

LONG ISLAND RAIL ROAD MORRIS PARK YARD FACILITY

SITE INVESTIGATION REPORT

QUEENS, NEW YORK
PB PROJECT No. 51335B/YU PROJECT No: 0707401



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Acronyms

ADT	Aquifer Drilling and Testing, Inc.
Amsl	above mean sea level
bgs	below ground surface
BN	Base Neutral Compounds
BUD	Beneficial Use Determination
CFCs	Chlorofluorocarbons
ELAP	Environmental Laboratory Accreditation Program
ft	feet
gpm	gallons per minute
GPS	Global Positioning System
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
HSA	Hollow Stem Auger
ID	Inner Diameter
IDW	Investigation-Derived Waste
LIRR	Long Island Rail Road
LNAPL	Light Non-Aqueous Phase Liquid
mg/kg	milligrams per kilogram
µg/L	micrograms per liter
mg/L	milligrams per liter
MTA	Metropolitan Transportation Authority
NAVD	North American Vertical Datum
NYSDEC	New York State Department of Environmental Conservation
OD	Outer Diameter
ORP	Oxygen Reduction Potential
PAHs	Polycyclic Aromatic Hydrocarbons
PB	Parsons Brinckerhoff
PCBs	Polychlorinated Biphenyls
PID	Photo-ionization Detector
ppb	parts per billion
ppm	parts per million
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RSCOs	Recommended Soil Cleanup Objectives
RTK	Real Time Kinematic
SCOs	Soil Cleanup Objectives
SI	Site Investigation
SIWP	Site Investigation Work Plan
SU	standard units
SVOCs	Semi-Volatile Organic Compounds
TAGM	Technical Administrative Guidance Memorandum
TAL	Target Analyte List
TCL	Target Compound List

TCLP	Toxicity Characteristic Leaching Procedure
TPH-DRO	Total Petroleum Hydrocarbons – Diesel Range Organics
USEPA	United States Environmental Protection Agency
USTs	Underground Storage Tanks
VOCs	Volatile Organic Compounds
WC	Waste Classification
YU	YU & Associates Engineers, P.C.

1.0 INTRODUCTION

Parsons Brinckerhoff (PB) and YU & Associates Engineers, P.C. (YU) have prepared this Site Investigation Report on behalf of the Metropolitan Transportation Authority Long Island Rail Road (MTA LIRR) to document the results of soil and groundwater sampling activities conducted in April and May 2009 at the Morris Park Yard Facility (the "Site"), in Queens, New York. A Site Location Map is presented in Figure 1.

The purpose of the site investigation (SI) was to define soil and groundwater quality conditions and identify on-site contamination to allow the MTA LIRR to manage these conditions during and following construction of a proposed new Locomotive Repair and Overhaul Shop and associated track realignment.

This Site Investigation Report consists of a summary of the fieldwork performed, results of the site investigation and laboratory analyses, a discussion of the impacts to soil and groundwater at the site, and recommendations for soil disposal.

1.1 Project Background

Information regarding the location, previous investigations, and site geology and hydrogeology is provided in the following sections.

1.1.1 Site Location

The Morris Park Yard Facility is an approximately 23-acre Rail Yard and Service Facility and is surrounded by residential, light industrial and commercial zones. A Site Plan is shown on Figure 2. The facility is located on the northeast corner of the intersection of Atlantic Avenue and 121st Street in Richmond Hill, Queens, New York.

1.1.2 Previous Investigations

The facility has operated since the 1890s as the central location for maintenance of diesel locomotives and electric powered coaches. The majority of the facility closed in the early 1990s coinciding with the opening of the LIRR Hillside Maintenance Complex, Jamaica, New York. While several of the buildings have been demolished since the decommissioning, diesel locomotive fueling, maintenance and repair are still performed at the Site.

In the early 1990s, several underground storage tanks (USTs) containing gasoline and diesel fuel were removed from the Site. Coinciding with the removal of the USTs, petroleum contamination was discovered at several locations within the facility, and the MTA LIRR subsequently completed a Remedial Investigation (RI). Results of the RI indicated the following:

- Diesel fuel contamination was predominant in the southern portion of the Site;
- A light, non-aqueous phase liquid (LNAPL) plume is located in the southern portion of the Site and is identified as diesel fuel; and,
- Chlorofluorocarbons (CFCs) were the most frequently occurring volatile organic compound (VOC), and were detected in several on-site and off-site wells above New York State Department of Environmental Conservation (NYSDEC) regulatory standards.

The findings and results from the RI, as stated above, have been documented and are currently being addressed separately by the MTA LIRR.

Per the May 1994 Closure Plan approved by NYSDEC, Dvirka and Bartilucci (D&B) conducted a closure program for two Resource Conservation and Recovery Act (RCRA) hazardous waste management units (container storage area and former paint stripping operations) associated with the former operations at the Site. The closure activities were completed in accordance with the Closure Plan and were summarized in D&B's January 1997 Closure Program Report.

Numerous groundwater monitoring wells have been installed at the site from prior investigations. The September 2006 drawings, prepared by TRC Engineers, include soil and groundwater data collected by STV, Inc. as part of the RI (May 1998).

1.2 Site Geology

Existing data from prior subsurface investigations and previous reports by others was compiled to provide this summary of geologic conditions at the Site. Previous investigations adjacent to the Site have shown the subsurface to consist of fill materials underlain by sands and gravels, with sporadic lenses of silt, of varying density, which eventually terminate at bedrock at depths ranging from 500 to 600 feet below ground surface (ft bgs).

The findings of the Site Investigation by PB and YU are consistent with prior geologic investigations identifying fill materials underlain by sand, gravel and cobbles.

1.3 Site Hydrogeology

The RI Report prepared by STV, Inc. in May 1998 summarized hydrogeologic characteristics of the Site.

Based on the RI report, the Upper Glacial formation, which is underlain by the Gardiner's Clay, is an unconfined aquifer located beneath the Site. The Gardiner's Clay is found approximately 160 ft bgs with local variations. The Upper Glacial aquifer deposits at the Site consist of outwash and till. Remnant glacial till deposits occur in a zone 30 ft bgs which are composed of an unstratified mix of clay, silt, sand, gravel, and boulders. Glacial outwash deposits below this zone are primarily fine to medium sand.

Based on the RI report, the range of groundwater depth varied from 39 to 44 ft bgs across the Site. The groundwater elevation in the Upper Glacial aquifer ranged between 10 and 15 feet above mean sea level (amsl).

Regional groundwater flow is southerly and discharges into Jamaica Bay. At the Site, groundwater flow direction has been shown to be southwesterly. Depth to groundwater ranged between 39 ft bgs (10 ft amsl) at the northeastern portion of the site to 44 ft bgs (15 ft amsl) at the southwestern portion of the Site, indicating a southwesterly groundwater flow. Hydrogeologic tests were performed as part of previous RI activities. Based on the RI report, the hydraulic conductivity was calculated as 50 feet per day across the Site.

The findings of the Site Investigation by PB and YU are consistent with prior hydrogeologic investigations identifying the depth to groundwater between 38 and 42 ft bgs.

1.4 Site Investigation Scope of Work

In December 2008, PB and YU developed a Site Investigation Work Plan (SIWP) to identify and delineate subsurface soil and groundwater contamination beneath areas of the proposed footprint for construction of the proposed Morris Park Locomotive Repair and Overhaul Shop and associated track

realignment. The SI area was divided into two distinct areas, Area A and Area B, to facilitate sequential construction as shown on Figure 3. Area A includes the footprint of the existing locomotive repair shop, the east transfer table/pit, A/C Shop and the former paint shop. Area B includes areas not investigated extensively in previous studies. These areas include the bone yard, the area immediately south of the bone yard, and associated ancillary track and facilities areas to be impacted by the proposed construction.

The proposed Morris Park Locomotive Repair and Overhaul Shop is anticipated to have a footprint of approximately 50,000 square feet. The building will be a pre-engineered structure accommodating areas for maintenance, overhaul and heavy repairs of locomotives as well as office areas, a conference room/lunch room, communication support service areas, and employee facilities. Additional storage space for large locomotive components will be provided within close proximity to appropriate shop areas. A new employee welfare area accommodating approximately 75 employees that are not affiliated with the Locomotive Repair and Overhaul Shop will be constructed at grade level.

The SI activities were divided between PB and YU as follows:

- YU conducted the Area A and Supplemental Area A Site Investigations.
- PB conducted the Area B Site Investigation.

The field operations of this SI included:

- Advancement of soil borings within Area A and Area B of the Site using hollow stem augers (HSA). Boring locations completed in this SI were based on the construction area of the site/track layout designed by PB and approved by LIRR.
- Collection of soil samples at selected shallow and deep soil boring locations to determine and delineate the extent of contamination within the proposed construction areas and to classify soil for disposal purposes;
- Installation of temporary groundwater monitoring wells at selected deep soil boring locations within Area A and Area B of the Site; and
- Collection of groundwater samples from the temporary wells.

The identification of soil borings, soil samples depths and boring depths are presented for Areas A and B in Table 1A and Table 1B, respectively.

2.0 AREA A ENVIRONMENTAL INVESTIGATION

2.1 Geophysical Survey

Diversified Geophysics, Inc., a subcontractor to PB and YU, conducted a geophysical survey to clear 27 proposed soil boring locations in Area A from April 2 to April 7, 2009. The geophysical survey was implemented using a pipe and cable locator, a magnetometer and ground penetrating radar (GPR) equipment. The geophysical survey identified various subsurface anomalies, including the presence of buried metal railroad tracks and buried metal debris in the vicinity of selected proposed borings. Based on the results of the geophysical survey, proposed soil boring locations were subsequently adjusted.

2.2 Soil Boring Advancement

Aquifer Drilling and Testing, Inc. (ADT), a subcontractor to PB and YU, pre-cleared and advanced soil borings using a truck-mounted CME-75 drill rig at 27 locations in Area A between April 1 and 22, 2009. Of the 27 soil borings, 8 were designated for environmental and geotechnical purposes, 13 for environmental purposes only and 6 for geotechnical purposes only.

The soil boring locations are shown on Figures 4 and 5A.

The purpose of the soil investigation in Area A was to evaluate the environmental subsurface conditions in preparation for future construction in areas such as the locomotive repair shop, east transfer table/pit, A/C shop and former paint shop.

In accordance with the SIWP, 9 soil borings designated as shallow borings were completed to depths ranging from 12 to 17 ft bgs and 18 soil borings designated as deep borings were completed to depths ranging from 32 to 47 ft bgs. As discussed in Section 2.3 below, three of the deep borings were advanced into groundwater and completed with installation of temporary monitoring wells.

In accordance with the SIWP, three discrete soil samples were collected from each of 21 environmental soil borings and retained in glassware for laboratory analysis. An additional soil sample was also collected from each of three environmental soil borings (AEG-10D, AEG-14D and AEG-16D). In addition, based on the proposed location of the building footprint and track layout designed by PB, 10 waste classification soil samples were collected from eight borings (AE-06S, AE-01D, AE-11S, AEG-10D, AEG-14D, AG-01D, AG-02D, AG-03D) located in Area A. The waste classification sample consisted of soils collected between 4 and 30 ft bgs.

The soils from the borings were visually inspected and screened for total VOCs using a photo-ionization detector (PID). The field observations of the soil borings were logged by the field geologist and are presented in Table 1A and in the boring logs (Appendix A). Following sampling activities, the borings were grouted to grade with a mixture of concrete and bentonite.

Although a geophysical survey was previously conducted, soil borings were pre-cleared to depths of 6 ft bgs between April 1 and 13, 2009 to further reduce the risk of interference with buried objects such as utilities and debris. The clearing was performed with mechanical equipment (e.g., jackhammer, vactron unit, air knife) and manual equipment (e.g., post-hole digger, shovel, and hand-auger). The first discrete sample for laboratory analysis at each boring was collected from immediately below the concrete/asphalt pavement or gravel cover using a hand auger.

Between April 2 and 22, 2009, 27 soil borings (AEG-02D, AEG-03D, AEG-04D, AEG-09D, AEG-10D, AEG-14D, AEG-15D, AEG-16D, AE-01D, AE-05D, AE-12D, AE-17D, AE-06S, AE-07S, AE-08S, AE-11S, AE-13S, AE-18S, AE-19S, AE-20S, AE-21S, AG-01D, AG-02D, AG-03D, AG-04D, AG-05D and AG-06D) were completed using a conventional HSA rig with 4-1/4-inch inner-diameter (ID) augers. Mud rotary drilling techniques were used to complete two of these soil borings (AG-04D and AG-06D); however, soil samples for environmental purposes were not collected at either of these locations. The soil samples from the shallow borings were collected continuously between 6 and 12 ft bgs using two-foot stainless steel split-spoon samplers. The deep borings samples were collected with split-spoon samplers every five feet until the boring was completed.

The second discrete soil sample was collected from intervals where the soils exhibited the highest PID reading and/or evidence of staining. The third discrete soil sample was collected from the interval where the soils did not exhibit field evidence of contamination (e.g., no PID readings or odor). When the entire soil boring did not exhibit detectable PID readings or evidence of staining (as was typical for most borings), the second sample was collected from the approximate midpoint of the boring and the third discrete sample was collected at the boring's termination depth (e.g., 10-12 ft bgs for shallow borings) or at the soil/groundwater table interface (e.g., 35-37 ft bgs for deep borings).

For AEG-10D and AEG-14D, the first discrete sample was repeated on a different date upon relocating the soil boring after refusal was encountered during drilling. For AEG-16D, a fourth discrete sample was collected at 40-42 ft bgs.

Each soil sample collected was assigned a unique sample identification, consisting of the following components:

- The first set of characters in the boring identification describes *the area* in which the boring is located and *the nature of the boring*. The sample location identification is two or three characters in length, ex. "AEG" (Area A and Environmental and/or Geotechnical);
- Following the boring location identification, numerical digit(s) were used to indicate *the particular boring*. Immediately following the numerical digits, the boring identification was completed either with an "S" to designate a shallow boring or with a "D" to designate a deep boring. A complete example of the nomenclature is as follows: The first environmental soil boring from Area A was designated with the boring identification: AE-01D.
- After the boring number and either S or D, a minimum of 2 digits were used to indicate *the upper boundary* of the depth at which the sample was collected. A zero always precedes single digit depths in the sample identification, ex. 08 (sampling interval from 8 to 10 ft bgs).
- After the depth, either S or WC was used to indicate the sample type as soil or waste classification.

After drilling, screening and sampling were completed, the boring was grouted to grade with a mixture of concrete and bentonite. As discussed in Section 2.8, impacted soil was placed into drums and staged for disposal off-site.

2.3 Monitoring Well Installation

In accordance with the SIWP, upon completion of three soil borings in Area A (AEG-16D, AEG-04D, AE-01D), ADT installed temporary groundwater monitoring wells on April 2, April 7, and April 15, 2009, respectively. The monitoring well locations are shown on Figures 4 and 5A.

The temporary monitoring wells were set at depths from 44 to 45 ft bgs using 10 feet of slotted screen and 34 to 35 feet of riser such that the screen intercepted the water table. The temporary monitoring wells were constructed using 2-inch diameter schedule 40 PVC screen and casing. The borehole area surrounding the PVC screen was then filled with Morie #2 sand until the top of the screen was covered. Bentonite chips were then added as a seal. The remainder of the borehole area surrounding the PVC riser pipe was then grouted with a mixture of concrete and bentonite. The temporary monitoring wells were completed as flush-mount with J-plug covers and a manhole cover. Well installation logs are provided in Appendix B.

2.4 Monitoring Well Development

Well development activities were conducted between April 3 and April 16, 2009 in the order of monitoring well installation. All monitoring wells were developed within one day of installation. Whale pumps with a 1-7/16-inch Outer Diameter (OD) and ½-inch OD tubing were used to develop the monitoring well at an approximate rate of 0.5 gallons per minute (gpm) for approximately one hour. Development of each well continued until low turbidity conditions stabilized or turbid free groundwater was observed. Well development records are provided in Appendix C.

2.5 Groundwater Sampling

Groundwater sampling of three Area A monitoring wells (AE-01D, AEG-04D and AEG-16D) was conducted on April 21, 2009. Each groundwater sample collected was designated with the soil boring identification followed by a GW to indicate the sample type as groundwater. Groundwater purging and sampling records are provided in Appendix D.

Groundwater purging was conducted using a Grundfos Redi-Flo 2 pump with a 2-inch OD and a control box to regulate the flow rate and ½-inch OD polyethylene tubing. A minimum of three well volumes was purged from each monitoring well prior to sampling. Purge rates were minimized to ensure minimal drawdown, as well as the lowest possible turbidity during purging and sampling.

Groundwater stabilization parameters including turbidity, temperature, conductivity, Dissolved Oxygen (DO), pH, and Oxygen Reduction Potential (ORP) were measured during purging and sampling using a Horiba U-22 water quality meter with a flow-through cell. Following the purging of three well volumes, groundwater samples were collected in appropriate glassware for laboratory analysis.

2.6 Equipment Decontamination

Sampling equipment (hand augers, HSA, split-spoon samplers) were decontaminated prior to use and in between advancement of each boring. A two-step decontamination procedure was followed throughout the course of the soil sampling event: the first step included Alconox and potable water rinse; and the second step included potable water rinse. Two equipment blanks were collected from sampling equipment to establish background conditions in the event of any suspected or potential cross-contamination.

During groundwater sampling, the Grundfos Redi-Flo 2 pump and associated parts were rinsed using Alconox solution followed by distilled water. Disposable ½-inch OD polyethylene tubing was used to purge and pump out the groundwater from the monitoring well and was replaced in between sampling each well.

2.7 Laboratory Analysis

Laboratory analysis was performed by Veritech, a division of Hampton-Clarke, of Fairfield, New Jersey. Veritech participates in the Environmental Laboratory Accreditation Program (ELAP) and is NY/ELAP certified (certification #11408/11939).

Sixty-six soil samples from Area A were submitted for laboratory analysis for Target Compound List (TCL) volatile organic compounds (VOCs) by USEPA method 8260, TCL semi-volatile organic compounds/base neutrals (SVOCs/BNs) by USEPA method 8270, 23 Target Analyte List (TAL) metals by USEPA methods 6010 and 7471A, chlorinated herbicides by USEPA method 8151, organochlorine pesticides by USEPA method 8081 and polychlorinated biphenyls (PCBs) by USEPA method 8082. In addition, as quality control samples, two aqueous field blanks and five trip blanks were submitted for analysis for the same parameters.

Ten waste classification samples from Area A were submitted for laboratory analysis using Toxicity Characteristic Leaching Procedure (TCLP) USEPA method 1311 and analysis of the extract for VOCs by USEPA method 8260, SVOCs by USEPA method 8270, eight Resource Conservation and Recovery Act (RCRA) metals by USEPA methods 6010 and 7470A, pesticides by USEPA method 8081 and herbicides by USEPA method 8151. The 10 waste classification samples were also submitted for laboratory analysis of RCRA characteristics including ignitability (also known as flash point) by USEPA method 1030, corrosivity (also known as pH) by USEPA methods 9040B/9045C, reactive cyanide by USEPA method 7.3.3 and reactive sulfide by USEPA method 7.3.4. In addition, the 10 waste classification samples were submitted for laboratory analysis for total petroleum hydrocarbons - diesel range organics (TPH-DRO) by USEPA method 8015B and a paint filter test by USEPA method 9095A.

Three groundwater samples from Area A were submitted for laboratory analysis of TCL VOCs by USEPA method 8260, TCL SVOCs/BNs by USEPA method 8270, 23 TAL metals (filtered and unfiltered) by USEPA methods 6010 and 7470A, chlorinated herbicides by USEPA method 8151, organochlorine pesticides by USEPA method 8081 and PCBs by USEPA method 8082.

Laboratory analytical results were provided using standard turnaround time and Category A deliverables format. Data validation was not required to be performed on the samples as specified by LIRR's scope of work.

2.8 Investigation Derived Waste Management

Water and soil collected from equipment decontamination, monitoring well development, boring installation, and well completion were containerized in 55-gallon drums and labeled as non-hazardous waste. Ten in-situ soil samples for waste classification were collected from Area A and analyzed as discussed in Section 2.7. The analytical laboratory data is provided in Appendix E.

Investigation Derived Waste (IDW) has not yet been disposed as of the issuance of this report.

2.9 Surveying

NAIK Consulting Group, P.C., a subcontractor to PB, surveyed the soil borings and monitoring wells on May 1, 2009. The survey was performed using a Global Positioning System (GPS) survey system in Real Time Kinematic (RTK) mode. The ground elevation was measured at each location and tied in to the existing survey controls in North American Vertical Datum (NAVD) 88 datum. The boring coordinates

and surface elevations are presented on the boring logs provided in Appendix A and shown on Figures 4 and 5A.

2.10 Monitoring Well Abandonment

Well abandonment was performed by ADT on May 19, 2009. Silt traps were removed from the three 2-inch diameter wells (AE01D, AEG04D, and AEG16D) in Area A prior to the removal of the PVC riser pipe and screen. The PVC pipe was pulled from the borehole and was used as a tremie-pipe to grout the borehole from bottom to top. For two of three wells (AE01D and AEG16D), the PVC pipe had separated in the borehole after approximately 15 to 20 feet was recovered. However, since a significant portion of the PVC pipe was able to be recovered, over-drilling of the boreholes was not conducted. The top of the borehole was sealed using cement and finally asphalted at the surface.

2.11 Supplemental Area A Environmental Investigation

On May 12, 2009, a meeting was held at MTA LIRR's offices in Jamaica, Queens, NY with representatives from PB and YU in attendance. The purpose of the meeting was to discuss the soil and groundwater analytical results from the environmental investigation for Areas A and B. Upon review of the data, LIRR directed YU to conduct a supplemental environmental investigation in Area A which consisted of advancing two additional soil borings south of the proposed building footprint to complete the data gap in this vicinity. On May 19, 2009, YU provided field oversight to ADT in advancing two supplemental soil borings (SAE22S and SAE23S) (directly south of the proposed building footprint) to a depth of 10 ft bgs. In boring SAE22S, two samples were collected at 1 ft bgs and 6-8 ft bgs. In boring SAE23S, three samples were collected at 1 ft bgs, 6-8 ft bgs, and 8-10 ft bgs. Based on the results of the Site Investigation for Areas A and B, the soil samples were submitted to Veritech for laboratory analysis of a reduced list of suspected contaminants consisting of VOCs, SVOCs and TAL Metals.

3.0 AREA B ENVIRONMENTAL INVESTIGATION

3.1 Geophysical Survey

Diversified Geophysics, Inc. conducted a geophysical survey to clear 15 proposed soil boring locations in Area B on April 13 and 15, 2009. The survey in Area B was completed in two days. LIRR flag protection was required during the geophysical survey for 6 soil borings located between or near railroad tracks. The geophysical survey was implemented using a pipe and cable locator, magnetometer and GPR equipment. The geophysical survey identified various subsurface anomalies including the presence of buried metal railroad tracks in the vicinity of BE-10S, buried metal debris in the vicinity of BE-14S and a sewer utility line in the vicinity of BE-03D. Based on the results of the geophysical survey, proposed soil boring locations were subsequently adjusted.

3.2 Soil Boring Advancement

ADT pre-cleared and advanced soil borings using either a truck-mounted CME-75 drill rig or a track-mounted CME-55 drill rig at 15 locations in Area B between April 13 and 23, 2009. The soil boring locations are shown on Figures 4 and 5B. LIRR flag protection was required during soil boring advancement for 8 soil borings located between or near railroad tracks.

The purpose of the soil investigation in Area B was to evaluate the environmental subsurface conditions in preparation for future track realignment in areas such as the bone yard, the area immediately south of the bone yard and associated ancillary track and facilities areas.

In accordance with the SIWP, 10 soil borings designated as shallow borings were completed to depths of 12 ft bgs and five soil borings designated as deep borings were completed to depths ranging from 37 to 47 ft bgs where groundwater was encountered. As discussed in Section 3.3 below, three of the deep borings were advanced into groundwater and completed with installation of temporary monitoring wells.

In accordance with the SIWP, three discrete soil samples were collected from each of the 15 soil borings and retained in glassware for laboratory analysis. In addition, based on the proposed site/track layout designed by PB, six waste classification soil samples were collected from six borings (BE-07S, BE-08D, BE-09S, BE-12S, BE-13S and BE-15S) located in the eastern portion of Area B. The waste classification sample consisted of soils collected between the surface and 5 ft bgs.

The soils from the borings were visually inspected and screened for total VOCs using a PID. The field observations of the soil borings were logged by the field geologist and are presented in Table 1B and in the boring logs (Appendix A). Following sampling activities, the borings were backfilled to grade with the same fill material and soil that was removed.

Although a geophysical survey was previously conducted, soil borings were pre-cleared between April 13 and 16, 2009 to further reduce the risk of interference with buried objects such as utilities and debris to depths of 6 ft bgs. The clearing was performed with mechanical equipment (e.g., jackhammer, vactron unit, air knife) and manual equipment (e.g., post-hole digger, shovel, and hand-auger). The first discrete sample for laboratory analysis at each boring was collected from immediately below the concrete/asphalt pavement or gravel cover using a hand auger.

Between April 16 and 21, 2009, five shallow and five deep soil borings (BE-01D, BE-02D, BE-03D, BE-04S, BE-05D, BE-07S, BE-08D, BE-09S, BE-10S and BE-11S) were completed using a conventional HSA rig with 4-1/4-inch ID augers. A track-mounted HSA rig with 4-1/4-inch ID augers was used to

complete five additional shallow soil borings (BE-06S, BE-12S, BE-13S, BE-14S and BE-15S) between April 22 and 23, 2009. These borings required special access since these were located in between railroad tracks. The soil samples from the shallow borings were collected continuously between 6 and 12 ft bgs using two-foot stainless steel split spoon samplers. The deep borings samples were collected with split spoon samplers every five feet until the boring was completed.

The second discrete soil sample was collected from intervals where the soils exhibited the highest PID reading and/or evidence of staining. The third discrete soil sample was collected from the interval where the soils did not exhibit field evidence of contamination (e.g., no PID readings or odor). When the entire soil boring did not exhibit detectable PID readings or evidence of staining (typical for most borings), the second sample was collected from the approximate midpoint of the boring and the third discrete sample was collected at the boring's termination depth (e.g., 10-12 ft bgs for shallow borings) or at the soil/groundwater table interface (e.g., 35-37 ft bgs for deep borings).

Each soil sample collected was assigned a unique sample identification, consisting of the following components:

- The first set of characters in the boring identification describes *the area* in which the boring is located and *the nature of the boring*. The sample location identification is two characters in length, ex. "BE" (Area B and Environmental);
- Following the boring location identification, numerical digit(s) were used to indicate *the particular boring*. Immediately following the numerical digits, the boring identification was completed either with an "S" to designate a shallow boring or with a "D" to designate a deep boring. A complete example of the nomenclature is as follows: The first environmental soil boring from Area B was designated with the boring identification: BE-01D.
- After the boring number and either S or D, a minimum of 2 digits were used to indicate *the upper boundary* of the depth at which the sample was collected. A zero always precedes single digit depths in the sample identification, ex. 08 (sampling interval from 8 to 10 ft bgs).
- After the depth, either S or WC was used to indicate the sample type as soil or waste classification.

After drilling, screening and sampling was completed, the location was backfilled to grade with drill cuttings derived from the soil boring that had been field screened with a PID and did not exhibit elevated readings or visual evidence of impact. As discussed in Section 3.8, impacted soil was placed into drums and staged for disposal off-site.

3.3 Monitoring Well Installation

In accordance with the SIWP, upon completion of three soil borings in Area B (BE-01D, BE-03D and BE-08D), ADT installed temporary groundwater monitoring wells on April 16 and 17, 2009. Based on prior site investigations indicating that the site groundwater flow direction is towards the southwest, BE-01D and BE-08D were installed as upgradient wells and BE-03D was installed as a downgradient well. The monitoring well locations are shown on Figures 4 and 5B.

The field geologist observed wet/saturated soil conditions in split spoon soil samples collected at depths of 40 to 42 ft bgs at each of the three monitoring well locations. Therefore, the temporary monitoring wells were set at depths of 45 ft bgs using 10 feet of slotted screen and 35 feet of riser such that the screen intercepted the water table. The temporary monitoring wells were constructed using 2-inch diameter schedule 40 PVC screen and casing. The borehole area surrounding the PVC was then filled with Morie

#2 sand until the top of the screen was covered. Bentonite chips were then added as a seal. The remainder of the borehole area surrounding the PVC was then backfilled to grade with drill cuttings derived from the soil boring that had been field screened with a PID and did not exhibit elevated readings or visual evidence of impact. The temporary monitoring wells were completed as stick-up casing with J-plug covers. Well installation logs are provided in Appendix B.

The field geologist then gauged the temporary monitoring wells from grade level, encountering the water table at depths of 39.55 ft bgs at BE-01D, 39.22 ft bgs at BE-08D and 39.55 ft bgs at BE-03D.

3.4 Monitoring Well Development

Well development activities were conducted on April 17, 2009 in the order of monitoring well installation. All monitoring wells were developed within one day of installation. Whale pumps with a 1-7/16-inch OD and ½-inch OD tubing were used to develop the monitoring well at an approximate rate of 0.5 gpm for approximately one hour. Development of each well continued until low turbidity conditions stabilized or turbid free groundwater was observed. Well development records are provided in Appendix C.

3.5 Groundwater Sampling

Groundwater sampling of three Area B groundwater wells (BE-01D, BE-03D, BE-08D) was conducted on April 21, 2009. Each groundwater sample collected was designated with the soil boring identification followed by a GW to indicate the sample type as groundwater. Groundwater purging and sampling records are provided in Appendix D.

Groundwater purging was conducted using a Grundfos Redi-Flo 2 pump with a 2-inch OD and a control box to regulate the flow rate and ½-inch OD polyethylene tubing. A minimum of three well volumes was purged from each monitoring well prior to sampling. Purge rates were minimized to ensure minimal drawdown, as well as the lowest possible turbidity during purging and sampling.

Groundwater stabilization parameters (turbidity, temperature, conductivity, DO, pH, and ORP) were measured during purging and sampling using a Horiba U-22 water quality meter with a flow-through cell. Following the purging of three well volumes, groundwater samples were collected in appropriate glassware for laboratory analysis.

3.6 Equipment Decontamination

Sampling equipment (hand augers, HSA and split-spoon samplers) were decontaminated prior to use and in between advancement of each boring. A two step decontamination procedure was followed throughout the course of the soil sampling event: the first step included Alconox and potable water rinse; and the second step included potable water rinse. Two equipment blanks were collected from sampling equipment to establish background conditions in the event of any suspected or potential cross-contamination.

During groundwater sampling, the Grundfos Redi-Flo 2 pump and associated parts were rinsed using Alconox solution followed by distilled water rinse. Disposable ½-inch OD polyethylene tubing was used to purge and pump out the water from the monitoring well and was replaced in between sampling each well.

3.7 Laboratory Analysis

Laboratory analysis was performed by Veritech, similar to the Area A samples.

Forty-five soil samples from Area B were submitted for laboratory analysis of TCL VOCs by USEPA method 8260, TCL SVOCs/BNs by USEPA method 8270, 23 TAL metals by USEPA methods 6010 and 7471A, chlorinated herbicides by USEPA method 8151, organochlorine pesticides by USEPA method 8081 and PCBs by USEPA method 8082. In addition, as quality control samples, two aqueous field blanks were submitted for analysis for the same parameters.

Six waste classification samples from Area B were submitted for laboratory analysis using TCLP USEPA method 1311 and analysis of the extract for VOCs by USEPA method 8260, SVOCs by USEPA method 8270, eight RCRA metals by USEPA methods 6010 and 7470A, pesticides by USEPA method 8081 and herbicides by USEPA method 8151. The six waste classification samples were also submitted for laboratory analysis of RCRA characteristics including ignitability by USEPA method 1030, corrosivity by USEPA methods 9040B/9045C, reactive cyanide by USEPA method 7.3.3 and reactive sulfide by USEPA method 7.3.4. In addition, the six waste classification samples were submitted for laboratory analysis for TPH-DRO by USEPA method 8015B and a paint filter test by USEPA method 9095A.

Three groundwater samples from Area B were submitted for laboratory analysis of TCL VOCs by USEPA method 8260, TCL SVOCs/BNs by USEPA method 8270, 23 TAL metals (filtered and unfiltered) by USEPA methods 6010 and 7470A, chlorinated herbicides by USEPA method 8151, organochlorine pesticides by USEPA method 8081 and PCBs by USEPA method 8082. In addition, as quality control samples, one aqueous field blank was submitted for analysis for the same parameters and one aqueous trip blank was submitted for analysis for TCL VOCs.

Laboratory analytical results were provided using standard turnaround time and Category A deliverables format. Data validation was not required to be performed on the samples as specified by LIRR's scope of work.

3.8 Investigation Derived Waste Management

Water and soil collected from equipment decontamination, monitoring well development, boring installation, and well completion were containerized in 55-gallon drums and labeled as non-hazardous waste. Six in-situ soil samples for waste classification were collected from Area B as discussed in Section 3.7. The analytical laboratory data is provided in Appendix E.

IDW has not yet been disposed as of the issuance of this report.

3.9 Surveying

NAIK Consulting Group, P.C. surveyed the soil borings and monitoring wells on May 1, 2009. The survey was performed using a GPS survey system in RTK mode. The ground elevation was measured at each location and tied in to the existing survey controls in NAVD 88 datum. The boring coordinates and surface elevations are presented on the boring logs provided in Appendix A and shown on Figures 4 and 5B.

3.10 Monitoring Well Abandonment

Well abandonment was performed by ADT on May 19, 2009. Silt traps were removed from the three 2-inch diameter wells (BE03D, BE08D, and BE01D) in Area B prior to the removal of the PVC riser pipe and screen. The PVC pipe was pulled from the borehole and was used as a tremie-pipe to grout the borehole from bottom to top. The top of the borehole was sealed using cement and finally asphalted at the surface.

4.0 LABORATORY ANALYTICAL RESULTS

4.1 Area A Soil Analytical Results

A total of 66 soil samples were collected from Area A and submitted for VOCs, SVOCs, TAL metals, pesticides, herbicides and PCB analyses. Soil sample results were compared to NYSDEC Technical and Administrative Guidance Memorandum (TAGM) # 4046 Recommended Soil Cleanup Objectives (RSCOs); Eastern USA background levels (for metals only) and NYSDEC Part 375 restricted industrial use Soil Cleanup Objectives (SCOs) and are included in Tables 2.1A, 2.2A, 2.3A and 2.4A. Raw laboratory data is provided in Appendix E. Although contaminants were detected in a number of samples, only SVOCs and TAL metals exceeded the regulatory standards.

4.1.1 Volatile Organic Compounds (VOCs)

No VOCs were detected at concentrations exceeding the RSCO in any of the 66 soil samples. The highest total VOC concentration in any sample was observed to be 0.669 mg/kg in the sample AE11S06S, significantly below the RSCO of 10 mg/kg. The Soil Analytical Results Summary for VOCs is shown in Table 2.1A.

4.1.2 Semi-Volatile Organic Compounds (SVOCs)

The Soil Analytical Results Summary for SVOCs is shown in Table 2.2A.

From the SVOCs analyzed, Polycyclic Aromatic Hydrocarbons (PAHs) which are commonly found in historic fill were found to be present in the soil, predominantly concentrated to a depth of 15 ft. The benzene compound phenol was also detected on site.

The following PAH components were found to exceed their respective RSCOs:

- Benzo(a)anthracene was detected in 25 samples with 21 samples exceeding the RSCO of 0.224 mg/kg. The sample concentrations exceeding the RSCO range from 0.25 mg/kg in AEG10D02S to 16mg/kg in sample AE21S06S. Two samples exceeded the Part 375 restricted industrial use SCO for benzo(a)anthracene.
- Benzo(a)pyrene was detected in 25 samples with all samples exceeding the RSCO of 0.061 mg/kg. The sample concentrations exceeding the RSCO range from 0.096 mg/kg in sample AEG09D02S to 14 mg/kg in sample AE21S06S. Twelve samples exceeded the Part 375 restricted industrial use SCO for benzo(a)pyrene.
- Benzo(b)fluoranthene was detected in 27 samples with 13 samples exceeding the RSCO of 1.1 mg/kg. The sample concentrations exceeding the RSCO range from 1.2 mg/kg in sample AEG14D02S to 18 mg/kg in sample AE21S06S. Three samples exceeded the Part 375 restricted industrial use SCO for benzo(b)fluoranthene.

- Benzo(k)fluoranthene was detected in 23 samples with 9 samples exceeding the RSCO of 1.1 mg/kg. The sample concentrations exceeding the RSCO range from 1.3 mg/kg in sample AE21S02S to 7.9 mg/kg in sample AEG10D02S.
- Chrysene was detected in 28 samples with 17 samples exceeding the RSCO of 0.4 mg/kg. The sample concentrations exceeding the RSCO range from 0.41 mg/kg in sample AE0608S to 15 mg/kg in sample AEG15D02S.
- Dibenz(a,h)anthracene was detected in 18 samples with all samples exceeding the RSCO of 0.014 mg/kg. The sample concentrations exceeding the RSCO range from 0.078 mg/kg in sample AE20S02S to 3.1 mg/kg in sample AE21S06S. Six samples exceeded the Part 375 restricted industrial use SCO for dibenz(a,h)anthracene.
- Indeno(1, 2, 3-cd)pyrene was detected in 24 samples with 7 samples exceeding the RSCO of 3.2 mg/kg. The sample concentrations exceeding the RSCO range from 3.7 mg/kg in sample AE05D02S to 12 mg/kg in sample AEG10D02S. One sample exceeded the Part 375 restricted industrial use SCO for indeno(1,2,3-cd)pyrene.
- Naphthalene was detected in 9 samples with only one sample exceeding the RSCO of 13 mg/kg. Sample AE21S06S had a concentration of 24 mg/kg.
- Phenol, a benzene compound with a hydroxyl group substitution, was detected in one sample, AE11S06S, at a concentration exceeding the RSCO of 0.03 mg/kg. The sample concentration was 0.37 mg/kg.

4.1.3 Target Analyte List (TAL) Metals

The following TAL metals were found to exceed their respective RSCOs:

- Arsenic was detected in 34 samples with four samples exceeding the RSCO of 7.5 mg/kg (AE07S02S at 9.1 mg/kg, AE12D02S at 12 mg/kg, AE20S02S at 11 mg/kg, and AE19S06 at 8.8 mg/kg) and 5 samples exceeding both the RSCO and Eastern USA Site Background Criteria of 3-12 mg/kg (AE11S02S at 34 mg/kg, AE21S02S at 22 mg/kg, AE21S06S at 17 mg/kg, AEG10D02S at 27 mg/kg, AEG15D02S at 14 mg/kg).
- Barium was detected in 65 samples at concentrations ranging from 12 mg/kg to 720 mg/kg with only one sample (AEG10D02S at a concentration of 720 mg/kg) exceeding the RSCO of 300 mg/kg.
- Beryllium was detected in 11 samples with all 11 samples exceeding the RSCO of 0.16 mg/kg. The sample concentrations exceeding the RSCO range from 0.72 mg/kg in sample AEG09D02S to 12 mg/kg in sample AEG15D30S.
- Cadmium was detected in 7 samples with two samples (sample AE11S02S at a concentration of 1.5 mg/kg and sample AEG10D02S at a concentration of 6 mg/kg) slightly above the Eastern USA Background Concentration of 1 mg/kg. No samples were above the NYSDEC proposed RSCO value of 10 mg/kg.
- Chromium was detected in 64 samples with only two samples (sample AE21S02S at a concentration of 63 mg/kg and sample AEG10D02S at a concentration of 170 mg/kg) exceeding both the RSCO criteria of 50 mg/kg and Eastern USA Background Concentration of 40 mg/kg. One sample, AE18S08S exceeded the Part 375 restricted industrial use SCO for chromium of 800 mg/kg with a concentration of 1,600 mg/kg.

- Cobalt was detected in 56 samples with only one sample exceeding the RSCO of 30 mg/kg. Sample AEG10D02S had a concentration of 51 mg/kg.
- Lead was detected in 34 samples with 5 samples exceeding both the RSCO and NYSDEC Eastern USA Background Criteria of 500 mg/kg. The sample concentrations exceeding the RSCO range from 530 mg/kg in sample AE06S02S to 1,500 mg/kg in samples AEG10D02S and AEG15D02S.
- Nickel was detected in 62 samples with 28 samples exceeding the RSCO of 13 mg/kg. The sample concentrations exceeding the RSCO range from 14 mg/kg in sample AE01D02S to 92 mg/kg in sample AE18S08S. Six samples also exceeded the Eastern USA Site Background range of 0.1-3.9 mg/kg for nickel.
- Selenium was detected in 27 samples with 25 samples exceeding the RSCO of 2 mg/kg. The sample concentrations exceeding the RSCO range from 2.3 mg/kg in sample AE19S06S to 8.7 mg/kg in sample AE21S02S.
- Vanadium was detected in 57 samples with no samples exceeding the RSCO of 150 mg/kg. Vanadium concentrations range from 10 mg/kg in sample AE12D30S to 52 mg/kg at sample AE19S06S.
- Zinc was detected in 60 samples with 41 samples exceeding the RSCO of 20 mg/kg. The sample concentrations exceeding the RSCO range from 21 mg/kg in samples AEG16D02S and AE20S15S to 590 mg/kg in sample AEG10D02S. Thirteen samples exceeded the Eastern USA Site Background range of 9-50 mg/kg for zinc.

The Soil Analytical Results Summary for Metals is shown in Table 2.3A.

RSCOs for aluminum, antimony and calcium have not been established. Detections for these three metals were compared to the Eastern USA Site Background values. No samples exceeded background values of aluminum (33,000 mg/kg) and antimony (not established). Only one sample exceeded calcium's Eastern USA Site Background value of 35,000 mg/kg. Sample AE08S06S had a calcium concentration of 50,000 mg/kg.

Naturally occurring metals such as copper, iron, magnesium, manganese, and potassium were detected in most of the samples. These metals are commonly found at industrial sites and workshops. Copper exceeded the RSCO of 25 mg/kg in 20 samples. Copper concentrations exceeding the RSCO range from 26 mg/kg at sample AEG16D02S to 1,300 mg/kg at sample AEG15D02S. Iron concentrations exceeded the RSCO of 2,000 mg/kg in all 66 samples. Iron concentrations range from 7,900 mg/kg at samples AEG03D35S and AEG16D40S to 180,000 mg/kg at sample AE18S08S. Magnesium was detected in 65 samples with 5 samples above the RSCO and Eastern USA Site Background value of 5,000 mg/kg. Magnesium concentrations exceeding the RSCO range from 5,100 mg/kg at AEG15D02S to 7,800 mg/kg at AE19S06S. Manganese was detected in all 66 samples with all samples below the RSCO of 5,000 mg/kg. Manganese concentrations range from 26 mg/kg in sample AE07S02S to 1,000 mg/kg in sample AE18S08S. Potassium was detected in 39 samples with all samples significantly below the RSCO of 43,000 mg/kg. Potassium concentrations ranged from 530 mg/kg to 1,700 mg/kg.

4.1.4 Pesticides

No pesticides were detected above their respective RSCOs. 4,4'-DDE was detected in three samples. 4,4'-DDT was detected in 10 samples. Beta-BHC and Total Chlordane were each detected in one sample. Their respective RSCO are 2.1 mg/kg, 2.1 mg/kg, 0.2 mg/kg, and 0.54 mg/kg.

The Soil Analytical Results Summary for pesticides is shown in Table 2.4A.

4.1.5 Herbicides

Herbicides were not detected in any of the soil samples.

The Soil Analytical Results Summary for Pesticides is shown in Table 2.4A.

4.1.6 Poly-Chlorinated Biphenyls (PCBs)

No PCBs were detected above their respective RSCOs. Aroclor 1016 and Aroclor 1248 were each detected at one sample. Aroclor 1254 was detected at two samples and Aroclor 1260 was detected in three samples. Their respective RSCOs are all 1 mg/kg for surface soils within the first 2 feet bgs and 10 mg/kg for soils greater than 2 feet bgs.

The Soil Analytical Results Summary for PCBs is shown in Table 2.4A.

4.1.7 Supplemental Area A Soil Analytical Results

Five soil samples were collected and submitted for SVOCs and TAL Metals analyses. In addition, two out of five samples (SAE23S08S and SAE23S01S) were analyzed for VOCs. Soil sample results were compared to NYSDEC TAGM # 4046 RSCOs; Eastern USA background levels (for metals only) and NYSDEC Part 375 restricted industrial use SCOs and were added to Tables 2.1A, 2.2A and 2.3A. Raw laboratory data is provided in Appendix E.

No VOCs were detected in any of the supplemental samples.

Fourteen SVOCs were detected in a number of samples:

- Eleven SVOCs (Acenaphthylene, Anthracene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, bis(2-Ethylhexyl)phthalate, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene) were detected below the RSCOs.
- Three SVOCs (Benzo(a)anthracene, Benzo(a)Pyrene and Chrysene) were detected above their respective RSCOs; however they were below their respective Part 375 restricted industrial use SCOs.

Sixteen metals were detected in a number of samples:

- Twelve metals (Aluminum, Arsenic, Barium, Calcium, Chromium, Cobalt, Iron, Lead, Magnesium, Manganese, Potassium and Vanadium) were detected below the RSCOs and Eastern USA background concentrations.
- Four metals (Mercury, Copper, Nickel and Zinc) were detected above their respective RSCOs and Eastern USA background concentrations; however they were below their respective Part 375 restricted industrial use SCOs.

4.2 Area B Soil Analytical Results

A total of 45 soil samples were collected from Area B and submitted for VOCs, SVOCs, TAL metals, pesticides, herbicides and PCB analyses. Soil sample results were compared to NYSDEC TAGM # 4046 RSCOs; Eastern USA background levels (for metals only) and NYSDEC Part 375 restricted industrial use SCOs and are included in Tables 2.1B, 2.2B, 2.3B and 2.4B. Raw laboratory data is provided in

Appendix E. Although contaminants were detected in a number of samples, only SVOCs and TAL metals exceeded the regulatory standards.

4.2.1 VOCs

Total VOC concentrations ranged from non-detect to 0.436 mg/kg. None of the soil samples exceeded the RSCO for Total VOCs of 10 mg/kg.

Eight VOCs were detected in a number of samples:

- Acetone was detected in four soil samples. One soil sample (BE-03D1S) exhibited an acetone concentration of 0.038 mg/kg, which is above the RSCO of 0.2 mg/kg but well below the Part 375 restricted industrial use SCO of 1,000 mg/kg. Acetone concentrations detected in the other three samples (BE-14S6S, BE-14S10S and BE-15S6S) were below the RSCO.
- 1,1,2,2-Tetrachloroethane was detected in one soil sample (BE-07S) at a concentration of 0.018 mg/kg, which is below the RSCO of 0.6 mg/kg.
- 1,1,2-Trichloro-1,1,2-trifluoroethane was detected in three soil samples (BE-04S10S, BE-14S0.5S, BE-15S0.5) at concentrations ranging from 0.011 to 0.021 mg/kg, which are below the RSCO of 6 mg/kg.
- 1,2,4-Trimethylbenzene was detected in two soil samples (BE-09S8S and BE-12S0.5S) and concentrations ranging from 0.0016 to 0.0018 mg/kg, which are below the RSCO of 13 mg/kg.
- 2-Butanone (also known as Methyl Ethyl Ketone) was detected in one soil sample (BE-03D1S) at a concentration of 0.056 mg/kg, which is below the RSCO of 0.3 mg/kg.
- Methylene Chloride was detected in 10 soil samples (BE-01D0.5S, BE-01D35S, BE-04S10S, BE06S0.5S, BE-07S0.5S, BE-08D0.5S, BE-09S0.5S, BE-12S0.5S, BE-12S11S and BE-14S0.5S) at concentrations ranging from 0.0064 to 0.026 mg/kg, which are below the RSCO of 0.1 mg/kg.
- Toluene was detected in one soil sample (BE-12S0.5S) at a concentration of 0.0014 mg/kg, which is below the RSCO of 1.5 mg/kg.
- Although there is no applicable RSCO, t-Butyl Alcohol was also detected in one soil sample (BE-09S0.5S) at a concentration of 0.03 mg/kg.

The Soil Analytical Results Summary for VOCs is shown in Table 2.1B.

4.2.2 SVOCs

Total SVOC concentrations ranged from non-detect to 48.81 mg/kg. None of the soil samples exceeded the RSCO for Total SVOCs of 500 mg/kg.

Twenty-two SVOCs were detected in a number of samples:

- Seventeen SVOCs (2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Benzoic acid, Bis(2-Ethylhexyl)phthalate, Carbazole, Dibenzofuran, Di-n-butylphthalate, Di-n-octylphthalate, Fluoranthene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene and Pyrene) were detected but at concentrations below the applicable RSCOs.

- Four SVOCs (Benzo(a)anthracene, Benzo(b)fluoranthene, Chrysene, Dibenz(a,h)anthracene), all of which are PAHs, exceeded the applicable RSCOs but were below the Part 375 restricted industrial use SCOs. These soil samples exhibited the following concentration ranges:
 - Benzo(a)anthracene detected in eight soil samples (BE-03D1S, BE-06S0.5S, BE-08D0.5S, BE-09S0.5S, BE-11S0.5S, BE-12S0.5S, BE-14S0.5S, BE-15S0.5S) at concentrations ranging from 0.23 to 3.3 mg/kg, exceeded the RSCO of 0.224 mg/kg.
 - Benzo(b)fluoranthene detected in six soil samples (BE-08D0.5S, BE-09S0.5S, BE-11S0.5S, BE-12S0.5S, BE-14S0.5S and BE-15S0.5S) at concentrations ranging from 1.7 to 6.4 mg/kg, exceeded the RSCO of 1.1 mg/kg.
 - Chrysene detected in six soil samples (BE-08D0.5S, BE-09S0.5S, BE-11S0.5S, BE-12S0.5S, BE-14S0.5S and BE-15S0.5S) at concentrations ranging from 1.2 to 4.5 mg/kg, exceeded the RSCO of 0.4 mg/kg.
 - Dibenz(a,h)anthracene detected in seven soil samples (BE-04S0.5S, BE-08D0.5S, BE-09S0.5S, BE-11S0.5S, BE-12S0.5S, BE-14S0.5S and BE-15S0.5S) at concentrations ranging from 0.088 to 0.76 mg/kg, exceeded the RSCO of 0.014 mg/kg.
- Another PAH, Benzo(a)pyrene, detected in 10 soil samples (BE-01D0.5S, BE-02D1S, BE-03D1S, BE-04S0.5S, BE-06S0.5S, BE-09S0.5S, BE-12S0.5S, BE-14S0.5S, BE-14S6S and BE-15S10S) at concentrations ranging from 0.73 to 1.1 mg/kg, exceeded the RSCO of 0.061 mg/kg. In addition, the concentrations of Benzo(a)pyrene in three surface soil samples (BE-08D0.5S, BE-11S0.5S and BE-15S0.5S) of 1.2 mg/mg, 2.2 mg/kg and 2.9mg/kg, respectively, exceeded both the RSCO and the Part 375 restricted industrial use SCO of 1.1 mg/kg.

The Soil Analytical Results Summary for SVOCs is shown in Table 2.2B.

4.2.3 TAL Metals

Twenty-one out of 23 metals analyzed were detected in a number of samples:

- Ten metals (Aluminum, Antimony, Beryllium, Calcium, Cobalt, Iron, Manganese, Potassium, Sodium and Vanadium) were detected but at concentrations below the applicable RSCOs and Eastern USA background criteria.
- Ten metals (Barium, Cadmium, Chromium, Copper, Lead, Magnesium, Mercury, Nickel, Selenium, and Zinc) exceeded the applicable RSCOs and/or Eastern USA background criteria but were below the Part 375 restricted industrial use SCOs. These soil samples exhibited the following concentration ranges:
 - Barium was detected in 45 samples with 3 samples exceeding the RSCO of 300 mg/kg. One of these samples also exceeded the Eastern USA background criteria of 600 mg/kg. The maximum concentration of Barium was 1,700 mg/kg at BE-09S0.5S.
 - Cadmium was detected in 10 samples with 9 samples exceeding the Eastern USA background criteria of 1 mg/kg. All concentrations were below the NYSDEC proposed RSCO of 10 mg/kg. The maximum concentration of Cadmium was 5.2 mg/kg at BE-08D0.5S.
 - Chromium was detected in 45 samples with 4 samples exceeding the Eastern USA background criteria of 40 mg/kg as well as the proposed RSCO of 50 mg/kg. The maximum concentration of Chromium was 80 mg/kg at BE-04S0.5S.
 - Copper was detected in 45 samples with 20 samples exceeding the RSCO of 25 mg/kg. Fifteen of these samples also exceeded the Eastern USA background criteria of 50 mg/kg. The maximum concentration of Copper was 560 mg/kg at BE-15S0.5S.

- Lead was detected in 22 samples with 5 samples exceeding the Eastern USA background criteria of 500 mg/kg. The maximum concentration of Lead was 3,600 mg/kg at BE-04S0.5S.
- Magnesium was detected in 37 samples with 1 sample exceeding the Eastern USA background criteria of 5,000 mg/kg. BE-12S0.5S exhibited a magnesium concentration of 8,200 mg/kg.
- Mercury was detected in 9 samples with 9 samples exceeding the RSCO of 0.1 mg/kg. Seven of these samples also exceeded the Eastern USA background criteria of 0.2 mg/kg. The maximum concentration of Mercury was 0.92 mg/kg at BE-04S0.5S.
- Nickel was detected in 45 samples with 25 samples exceeding the RSCO of 13 mg/kg. Five of these samples also exceeded the Eastern USA background criteria of 25 mg/kg. The maximum concentration of Nickel was 62 mg/kg at BE-12S0.5S.
- Selenium was detected in 12 samples with 10 samples exceeding the RSCO of 2 mg/kg. Seven of these samples also exceeded the Eastern USA background criteria of 3.9 mg/kg. The maximum concentration of Selenium was 15 mg/kg at BE-01D0.5S
- Zinc was detected in 44 samples with 32 samples exceeding the RSCO of 20 mg/kg. Seventeen of these samples also exceeded the Eastern USA background criteria of 50 mg/kg. The maximum concentration of Zinc was 850 mg/kg at BE-09S0.5S.
- In addition, Arsenic was detected in 21 soil samples. The Arsenic concentration in one soil sample (BE-12S0.5S) of 9.5 mg/kg, exceeded the RSCO of 7.5 mg/kg. The Arsenic concentration in one soil sample (BE-06S0.5S) of 14 mg/kg exceeded the RSCO and the Eastern USA background criteria of 12 mg/kg. The Arsenic concentrations in six soil samples (BE-01D0.5S, BE-04S0.5S, BE-07S0.5S, BE-08D0.5S, BE-09S0.5S and BE-15S0.5S) ranging from 17 to 26 mg/kg, exceeded the RSCO, Eastern USA background criteria and the Part 375 restricted industrial use SCO of 16 mg/kg.

The Soil Analytical Results Summary for metals is shown in Table 2.3B.

4.2.4 Pesticides

Four pesticides were detected in a number of samples:

- Chlordane was detected in three soil samples. Two soil samples (BE-12S0.5S and BE-09S0.5S) exhibited chlordane concentrations of 0.98 mg/kg and 1.6 mg/kg, respectively, which are both above the RSCO of 0.54 mg/kg but well below the Part 375 restricted industrial use SCO of 47 mg/kg. The chlordane concentration of 0.02 mg/kg detected in the other sample (BE-12S11S) was below the RSCO.
- 4,4-D,D,D was detected in one soil sample (BE-03D1S) at a concentration of 0.0038 mg/kg, which is below the RSCO of 2.9 mg/kg.
- 4,4-D,D,E was detected in four soil samples (BE-03D1S, BE-09S0.5S, BE-12S0.5S, BE-15S0.5S) at concentrations ranging from 0.0032 to 0.018 mg/kg, which are below the RSCO of 2.1 mg/kg.
- 4,4-D,D,T was detected in twelve soil samples (BE-01D0.5S, BE-03D1S, BE-04S0.5S, BE-06S0.5S, BE-07S0.5S, BE-08D0.5S, BE-09S0.5S, BE-12S0.5S, BE-14S0.5S, BE-14S6S, BE-15S0.5S, BE-15S10S) at concentrations ranging from 0.0045 to 0.065 mg/kg, which are below the RSCO of 2.1 mg/kg.

The Soil Analytical Results Summary for Pesticides is shown in Table 2.4B.

4.2.5 Herbicides

Herbicides were not detected in any of the soil samples.

The Soil Analytical Results Summary for Herbicides is shown in Table 2.4B.

4.2.6 PCBs

Total PCB concentrations ranged from non-detect to 0.73 mg/kg. None of the soil samples exceeded the RSCO for Total PCBs in surface soil of 1 mg/kg.

Three Aroclors were detected in a number of samples:

- Aroclor 1242 was detected in one surface soil sample (BE-03D1S).
- Aroclor 1260 detected in six surface soil samples (BE-03D1S, BE-04S0.5S, BE-06S0.5S, BE-08D0.5S, BE-09S0.5S and BE-12S0.5S).
- Aroclor 1262 was detected in one surface soil sample (BE-15S0.5S).

All intermediate and deep soil samples exhibited non-detectable PCB concentrations.

The Soil Analytical Results Summary for PCBs is shown in Table 2.4B.

4.3 Area A Waste Classification Summary and Analysis

Ten soil samples were collected and submitted for analysis of TCLP VOCs, TCLP SVOCs, TCLP Metals, TCLP Pesticides, TCLP Herbicides, Total Petroleum Hydrocarbons-Diesel Range Organics (DRO), Paint Filter Test and RCRA Characteristics. Soil results were compared to USEPA Hazardous Waste Regulatory Levels and are included in Table 2.5A. Raw laboratory data is provided in Appendix E. TCLP VOCs, TCLP Metals and TPH-DRO were detected in a number of samples and are summarized below.

4.3.1 TCLP VOCs

Tetrachloroethene was detected in one waste classification sample (WCAG03D25S) at a concentration of 0.0036 mg/L. This concentration is significantly lower than the USEPA Hazardous Waste Regulatory Level of 0.7 mg/L for Tetrachloroethene.

4.3.2 TCLP SVOCs

SVOCs were not detected in any of the 10 waste classification soil samples.

4.3.3 TCLP RCRA Metals

Barium was detected in eight samples at concentrations ranging from 0.27 mg/L to 1.7 mg/L; however, all of the concentrations were detected below the US EPA Hazardous Waste Regulatory Level of 100 mg/L for barium.

Lead was detected in one sample (WC06S04S) at a concentration of 0.35 mg/L. This concentration is well below the US EPA Hazardous Waste Regulatory Level of 5 mg/L for lead.

Mercury was detected in one sample (WCAG02D15S) at a concentration of 0.00077 mg/L. This concentration is well below the US EPA Hazardous Waste Regulatory Level of 0.2 mg/L for mercury.

4.3.4 TCLP Herbicides

Herbicides were not detected in any of the 10 waste classification soil samples.

4.3.5 TCLP Pesticides

Pesticides were not detected in any of the 10 waste classification soil samples.

4.4.6 RCRA Characteristics

For all 10 waste classification soil samples, ignitability results were negative. Corrosivity results ranged from 5 to 11 S.U. at WCAEG14D08S and WCAE01D06S, respectively, and were within the acceptable range of 2 to 12.5 S.U. Reactivity results for both cyanide and sulfide were not detected in any of the samples.

4.3.6 Total Petroleum Hydrocarbons (TPH) - Diesel Range Organics (DRO)

Currently, regulatory criteria does not exist for TPH-DRO; however, the waste classification samples indicated a presence of TPH-DRO in 2 of the samples at concentrations of 280 mg/kg in sample WC06S04S and 150 mg/kg in sample WCAG02D15S.

4.3.7 Paint filter test

The paint filter test results were negative for all 10 waste classification soil samples.

4.4 Area B Waste Classification Summary and Analysis

A total of six soil samples were collected from Area B for waste classification purposes and submitted for TCLP extraction followed by VOCs, SVOCs, RCRA metals, Herbicides and Pesticides analyses; RCRA characteristics of ignitability, corrosivity, reactive cyanide and reactive sulfide analyses; TPH-DRO analysis and a paint filter test analysis. The results are included in Table 2.5B. The TCLP and RCRA results were compared to USEPA hazardous waste regulatory levels. Neither the TPH-DRO nor the paint filter test results were compared to applicable standards or guidance values. Raw laboratory data is provided in Appendix E.

4.4.1 TCLP VOCs

VOCs were not detected in any of the six waste classification soil samples.

4.4.2 TCLP SVOCs

SVOCs were not detected in any of the six waste classification soil samples.

4.4.3 TCLP RCRA Metals

Barium was detected in all six waste classification soil samples (BE-07S2WC, BE-08D0.5S, BE-09S2WC, BE-12S4WC, BE-13S4WC, and BE-15S0.5S) at concentrations ranging from 0.30 mg/L to 0.45 mg/L, which are well below the hazardous waste limit of 100 mg/L.

Lead was detected in one of the six waste classification samples (BE-08D0.5S) at a concentration of 0.3 mg/L, which is well below the hazardous waste limit of 5 mg/L. Lead was not detected in the other five waste classification soil samples.

No other RCRA metals were detected in any of the six waste classification soil samples.

4.4.4 TCLP Herbicides

Herbicides were not detected in any of the six waste classification soil samples.

4.4.5 TCLP Pesticides

Pesticides were not detected in any of the six waste classification soil samples.

4.4.6 RCRA Characteristics

For all six waste classification soil samples, ignitability results were negative, corrosivity results ranging from 4.8 to 7.6 S.U. were within the acceptable range of 2 to 12.5 S.U. and reactivity results for both cyanide and sulfide were not detected.

4.4.7 TPH-DRO

TPH-DRO concentrations were reported in two of the six waste classification samples. Samples BE-08D0.5S and BE-15S0.5S, which were both collected at a depth of 0.5 ft bgs, exhibited TPH-DRO concentrations of 280 mg/kg and 1,200 mg/kg, respectively. There is no applicable standard for TPH-DRO. However, at these locations Total VOC concentrations were 0.013 mg/kg and 0.021 mg/kg, respectively, and Total SVOC concentrations were 20.24 mg/kg and 48.81 mg/kg, respectively.

TPH-DRO was not detected in the other four waste classification soil samples (BE-07S2WC, BE-09S2WC, BE-12S4WC, and BE-13S4WC), which were collected at depths of 2 ft bgs or 4 ft bgs.

4.4.8 Paint filter test

The paint filter test results were negative for all six waste classification soil samples.

4.5 Area A Groundwater Analytical Results

A total of three groundwater samples were collected and submitted for VOCs, SVOCs, metals (filtered and unfiltered), PCBs, Pesticides and Herbicides analyses. One trip blank (and one equipment blank collected in Area B only) was also submitted for analyses. Groundwater results were compared to the NYSDEC Class GA Criteria and are included in Tables 3.1A, 3.2A, 3.3A and 3.4A. Raw laboratory data is provided in Appendix E.

4.5.1 VOCs

Chloroform was detected in sample AE01D40GW at a concentration of 1.8 µg/L, which is below the NYSDEC Class GA criteria of 7 µg/L. Tetrachloroethene was detected in sample AEG16D04GW at a concentration of 1.2 µg/L and Trichlorofluoromethane was detected in sample AEG04D40GW at a concentration of 1.1 µg/L, both of which are well below their NYSDEC Class GA criterion of 5 µg/L.

4.5.2 SVOCs

No SVOCs were detected in any of the groundwater samples. SVOC groundwater results are shown in Table 3.2A.

4.5.3 TAL Metals

NYSDEC Class GA Criteria for aluminum have not been established. Aluminum was detected in all three unfiltered groundwater samples at concentrations ranging from 390 to 1,100 µg/L. However, aluminum was not detected in any of the three filtered groundwater samples.

Barium was detected in one of the three groundwater samples (AEG16D40GW) at concentrations of 61 µg/L (unfiltered) and 58 µg/L (filtered), both below the NYSDEC groundwater criteria of 1,000 µg/L. The remaining two unfiltered groundwater samples and two filtered groundwater samples were not detected.

Without exception, all filtered groundwater samples were reported below their respective unfiltered groundwater counterparts.

Calcium was detected in all three unfiltered and in all three filtered groundwater samples at concentrations ranging from 13,000 to 37,000 µg/L and 14,000 to 38,000 µg/L, respectively. However, NYSDEC Class GA criteria have not been established for calcium.

Iron was detected above groundwater standards of 500 µg/L in all three unfiltered groundwater samples at concentrations ranging from 1,300 to 3,400 µg/L. However, iron was not detected in any of the three filtered groundwater samples. Without exception, all filtered groundwater samples were detected below their respective unfiltered groundwater sample counterparts.

Magnesium was detected in all three unfiltered and in all three filtered groundwater samples at concentrations ranging from 2,900 to 12,000 µg/L and 2,700 to 12,000 µg/L, respectively. However, all filtered and unfiltered groundwater samples were detected below groundwater standards of 35,000 µg/L.

Manganese was detected in all three unfiltered and all three filtered groundwater samples at concentrations ranging from 220 to 370 µg/L and 110 to 290 µg/L, respectively. All filtered and unfiltered groundwater samples were detected at concentrations below the groundwater standard of 300 µg/L with the exception of one unfiltered sample (AEG04D40GW), which was detected at a concentration of 370 µg/L.

NYSDEC Class GA criteria have not been established for Potassium. However, potassium was detected in two unfiltered and filtered groundwater samples (AEG04D40GW and AEG16D40GW) at concentrations ranging from 10,000 to 12,000 µg/L and 9,700 to 11,000 µg/L, respectively.

Sodium was detected above the groundwater standards of 20,000 µg/L in two of three unfiltered and filtered groundwater samples (AEG16D40GW and AEG04D40GW) at concentrations ranging from 32,000 to 54,000 µg/L and 33,000 to 52,000 µg/L, respectively. One filtered and unfiltered groundwater sample (AE01D40GW) was detected below the groundwater standards at a concentration of 9,900 µg/L and 11,000 µg/L, respectively.

4.5.4 Pesticides/Herbicides/PCBs

No pesticides, herbicides or PCBs were detected in any of the groundwater samples. Groundwater Analytical Results for Pesticides, Herbicides, and PCBs can be found in Table 3.4A.

4.6 Area B Groundwater Analytical Results

A total of three groundwater samples were collected from three temporary groundwater monitoring wells in Area B including upgradient wells BE-1D and BE8-D and downgradient well BE-03D. The samples were submitted for analysis of VOCs, SVOCs, metals (filtered and unfiltered), Pesticides, Herbicides and PCBs. Groundwater results are compared to the NYSDEC Class GA Groundwater standards and guidance values and are included in Tables 3.1B, 3.2B, 3.3B and 3.4B. Raw laboratory data is provided in Appendix E. The field and trip blank associated with the samples exhibited non-detectable concentrations for all parameters analyzed.

4.6.1 VOCs

Trichloroethene was detected in downgradient well BE-03D at a concentration of 7.9 µg/L, which is above the Class GA groundwater standard of 5 µg/L. Trichloroethene was not detected in the two upgradient wells.

Tetrachloroethene was detected in upgradient wells BE-1D and BE-8D at concentrations of 1.6 µg/L and 3 µg/L, respectively, which are each below the Class GA groundwater standard of 5 µg/L. Tetrachloroethene was not detected in downgradient well BE-03D.

No other VOCs were detected in any of the three samples collected from the temporary monitoring wells.

4.6.2 SVOCs

SVOCs were not detected in any of the three samples collected from the temporary monitoring wells.

4.6.3 TAL Metals

Aluminum was detected in each of the unfiltered samples collected from wells BE-1D, BE8-D, and BE-03D but not in the filtered samples. There is no applicable standard or guidance value for comparison.

Calcium was detected in all three unfiltered samples collected from wells BE-1D, BE8-D, and BE-03D at concentrations of 32,000 µg/L, 17,000 µg/L and 39,000 µg/L, respectively, and all three filtered samples collected from the same wells at concentrations of 30,000 µg/L, 16,000 µg/L and 40,000 µg/L, respectively. However, there is no applicable standard or guidance value for comparison.

Iron was detected in each of the unfiltered samples collected from wells BE-1D, BE8-D, and BE-03D at concentrations of 5,300 µg/L, 2,700 µg/L and 5,900 µg/L, respectively, which are above the Class GA groundwater standard of 300 µg/L. However, iron was not detected in any of the three filtered samples.

Magnesium was detected below the Class GA groundwater guidance value of 35,000 µg/L in all three unfiltered samples and all three filtered samples.

Manganese was detected in each of the unfiltered samples collected from wells BE-1D, BE8-D, and BE-03D at concentrations of 380 µg/L, 330 µg/L and 560 µg/L, respectively, which are above the Class GA groundwater standard of 300 µg/L. However, manganese was not detected in any of the three filtered samples.

Sodium was detected above the Class GA groundwater standard of 20,000 µg/L in one unfiltered sample (BE-03D) at a concentration of 27,000 µg/L and one filtered sample (BE-03D) at a concentration of 27,000 µg/L. However, sodium was detected below the class GA groundwater standard of 20,000 µg/L in the other two unfiltered samples and the other two filtered samples.

4.6.4 Pesticides/Herbicides/PCBs

No pesticides, herbicides or PCBs were detected in any of the groundwater samples. Groundwater Analytical Results for Pesticides, Herbicides, and PCBs can be found in Table 3.4B.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

As discussed, slightly elevated levels (above RSCOs) of SVOCs were present in soil throughout the Site and to the planned excavation depths beneath the proposed structures. The detected SVOCs consisted primarily of PAHs, a class of compounds commonly present in historic fill materials. Additionally, elevated levels (above RSCOs and Eastern USA background levels) of metals were present in specific areas at the Site. Arsenic was reported to exceed the RSCO in approximately half of the soil samples collected and to exceed the Part 375 restricted industrial use SCO in a number of samples that were concentrated in the track area. This is also typically found at an industrial site which has been in use and operating for several years.

In total, six groundwater samples were collected and analyzed from the six temporary monitoring wells installed on the Site. No SVOCs, pesticides, herbicides or PCBs were detected at concentrations exceeding regulatory standards or guidance values. One VOC, trichloroethene, exceeded its NYSDEC class GA standard. A few metals exceeded their NYSDEC class GA standards or guidance values, specifically iron, manganese and sodium. Due to the groundwater elevation, dewatering will not be required for the Site. Therefore, no special handling of groundwater is anticipated.

5.2 Recommendations

Environmental monitoring shall be performed in accordance with the Site-Specific Health and Safety Plan (HASP) during intrusive and soil disturbance activities to minimize exposure to on-site personnel and the surrounding area.

Exposure to contaminated soils will be mitigated with proper handling and disposal. The following are potential options for the proper handling and disposal of contaminated soils located at the LIRR Morris Park Yard Facility:

- Excavation and stockpiling of contaminated soils to be disposed at an approved handling facility. Although the soil has been found to be non-hazardous, soil disturbed during excavation for proposed construction must be managed in accordance with NYSDEC Part 360 and transported in accordance with NYSDEC Part 364 regulations.
- Application for a Beneficial Use Determination (BUD) through the NYSDEC Division of Solid & Hazardous Materials may be filed. Potentially, the BUD allows for alternatives to disposal once the contaminated soil is excavated.
- If there is no potential for direct contact during proposed construction, contaminated soil may be left in place undisturbed. By applying NYSDEC subpart 375-6 regulations for industrial sites, the contaminated soil may then be left in place with a “restricted use” qualifier.

In reviewing the soil sample data (included in D&B’s January 1997 Closure Program Report) in the area of the former paint shop and east transfer pit, the results indicated elevated levels of metals (arsenic, cadmium and mercury) when compared to the NYSDEC Soil/Sediment Action Levels and current Restricted Industrial Use SCO. In this SI, the soil sample results adjacent to this area confirm metals concentrations with slightly elevated levels. Soil mitigation in this area will be addressed in the specifications developed for construction.

In addition, exposure to contaminated soil will be mitigated when construction activities are completed with a new Site cover consisting of pavement and/or capping with clean fill material.

REFERENCES

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YU & Associates, Inc., *2008 Site Investigation Work Plan*, LIRR Morris Park, Queens, NY.

YU & Associates, Inc., *2008 Quality Assurance Project Plan*, LIRR Morris Park, Queens, NY.

TABLES

FIGURES

APPENDIX A
BORING LOGS

APPENDIX B

WELL INSTALLATION LOGS

APPENDIX C

WELL DEVELOPMENT LOGS

APPENDIX D

GROUNDWATER PURGING AND SAMPLING LOGS

APPENDIX E

LABORATORY ANALYTICAL DATA