SITE CHARACTERIZATION

PHASE I DATA SUMMARY REPORT

WORK ASSIGNMENT D004433-22

MEEKER AVENUE PLUME TRACKDOWN
GREENPOINT SECTION OF BROOKLYN

SITE NO. 2-24-121
KINGS (C), NY

Prepared for:
NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
625 Broadway, Albany, New York

Alexander B. Grannis, Commissioner

DIVISION OF ENVIRONMENTAL REMEDIATION
REMEDIAL BUREAU B

URS Corporation
77 Goodell Street
Buffalo, New York 14203

Final
October 2007

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PHASE 1

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77 GOODELL STREET

BUFFALO, NEW YORK 14203

FINAL

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LIST OF ACRONYMS AND ABBREVIATIONS

ADT	Aquifer Drilling and Testing, Inc.
aka	also known as
amsl	above mean sea level
ASP	Analytical Services Protocol
bgs	below ground surface
BP	British Petroleum
C&D	construction and demolition
CO	carbon monoxide
COC	chain-of-custody
Con-Test	Con-Test Analytical Laboratory
DCE	dichloroethene, aka dichloroethylene
DNAPL	dense non-aqueous phase liquid
DOT	Department of Transportation
DUSR	Data Usability Summary Report
EDR	Environmental Data Resources, Inc.
ELAP	Environmental Laboratory Approval Program
EM	electromagnetic
EPM	Environmental Planning and Management, Inc.
FAP	Field Activities Plan
FID	flame ionization detector
Frank's	Frank's Vacuum Truck Service, Inc.
FSP	Field Sampling Plan
Geologic	GeoLogic NY, Inc.
GPR	ground penetrating radar
HASP	Health and Safety Plan
HC-V	Hampton-Clarke, Inc.- Veritech Laboratory
HDPE	high-density polyethylene
HSA	hollow stem auger
ID	inside diameter
IDW	investigation derived wastes
L	liter
LEL	lower explosive limit
mg/kg	milligrams per kilogram (parts per million)
mL	milliliter
MW	monitoring well
MTBE	Methyl tert-butyl ether
NAVD	North American Vertical Datum
NYC	New York City
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OD	outside diameter
PCB	polychlorinated biphenyl
PCE	perchloroethene, aka tetrachloroethene or tetrachloroethylene or perchloroethylene

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

PID	photoionization detector
PMWP	Project Management Work Plan
ppbv	parts per billion by volume
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RQD	rock quality designation
RSI	Radar Solutions International
SAP	Sampling and Analysis Plan
SVOC	semivolatile organic compound
TAGM	Technical and Administrative Guidance Memorandums
TCE	trichloroethene, aka trichloroethylene
TCL	target compound list
TIC	tentatively identified compound
TOGS	Technical and Operational Guidance Series
µg/kg	micrograms per kilogram (parts per billion)
µg/L	micrograms per liter (parts per billion)
$\mu g/m^3$	micrograms per cubic meter
UHP	ultra high purity
URS	URS Corporation
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WA	Work Assignment

1.0 INTRODUCTION

This Data Summary Report has been prepared to summarize the field activities and analytical results for the Meeker Avenue plume track-down site in the Greenpoint section of Brooklyn, New York. The work for this site was issued to URS Corporation (URS) as Work Assignment (WA) No. D004433-22. This Site Characterization Data Summary Report presents data and information gathered during the Phase I field investigation conducted from May 7 through July 10, 2007.

1.1 Site Background

1.1.1 Site Location and Description

The Meeker Avenue Plume Trackdown Site is located in the Greenpoint section of the Borough of Brooklyn, New York (Figure 1). The site investigation area is bounded by the former Mobil Brooklyn Refinery/current British Petroleum (BP) Terminal to the north (Norman Avenue/Bridgewater Street), Newtown Creek to the east, Lombardy Street to the south, and Kingsland Avenue to the west (Figure 2). During the first phase of fieldwork, the southern boundary of the site investigation area along Lombardy Street between Porter and Morgan Avenues was extended south to Richardson Street. The area located north of Nassau Avenue and east of Van Dam Street and south of Meeker Avenue is primarily used for commercial /industrial purposes. Residential areas are located in both the northwest portion of the site (extending from Van Dam Street between Nassau and Meeker Avenues, to the western site boundary) and within the southern portion of the site (along Beadel Street from Morgan to Porter Avenues and along Vandervoort Avenue from Lombardy Street to Division Place).

The site investigation area is located in a region of historic petroleum refining and storage operations that occupied a significant portion of the Greenpoint area since approximately 1866, and by 1870 over 50 refineries were located along the banks of Newtown Creek. Currently, bulk oil storage terminals exist north of the site, including the BP Terminal, and the ExxonMobil Brooklyn Terminal (Brooklyn Terminal). The former Paragon Oil facility was located on the site along

Newtown Creek, north of Bridgewater Street, between Meeker Avenue and Apollo Street. Peerless Importers, Inc., currently is located on a portion of the former Paragon Oil facility along Newtown Creek.

In September 1978, the United States Coast Guard (USCG) noted the signs of an oil spill entering Newtown Creek from the area at the end of Meeker Avenue. A subsequent investigation concluded that the area of the spill under the Greenpoint area was in excess of 52 acres and the total spill volume, as estimated in 1979, was approximately 17 million gallons of petroleum products. The current BP property was determined to be the source of the petroleum free product plume. Investigation and remediation activities were conducted by Roux Associates Inc. (Roux Associates) on behalf of ExxonMobil from 1990 to the present and have further defined the extent of the Off-Site Plume. The Off-Site Plume area consists of the area underlain by the petroleum free product plume that is not on the BP Terminal or the Peerless Imported, Inc. properties. Currently, the extent of the Off-Site Plume area is less than what it was in 1990 due to the operation of the Off-Site Free Product Recovery System (Off-Site System). The Off-Site System has recovered approximately 3,500,000 gallons since it became operational in 1995.

The current Off-Site Plume area boundary measured by Roux Associates on February 22, 2007 (1st Quarter of 2007 Progress Report, Roux Associates, April 30, 2007) is shown on Figure 2.

1.1.2 Previous Investigations

In September 2005, Roux Associates on behalf of ExxonMobil sampled soil-gas at 23 temporary locations in the Off-Site Plume area (Soil Vapor Investigation Report, Roux Associates, October 18, 2005). The soil-gas samples collected in September 2005 indicated the presence of tetrachloroethene (PCE) at concentrations of 1,500 and 1,040 parts per billion by volume (ppbv) at locations SG-20 (southwest corner of Vandervoort and Anthony) and SG-21 (west side of Morgan between Nassau and Norman) respectively, and at much lower concentrations detected throughout the Off-Site Plume area. In addition, trichloroethene (TCE) was detected at concentrations of 831 and 28,100 ppbv at SG-17 (west side of Apollo between Nassau and Meeker) and SG-21 respectively, and at much lower concentrations detected throughout the Off-Site Plume area. It was determined

that the chlorinated solvents detected (i.e., PCE and TCE) were from a different source than the petroleum free product plume.

Between June and September 2006, Roux Associates performed a soil-gas investigation in the Off-Site Plume area (Phase IV Soil Vapor Investigation Report, Roux Associates, November 10, 2006). A total of 50 permanent soil-gas monitoring points were installed. This included 20 nested monitoring points (one shallow and one deep) in the commercial/ industrial areas and 10 deep monitoring points in the residential areas. Elevated concentrations of PCE were detected at 191 and 137 ppbv at the MP-018D (northwest corner of Morgan and Nassau) and MP-033 (west side of Van Dam between Nassau and Meeker) locations, respectively. Elevated concentrations of TCE were detected at 1,530 and 131 ppbv at the MP-016 (east side of Apollo between Bridgewater and Nassau) and MP-018D locations, respectively.

In September 2005, Environmental Planning and Management, Inc. (EPM) completed an investigation for the New York State Department of Transportation (NYSDOT) in connection with the Kosciuszko Bridge Project (Draft Contaminated Material Investigation Findings Report, EPM, January 2006). The investigation included the collection and analysis of soil and groundwater. PCE was detected at a concentration of 7,760 micrograms per kilogram (µg/kg) in the 0-4 foot sample from boring SB-29 (southeast intersection of Gardner Avenue and Thomas Street). PCE was also detected at concentration of 89.9, 569, and 1,1060 micrograms per liter (µg/L) in ExxonMobil wells MW-018 (east side of Vandervoort between Anthony and Cherry), MW-023 (southwest corner at the intersection of Gardner and Thomas), and MW-030 (east side of Varick between Anthony and Cherry), respectively.

1.2 Scope of the Project

In accordance with the NYSDEC Scope of Work (NYSDEC, February 1, 2007) URS prepared a Project Management Work Plan (PMWP) and budget estimate (Final, April 2007), a Field Activities Plan (FAP, April 2007) which includes the Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HASP, April 2007).

The work assignment provided by NYSDEC indicates that the fieldwork associated with the Meeker Avenue Site Characterization will proceed in four phases (or time periods) in order to help identify the PCE and TCE sources areas.

Tasks performed during the Phase I field investigation included:

- Obtaining historical information reports (e.g., Sanborn maps) from Environmental Data Resources, Inc.;
- Obtaining utility clearances and permits;
- Utility locating by Radar Solutions International of Waltham, MA;
- Installation of 23 soil-gas conduits by GeoLogic NY, Inc. of Homer, NY;
- Manual and/or Vac-Tron® utility clearance for monitoring well installation by Aquifer Drilling and Testing, Inc., of New Hyde Park, NY;
- Installation of 20 groundwater monitoring wells by Aquifer Drilling and Testing, Inc. of New Hyde Park, NY;
- Collection of 27 soil-gas samples from 21 newly installed and 6 existing soil-gas conduits for analysis by Con-Test Analytical Laboratory, of East Longmeadow, MA;
- Collection of 26 samples from 20 soil borings for analysis by Hampton-Clarke, Inc – Veritech Laboratory, of Fairfield, NJ;
- Collection of 28 groundwater samples from 20 newly installed and 8 existing monitoring wells for analysis by Hampton-Clarke, Inc – Veritech Laboratory, of Fairfield, NJ;
- Daily pick-up of investigation derived waste for disposal through Frank's Vacuum Truck Service of Niagara Falls, NY; and
- Site survey by NAIK Consulting Group, P.C. (formerly NAIK-PRASAD, Inc.), of Edison, NJ.

1.3 Data Presentation

A site plan based on an orthophotograph is presented in Figure 2. The areas for which Sanborn maps have been obtained are shown on Figure 3, and the results of the historic records search and personal interviews as to possible sources of PCE and TCE are shown on Figure 4. All monitoring well and soil-gas conduit locations installed and/or sampled during this event are shown on Figure 5. Figure 6 shows locations of the subsurface cross-sections in Figures 7, 8, 9, and 10. Figures 11 and 12 show the potentiometric surface from the June 21-29, 2007 groundwater elevation measurements. Figures 13 and 14 show the potentiometric surface from the September 11, 2007 groundwater elevation measurements. Figure 15 shows the June 2007 soil-gas analytical results for PCE and its breakdown products. Figures 16 and 17 show the soil-gas PCE and TCE isocontours, respectively. Figure 18 shows the May-June 2007 soil analytical results that exceeded regulatory criteria. Figure 19 shows the June-July 2007 groundwater analytical results that exceeded regulatory criteria. Figures 20 and 21 show the groundwater PCE and TCE isocontours, respectively. Figures 22 and 23 show recommended soil-gas conduit and direct-push boring, and direct-push groundwater sample and monitoring well locations, respectively.

Table 1 lists the analytical parameters for soil-gas samples, with PCE and its breakdown products identified by an asterisk. Table 2 lists the analytical parameters for soil and groundwater samples. Table 3 lists the analytical parameters for the suspected dense non-aqueous phase liquid (DNAPL) sample. Table 4 provides groundwater elevation measurements. Table 5 provides a summary of detections in the soil-gas samples. Table 6 provides a statistical summary of detected parameters in the soil-gas samples. Table 7 provides a summary of detections in the soil samples with regulatory criteria and exceedances circled. Table 8 provides a summary of detections in the groundwater samples, with regulatory criteria and exceedances circled. Table 9 provides a statistical summary of detected parameters in the groundwater samples. Table 10 provides a summary of detections in the suspected DNAPL sample.

This report also includes: electronic versions of the Environmental Data Resources, Inc. (EDR) reports on a compact disk (Appendix A); geophysical survey report (Appendix B); photographic log (Appendix C); typical soil-gas conduit construction log (Appendix D); field notes (Appendix E); Summa Canister Sampling Field Data Sheets (Appendix F) soil boring logs (Appendix

G); monitoring well construction logs (Appendix H); monitoring well development logs (Appendix I); monitoring well purge logs (Appendix J); investigation derived waste (IDW) disposal documents (Appendix K); the site survey notes and drawing (Appendices L and M, respectively); and a Data Usability Summary Report (DUSR) on a compact disk (Appendix N) generated from the May 7, 2007 to July 10, 2007 field investigation.

2.0 FIELD ACTIVITIES

Field activities performed during Phase I of the site characterization are discussed below.

2.1 Historical Record Review Results

Historical records were obtained prior to the commencement of fieldwork through EDR. Four areas were selected, based on locations that were identified from data compiled from previous investigations as containing elevated concentrations of PCE and/or TCE in soil-gas, subsurface soil and/or groundwater. A fifth record search was obtained from EDR to expand the search area to south of Richardson Street, base on testimony from neighborhood residents. Figure 3 depicts the Sanborn Map coverage over the investigation area. The EDR reports are provided on a compact disk in Appendix A.

The Sanborn maps and radius reports were reviewed for the presence of dry cleaners and other businesses that may have used dry cleaner-related fluids. The 1933 through 1968 Sanborn maps in the block bound by Morgan Avenue and Vandervoort Avenue between Division Place and Beadel Street and the 1942 through 1951 Sanborn maps for the building at the southwest corner of Kingsland and Norman Avenues indicate two former dry cleaner locations. A rug cleaning company was identified to the east of the former dry cleaners on Division Place and occupied this location from approximately 1986 to present. In addition to dry cleaners, numerous other facilities that may have used PCE and/or TCE as degreasers or processed drums containing degreasers (e.g., metal foundries, metalworking facilities, electrical manufacturing facilities, chemical works, and drum recycling/ storage facilities) have been identified in the site investigation area.

A search of on-line yellow page directories for dry cleaning facilities identified 301 Norman Avenue, which houses the New York Rug Cleaning Institute/Bloomingdale Carpet and Furniture Cleaning Department. Also listed was 35 Division Place, which houses both Naxos Cleaners and Aphrodite Cleaners.

During the Phase I field investigation, a URS representative was informed by an area resident that she was an employee during the 1970's - 80's at a dry cleaning establishment that was located in the block bound by Vandervoort and Morgan Avenues between Richardson and Frost Streets. The Sanborn maps identify the buildings in that block as housing mattress manufacturing, clothing warehouse, printing plate manufacturing, and cooperage. Another area resident indicated that there was a dry cleaner in the block northwest of the Kingsland and Norman Avenues intersection, although more specific information was not provided. All the locations discussed above are shown on Figure 4.

2.2 Utility Clearance

Prior to site work, each subcontractor arranged for all appropriate utility clearances. This included (but was not limited to) contacting the New York City Departments of Environmental Protection and Transportation, the Transit Authority, Consolidated Edison, Keyspan, and Verizon in addition to using the Dig-Safe number for New York City – (800) 272-4480.

2.3 Geophysical Survey for Utility Markouts

On May 7, 2007, Radar Solutions International (RSI) mobilized a crew with ground penetrating radar (GPR) and electromagnetic (EM) induction equipment to the site for the purpose of screening for and identifying the presence of underground utilities in areas where drilling for monitoring well installations and direct-push borings (e.g., Geoprobe®) for soil-gas conduit installations were proposed.

A 10-foot square reference grid was established around each monitoring well and direct-push boring location prior to collecting the geophysical data. A GSSI SIR-2000 digital radar system was used to perform the GPR survey. GPR data were acquired along lines spaced 1.0 to 2.5 feet apart. The EM induction equipment used to determine the location of buried utilities was a Ditch Witch 950 RT locating system, which consists of a locator and a transmitter.

RSI marked utilities and anomalies by spray-painting the outline on the pavement as soon as they were located. A URS Geologist supervised and assisted RSI. RSI's report is provided in Appendix B.

2.4 Soil Gas Conduit Installation

Prior to any intrusive activities, the subcontractor obtained all necessary permits (i.e., street opening permits) for conducting intrusive activities. Twenty-three permanent soil-gas conduits (SG-001 through SG-023) were installed from May 22 through May 24, 2007 by GeoLogic NY, Inc. (Geologic), under the direction of NYSDEC representative and a URS Geologist. The locations of the soil-gas conduits are shown on Figure 5. All locations were installed through sidewalks. Rotary concrete drill bits were used to drill through the concrete sidewalk. A track-mounted Geoprobe® 6620 DT hydraulic push unit was utilized to advance a 1.5 inch outer diameter (OD) rod with an expendable point to a depth of approximately 8 feet below ground surface (bgs). No soil samples were collected.

A six inch long double woven stainless steel Geoprobe® vapor sampling implant was inserted through the rod and connected to an anchor, positioning the implant at the bottom of the probe hole. Polyethylene tubing (3/8 inch OD) connected to the implant was extended to the top of each conduit, where it was cut above the ground surface. The annular space around the implant (screen) was backfilled with #1 silica sand to 6 inches above the implant. A bentonite slurry was placed immediately above the sand for the seal, and extended to the ground surface. The conduits were completed with 4-inch diameter aluminum flush-mount protective casings, secured with approximately 1 foot of concrete. Each flush mount casing cover was secured with a $^{9}/_{16}$-inch bolt. The downhole equipment was brush-cleaned by Geologic between conduit locations. No IDW were generated during the soil-gas conduit installation. A photograph of the installation of a soil-gas conduit may be found in Appendix C. A typical soil-gas conduit construction log is provided in Appendix D. Copies of the daily field notes are provided in Appendix E.

2.5 Soil-Gas Sampling

Between June 12 and June 15, 2007 soil-gas samples were collected from 27 soil-gas conduits (21 new soil-gas conduits and 6 existing ExxonMobil conduits) plus quality assurance/quality control (QA/QC) samples. Roux Associates acting on behalf of ExxonMobil, provided URS with split-samples from the 6 ExxonMobil conduits (MP-008D, MP-018D, MP-021, MP-024, MP-025, and MP-026). There was no loss in the Summa® canister vacuum pressure in the attempt to collect a sample at locations SG-012 and SG-013 due to suspected screen blockage, therefore samples were not collected at these two locations.

The soil-gas samples were collected in accordance with the procedures outlined in the FAP (URS, April 2007) using laboratory evacuated 6-liter Summa® canisters with 1 hour flow regulators (i.e., calibrated at the flow rate of approximately 0.08 L per minute) provided by Con-Test Analytical Laboratory (Con-Test). Per *New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006), a helium tracer gas was utilized during the sampling of each soil-gas conduit. The tracer gas was used to verify that the infiltration of outdoor (ambient) air was not occurring during sample collection. A two-quart enclosure was placed over the well head. The well tubing was run through an outlet and plumber's putty was used to seal the interface between the tubing and the enclosure. The enclosure was then sealed at the ground surface with a polyurethane foam gasket. A tank containing ultra high purity (UHP) helium (99.999%) was connected to the side port of the enclosure and enough helium was released to displace any ambient air maintain and to maintain a positive pressure within the enclosure. Following the application of the tracer gas, one to three volumes were purged from the soil-gas conduit using a Gillian GilAir-3 air sample pump.

A Dielectric MGD-2002 helium detector was used to check for the presence of the tracer gas in the soil vapor; if less that 10% of the tracer gas was detected, a sample was collected. Following the collection of the soil-gas sample, the helium detector was re-connected to the tubing to check for the presence of the tracer gas in the soil vapor; if less that 10% of the tracer gas was detected, the sample was acceptable for analyses. No elevated concentrations of helium were detected prior to or following the sample collection from any of the soil-gas conduits.

Outdoor (ambient) air samples were collected from points upwind of the sample locations. The outdoor ambient air sample was collected by opening a summa canister fitted with a one-hour flow controller and drawing in the ambient air. Field duplicate samples were collected using stainless steel 'T' fittings. Copies of the completed Summa Canister Sampling Field Data Sheets from the sampling event are provided in Appendix F.

A chain-of-custody (COC) form was maintained and accompanied the samples which were shipped via Federal Express to Con-Test, a NYSDOH Environmental Laboratory Approval Program (ELAP) accredited laboratory. The samples were analyzed for the volatile organic compounds (VOCs) listed in Table 1, following United States Environmental Protection Agency (USEPA) Method TO-15.

2.6 Direct-Push Groundwater Sampling

With the consensus of the Department, no direct-push groundwater samples were collected during this phase of fieldwork based on the limited amount of subsurface data in the areas of investigation (e.g., groundwater depth, subsurface geological conditions, areas of contamination). Although extensive subsurface knowledge is known to the east and north of the investigation area, limited data is available within this area of investigation. The results from this first phase of investigation will allow for the possible implementation of direct- push groundwater sampling during the Phase II fieldwork.

2.7 Groundwater Monitoring Well Installation

Initially 22 locations were selected for monitoring well installation (DEC-001 through DEC-022). However, monitoring wells were not installed at two locations (DEC-007 and DEC-013) during this phase of fieldwork. At location DEC-007, a monitoring well was initially installed to 46.0 feet bgs but contained insufficient water (less than 1 foot) to allow for proper well development and sampling. An attempt to remove the well and drill deeper within the same borehole was unsuccessful and as a result the well was removed and the borehole was backfilled with bentonite chips. At location DEC-013, the boring was pre-cleared to 5.0 feet bgs, however access to the

location for drilling was prevented due to utility work on Division Place at that location. These wells will be installed during Phase II fieldwork.

2.7.1 Pre-Boring Clearing

Prior to any intrusive activities, the subcontractor obtained all necessary permits (i.e., street opening permits) for conducting intrusive activities. On May 8, 2007, Aquifer Drilling and Testing, Inc. (ADT), mobilized a Vac-Tron® unit to perform location specific utility clearance at each of the proposed monitoring well locations. A total of 22 monitoring well locations were cleared. At each location, a two-foot square by approximately five-foot deep area was excavated manually using post-hole diggers, pry bars, soil knife, and hand digging along with the Vac-Tron unit. After the location was cleared for drilling, the hole was backfilled flush with the sidewalk using the excavated spoils (small rocks and debris removed) and if necessary, temporarily patched with blacktop patch or concrete.

2.7.2 Soil Borings

During the period of May 7-June 15, 2007 ADT utilized Central Mine Equipment Company CME 55LC track-mounted drill rigs for the installation of 20 monitoring wells (DEC-001 through DEC-022). This drill rig is a dual-purpose hollow-stem augers (HSA)/mud rotary rig designed to work in areas requiring low clearance.

The soil borings were advanced using 4 ¼-inch inside diameter (ID) HSAs. Split spoon samples were collected continuously using standard penetration techniques (ASTM D1586-84) unless an obstruction was encountered that required the advancement of the augers to drill past the obstruction. At some well locations, auger refusal was encountered due to the presence of cobbles and boulders. As a result, ADT switched to mud-rotary drilling techniques to advance the borings to the required depths. The final boring depths ranged from 29 to 63 feet bgs. All IDW generated from the monitoring well installation was containerized in Department of Transportation (DOT) approved 55-gallon drums and picked up by Frank's Vacuum Truck Service (Frank's) on a daily basis for off-site disposal at a permitted facility.

Each split spoon sample was screened with a photoionization detector (PID). Up to two soil samples were collected from each boring, one soil sample was collected from the interval just above water table, the second sample was collected from the interval exhibiting odors, staining, or the highest PID reading. If no odors, staining, or elevated PID reading are encountered, then only one sample from the interval just above water table was collected. Four samples were collected from borehole DEC-016 and 3 from borehole DEC-018 because of high PID readings. Site photographs are provided in Appendix C, copies of the daily field notes are provided in Appendix E and soil boring logs are provided in Appendix G.

A COC form was maintained and accompanied the sample containers to Hampton-Clarke, Inc.- Veritech Laboratory (HC-V), which is a NYSDOH ELAP accredited laboratory. The soil samples were analyzed for target compound list (TCL) VOCs as listed in Table 2 plus tentatively identified compounds (TICs) analysis by USEPA SW846 Method 8260B.

2.7.3 Well Construction

The monitoring wells were constructed with 15 to 20 feet of 2-inch ID, Schedule 40 polyvinyl chloride (PVC) 0.010-inch slot screen and riser. The screen was nominally set between 5 feet above and 10 to 15 feet below the water table at each location. A 10 to 20 mesh size sand pack was installed from the bottom of the well up to 2 feet above the top of the well screen. Bentonite chips were then installed around the riser to an elevation of 1 foot below grade. Each monitoring well was finished with a locking well cap, a 2 foot square concrete apron, and a flush-mounted curb box. Security bolts were installed in the well covers to minimize unauthorized well access. The concrete apron thickness was consistent with the thickness of the existing pavement/sidewalk. Site photographs are provided in Appendix C, monitoring well construction logs are provided in Appendix H. Figure 5 shows the locations where groundwater monitoring wells were installed during this task (i.e., DEC-001 through DEC-022, with the exception of DEC-007 and DEC-013).

2.8 Monitoring Well Development

At least 24 hours after the monitoring wells were installed, the wells were developed by URS personnel using the pump and surge development method using a Wattera Hydrolift pump with dedicated/disposable high-density polyethylene (HDPE) tubing and HDPE check valves. Prior to well development, a 100-foot long Solonist oil/water interface probe was used to check for the presence/ thickness of any free product. During well development, water quality parameters (pH, specific conductivity, temperature and turbidity) were measured using a Hanna 991301 Multiparameter Meter and a Lamotte 2020 turbidimeter and recorded. A monitoring well was considered developed when a minimum of 5 well volumes were removed, and water quality parameters had stabilized. Well development logs may be found in Appendix I. Well development water was collected into DOT approved 55-gallon drums and picked up daily by Frank's for off-site disposal at a permitted facility.

2.9 Dense Non-Aqueous Phase Liquid Sampling

On June 11, a strong odor and a clear dense non-aqueous phase liquid (DNAPL) was encountered while developing monitoring well DEC-018, as measured with a100-foot long Solonist oil/water interface probe. Approximately 5.89 feet of the clear DNAPL was measured in the bottom of the well. The development of the well was ceased and the well was secured.

URS developed a HASP Addendum to address the safe and proper sampling procedure necessary to sample the unknown DNAPL. On June 19, 2007, the DNAPL was sampled by three URS personnel and a Department representative using Level B personal protective equipment (PPE). Prior to sampling, the headspace readings at the well were measured with a Foxboro 1000 PID/flame ionization detector (FID) for VOCs and a Rae Systems QRAE multimeter was used to measure percent oxygen (%O_2), percent of the lower explosive limit (%LEL), and carbon monoxide (CO) in parts per million (PPM). The headspace of the well indicated a VOC concentration of 317 ppm, a LEL of 1% and O_2 level of 12 %. A 100-foot long Solonist oil/water interface probe was used to check for the presence/ thickness of the DNAPL. No DNAPL was measured in the well. A sample was collected from the bottom of the well using a stainless steel bailer and dedicated/disposable

nylon rope. Site photographs are provided in Appendix C and copies of the daily field notes are provided in Appendix E.

A COC form was maintained and accompanied the sample containers to HC-V. The sample was analyzed for: TCL VOCs and additional petroleum-related volatiles plus TICs by 8260B; TCL semivolatile organic compounds (SVOCs) plus TICs by 8270C; TCL pesticides by 8081; TCL polychlorinated biphenyls (PCBs) by 8082; and flashpoint by 1010. The parameter list is provided in Table 3.

The well was subsequently developed and sampled on July 9, 2007 using Level C PPE.

2.10 Groundwater Sampling

On June 21-29, and July 10, 2007, URS sampled 28 (20 newly installed and 8 existing ExxonMobil) monitoring wells using low-flow sampling procedures. Roux Associates acting on behalf of ExxonMobil, provided URS with split-samples from the eight ExxonMobil locations (MW-014, MW-018, MW-019, MW-020, MW-023, MW-030, MW-092, and MW-095). ExxonMobil well MW-004 could not be accessed during this phase of fieldwork due to a large pile of construction and demolition (C&D) debris situated on top of the well.

Prior to sample collection, standing water was purged from each well with a QED SamplePro Micropurge bladder pump using dedicated/disposable bladders and HDPE tubing. Wells were purged at a rate of 1-liter per minute or less and the purge rate was adjusted to minimize draw down. A minimum of 1 well volume was purged from each well. During the purging of the well water quality parameters (pH, specific conductivity, temperature, dissolved oxygen, turbidity) were measured using a Horiba U-22 Multiparameter Instrument with a flow-through cell and documented on a purge log. The water quality parameters were stable prior to sampling. Purge logs are provided in Appendix J. Purge water collected into DOT approved 55-gallon drums was picked up daily by Frank's for proper disposal.

All samples were transported under COC via laboratory courier to HC-V. The samples were analyzed for TCL VOCs plus TICs by USEPA SW846 Method 8260B as listed in Table 2.

2.11 Investigation Derived Waste Disposal

Frank's Vacuum Truck Service (Frank's) was contracted for the daily pick-up and disposal of all drummed IDW at a permitted disposal facility. Copies of the non-hazardous bills of lading are provided in Appendix K.

2.12 Site Survey

NAIK Consulting Group surveyed the area, including all monitoring well and soil-gas conduit locations installed and/or sampled during the field investigation for location and elevation. The survey provides 100-scale mapping and does not include elevated roadways and expressways (i.e., Brooklyn-Queens Expressway). All surveying was performed under the supervision of a New York State licensed land surveyor. All vertical control points were referenced to the North American Vertical Datum 1988 (NAVD 1988). Horizontal datum was referenced to the North American Datum of 1983 (NAD83), New York State Plane Coordinate System, Long Island Zone. Copies of survey field notes and site sketches are provided in Appendix L. A site survey drawing is provided in Appendix M.

3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

The topography of the site investigation area varies from approximately 6 feet above mean sea level (amsl) at the bulkhead along Newtown Creek to approximately 56 feet amsl in the central part of the site. The site is located on an unconfined surficial glacial aquifer system consisting of outwash deposits that are underlain by a confining unit. Based upon subsurface data obtained during this and previous investigations, the site is underlain in most areas from the surface downward by: a fill unit, a sand unit, a discontinuous till unit, and a discontinuous clay/silt unit.

The fill unit varies from approximately 0 to 9 feet thick and consists of a heterogeneous mixture of sand, silt, clay and varying amounts of construction and demolition debris (i.e., bricks, concrete, coal, slag, etc.) and has been found at most boring locations. The sand unit has been found underlying the fill unit at most boring locations and is represented by stratified sands of varying textures containing some to no fines. The entire thickness of the sand unit has not been penetrated, however it was found to be approximately 63 feet thick at location DEC-016 (Anthony Street between Porter and Varick Avenues). The discontinuous till unit was noted in borings in the western and southwestern portion of the site (i.e., west of Morgan Avenue north of Meeker Avenue and west of Porter Avenue south of Meeker Avenue) and consists of a heterogeneous mixture of sand, silt, and clay and varying amounts of gravel, cobbles and boulders. The discontinuous clay/silt unit has been observed as an inclusive unit within the sand unit and has been observed in most of the borings at the site except in the central northwest portion of the site where it is absent. The thickness of the clay/silt unit, where present, varies from 0.5 to over 10 feet thick.

Figure 6 depicts the locations of cross-sections A-A', B-B', C-C', and D-D' which are shown on Figure 7 through Figure 10.

3.2 Investigation Area Hydrogeology

The primary hydrogeologic unit identified beneath the investigation area is the surficial aquifer present in the sand unit. Perched groundwater has been found in some site borings (DEC-004, DEC-007, DEC-015, and DEC-017) where less permeable units are present above the sand unit (i.e., till and or clay/silt unit). The water table surface may be found between approximately 24 and 53 feet bgs depending on the well location, which has been significantly influenced by the operation of the Off-Site System operated by ExxonMobil since approximately 1995. The operation of the Off-Site System has produced localized cones of depression resulting in an inward hydraulic gradient around the perimeter of the Off-Site Plume area, which has prevented the expansion of the Off-Site Plume. However, the Off-Site System was shutdown on March 7, 2007.

A potentiometric surface map based on the water level measurements obtained during well sampling (June 21-29, 2007) is provided in Figure 11. The water level measurements are provided in Table 4. Rainfall during that time period was as follows.

Date	Precipitation	Date	Precipitation
June 21	0.1 inch	June 26	None
June 22	0.25 inches	June 27	None
June 23	None	June 28	2 inches
June 24	None	June 29	0.25 inches
June 25	None		

The groundwater flow in the study area north of Meeker Avenue is eastward towards the Off-Site System with a groundwater mound at MW-20. The groundwater flow in the area south of Meeker Avenue appears to be flowing radially away from a groundwater mound located around DEC-006 and DEC-022 with a northward flow direction in the eastern most wells (towards the Off-Site System). Based on subsurface data collected from DEC-006 and DEC-022 and a review of cross-section A-A', the water level data obtained from DEC-006 and DEC-022 may represent perched groundwater. For comparison, the water level data from DEC-006 and DEC-022 has been removed and an alternative potentiometric surface has been shown on Figure 12. Based on the alternative potentiometric surface, the groundwater flow in the study area north of Meeker Avenue is still eastward towards the Off-Site System with a groundwater mound at MW-020. However, the

groundwater flow in the area south of Meeker Avenue appears to be flowing northward towards the Off-Site System.

On September 11, 2007 a round of synoptic groundwater level measurements were obtained from 25 wells for comparison to the water level measurements obtained from the purge logs (June 21-29, 2007). The water level measurements are provided in Table 4. The water level collected from well MW-030 was not used in developing the September 11, 2007 contour because of a suspected field measurement error. Well DEC-005 was damaged, therefore a water level measurement could not be taken. Wells DEC-010 and DEC-011 could not be measured because the security bolts were stuck. Figure 13 depicts the potentiometric surface on the September 11, 2007 water level measurements. The groundwater flow on September 11, 2007 closely resembles that generated from the purge logs (June 21-29, 2007). For comparison to Figure 12, the water level data from DEC-006 and DEC-022 has been removed and an alternative potentiometric surface has been shown on Figure 14.

The impacts of the Off-Site System shutdown on March 7, 2007 on the potentiometric surface and groundwater flow direction is currently not known because any groundwater data collected by Roux Associates subsequent to the shutdown was not available at the time of this report.

4.0 ANALYTICAL RESUTS

4.1 Soil-Gas Analytical Results

A summary of detected VOCs in the soil-gas and ambient air samples is presented in Table 5. The location of detected concentrations of PCE and its breakdown products are shown on Figure 15. There are no current promulgated criteria for contaminants in soil-gas samples. The complete validated analytical results from the June soil-gas sampling are presented in the DUSR in Appendix N. The Form Is and data summary tables provided in the DUSR include the reporting limit for each non-detected compound. Table 6 summarizes the detected parameters for the June sampling event as follows: the number of detections; the minimum, maximum and average values; and the location of the maximum value. Isocontours of PCE and TCE in the soil-gas are shown on Figures 16 and 17, respectively.

PCE was detected at concentrations ranging from 14 micrograms per cubic meter ($\mu g/m^3$) to 13,000 $\mu g/m^3$ with the highest concentrations found at locations SG-018 (7,200 $\mu g/m^3$), SG-022 (5,700 $\mu g/m^3$), and SG-023 (13,000 $\mu g/m^3$) along Vandervoort Avenue and Beadel Street between Lombardy Street and Division Place. SG-023 is approximately 200 feet east of the dry cleaner identified on the Sanborn maps between Beadel Street, Morgan Avenue, and Division Place.

A separate area of PCE contamination was centered around location SG-008 (2,400 $\mu g/m^3$), on Sutton Street between Nassau and Norman Avenues, which is located adjacent to a former metal working facility and research lab, and approximately 400 feet southeast of the dry cleaner identified on the Sanborn maps at the southwest intersection of Kingsland and Norman Avenues.

TCE was detected in the same general areas where PCE was found, as shown on Figure 17. Concentrations ranged from 0.32 $\mu g/m^3$ to 740 $\mu g/m^3$, with the highest concentration at SG-007 (740 $\mu g/m^3$), located on Sutton Street approximately 300 feet south of SG-008. The highest concentration in the Vandervoort Avenue/Beadel Street area was at SG-023 (370 $\mu g/m^3$), which also had the highest PCE concentration in the soil-gas samples collected.

The only location where PCE and/or the breakdown products were not detected was at location MP-008D located at the southwest corner of Norman Avenue and Hausman Street, however 1,1,2-trichloroethane, which is not a breakdown product of PCE, was detected at 2,600 µg/m^3 at this location (see Figure 15). 1,1,2-Trichloroethane was used as a solvent for fats, oils, waxes, and resins. A foundry was identified as occupying the buildings on both sides of Hausman Street adjacent to MP-008D until the 1980 Sanborn map. A chemical works was located approximately 100 feet south on the east side of Hausman Street until the 1951 Sanborn map. The manufacture of resins products were identified on the Sanborn maps starting in 1978 for the buildings on Morgan Avenue between Nassau and Norman Avenues, approximately 200 feet southwest of MP-008D. Several adhesive manufacturers are also identified in the buildings on the blocks between Sutton and Apollo Streets.

4.2 Soil Analytical Results

The soil sample results were compared to Technical and Administrative Guidance Memorandum (TAGM) #4046, Determination of Soil Cleanup Objectives and Cleanup Levels, January 24, 1994. As shown in Figure 18, the only soil sample that had a detection that exceeded TAGM 4046 criteria was from DEC-016 located at 86 Anthony Street between Porter and Varick Avenues, with 220 milligrams per kilogram (mg/kg) of PCE. Until 1992, a brass foundry was identified on the Sanborn maps for the building on the southwest side of DEC-016, and a junkyard occupies the property on the north side. Metal and steel products and metal works occupy the buildings in the blocks to the west of DEC-016 up to Vandervoort Avenue.

A summary of the detected TCL VOCs in the soil samples is presented in Table 7 with results exceeding TAGM 4046 criteria indicated with a circle. The complete validated analytical results are presented in the DUSR in Appendix N. The Form Is and data summary tables provided in the DUSR include the reporting limit for each compound.

4.3 Groundwater Analytical Results

A summary of the detected TCL VOCs in the groundwater samples is presented in Table 8 with results exceeding Division of Water Technical and Operational Guidance Series (TOGS) No.

1.1.1 Class GA groundwater criteria indicated with a circle. The complete validated analytical results from the June/July groundwater sampling are presented in the DUSR in Appendix N. The Form Is and data summary tables provided in the DUSR include the reporting limit for each compound. Table 9 summarizes the detected parameters for the June/July sampling event as follows: the number of detections; the minimum, maximum and average values; the number of samples with Class GA groundwater criteria exceedances; and the location of the maximum value.

Figure 19 shows the location and concentration of the compound(s) detected in the groundwater samples that exceeded TOGS No. 1.1.1 Class GA groundwater criteria. Isocontours of PCE and TCE in groundwater are shown on Figures 20 and 21, respectively.

The highest concentrations of PCE were detected at DEC-014 [1,900 micrograms per liter (µg/L)], DEC-016 (5,700 µg/L), and DEC-018 (7,600 µg/L). DEC-014 is located approximately 400 feet southeast of a former dry cleaner, 300 feet northeast of a second former dry cleaner, and 100 feet east of a drum recycling/ storage facility. DEC-016 is located adjacent to a former brass foundry and was also the location with the highest concentration of PCE detected in soil (see Figure 18 and Section 4.2). DEC-018 is located adjacent to a former soap manufacturer. No significant levels of PCE in groundwater were found in the northern portion of the site investigation area.

TCE was detected at concentrations that exceeded PCE levels by an order of magnitude at DEC-005 (4,700 µg/L vs. 44 µg/L PCE), DEC-004 (230 µg/L vs. 1.4 µg/L PCE), DEC-001 (110 µg/L vs. 10 µg/L PCE), and MW-092 (69 µg/L vs. non-detect PCE). This suggests that the source of TCE is not solely related to PCE degradation. DEC-005, located on Vandervoort Avenue between Anthony and Lombardy Streets is adjacent an iron works business. Metal works, steel products, scrap metal, drum storage, etc. are predominant in this area. In the area to the east of DEC-005, the TCE may be the result of PCE breakdown (from the DEC-016 and DEC-018 area) and/or groundwater flow from the DEC-005 area.

Another area of TCE contamination is in the area centered around DEC-001, located on Morgan Avenue between Nassau and Norman Avenues. As noted in Section 4.1, this location was adjacent to a foundry to the east and resin and adhesive producers to the west.

4.4 DNAPL Sample Analytical Results

Upon receipt of the suspected DNAPL collected on June 19, 2007, laboratory personnel inspected the sample for phase separation. The entire sample was determined to be an aqueous matrix, with the highest concentrations of identified compounds being PCE and TCE at 9.6 and 1.3 parts per million (ppm), respectively. A summary of the detected compounds in the sample (DEC-018 LH) is presented in Table 10 with results exceeding TOGS 1.1.1 Class GA groundwater criteria indicated with a circle. The complete validated analytical results from the DNAPL sample are presented in the DUSR in Appendix N. The Form Is and data summary tables provided in the DUSR include the reporting limit for each compound.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon the results of this Phase of the investigation, the following conclusions are provided:

- Soil-gas samples from north of Meeker Avenue indicated that PCE has impacted soil-gas quality at all locations sampled, the highest concentrations my be found in the vicinity of SG-008, which is located adjacent to a former metal working facility and research lab and approximately 400 feet southeast of a former dry cleaner located on the southwest corner of Kingsland and Norman Avenues. Soil-gas has also been impacted to a lesser extent by TCE, most notably in the vicinity of SG-007, which is located approximately 300 feet south of SG-008.

- Soil-gas samples from south of Meeker Avenue indicated that PCE has impacted soil-gas quality at all locations sampled, the highest concentrations my be found in the vicinity of SG-015, SG-018, SG-022, and SG-023. SG-023 is located approximately 200 feet east of the former dry cleaner identified on the Sanborn maps between Beadel Street, Morgan Avenue, and Division Place. The remaining soil-gas samples are located either side-gradient or down gradient of the former dry cleaner. Soil-gas has also been impacted to a lesser extent by TCE, most notably in the vicinity of SG-015, SG-018, SG-022, and SG-023.

- A soil sample from the 5-6 feet bgs interval from monitoring well location DEC-016 that is located adjacent to a former brass foundry was the only sample that exceeded TAGM 4046 criteria, with 220 mg/kg of PCE.

- Groundwater samples from north of Meeker Avenue indicated that groundwater has been impacted slightly above Class GA groundwater standards for PCE at DEC-001 and DEC-003. Also, groundwater has been impacted above Class GA groundwater standards for TCE at DEC-001, DEC-003 and MW-092.

- Groundwater samples from south of Meeker Avenue indicate that groundwater has been impacted above Class GA groundwater standards for PCE at all locations except for MW-019. The highest concentrations of PCE appear to be centered on DEC-14 (downgradient and side-gradient of two former dry cleaners and side-gradient from a

drum recycling facility); DEC-16 (adjacent to a former brass foundry); and DEC-018 (adjacent to a former soap manufacturer). Also, groundwater has been impacted above Class GA groundwater standards for TCE at all locations except for DEC-019 and MW-019. The highest concentrations of TCE appear to be centered on DEC-005 (adjacent to a metal working facility) and DEC-018. Based on the groundwater results there appears to be potentially two point sources for PCE (DEC-014 and DEC-016); one point source for PCE and TCE (DEC-018); and one point source for TCE (DEC-005).

The following recommendations are offered for consideration by the Department:

- Additional soil-gas conduits should be installed to further delineate impacted soil-gas both north and south of Meeker Avenue at the locations shown on Figure 22 during Phase II fieldwork.
- Based on the subsurface soil sample results from monitoring well location DEC-16, direct-push borings should be advanced in the vicinity of DEC-16 to delineate the horizontal and vertical extent of PCE impacted subsurface soil. The direct push boring should be advanced to approximately 20 feet bgs, with a sample collected from the one-foot interval exhibiting the highest PID reading. The samples will be analyzed for TCL VOCs plus TICs by USEPA SW846 Method 8260B. The proposed direct-push boring locations are shown on Figure 22.
- Based on the subsurface condition encountered during this phase of fieldwork, direct-push groundwater sampling may be feasible south of Meeker Avenue and east of Porter Avenue. The collection of the direct-push groundwater samples may aid in the delineation of PCE and TCE impacted groundwater in this area. The proposed direct-push groundwater samples locations are shown on Figure 23.
- Based on the impacts to groundwater quality by PCE and TCE, additional monitoring wells should be installed to delineate the horizontal extent of the PCE and TCE impacts and to help distinguish potential point sources. Also, a deep monitoring well should be installed at DEC-006 and/or DEC-022 to determine if the groundwater encountered in these wells are perched or represents the true potentiometric surface. This data will assist in determining the potential migration direction of impacted groundwater. The proposed monitoring well locations are shown on Figure 23.

- Because of damage observed in subsequent site visits, well repairs should be made to DEC-005 and well bolts should be replaced at DEC-010 and DEC-011.