-(2-Chloroethoxy)methane	50.0 mg/kg	ND	ND
4-Bromophenylphenylether	50.0 mg/kg	ND	ND
Butylbenzylphthalate	50.0 mg/kg	ND	ND
Carbazole	32.0 mg/kg	ND	ND
4-Chloroaniline	0.220 or MDL	ND	ND
4-Chloro-3-methylphenol	0.240 or MDL	ND	ND
2-Chlorophenol	0.8 mg/kg	ND	ND
4 Chlorophenylphenylether	50.0 mg/kg	ND	ND
2 Chloronapthalene	50.0 mg/kg	ND	ND
2,4-Dinitrotoluene	50.0 mg/kg	ND	ND
Dibenzofuran	6.2 mg/kg	ND	ND
1,2-Dichlorobenzene	50.0 mg/kg	ND	ND
1,3-Dichlorobenzene	50.0 mg/kg	ND	ND
1,4-Dichlorobenzene	50.0 mg/kg	ND	ND
3,3'-Dichlorobenzidine	1.4 mg/kg	ND	ND
2,4-Dichlorophenol	0.4 mg/kg	ND	ND
4,6 Dinitro-2-methylphenol	50.0 mg/kg	ND	ND
2,4-Dimethylphenol	50.0 mg/kg	ND	ND
2,4-Dinitrophenol	0.200 or MDL	ND	ND
2,6-Dinitrotoluene	1.0 mg/kg	ND	ND
Diethylphthalate	7.1 mg/kg	ND	ND
Dimethylphthalate	2.0 mg/kg	ND	ND
Di-n-butylphthalate	8.1 mg/kg	ND	ND
Di-n-octyphthalate	50.0 mg/kg	ND	ND
Fluoranthene	50.0 mg/kg	ND	ND
Fluorene	50.0 mg/kg	ND	ND
Hexachlorobenzene	0.41 mg/kg	ND	ND

Table 11-10b(continued-page 2)
Wetland Sand Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Hexachlorobutadiene	8.2 mg/kg	ND	ND
Hexachloroethane	46.0 mg/kg	ND	ND
Hexachlorocycpentadiene	50.0 mg/kg	ND	ND
Isophorone	4.4 mg/kg	ND	ND
2-Methylnaphthalene	36.4 mg/kg	ND	ND
2-Methylphenol	0.100 or MDL	ND	ND
4-Methylphenol	0.9 mg/kg	ND	ND
Naphthalene	13.0 mg/kg	ND	ND
Nitrobenzene	0.200 or MDL	ND	ND
2-Nitroaniline	0.430 or MDL	ND	ND
4 Nitroaniline	50.0 mg/kg	ND	ND
2-Nitrophenol	0.330 or MDL	ND	ND
4-Nitrophenol	0.100 or MDL	ND	ND
3-Nitroaniline	0.500 or MDL	ND	ND
N-Nitroso-di-n-propylamine	0.091 mg/kg	ND	ND
N-Nitrosodiphenylamine	50.0 mg/kg	ND	ND
2,2'-oxybis(1-Chloropropane)	50.0 mg/kg	ND	ND
Pentachlorophenol	1.0 or MDL	ND	ND
Phenanthrene	50.0 mg/kg	ND	ND
Phenol	0.03 or MDL	ND	ND
Pyrene	50.0 mg/kg	ND	ND
1,2,4-Trichlorobenzene	50.0 mg/kg	ND	ND
2,4,5-Trichlorophenol	0.1 mg/kg	ND	ND
2,4,6-Trichlorophenol	50.0 mg/kg	ND	ND

Table 11-106c
Wetland Sand Chemical Test Results Summary
Pesticides and PCB's

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Total Pesticides	10 ppm	ND	ND
Aldrin	0.041 mg/kg	ND	ND
alpha-BHC	0.11 mg/kg	ND	ND
Endrine aldehyde	*	ND	ND
Alpha-chlordane	*	ND	ND
beta-BHC	0.2 mg/kg	ND	ND
delta-BHC	0.3 mg/kg	ND	ND
4,4'-DDD	2.9 mg/kg	ND	ND
4,4'-DDE	2.1 mg/kg	ND	ND
4,4'-DDT	2.1 mg/kg	ND	ND
Dieldrin	0.044 mg/kg	ND	ND
Endosulfan I	0.9 mg/kg	ND	ND
Endosulfan II	0.9 mg/kg	ND	ND
Endosulfan Sulfate	1.0 mg/kg	ND	ND
Endrin	0.10 mg.kg	ND	ND
Endrin ketone	N/A	ND	ND
gamma-BHC (Lindane)	0.06 mg/kg	ND	ND
gamma-chlordane	0.54 mg/kg	ND	ND
Heptachlor	0.10 mg/kg	ND	ND
Heptachlor epoxide	0.02 mg/kg	ND	ND
Methoxychlor	*	ND	ND
Total PCBs	1.0 mg/kg	ND	ND
Toxaphene	*	ND	ND

* Contaminants marked with an "*" do not have individual limits in NYSDEC's TAGM 4046; however, the total pesticides and PCB concentrations shell be less than the maximum allowable concentrations listed above as Total Pesticides and Total PCB's, respectively.

Table 11-10d
Wetland Sand Chemical Test Results Summary
Heavy Metals, Asbestos and Conventionals

Contaminant	Soil Use Criteria	Range of Results	
		Minimum	Maximum
Aluminum	33000 mg/kg	1050	2160
Antimony	10 mg/kg	ND	ND
Arsenic	10 mg/kg	3.59	7.19
Barium	300 mg/kg	0.632	4.69
Berylium	1 mg/kg	0.07	0.65
Cadmium	5 mg/kg	0.285	0.411
Chromium	160 mg/kg	3.92	7.75
Cobalt	60 mg/kg	0.348	1.24
Copper	115 mg/kg	0.498	1.52
Cyanide	4 mg/kg	0.826	3.02
Iron	30000 mg/kg	5620	7680
Lead	400 mg/kg	1.2	2.44
Manganese	1300 mg/kg	1.99	8.87
Mercury	0.6 mg/kg	0.009	0.017
Nickel	75 mg/kg	0.501	0.561
Selenium	2 mg/kg	0.562	0.562
Silver	200 mg/kg	0.305	0.332
Thallium	20 mg/kg	ND	ND
Vanadium	150 mg/kg	7	14.7
Zinc	100 mg/kg	3.91	6.78
Asbestos Fiber Content	1% (by weight)	ND	ND
pH	5.5-7.5	ND	ND
Sulfides	50000 mg/kg	2.13	3.47
Ammonia	40 mg/kg	1050	2160

12.0 TOPSOIL AND SEEDING

The final step in the landfill final cover system was the construction of a 6-inch thick layer (minimum) of topsoil in non-planting island areas and up to a 3.0'-foot thick layer (minimum) of topsoil in areas designated as planting islands, to sustain a well-established vegetative cover, which will protect the cap from erosion. Topsoil and seeding were placed on top of the barrier protection layer (cover soil layer).

12.1 Material Source – Topsoil

The material used for the topsoil layer construction was in general conformance with the Contract Specifications. All topsoil used on the project was tested and approved per the QA/QC requirement of the Specifications prior to use at the Fountain Avenue Landfill. Most of the topsoil piles submitted for review had one or more QC and QA test results which were numerically outside the specification for agricultural parameters. Usually these differences from the Specification were not materially significant to the intended function of the topsoil. In all cases where the engineer observed these differences, the QC and QA agricultural data were forwarded to the NYCDEP for final approval. This occurred for all but a few of the approved topsoil piles.

The topsoil was a manufactured soil formulated specifically to meet the narrow range of agricultural parameters specified. Topsoil was free of refuse, hard clods, woody vegetation, stiff clay, construction debris, boulders, stones larger than one and one-half inches, hydrocarbons, petroleum materials or chemicals toxic to plants, and other miscellaneous or otherwise unstable or undesirable materials. Topsoil rejections were generally for failure to be within an acceptable range of the required agricultural formulation.

Topsoil had a minimum organic content of two and one-half (2.5) percent by weight as determined by the method described in the "Soil Testing Procedures for the Northeastern United States, 2nd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin #493, 12/95." Topsoil had a pH value within a range of 5.0 to 7.0 as required by the Specifications.

The 720,089cy of topsoil used on this project was a mixed material that was manufactured and supplied by two main suppliers: EME (Excavating Materials and Equipment) of New Egypt, New Jersey, and TFC (Thomas F Corbett) of Salem, New Jersey. Each supplied approximately half of the total. About 10,000 cy was accepted from a third supplier, Long Island Compost, of Syosset, (Long Island) New York Soil was blended from mined sand and from leaf compost according to approved mix ratio of four (4) parts sand to one (1) part compost.

URS provided a full-time onsite inspector at each of the two main suppliers to observe the blending process and raw materials, collect samples of each pile for all QA analyses, and observe all Contractor QC sample collection. The URS inspector at each source would also

track the onsite movement of each approved stockpile, the trucking of each stockpile to shipping point and loading onto the barges. This was critical to maintain the integrity and volume of each pile. The efforts of the suppliers in tracking and maintaining separation of the approved piles proved insufficient on a number of occasions. The Contractor did not keep any personnel on the suppliers' sites except for a brief trip to each completed pile for acceptance sampling.

Table 12-1 shows the source testing requirements.

Table 12-1
Source - Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One per source
pH	See Note 1 Below	One per source
Organic Content	See Note 1 Below	One per source
Soluble salts	See Note 1 Below	One per source
Macro/Micro Nutrients	See Note 1 Below	One per source
Nitrogen (inorganic and TKN)	NEC-67(see 2 below)	One per source
Acid Producing Soil (iron sulfide)	Rutgers University Soils Lab	One per source
Chemical Analysis (TAL metals & TCL organics)	USEPA SW-846	One per source

NOTES:

1. These soil tests were conducted in accordance with Soil Testing Procedure for the Northeastern United States, 2nd Edition, Northeast Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin #493, 12/95.
2. Method is as referenced in the Northeast Coordinating Committee on Soil Testing NEC-67

The general requirements for Topsoil are shown in Table 12-2.

Table 12-2
Topsoil Requirements

Property	Criteria
Estimated Bulk Density	1.0 - 1.4 (g/cm3)
Organic Content	2.5% - 5%
Gravel Content	≤ 8%
Sand Content	60% - 80%
Silt Content	10% - 20%
Clay Content	10% - 20%
USDA Classification	Sandy Loam
Max Grain Size	≤ 1.5´´
pH	5 -7
Acid Producing Soil Test	pH > 4.5
Soluble Salts	0 - 0.4 mmhos/cm
Nitrogen Total (TKN)	0.06%-0.15%
Nitrate Content	< or = 12 ppm
Macronutrients	
Phosphorus (P)	20 – 80 lbs/acre
Potassium (K)	70 – 225 lbs/acre
Magnesium (Mg)	200–300 lbs/acre
Calcium (Ca)	400–2000 lbs/acre
Total (Mg+K+Ca)	< or = 2500 lb/acre
Micronutrients	
Zinc (Zn)	1 ppm – 12 ppm
Copper (Cu)	0.1 ppm – 4 ppm
Manganese (Mn)	2 ppm – 25 ppm
Boron (B)	0.8 ppm – 3 ppm

Refer to Appendix I for Source testing results.

12.2 Installation – Topsoil

All topsoil was received on barges, and then stockpiled or directly placed on the landfill.

Temporary stockpiles were placed and graded for proper drainage and were not placed near the edge of side slopes. Topsoil delivered to the site was visually and continuously inspected by the Engineer during placement to ensure consistency in materials and procedures. No topsoil was permitted to be spread until the underlying barrier protection layer and the topsoil were approved by URS and NYCDEP.

Topsoil was evenly placed with a LGP bulldozer to a minimum of either six (6) inches or up to three (3) feet in areas designated as (tree) planting islands, within the limit of final cover system and limits of the work area. Grade stakes were used on a limited basis along with laser guidance on bulldozer blades to ensure that the proper lift was achieved. Irregularities in the surface resulting from topsoil placement or other operations were corrected in order to prevent the formation of depressions where water would pond. Topsoil was not placed when the subgrade surface was frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to the proposed seeding program. In addition, mud, snow, ice or frozen earth was not permitted to be incorporated in the topsoil. Topsoil work within the limits of the final cover system was executed in conformance with the lines and grades shown on the Drawings.

For all work within the limit of the final cover system, slopes had a minimum of 4 percent and a maximum of 33 percent. Topsoil was placed so that the surface was free draining. Runoff and other water were conveyed in ditches and channels to the site perimeter storm water management system.

12.3 Quality Assurance/Quality Control During Installation – Topsoil

Quality control during the topsoil layer construction consisted of full-time observation, laboratory testing and field-testing. In addition, MCC was required to verify the thickness by hand digging test holes in the presence of URS QA inspectors. In place density testing (bulk density) was conducted to verify compliance to the contract requirements.

Density test results are included in Appendix I.

As the construction progressed, QA/QC conformance sampling and testing for agricultural and geotechnical analyses was conducted per the Specifications at a frequency of no less than one test for every 2,500 cubic yards of topsoil material delivered to the site.

All QC laboratory and field testing was performed by the approved independent chemical laboratory and approved independent geotechnical laboratory, employed by MCC. Chemical analyses were provided by Accredited Laboratories, Inc., located in Carteret, New Jersey and Chemtech, of Mountainside, New Jersey. Geotechnical analyses were provided by Testwell Laboratories, Inc., located in Ossining, New York. Field in-place density testing (IPD) was performed by Testwell and later by Certified Testing Laboratories, Inc of the Bronx, New York. Nutrient analyses were provided by A&L Eastern Agricultural Laboratories located in Richmond, Virginia. Periodic quality control was performed by the contractor in accordance with Table 12-3 below.

Table 12-3
Quality Control – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 2,500 yd^3
pH	See Note 1 Below	One test every 2,500 yd^3
Organic Content	See Note 1 Below	One test every 2,500 yd^3
Soluble salts	See Note 1 Below	One test every 2,500 yd^3
Macro/Micro Nutrients	See Note 1 Below	One test every 2,500 yd^3
Nitrogen (inorganic and TKN)	NEC-67(see 2 below)	One test every 2,500 yd^3
Acid Producing Soil (iron sulfide)	Rutgers University Soils Lab	One test every 2,500 yd^3
Chemical Analysis (TAL metals & TCL organics)	USEPA SW-846	One test every 3,000 yd^3 See note 1
Field Density (IPD)	ASTMD-2922	100 ft grid
Thickness check	Manual / Visual	50 ft grid

NOTE:

1. Actual chemical testing frequency was every 2,500 cy to conform to the same frequency of testing as all other tests and allow a pile size of 2,500 cy.
2. Field (bulk) density (IPD) and layer thickness were always corrected to meet spec for every case where testing showed an out of spec condition.

All original field test data sheets are in Appendix I.

All QA laboratory and field testing was performed by the approved independent chemical laboratory and geotechnical laboratory, employed by URS. Chemical analyses were provided by Veritech Laboratory, a division of Hampton-Clarke, Inc., located in Fairfield, New Jersey. Geotechnical analysis was performed by URS Soil Testing Laboratory in Totowa, NJ.

QA testing was performed in accordance with Table 12-4 below, periodic quality assurance. (QA) inspection and testing was performed by URS to verify the QC testing.

Table 12-4
Quality Assurance – Field and Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One test every 2,500 yd^3
pH	See Note 1 Below	One test every 2,500 yd^3
Organic Content	See Note 1 Below	One test every 2,500 yd^3
Soluble Salts	See Note 1 Below	One test every 2,500 yd^3
Macro/Micro Nutrients	See Note 1 Below	One test every 2,500 yd^3
Nitrogen (inorganic and TKN)	NEC-67(see 2 below)	One test every 2,500 yd^3
Acid Producing Soil (iron sulfide)	Rutgers University Soils Lab	One test every 2,500 yd^3
Chemical Analysis (TAL metals & TCL organics)	USEPA SW-846	One test every 60,000 yd^3

NOTE: The pH of soils, organic content, Macro and Micro Nutrients, and soluble salts were tested in accordance with the Soil Testing Procedure for the Northeastern United States, 2nd Edition, Northeastern Regional Publication, Agricultural Experiment Station, University of Delaware, Bulletin # 493, 12/95.

In addition, QA Geotechnical Inspectors visually and periodically inspected the material delivered to the site to ensure consistency. If changes in the material occurred, the QA Site Manager rejected any work performed by MCC using the new material until the pre-construction QA and QC procedures were executed and approved by the QA Site Manager

Refer to Table 12-5 and 12-6 for summary test results.

Table 12-5
* Topsoil Agricultural Specifications and Test Results

Property	Criteria	Range of Results (EME)		Range of Results (TFC)		Range of Results (LIC)	
		Min	Max	Min	Max	Min	Max
Organic Content	2.5%-5%	2.0	5.70	1.60	4.20	2.40	2.90
Gravel Content	≤ 8%	0.00	13.30	1.70	15.00	9.70	16.20
Sand Content	60% - 80%	67.80	87.80	66.10	84.00	61.20	65.90
Sand Sieve Analysis							
Very Coarse (%)	N/A	2.40	11.60	1.10	11.50	10.10	11.10
Coarse (%)	N/A	8.45	27.80	2.60	20.10	19.70	23.40
% medium or larger	N/A	7.00	54.00	7.70	58.20	35.40	38.00
Fine (%)	N/A	12.76	64.30	7.30	60.30	21.00	24.20
Very Fine (%)	N/A	1.90	22.80	2.30	81.30	8.50	9.80
Silt Content	10% - 20%	1.90	14.00	2.00	16.50	10.20	12.60
Clay Content	10% - 20%	3.90	19.20	0.00	19.60	9.50	11.70
USDA Classification							
Max Grain Size	≤ 1.5´´	0.19	1.25	0.18	1.38	0.50	0.60
pH	5 - 7	4.50	6.80	5.10	6.60	6.20	6.50
Acid Producing Soil Test	pH > 4.5	4.50	7.00	4.65	6.70	5.50	6.00
Soluble Salts	0 - 0.4 mmhos/cm	0.10	0.50	0.10	0.30	0.10	0.20
Nitrogen Total (TKN)	0.06%-0.15%	0.01	0.15	0.01	3.00	0.10	0.10
Nitrate Content	≤12 ppm	1.00	12.00	0.06	29.00	1.00	7.00
Macronutrients							
Phosphorus (P)	20 - 80 lb/acre	18.00	166.00	34.00	134.00	130.00	150.00
Potassium (K)	70 - 225 lb/acre	64.00	324.00	120.00	474.00	192.00	204.00
Magnesium (Mg)	200 - 300 lb/acre	80.00	460.00	140.00	334.00	180.00	190.00
Calcium (Ca)	400 - 2000 lb/acre	420.00	2,460	500.00	1,880	880.00	1,080
Total (Mg+K+Ca)	≤2500 lb/acre	0.00	2,898	838.00	2,484	1,252	1,464
Micronutrients							
Zinc (Zn)	1 ppm - 12 ppm	0.90	9.10	2.30	10.00	3.70	4.40
Copper (Cu)	0.1 ppm - 4 ppm	0.10	5.90	0.50	2.20	1.20	1.30
Manganese (Mn)	2 ppm - 25 ppm	3.00	30.00	8.00	35.00	65.00	92.00
Boron (B)	0.8 ppm - 3 ppm	0.10	2.50	0.20	2.40	0.20	0.30

* All variances where reviewed and accepted by the site restoration ecologist and NYCDEP.

Table 12-6a
Topsoil Chemical Test Results Summary
Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results (EME)		Range of Results (TFC)		Range of Results (LIC)	
		Min	Max	Min	Max	Min	Max
Total VOCs	10.0 mg/kg	0.0014	0.5347	0.001	0.11	0.016	0.025
Acetone	0.2 mg/kg	0.0042	0.49	0.0058	0.11	0.011	0.019
Benzene	0.06 mg/kg	ND	ND	0.00078	0.00078	ND	ND
Bromodichloromethane	*	ND	ND	ND	ND	ND	ND
Bromoform	*	ND	ND	ND	ND	ND	ND
Bromomethane	*	ND	ND	ND	ND	ND	ND
2-Butanone	0.3 mg/kg	0.0044	0.059	0.0034	0.0056	ND	ND
Carbon Disulfide	2.7 mg/kg	0.0014	0.0032	ND	ND	ND	ND
Carbon Tetrachloride	0.6 mg/kg	0.0096	0.0096	ND	ND	ND	ND
Chlorobenzene	1.7 mg/kg	ND	ND	ND	ND	ND	ND
Chloroethane	1.9 mg/kg	ND	ND	ND	ND	ND	ND
Chloroform	0.3 mg/kg	0.0013	0.011	ND	ND	ND	ND
Chloromethane	*	ND	ND	ND	ND	ND	ND
Cis-1,3-Dichloropropene	*	ND	ND	ND	ND	ND	ND
Dibromochloromethane	*	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	0.2 mg/kg	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	0.1 mg/kg	ND	ND	ND	ND	ND	ND
1,1-Dichloroethene	0.4 mg/kg	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene (total)	*	ND	ND	ND	ND	ND	ND
1,2-Dichloropropane	*	0.032	0.032	ND	ND	ND	ND
1,3-Dichloropropene (trans)	*	ND	ND	ND	ND	ND	ND
Ethylbenzene	5.5 mg/kg	0.00075	0.0017	0.0015	0.0015	ND	ND
2-Hexanone	*	0.0049	0.0054	0.0013	0.0013	ND	ND
Methylene Chloride	0.1 mg/kg	0.0013	0.044	0.0022	0.019	ND	ND
4-Methyl-2-Pentanone	1.0 mg/kg	0.0024	0.0024	ND	ND	ND	ND
Styrene	*	ND	ND	ND	ND	ND	ND
Tetrachloroethene	1.4 mg/kg	0.0012	0.0088	ND	ND	ND	ND
1,1,1-Trichloroethane	0.8 mg/kg	ND	ND	ND	ND	ND	ND
1,1,2-Trichloroethane	*	ND	ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane	0.6 mg/kg	ND	ND	ND	ND	ND	ND
Toluene	1.5 mg/kg	0.00062	0.035	0.0011	0.013	ND	ND
Trichloroethene	0.7 mg/kg	ND	ND	ND	ND	ND	ND
Vinyl Chloride	0.2 mg/kg	ND	ND	ND	ND	ND	ND
Xylenes (total)	1.2 mg/kg	0.0012	0.011	0.001	0.0045	ND	ND

* Contaminants with an"*" do not have individual limits in the NYSDEC's TAGM 4046. The total of all TCL volatile organic compounds, however, shall not exceed the maximum allowable concentration listed above as Total VOCs.

Table 12-6b
Topsoil Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results (EME)		Range of Results (TFC)		Range of Results (LIC)	
		Min	Max	Mix	Max	Min	Max
Total SVOCs	500 mg/kg	0.013	8.859	0.042	2.39	0.094	0.11
Total CPAHs	10.0 mg/kg	0.043	4.33	0.041	1.21	0.094	0.11
Acenaphthene	50.0 mg/kg	0.096	0.096	ND	ND	ND	ND
Acenaphthylene	41.0 mg/kg	ND	ND	ND	ND	ND	ND
Anthracene	50.0 mg/kg	0.063	0.23	0.076	0.21	ND	ND
Benzo(g,h,I)perylene	50.0 mg/kg	0.09	0.22	0.2	0.2	ND	ND
bis(2-ethylexyl)phthalate	50.0 mg/kg	0.013	0.76	0.042	0.35	ND	ND
bis-(2-Chloroethyl)ether	0.58 mg/kg	ND	ND	ND	ND	ND	ND
bis-(2-Chloroethoxy)methane	50.0 mg/kg	0.11	0.11	ND	ND	ND	ND
4-Bromophenylphenylether	50.0 mg/kg	ND	ND	ND	ND	ND	ND
Butylbenzylphthalate	50.0 mg/kg	ND	ND	0.064	0.064	ND	ND
Carbazole	32.0 mg/kg	0.1	0.1	ND	ND	ND	ND
4-Chloroaniline	0.220 or MDL	ND	ND	ND	ND	ND	ND
4-Chloro-3-methylphenol	0.240 or MDL	ND	ND	ND	ND	ND	ND
2-Chlorophenol	0.8 mg/kg	ND	ND	ND	ND	ND	ND
4 Chlorophenylphenylether	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2 Chloronapthalene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2,4-Dinitrotoluene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
Dibenzofuran	6.2 mg/kg	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
1,3-Dichlorobenzene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
1,4-Dichlorobenzene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine	1.4 mg/kg	ND	ND	ND	ND	ND	ND
2,4-Dichlorophenol	0.4 mg/kg	ND	ND	ND	ND	ND	ND
4,6 Dinitro-2-methylphenol	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2,4-Dimethylphenol	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2,4-Dinitrophenol	0.200 or MDL	ND	ND	ND	ND	ND	ND
2,6-Dinitrotoluene	1.0 mg/kg	ND	ND	ND	ND	ND	ND
Diethylphthalate	7.1 mg/kg	0.067	0.28	0.068	0.46	ND	ND
Dimethylphthalate	2.0 mg/kg	ND	ND	ND	ND	ND	ND
Di-n-butylphthalate	8.1 mg/kg	ND	ND	0.064	0.18	ND	ND
Di-n-octyphthalate	50.0 mg/kg	ND	ND	ND	ND	ND	ND
Fluoranthene	50.0 mg/kg	0.056	1.6	0.057	0.32	ND	ND
Fluorene	50.0 mg/kg	0.089	0.089	ND	ND	ND	ND
Hexachlorobenzene	0.41 mg/kg	ND	ND	ND	ND	ND	ND

Table 12-6b(continued-page 2)
Topsoil Chemical Test Results Summary
Semi-Volatile Organic Compounds

Contaminant	Soil Use Criteria	Range of Results (EME)		Range of Results (TFC)		Range of Results (LIC)	
		Min	Max	Min	Max	Min	Max
Hexachlorobutadiene	8.2 mg/kg	ND	ND	ND	ND	ND	ND
Hexachloroethane	46.0 mg/kg	ND	ND	ND	ND	ND	ND
Hexachlorocycpentadiene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
Isophorone	4.4 mg/kg	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	36.4 mg/kg	ND	ND	ND	ND	ND	ND
2-Methylphenol	0.100 or MDL	ND	ND	ND	ND	ND	ND
4-Methylphenol	0.9 mg/kg	0.067	0.3	ND	ND	ND	ND
Naphthalene	13.0 mg/kg	ND	ND	ND	ND	ND	ND
Nitrobenzene	0.200 or MDL	ND	ND	ND	ND	ND	ND
2-Nitroaniline	0.430 or MDL	ND	ND	ND	ND	ND	ND
4 Nitroaniline	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2-Nitrophenol	0.330 or MDL	ND	ND	ND	ND	ND	ND
4-Nitrophenol	0.100 or MDL	ND	ND	ND	ND	ND	ND
3-Nitroaniline	0.500 or MDL	ND	ND	ND	ND	ND	ND
N-Nitroso-di-n-propylamine	0.091 mg/kg	ND	ND	ND	ND	ND	ND
N-Nitrosodiphenylamine	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2,2'-oxybis(1-Chloropropane)	50.0 mg/kg	ND	ND	ND	ND	ND	ND
Pentachlorophenol	1.0 or MDL	ND	ND	ND	ND	ND	ND
Phenanthrene	50.0 mg/kg	0.22	0.65	0.057	0.26	ND	ND
Phenol	0.03 or MDL	ND	ND	ND	ND	ND	ND
Pyrene	50.0 mg/kg	0.059	1.5	0.048	0.32	ND	ND
1,2,4-Trichlorobenzene	50.0 mg/kg	ND	ND	ND	ND	ND	ND
2,4,5-Trichlorophenol	0.1 mg/kg	ND	ND	ND	ND	ND	ND
2,4,6-Trichlorophenol	50.0 mg/kg	ND	ND	ND	ND	ND	ND

Table 12-6c
Topsoil Chemical Test Results Summary
Pesticides and PCB's

Contaminant	Soil Use Criteria	Range of Results (EME)		Range of Results (TFC)		Range of Results (LIC)	
		Min	Max	Min	Max	Min	Max
Total Pesticides	10 ppm	0.0017	0.0075	0.0019	0.109	ND	ND
Aldrin	0.041 mg/kg	ND	ND	ND	ND	ND	ND
alpha-BHC	0.11 mg/kg	ND	ND	ND	ND	ND	ND
Endrine aldehyde	*	ND	ND	ND	ND	ND	ND
Alpha-chlordane	*	0.0021	0.0021	0.0019	0.063	ND	ND
beta-BHC	0.2 mg/kg	ND	ND	ND	ND	ND	ND
delta-BHC	0.3 mg/kg	ND	ND	ND	ND	ND	ND
4,4'-DDD	2.9 mg/kg	ND	ND	0.0015	0.0015	ND	ND
4,4'-DDE	2.1 mg/kg	ND	ND	ND	ND	ND	ND
4,4'-DDT	2.1 mg/kg	0.0017	0.0075	0.0067	0.0067	ND	ND
Dieldrin	0.044 mg/kg	ND	ND	ND	ND	ND	ND
Endosulfan I	0.9 mg/kg	ND	ND	ND	ND	ND	ND
Endosulfan II	0.9 mg/kg	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	1.0 mg/kg	ND	ND	ND	ND	ND	ND
Endrin	0.10 mg.kg	ND	ND	ND	ND	ND	ND
Endrin ketone	N/A	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	0.06 mg/kg	ND	ND	ND	ND	ND	ND
gamma-chlordane	0.54 mg/kg	ND	ND	0.0012	0.046	ND	ND
Heptachlor	0.10 mg/kg	ND	ND	ND	ND	ND	ND
Heptachlor epoxide	0.02 mg/kg	ND	ND	ND	ND	ND	ND
Methoxychlor	*	ND	ND	ND	ND	ND	ND
Total PCBs	1.0 mg/kg	0.02	0.038	0.024	0.024	ND	ND
Toxaphene	*	ND	ND	ND	ND	ND	ND

* Contaminants marked with an "*" do not have individual limits in NYSDEC's TAGM 4046; however, the total pesticides and PCB concentrations shell be less than the maximum allowable concentrations listed above as Total Pesticides and Total PCB's, respectively.

Table 12-6d
Topsoil Chemical Test Results Summary
Heavy Metals, Asbestos and Conventionals

Contaminant	Soil Use Criteria	Range of Results (EME)		Range of Results (TFC)		Range of Results (LIC)	
		Min	Max	Min	Max	Min	Max
Aluminum	33000 mg/kg	0.0208	8670	877	8180	4670	7210
Antimony	10 mg/kg	0.0286	4.9	0.27	4.9	ND	ND
Arsenic	10 mg/kg	0.39	6.9	0.62	7.71	2.37	4.16
Barium	300 mg/kg	0.0036	103	6.96	55.6	23.6	35.4
Beryllium	1 mg/kg	0	0.451	0.04	0.474	0.292	0.424
Cadmium	5 mg/kg	0	0.98	0.04	1.8	0.058	0.114
Chromium	160 mg/kg	0.0072	24.8	0.44	23	7.67	10.1
Cobalt	60 mg/kg	0	3	0.152	6.5	2.94	4.16
Copper	115 mg/kg	1.23	12.6	1.05	16.1	6.6	9.3
Cyanide	4 mg/kg	0	0.804	ND	ND	ND	ND
Iron	30000 mg/kg	1,000	20,900	77	20700	6,250	8,630
Lead	400 mg/kg	0	21	3.5	50.5	8.3	14.4
Manganese	1300 mg/kg	10.1	91.8	10.2	321	119	194
Mercury	0.6 mg/kg	0.005	0.16	0.005	0.26	0.023	0.037
Nickel	75 mg/kg	0.167	15.54	0.33	20.1	5.02	6.79
Selenium	2 mg/kg	0	1.8	0.08	1.94	ND	ND
Silver	200 mg/kg	0	3.88	0.138	48.7	ND	ND
Thallium	20 mg/kg	0	16.2	0.598	1.8	1.09	1.09
Vanadium	150 mg/kg	5.64	54.2	1.4	27	11.1	15.8
Zinc	100 mg/kg	1.5	46	3.2	38.8	19.6	25.7
Asbestos Fiber Content	1% (by weight)	ND	ND	ND	ND	ND	ND
pH	5.5-7.5	ND	ND	ND	ND	ND	ND
Sulfides	50000 mg/kg	0.0032	30	2.31	34.34	6.11	9.4
Ammonia	40 mg/kg	0.0208	8670	877	8180	4670	7210

Refer to Appendix I for all geotechnical, chemical and field test results.

Photographs of the topsoil installation are included in Appendix K.

12.4 Seeding

Seed mixture and application rates conformed to the "Seed Mixture" Table of Section D-30.1 of the Contract Specifications. MCC submitted a certificate attesting that the seed mixture was composed of the specified varieties and proportions in the Detailed Specifications.

Refer to Appendix I for a copy of the seed mixture certificate of compliance.

Seed mixed prior to delivery was approved on the basis of a certification by the vendor stating the minimum percentage of germination and variety of each kind of seed, and the quantity of each kind of seed in the mixture. This was redone annually for each crop of seed.

Areas to be seeded were scarified sufficiently to break up the surface crust immediately before seeding except where the ground was loose and subject to rolling or sliding. Rocks, debris and all other objects were removed.

Seed was mechanically placed by a Trillion drill seeder. Calibration of the Trillion drill seeder was completed for each seeding application onsite in accordance with the manufacturer's recommendations. When the Trillion drill seeder was used, the seed was not to be planted any deeper than one-quarter of an inch. The seed was applied prior to and in a separate operation from mulching or placement of erosion control mats. Any un-growing areas observed after growth of the grass were re-seeded.

Organic biofertilizer was applied to the areas of seeding. Biofertilizer for warm-season grasses and wildflowers was provided at a minimum of 175 pounds per acre of Plant Health Care's "Healthy Start" (3-4-3) in accordance with the Contract Specifications.

All seeding areas were mulched or covered with erosion control mats. Areas requiring mulch received one and one-half (1.5) tons of straw mulch per acre, machine or hand spread evenly and uniformly over the entire surface of the area to be covered. Mulching was completed within two (2) days after seeding.

Photographs of the seeding installation are included in Appendix K.

12.5 Erosion Control Fabric/Mulching

Subsequent to the seeding installation, all seeded areas on the landfill received either one of two types of erosion control fabric or straw mulch in accordance with the approved plans and technical specifications. In general, landfill slopes greater than 5% slope received Type I erosion control fabric. Type I erosion control fabric was Curlex I as manufactured by American Excelsior Company. On landfill slopes less than 5%, straw mulch was installed after seeding operations.

The straw mulch supplied was wood cellulose fiber mulch as supplied by DeSante Bros, Inc. In drainage swales, Type III erosion control fabric was installed in accordance with the approved plans and specifications. Type III erosion control fabric was NAG P550 as manufactured by North American Green.

Photographs of the erosion control fabric and straw mulch installation are included in Appendix K

13.0 COARSE AGGREGATE AND RIPRAP

The coarse aggregate and riprap was placed on approved locations for proper flow lines of swales and along the perimeter of the landfill for several purposes including riprap channel protection and riprap outlet protection.

13.1 Material Source – Coarse Aggregate and Riprap

The material used for the coarse aggregate and riprap was environmentally clean stone and was in general conformance with the Contract Specifications. The coarse aggregate and riprap used on the project was tested and approved per the QA/QC requirements of the Specifications prior to being imported for use at the Fountain Avenue Landfill.

The 3,545.89 cy of coarse aggregate and 826.29 cy riprap was imported from a borrow site, Clinton Point Quarry, located in Clinton Point, New York.

Table 13-1 shows the source requirements for coarse aggregate and 13-2 shows the requirement for riprap.

Table 13-1
Source: Coarse aggregate - Laboratory Minimum Testing Requirements

Property	Test Method	Frequency
Particle-Size Analysis with Hydrometer	ASTM D-422	One per source
Aggregate Size Analysis	ASTM D-448	One per source
Permeability	ASTM D-2434	One per source
Index Density	ASTM D-4253	One per source

Table 13-2
Source: Riprap - Laboratory Minimum Testing Requirements

Property	Test Method	Requirement
Specific Gravity	COE C.D.-C-107	Dry unit weight 165lbs/cu ft or greater
Absorption	COE C.D.-C-107	Less than 1 percent
Soundness	COE C.D.-C-137	Less than 5 percent loss
Freezing and Thawing	COE C.D.-C-144	Less than 12 percent loss in 12 cycles
Abrasion Analysis	COE C.D.-C-145	Less than 20 percent loss for 500 revolutions
Wetting and Drying	Spec D-12.1 part 2.2 B.3	No major progressive cracking
Expansive Breakdown	COE C.D-C-148	No deterioration except minor crumbs from surface
Drop Test	Spec D-12.1 Part 2.2 B.4	No breakage or cracking

For NYSDOTSS items, certifications were submitted instead of actual laboratory test results which attest that the item meets all NYSDOTSS requirements for that item.

QA Geotechnical Inspectors visually and periodically inspected the material delivered to the site to ensure consistency. If changes in the material occurred, the QA Site Manager rejected any work performed by Modern Continental using the new material until the pre-construction QA and QC procedures were executed and approved by the QA Site Manager.

NYCDEP and URS inspected the borrow site prior to general acceptance and procurement. All coarse aggregate and riprap material was delivered to the Fountain Avenue Landfill pier via barge transportation.

13.2 Installation – Coarse Aggregate and Riprap

Special care was used by Modern Continental in the placement of the coarse aggregate and riprap at the approved locations on the landfill. Coarse aggregate consisted of Type 1 and Type 2 Stone, as classified by the New York State Department of Transportation Standard Specifications (NYSDOTSS), which was comprised of clean graded stone used for roadway subbase, box culverts and pipe bedding underneath roadways. Riprap, with diameters of six (6), nine (9) and twelve (12) inches, was used for channel and outlet protection such as gabions and reno mattresses.

The coarse aggregate and riprap was stockpiled and then loaded with equipment such as excavators and payloaders into articulated trucks for transport and placement onto various approved locations.

13.3 Quality Assurance/Quality Control During Installation

Quality assurance and quality control during construction of the coarse aggregate and riprap consisted of full-time observation in addition to field-testing. URS visually and continuously inspected the material delivered to the site to ensure consistency.

All field testing was performed by the Contractor, Modern Continental, and in accordance with Table 13-3, periodic quality control (QC) inspection and testing was performed as follows:

Table 13-3
Quality Control – Frequency Testing Requirements for Coarse Aggregate

Property	Test Method	Frequency
Particle-Size Analysis	ASTM D-422 (latest revision)	One test every 5,000 yd^3 of material in place; or one test every source for material with NYSDOTSS certification
Maximum Index Density	ASTM D-4253	One test every 15,000 yd^3 of material in place for roadway stone only

Table 13-4
Quality Assurance – Frequency Testing Requirements for Coarse Aggregate

Property	Test Method	Frequency
Particle-Size Analysis	ASTM D-422 (latest revision)	One test per source
Maximum Index Density	ASTM D-4253	One test per source

There was no test frequency for riprap required during construction. As the construction progressed, Modern Continental conducted only the required testing for acceptance of a new source for riprap or if the material changed and did not conform to the Specifications.

Refer to Appendix C for the field tests on Coarse Aggregate and Riprap.

Photographs of the aggregate and riprap installation are included in Appendix K

14.0 LANDFILL MECHANICAL SYSTEMS

14.1 Electrical Installation: Con Edison Power Source

Power source is coming from existing pole P-25 located at the entrance to Fountain Ave Landfill. There are existing poles onsite that supply power to the lights within the parking lot areas of the trailers, garage and salt pile. Power to run the trailers and Flare station come from underground utilities.

Three (3) 15KV cables from pole P-25 run through an electrical manhole (MH-1), located near the entrance to Fountain Ave Landfill, to a Con Edison supplied transformer (T-1) located near the DEP trailer. There are two (2) 5" diameter PVC conduits incased in concrete 2'-6' below grade. One conduit is the active conduit with the three (3) #2 15KV cable and the other conduit is for the #2 bare ground. Transformer, T-1, steps down the high voltage and supplies power to power center No. 1.

From the power center #1, PC-1, three (3) #6 lines run into pole P-26, located near the entrance to the landfill, which is used to power the overhead lights in front of the DEP trailer, contractor trailers, contractor garage and the salt pile. Power lines run thru underground conduits run from PC-1 to the old DEP trailer, security trailer, contractor trailer, DEP/URS trailer and garage.

Electrical manhole #1 is the transition manhole for splices. G-4 spliced into MH #1 to power PC-2 at the Flare Station. From MH #1 is a high voltage cable running approximately 4300 ft from the entrance to the landfill in the North to the Con ED transformer T2 located at the Flare Station on the South area of the landfill along Jamaica Bay. In the same trench (direct burial) 24" apart and 3' below grade are also the telephone lines. Transformer T-2 steps down the high voltage and supplies power to power center No. 2. Power center #2 in turn supplies power to the Flare Station.

Con Edison has performed the High Potential Proof Testing (Hi-Pot test) on the power lines

Refer to Appendix J for results of Hi-POT tests.

14.2 Communications

From the existing telephone pole outside the main gate, the telephone service, a 25 pair CLX cable, feeds into the Telephone manhole TMH-1 which then feeds into the telephone punch down station (PD-1). PD-1 services telephone lines to the security trailer, old DEP trailer, contractor trailers and DEP/URS trailers. Two 3" steel conduits run from TMH-1 to PD-1. All other conduits leading from PD-1 to other stations are PVC concrete encased. PD-1 also feeds PD-2 at the Flare Station. The telephone line from PD-1 to PD-2 is a direct burial, CLX 25 pair cable that runs parallel to the high voltage cable about 24" apart and at 3' below grade.

14.3 Water Main

The water main that services the Fountain Ave Landfill starts at the fire hydrant located outside the landfill on the corner of Seaview and Fountain Aves. The water line, from the fire hydrant at Seaview, proceeds across the street to the guard railing adjacent to Spring Creek. It follows this guard railing into Fountain Ave landfill to the next fire hydrant located along Spring Creek and across from the DEP/URS trailer.

From there, it leads to two areas. The first is the backflow preventor on the west side of the DEP/URS trailer which then feeds into the DEP/URS trailer, the contractor's garage and the contractor's trailer. The second line from the 2nd fire hydrant leads to the Flare Station located at the Southern area of the landfill adjacent to Jamaica Bay. It runs for around 4000 ft along adjacent to Spring Creek to the two fire hydrants located net to the Flare Station.

15.0 LANDFILL GAS BLOWER AND FLARE SYSTEM

An integral part of the Remediation of the Fountain Avenue Landfill was the construction of the Landfill Gas Extraction Wells and Landfill Blower and Flare system. The purpose of this section is to describe the construction and inspection of these items.

15.1 Monitoring Well Abandonment

Prior to installation of the new LFG extraction wells, the Contractor abandoned 31 existing monitoring wells in accordance with the plans and technical specifications. Prior to commencing work, the Contractor submitted for approval the personnel, equipment and methods for abandonment. For this portion of the work, the Contractor used Moretrench as a subcontractor to perform the well abandonment. Generally, abandonment consisted of overboring or removal of the casing followed by the perforation of any casing left in place. The wells were then sealed by injection of cement bentonite grout injected through a tremie pipe at the bottom of the well. Sealing was accomplished from the bottom of the well to within 5' below the existing ground surface. All cuttings and debris were disposed of on site within the limits of geomembrane in accordance with the contract requirements and covered with daily cover to prevent migration of contaminated material.

A log of the wells abandoned for this project is included in Appendix J.

Photographs of the monitoring well abandonment are included in Appendix K.

15.2 Installation of LFG Extraction Wells and Vaults

The contractor installed 251 LFG extraction wells within the landfill cap. The 3' diameter LFG extraction wells were generally installed at the locations and to the depths indicated on the plans and specifications except as otherwise noted. Boreholes were drilled to the depths indicated using dry drilling equipment. A 4" PVC pipe was installed which was surrounded by clean ¾" stone. Slight changes in the depths and locations of the wells were made to accommodate existing site conditions or conflicts and did not materially affect the design intent.

Boring logs for completed LFG extraction wells are included in Appendix J.

Photographs of the installation of LFG extraction wells are included in Appendix K.

15.3 Installation of Gas Collection Piping and Header System

The LFG collection piping and header system was installed in general conformance to the plans and specifications using high density polyethylene (HDPE) piping, fittings and appurtenances. The contractor installed 39,653 LF of 6" gas collection piping, 13,623 LF of 8" gas collection piping and 21,518 LF of 12" gas collection piping. Field joining of adjacent

sections was accomplished by the butt-fusion process by qualified, experienced personnel. All sections of completed pipe were air tested for leaks with pressurized air at 5 psig for a minimum of 15 minutes.

Manufacturer's certificates showing that the pipe used was in conformance to the project specifications are included in Appendix J

Pressure testing results for the gas collection piping and header system are included in Appendix J.

Photographs of the installation of the gas collection and header system are included in Appendix K.

15.4 Installation of LFG Blower and Flare

The LFG Blower and Flare system and appurtenances were installed in accordance with the plans and specifications. The manufacturer of the blower and flare system was Perennial Energy, West Plains, MO. The system includes the following:

- connections to the gas collection headers;
- a 8,000 gallon condensate storage tank and associated piping;
- a nitrogen bottle and appurtenances for the operation of the motorized valve**;**
- triple knock out pots and appurtenances;
- triple 2,500 CFM landfill gas blowers and appurtenances;
- a stainless steel header system between the blower and the flare
- a 12' diameter, 50' high A-36 steel flare stack and appurtenances
- a flare control panel, rack and supports to include connections to the power supply
- a flame arrestor, gas analysis cabinet**,** two ultra violet flame detectors**,** two combustible gas indicators and appurtenances; and
- a FDNY fire alarm panel with two manual pull stations linked to a central station monitoring unit for fire alarm notification.

The LFG blower and flare system was designed and constructed to operate for anticipated flow rates from 3,370 to 5,100 SCFM with each blower rated at 2,500 CFM at 40" vacuum. The system currently operates from between 30-65% of the maximum anticipated flow rate in accordance with NYC FDNY fire code.

After a successful Phase II operational period, the Flare was operated by Modern Continental for a period of 1 year to July 30th 2009. During that period, 2 Flare Stack Tests were performed. All test results were below the required limits of the Title 5 permit.

Flare Stack Test results are included in Appendix J.

Photographs of the installation of the LFG Blower and Flare System are included in Appendix K.

16.0 CONSTRUCTION PHOTOGRAPHS: G4/G1

CONTRACT LF-FAL-G4: Photographs of construction progress were taken throughout the duration of the work. Key elements where included in this list Final Cover Placement, Flare Construction, Pier Construction (G1/G4). Table 16.1 provides a description of each photograph.

Table 16.1
Construction Photography Log

PHOTO NO.	VIEW	DESCRIPTION
1	West	Site Grading August 2002
2	North	Trash Relocation during Site Re-grading
3	North	MCC Installing LFG Extraction Wells
4	East	MCC Off Loading Revetment Stone
5	East	MCC stockpiling Revetment Stone
6	South	Placement of Type 1 & 2 Grading Fill
7	North	Placement of Type 2 Grading Fill
8	East	Hand Finishing Type 2 Grading Fill
9	West	LFG Wells and Well boots on Type 2 Grading Fill
10	North	Placement of Liner over Type 2 Grading Fill
11	West	Placement of Textured Liner over Type 2 Grading Fill
12	North	Placement of Textured Liner in Wetlands over Type 2 Grading Fill
13	South	Anchor Trench for Liner
14	North	Installation of Geotextile over Liner
15	North	Installation of Geocomposite over Liner
16	East	Placing and Grading BPL
17	South	MCC completing an Energy Dissipation Structure
18	North	Installation of a Pipe Downchute
19	North	Grading of Topsoil
20	West	Grading of Topsoil
21	North	Stockpiling Wetlands Sand
22	West	MCC Placing Wetlands sand
23	East	Placement of Toe Drain at Wetlands
24	South	Installation of Type 1 Erosion Control Fabric
25	East	Installation of Type 1 Erosion Control Fabric and Silt Fence
26	East	MCC Seeding Stockpile Area With Traux Trillion Seeder
27	West	MCC preparing area for Seeding
		FLARE CONSTRUCTION AT FOUNTAIN AVE LANDFILL
28	West	Sheeting and Dewatering for Condensate Tank
29	West	Sheeting and Sub grade for Condensate Tank
30	East	Condensate Tank off loading
31	West	Condensate Tank Installed
32	West	Setting Flare Stack
33	West	144"X50' High Flare Stack
34	North	Completed Flare System

PHOTO NO.	VIEW	DESCRIPTION
		MECHCANICAL AND ELECTRICAL WORK
35	North	Electrical Power System Installation
36	East	Installation of Backflow Preventor
37	East	Installing Concrete Vault over Backflow Preventor
38	East	Installing 12" Water Main in Fountain Ave
39	East	Back filling and Compacting Fountain Ave Water main
40	North	Paving over 12 " Water main on Site
41	East	Completed Hydrant and Vaults off of Water Main

CONTRACT LF-FAL-G1 PIER: Photographs of construction progress were taken throughout the duration of the work. Included are Photos of the work WMS completed before being Defaulted and the work completed by MCC to make the pier operational. Table 16.2 provides a description of each photograph.

Table 16.2
Construction Photography Log

PHOTO NO.	VIEW	DESCRIPTION
		LF-FAL G1 Pier Construction
1	East	Pile Driving for Pier 2001
2	East	Pile Driving Sheeting at Pier
3	East	Installing Concrete Decking
4	East	Installing Concrete Decking
5	East	Installing Concrete Decking
		LF-FAL G4 Pier Construction
6	South	Retention Sheeting and Revetment Stone
7	South	Retention Sheeting
8	West	Completed Pier MCC Off-Loading Soil
9	East	Removal of Last Dolphins on site Temp Pier Removed

17.0 DESIGN MODIFICATIONS: G4/G1

17.1 Design Modifications: G4

The Remediation of the Fountain Avenue Landfill was constructed in general conformance with the NYSDEC approved Plans and Specifications. However, variations from the design were made with coordination of NYSDEC, NYCDEP and Modern Continental. Executed Contract Change Orders document these changes as follows:

CHANGE ORDER # 1	Credit for Modification of Site Security	($73,927.56)
CHANGE ORDER # 2	Temporary Off Loading Facility	$2,434,099.00
CHANGE ORDER # 3	Design Addition to Landfill Gas Blower and Flare System	
	ITEM #1: Install Water Line	$864,000.00
	ITEM #2: Additional Flare Instrumentation	$89,541.00
	ITEM #3: Credit for Substitution of Concrete Vaults with HDPE Vaults	($49,104.00)
CHANGE ORDER # 4	Miscellaneous G1 Tasks	$68,798.60
CHANGE ORDER # 5	Grading Fill (3A-1 & 3A-2) Quantity Increase	$8,977,056.84
CHANGE ORDER # 6	Salt Pile Relocation	$92,720.00
CHANGE ORDER # 7	Excavation outside the Limits of Final Cover	$462,557.37
CHANGE ORDER # 8	Hazardous Air Monitoring	$0.00
CHANGE ORDER # 9	Erskine Street Pumping	$233,792.36
CHANGE ORDER #10	Field Condition Revision to Electrical Services	$257,400.00
CHANGE ORDER #11	EQBA	$0.00

CHANGE ORDER #12	BPL and Topsoil Quantity Increase	
	ITEM #1: BPL delivered in barge	$1,840,939.30
	ITEM #2: Topsoil delivered in barge	$2,651,000.00
CHANGE ORDER #13	Riprap, Reno Mats, and Erosion Control Fabric Quantity Increase	
	ITEM #1: 6" Riprap	$1,415,392.46
	ITEM #2: Reno Mattresses	$373,537.80
	ITEM #3: Type 1 Erosion Control Fabric	$774,333.99
CHANGE ORDER #14	Roadway Paving Stone Quantity Increase	$136,383.03
CHANGE ORDER #15	Temporary Erosion Control	$866,359.20
CHANGE ORDER #16	Installation of Perimeter Gas Monitoring Wells	$48,538.84
CHANGE ORDER #17	Installation of Pier Security Fence	$30,040.40
CHANGE ORDER #18	Wetlands Soil	$1,235,437.64

17.2 Design Modifications: G1

The contract "The Construction of the Fountain Ave Landfill Pier" was constructed in general conformance with the NYSDEC approved Plans and Specifications. However, variations from the design were made with coordination of NYSDEC, NYCDEP and WMS Construction. Executed Contract Change Orders document these changes as follows:

CHANGE ORDER # 1	Installation of 10,000 gal Pre-cast Septic Tank	$0.00
CHANGE ORDER # 2	Credit for Modification of Site Security	($40,208.40)
CHANGE ORDER # 3	Credit due Owner to perform Static Load Test @ Bent 18	($57,260.00)
CHANGE ORDER # 4	Drainage Trench and Pipe Installation for Field Office	$8,845.00