ExxonMobil
Environmental Services

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Steve Trifiletti
Project Manager

March 11, 2010

Mr. Brian Davidson
New York State Department of Environmental Conservation
Remedial Bureau B
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233-7016

Re: Interim Site Characterization Report
Former Pratt Oil Works
Inland Parcels, Queens, New York

Dear Mr. Davidson:

Exxon Mobil Corporation ("ExxonMobil") is submitting for your review and comment the enclosed Interim Site Characterization Report for the subject site. Three hard copies and an electronic copy are provided per Section VIII of the Consent Order (D2-1002-12-07AM) executed between ExxonMobil and NYSDEC. This report has been prepared on behalf of ExxonMobil by Kleinfelder of Bohemia, New York.

Please do not hesitate to contact me at (718) 383-7374 if you have any questions.

Very truly yours,

John E Wolf for

Steve Trifiletti
Project Manager

Enclosure

Via FEDEX Overnight

cc: N. Sherman (HP Sherman Co. Inc. – hard copy only)
S. Caruso (NYSDEC – electronic copy only)
J. Wolf (Kleinfelder)

KLEINFELDER
Bright People. Right Solutions.

DELIVERED VIA ELECTRONIC MAIL

March 11, 2010

Mr. Steve P. Trifiletti
ExxonMobil Environmental Services Company
Global Remediation - Major Projects
400 Kingsland Avenue
Brooklyn, New York 11222

Re: Interim Site Characterization Report
The Inland Parcels (Tract I)
Former Pratt Oil Works
Parcel A - 38-40 Railroad Avenue
Parcel C - 38-70 Review Avenue
Parcel D - 38-84 Railroad Avenue
Parcel E - 38-50 Review Avenue and 38-54 Railroad Avenue
Parcel F - 38-98 Review Avenue
Parcel G - 38-78 review Avenue
Parcel H - 39-30 Review Avenue
Parcel I - 38-20 Review Avenue
Parcel J - 37-88 Review Avenue
Parcel K - 38-60 Review Avenue
Long Island City, New York
NYSDEC Case No. 07-07418 (Parcel A)
NYSDEC Case No. 08-13060 (Parcel C)
NYSDEC Case No. 09-04539 (Parcel D)
NYSDEC Case No. 09-03356 (Parcel E)
NYSDEC Case No. 09-03488 (Parcel G)
NYSDEC Case No. 09-03616 (Parcel H)
NYSDEC Case No. 09-03287 (Parcel I)
Consent Order Case No. D2-1002-12-07AM
NYSDEC Remedial Tracking No. S241115

Dear Mr. Trifiletti:

Enclosed, please find an Interim Site Characterization Report (ISCR) prepared by Kleinfelder East, Inc. (Kleinfelder) on behalf of ExxonMobil Environmental Services Company (ExxonMobil) for the Inland Parcels listed above, which compose Tract I of

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the Former Pratt Oil Works (FPOW) (further referred to as the Inland Project Area). The ISCR documents the methods and results of a site characterization conducted in the Inland Project Area at the above referenced addresses. The site characterization was conducted and this ISCR has been prepared in accordance with Item Nos. 1 and 2 of a Corrective Action Plan (CAP) included in Consent Order Case No. D2-1002-12-07AM which was executed between ExxonMobil Oil Corporation and the New York State Department of Environmental Conservation (NYSDEC) on July 15, 2008 ("Consent Order").

ExxonMobil voluntarily petitioned the NYSDEC to perform an investigation of the current environmental conditions at several individual parcels which formerly comprised the FPOW (the "Project Area"). By way of the Consent Order, subject to a reservation of rights, ExxonMobil voluntarily agreed to perform a site characterization of the Project Area, despite several decades of industrial and petroleum-related operations unrelated to ExxonMobil, that both pre- and post-dated ExxonMobil's predecessor's discrete presence in the Project Area (Parsons, 2008).

The methods of the site characterization were outlined in a *Site Characterization Work Plan for the Inland Parcels, Former Pratt Oil Works Site* (Work Plan) prepared by Parsons in August 2008 and a *Site Characterization Work Plan Addendum* prepared by Kleinfelder dated November 21, 2008, which was approved by the NYSDEC on December 1, 2008. The intent of the site characterization was to better understand the origin, nature, and extent of the environmental conditions that may exist in the Inland Project Area.

As memorialized in February 17, 2009 correspondence from the NYSDEC, each parcel would be assigned one NYSDEC case number, if warranted, in order to manage site characterization activities under one comprehensive case number per parcel. NYSDEC Case Nos. referenced in this cover letter are detailed in Section 1.1.2 of the ISCR detailing the date and cause for generation.

After securing access to Parcels A, C, D, E and G, site characterization activities commenced in the Inland Project Area on June 9, 2009, including the following: geophysical investigations; professional metes and bounds surveys; drilling of three soil borings including conversion of two to monitoring wells; drilling of nine monitoring wells; excavation of three soil test pits. The enclosed ISCR provides a description of the methods and results of the site characterization activities, as well as a discussion of the site history, site-specific geology and hydrogeology, conceptual site model and recommendations.

As stated above, ExxonMobil submits this ISCR in accordance with the CAP included in the Consent Order ExxonMobil voluntarily entered with the State of New York and subject to an express reservation of rights. Accordingly, ExxonMobil's submission of this ISCR, its contents, and ExxonMobil's performance of the investigation of the Project Area in accordance with the Consent Order shall not constitute an admission of liability, fault or wrongdoing by ExxonMobil and shall not give rise to any presumption of law or

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finding of fact. ExxonMobil expressly reserves any and all of its rights relative to ExxonMobil's performance of the investigation of the Project Area in accordance with the Consent Order.

If you have questions or comments, please contact the undersigned at (631) 218-0612.

Very truly yours,
Kleinfelder East, Inc.

John E. Wolf
Senior Project Manager

for
Michael Meyerhoefer
Field Supervisor

Enclosure

Copy: File (FPOW - 16)

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INTERIM SITE CHARACTERIZATION REPORT

The Inland Parcels (Tract I)
Former Pratt Oil Works
Parcel A - 38-40 Railroad Avenue
Parcel C - 38-70 Review Avenue
Parcel D - 38-84 Railroad Avenue
Parcel E - 38-50 Review Avenue and 38-54 Railroad Avenue
Parcel F - 38-98 Review Avenue
Parcel G - 38-78 review Avenue
Parcel H - 39-30 Review Avenue
Parcel I – 38-20 Review Avenue
Parcel J - 37-88 Review Avenue and
Parcel K - 38-60 Review Avenue
Long Island City, New York

NYSDEC Case No. 07-07418 (Parcel A)
NYSDEC Case No. 08-13060 (Parcel C)
NYSDEC Case No. 09-04539 (Parcel D)
NYSDEC Case No. 09-03356 (Parcel E)
NYSDEC Case No. 09-03488 (Parcel G)
NYSDEC Case No. 09-03616 (Parcel H)
NYSDEC Case No. 09-03287 (Parcel I)

Consent Order Case No. D2-1002-12-07AM
NYSDEC Remedial Tracking No. S241115

March 11, 2010

Prepared by:

Kleinfelder East, Inc.
One Corporate Drive, Suite 201
Bohemia, New York 11716
(631) 218-0612

Prepared for:

ExxonMobil Environmental
Services Company
400 Kingsland Avenue
Brooklyn, New York 11222
(718) 383 7374

INTERIM SITE CHARACTERIZATION REPORT

The Inland Parcels (Tract I)
Former Pratt Oil Works
Long Island City, New York

ENGINEERING CERTIFICATION

This report has been reviewed by Kleinfelder Engineering, P.C. for accuracy, content and quality of presentation. The Education Law of the State of New York prohibits any person from altering anything in the report in anyway unless it is under the direction of the licensed professional engineer. Where such alterations are made, the professional engineer must sign, seal, date and describe the full extent of the alteration (NYS Education Law Section 7209-2).

STATE OF NEW YORK · JUSTIN R. MOSES · LICENSED PROFESSIONAL ENGINEER · NO. 077926

Justin R. Moses, P.E.
Vice President and Secretary
Kleinfelder Engineering, P.C.

3/11/10
Date

INTERIM SITE CHARACTERIZATION REPORT

The Inland Parcels (Tract I)
Former Pratt Oil Works
Long Island City, New York

QUALITY ASSURANCE/QUALITY CONTROL

The following personnel have reviewed this report for accuracy, content, and quality of presentation:

John E. Wolf — 3/11/10
John E. Wolf
Project Manager
Date

for — 3/11/10
Michael Meyerhoefer
Field Supervisor
Date

John E. Wolf for — 3/11/10
Jeffrey Hale, PG
Technical Director
Date

3/11/10
Daniel Canavan
Project Hydrogeologist
Date

for — 3/11/10
Scott E. Strom
Environmental Scientist
Date

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APPENDICES

LIST OF ACRONYMS AND ABBREVIATIONS

µg/L	-	micrograms per liter
AST	-	aboveground storage tank
ASP	-	analytical services protocol
ASTM	-	American Society for Testing and Materials
AWHL	-	Alpha Woods Hole Labs
BDL	-	below instrument detection limit
BRL	-	below laboratory reporting limits
CAMP	-	Community Air Monitoring Plan
Carey	-	Carey Energy Company
CO	-	Carbon Monoxide
CSM	-	conceptual site model
CSO	-	combined sewer overflows
CST	-	centistokes
DO	-	dissolved oxygen
DSNY	-	New York City Department of Sanitation
DTB	-	depth to bottom
DTW	-	depth to water
DUSR	-	Data Usability Summary Report
ELAP	-	Environmental Laboratory Approval Program
EM	-	electromagnetic
eV	-	electron Volt
Fbg	-	feet below grade
ft/d	-	feet per day
ft/ft	-	feet per foot
FPOW	-	Former Pratt Oil Works
FSP	-	Field Sampling Plan
g/mL	-	grams per milliliter
GPR	-	ground penetrating radar
H_2S	-	Hydrogen Sulfide
Haley & Aldrich	-	Haley & Aldrich, Inc
HASP	-	Health and Safety Plan

LIST OF ACRONYMS AND ABBREVIATIONS

IDW	-	investigation-derived wastes
IRM	-	interim remedial measure
ISCR	-	Interim Site Characterization Report
LEL	-	Lower Exposure Limit
LIRR	-	Long Island Railroad
LNAPL	-	light non-aqueous phase liquid
LCS	-	Laboratory control sample
MDL	-	method detection limit
Mgal/d	-	million gallons per day
mg/kg	-	milligrams per kilogram
mg/L	-	milligrams per liter
mg/m^3	-	milligrams per cubic meter
$\mu g/m^3$	-	micrograms per cubic meter
ML	-	milliliter
mPas	-	Millipascal
MS	-	Matrix spike
MSD	-	Matrix spike duplicate
msl	-	mean sea level
mS/cm	-	milliSiemens per centimeter
MSW	-	municipal solid waste
MTBE	-	Methyl tertiary-butyl ether
mV	-	millivolts
NAPL	-	non-aqueous phase liquid
NTU	-	Nephelometric Turbidity Units
NYCRR	-	New York Codes Rules and Regulations
NYSDEC	-	New York State Department of Conservation
NYCDEP	-	New York City Department of Environmental Protection
NYSDOH	-	New York State Department of Health
ORP	-	oxidation reduction potential
PAH	-	polycyclic Aromatic Hydrocarbons
PCBs	-	polychlorinated biphenyls

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LIST OF ACRONYMS AND ABBREVIATIONS

Peerless	-	Peerless Oil Co.
PIANO	-	paraffin, isoparaffin, aromatics, napthenes, and olefins
PID	-	photoionization detector
PVC	-	polyvinyl chloride
PPE	-	personal protective equipment
ppm_v	-	parts per million by volume
QA	-	quality assurance
QAPP	-	Quality Assurance Project Plan
QC	-	quality control
RCA	-	recycled concrete aggregate
RUSCO	-	Restricted Use Soil Cleanup Objective
SCWP	-	Site Characterization Work Plan
SDG	-	Sample delivery group
SOCONY	-	Standard Oil Company of New York
su	-	standard unit
SVOCs	-	semi-volatile organic compounds
TAL	-	Target Analyte List
TAGM	-	Technical and Administrative Guidance Memorandum
TCL	-	Target Compound List
TOGS	-	*Technical and Operational Guidance Series*
TPH	-	total petroleum hydrocarbons
USDOT	-	United States Department of Transportation
USEPA	-	United States Environmental Protection Agency
USGS	-	United States Geologic Survey
UST	-	underground storage tank
VOCs	-	volatile organic compounds
WMC	-	Waste Management Corporation
WQS	-	water quality standards

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EXECUTIVE SUMMARY

ExxonMobil Environmental Services Company (ExxonMobil) contracted Kleinfelder East, Inc. (Kleinfelder) to conduct a site characterization of Inland Parcels A, C, D, E, G, H, and I included in Tract I of the Former Pratt Oil Works (FPOW) located in Long Island City, New York (the "Inland Project Area"). The Project Area encompasses approximately 18.51 acres located adjacent to Newtown Creek. The Project Area is divided by the Long Island Rail Road (LIRR) train tracks. Properties north of the LIRR are the Inland Parcels (Tract I) and south are the Waterfront Parcels (Tract II). For purposes of this Report, collectively, the Inland Parcels and the Waterfront Parcels are known as the "Project Area" and, separately, the Inland Parcels are known as the "Inland Project Area" and the Waterfront Parcels are known as the "Waterfront Project Area".

From the early 1850s to present, the Project Area was developed and used for industrial activities, including petroleum, chemical, gravel, manufacturing, warehousing/storage, and waste transfer operations by a variety of owners and operators. Of these various industrial activities, Standard Oil Company of New York (SOCONY) conducted the manufacture of wax, lubricating oils, burning oils, grease compounding, and barrel manufacturing for only a limited period of time, approximately 1892 until 1949. Several decades of industrial and petroleum-related operations both pre- and post-dated SOCONY's ownership. Subsequent to this discrete period of time, Parcel A was redeveloped and Carey Energy Company (Carey) and associated companies, including Peerless Oil Co. (Peerless), conducted petroleum and chemical operations from approximately 1953 and 1984. Waste Management Corporation (WMC) purchased Parcel A in 1998 for use as a New York City Department of Sanitation (DSNY) waste transfer station. Parcel B and the Inland Project Area were developed as warehouse space for multiple tenants/uses including, but not limited to, an insulation company, roll-off container storage, valve manufacturing, and vacant warehouse space.

The purpose of the site characterization was to investigate the soil and groundwater quality beneath the Inland Project Area to better understand the origin, nature, and extent of identified environmental conditions, if present.

EXECUTIVE SUMMARY

The scope of work consisted of the following investigation activities:

- Surface geophysical investigation activities;
- Drilling of 3 soil borings, including conversion of two to monitoring wells;
- Drilling of 9 groundwater monitoring wells;
- Excavation of 3 test pits;
- Laboratory analysis of selected soil samples for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), metals plus cyanide, pesticides and polychlorinated biphenyls (PCBs);
- Forensic analysis for hydrocarbon compositional analysis;
- Evaluation of groundwater elevation, flow direction, hydraulic gradient and light non-aqueous phase liquid (LNAPL) distribution;
- Groundwater sampling and analysis for VOCs, SVOCs, metals plus cyanide, pesticides, PCBs, and formaldehyde; and
- Collection of LNAPL samples for forensic analysis, including hydrocarbon compositional analysis.

The Project Area geology consists of unconsolidated glacial till predominately consisting of sands, with some gravels, cobbles and silt. Groundwater is present beneath the Project Area in the Upper Glacial Aquifer at depths ranging from 3.5 to 21 feet below grade (fbg). Groundwater generally flows in the direction of Newtown Creek at an approximate hydraulic gradient of 0.009 feet per foot (ft/ft).

NAPL with specific gravity less than one has been detected in monitoring wells on Parcels A, B, C, D, and E. NAPL was identified in the zone above the water table in the capillary fringe, at or below the water table, and beneath a semi-confining layer, appearing to indicate that a combination of water table fluctuation and hydrostratigraphic framework control the vertical distribution of NAPL. NAPL mobility is expected to be inhibited by the removal of potential historic sources, the attainment of steady-state conditions, sorption to the soil matrix, interfacial tension, capillary forces

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within the pore spaces and relatively high (64.78 to 92.18 centistokes [cst]) kinematic viscosity (Cole, 1994).

NAPL, characterized as broad cut distillates, was identified at several sampling locations throughout Waterfront Parcel A, in the northwest corner of Parcel B and in soil and LNAPL samples collected from the Inland Project Area. A wax-like substance was also identified at two locations and, as a secondary component, in three soil samples. The Project Area, including the area in which broad cut distillates were identified, is also punctuated by various detections of hydraulic fluid/greases, lube oil range material, light and middle distillate material, chlorinated VOCs, and gasoline constituents that potentially originate from non-FPOW sources. The presence of pyrogenic polycyclic aromatic hydrocarbons (PAHs) may be attributable to the coal ash fill material, which is present along the northern and southern portions of Waterfront Parcel A and Parcel B and onto the central portion of the Inland Project Area. This historic fill material appears to pre-date the FPOW operations.

Chlorinated VOCs were detected in soil samples collected from the west and northwest portion of Parcel A, near the water table in proximity to where these compounds were detected in groundwater. Chlorinated VOCs were detected in soil samples near the water table in the eastern portion of Parcel A. In addition, chlorinated VOCs were detected in soil samples collected from MW-14, MW-17 and MW-21 and in groundwater samples collected from MW-21. The source(s) of chlorinated VOCs are unknown.

Benzene and, to a lesser extent, toluene, ethylbenzene and xylenes were detected in soil samples throughout Waterfront Parcel A above NYSDEC Recommended Soil Cleanup Objectives (RSCOs). Isopropylbenzene and acetone were detected in soil samples above RSCOs collected from the Waterfront Project Area. VOCs were not detected in soil samples collected from the Inland Project Area above RSCOs with the exception of MW-17 (12.5-17'). Benzene was sparsely detected in groundwater samples from the Waterfront Project Area. Benzene detections in groundwater samples were not consistently associated with benzene concentrations in soil samples collected.

Methyl tertiary-butyl ether (MTBE) was detected in groundwater at the south-central portion of Parcels A and C. MTBE is not associated with FPOW operations.

With the exception of samples collected from SB-11, MW-16, MW-20, MW-22 and MW-24, SVOCs, in the form of PAHs, were detected above RSCOs in the soil samples collected. In general, PAH concentrations were greater in samples collected from the Waterfront Project Area, compared to the Inland Project Area. These PAHs are primarily attributed to the widespread distribution of coal ash within the fill that underlies the Project Area. SVOCs were minimally detected in groundwater throughout the Project Area, which appears consistent with the fact that SVOCs include high molecular weight hydrocarbons that tend to sorb to soils and have a low solubility in groundwater.

Metals were detected above RSCOs in soil samples collected from the Project Area. The majority of metals were detected in the fill material, in existence prior to FPOW operations, at or above the water table. The distribution of metals decreased in soil samples collected below the water table. The lower distribution of metals in groundwater relative to distribution in soil suggests the fill material as a likely source. Historical site information does not indicate that the metals identified in the Project Area were used in FPOW operations.

The closest residential structure to the Project Area containing a basement is located approximately 780 feet north-northwest (up-gradient). The closest commercial buildings with basements are located on the Inland Project Area including: 37-88 Review Avenue, 38-20 Review Avenue, 38-60 Review Avenue, and 38-54 Railroad Avenue. No schools, daycare centers, hospitals, or parks were identified within a half mile of the Project Area. The nearest surface water body is Newtown Creek, located adjacent to the southern property boundary (downgradient) of the Waterfront Project Area. There are no known municipal water supply wells within a half-mile of the Project Area, and water to the area is supplied by New York City Department of Environmental Protection (NYCDEP) Bureau of Water and Sewer Operations, the sources of which are Catskills and Delaware reservoir systems located in upstate New York. Pumping of groundwater for public supply in western Queens County stopped in 1974.

1.0 INTRODUCTION

ExxonMobil Environmental Services Company (ExxonMobil) contracted Kleinfelder East, Inc. (Kleinfelder) to conduct a site characterization of the Inland Project Area. The purpose of the site characterization was to investigate the soil and groundwater quality beneath the Inland Project Area to better understand the origin, nature, and extent of identified environmental conditions, if present. The site characterization and this Interim Site Characterization Report (ISCR) have been prepared in accordance with Item Nos. 1 and 2 of a Corrective Action Plan (CAP) included in Consent Order Case No. D2-1002-12-07AM which was executed between ExxonMobil Oil Corporation and the New York State Department of Environmental Conservation (NYSDEC) on July 15, 2008. The site characterization was conducted following a *Site Characterization Work Plan for the Inland Parcels, Former Pratt Oil Works Site* (Work Plan) completed by Parsons dated August 2008 and a *Site Characterization Work Plan Addendum* completed by Kleinfelder dated November 21, 2008 and approved by NYSDEC on December 1, 2008. The Work Plan included a Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HASP). An interim site characterization was previously conducted on the Waterfront Project Area as documented in an *Interim Site Characterization Report* prepared by Kleinfelder dated August 10, 2009. The location of the Project Area is illustrated on Figure 1.

The parcels that constitute the Project Area have changed ownership over the years. Further discussion of the ownership is provided in Section 2 of this ISCR. The addresses of the Inland Project Area, as well as current property owners, are listed in the following table:

Inland Project Area

Parcel	Address	Current owner
Parcel A	38-40 Railroad Avenue	Waste Management of New York
Parcel C	38-70 Review Avenue	Keane Realty LLC
Parcel D	38-84 Railroad Avenue	A&L Cesspool Ser./Co. DBA A&L Recycling
Parcel E	38-50 Review Avenue and 38-54 Railroad Avenue	HP Sherman Co. Inc. & William E. Williams Valve Corp.
Parcel F	38-98 Review Avenue	DG Properties LLC
Parcel G	38-78 Review Avenue	Werwaiss Realty Co.
Parcel H	39-30 Review Avenue	Pepatoba Corp.
Parcel I	38-20 Review Avenue	Review Associates
Parcel J	37-88 Review Avenue	Up From the Ashes, Inc.
Parcel K	38-60 Review Avenue	Renari LLC

A previous subsurface investigation was conducted on Parcel C, Lot 348 which is currently owned by Keane Realty, LLC. The investigation was conducted by EEA, Inc. in 1989. A report documenting this investigation and the results were provided as Appendix A in the Parsons Work Plan dated August 2008.

The site characterization field activities documented in this ISCR were initiated following procurement of access agreements with the concerned property owners. The scope of work consisted of the following:

- Secure access with current property owners;
- Perform a geophysical investigation, including a utility markout;
- Preclearing, by vacuum or hand, of three soil borings (SB-13 though SB-15), nine monitoring wells (MW-14 through MW-22) , and three test pits (TP-12 through TP-14);

- Drill three, on-site soil borings (SB-13, SB-14, and SB-15), including conversion of two soil borings to monitoring wells (SB-13 to MW-24 and SB-14 to MW-23);
- Drill nine monitoring wells (MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20, MW-21 and MW-22);
- Collect continuous, 2-inch diameter, 5-foot long macro-core or 2-inch diameter, 2-foot long split-spoon soil samples from the soil borings and monitoring wells from approximately 4 or 8 feet below grade (fbg), depending on the terminal depth completed during preclearing, to the terminal depth of the borings;
- Excavate three test pits (TP-12 through TP-14);
- Geophysical investigation of unidentified piping observed in test pit locations.
- Field screening of soil samples for volatile organic compounds (VOCs) using a photoionization detector (PID);
- Laboratory analysis of select soil samples from the soil borings, monitoring wells, and test pits for VOCs, semi-volatile organic compounds (SVOCs), metals plus cyanide, pesticides, and polychlorinated biphenyls (PCBs);
- Submittal of select soil samples to a laboratory for hydrocarbon compositional analysis;
- Submittal of select soil samples from the soil borings for sieve analysis with hydrometer for grain size analysis;
- Performance of a survey of the Inland Project Area by a licensed professional surveyor;
- Evaluation of groundwater elevation, flow direction, hydraulic gradient and light non-aqueous phase liquid (LNAPL) distribution for the Project Area;
- Collection of groundwater samples from monitoring wells, without detections of LNAPL, for laboratory analysis of VOCs, SVOCs, metals plus cyanide, pesticides and PCBs;
- Laboratory analysis of groundwater samples collected from monitoring wells MW-20 and MW-21 for formaldehyde;
- Collection of LNAPL samples from the monitoring wells, with adequate LNAPL volume, for hydrocarbon compositional analysis;
- Development of a preliminary site conceptual model; and

- Preparation of this ISCR.

1.1 Regulatory History

The following subsections summarize the regulatory history with the NYSDEC for the Project Area.

1.1.1 Consent Order

ExxonMobil Oil Corporation and the NYSDEC signed Consent Order Case No. D2-1002-12-07AM on July 15, 2008 by which ExxonMobil voluntarily agreed to perform a site characterization of the current environmental conditions of the Project Area. ExxonMobil voluntarily agreed to perform a site characterization of the Project Area, subject to an express reservation of rights and without admission of liability, despite several decades of industrial and petroleum-related operations unrelated to ExxonMobil, that both pre- and post-dated ExxonMobil's predecessor's discrete presence in the Project Area (Parsons, 2008).

1.1.2 NYSDEC Spill Numbers

As memorialized in February 17, 2009 correspondence from the NYSDEC, each parcel would be assigned one NYSDEC case number, if warranted, in order to manage site characterization activities under one comprehensive case number per parcel. NYSDEC case numbers generated for the Project Area include the following:

Parcel A: NYSDEC generated case No. 07-07418 on October 5, 2007 for 38-50 Review Avenue, Maspeth.

Parcel B: NYSDEC generated case No. 08-13060 on March 5, 2009 for 39-14 Review Avenue, Long Island City in response to VOCs detected while field screening soil samples collected during the preclearing of monitoring well MW-9.

Parcel C: NYSDEC generated case No. 07-07417 on October 5, 2007 for 38-70 Review Avenue, Maspeth.

Parcel D: NYSDEC generated case No. 09-04539 on July 19, 2009 for 38-84 Railroad Avenue, Long Island City in response to VOCs detected while field screening soil samples collected during the drilling of soil boring SB-13/MW-24.

Parcel E: NYSDEC generated case No. 09-03356 on June 22, 2009 for 38-54 Railroad Avenue in response to VOCs detected while field screening soil samples collected during the preclearing of monitoring well MW-17.

Parcel G: NYSDEC generated case No. 09-03488 on June 24, 2009 for 38-78 Review Avenue, Long Island City in response to odors detected in a soil sample collected during the drilling of soil boring SB-15.

Parcel H: NYSDEC generated case No. 09-03616 on June 27, 2009 for 39-30 Review Avenue, Long Island City in response to odors detected in a soil sample collected during the drilling of monitoring well MW-21.

Parcel I: NYSDEC generated case No. 09-03287 on June 20, 2009 for 38-20 Review Avenue, Long Island City in response to odors detected in a soil sample collected during the drilling of monitoring well MW-20.

2.0 SITE DESCRIPTION AND HISTORY

The following subsections provide a site description, describe historic and current property uses, and describe previous environmental activities performed at the Project Area.

2.1 Site Description

The Project Area encompasses approximately 18.5 acres located adjacent to Newtown Creek. The property has since been subdivided into 16-lots of Block 312. The Project Area is divided north and south by the Long Island Rail Road (LIRR) train tracks. Properties north of the LIRR are the Inland Parcels (Tract I) (Inland Project Area) and properties south of the LIRR are the Waterfront Parcels (Tract II) (Waterfront Project

Area). Each tract is further subdivided into parcels (Parcels A through K) based on property ownership. Therefore, each parcel may have more than one address based on property ownership. This ISCR is limited to the Inland Project Area. A Site Plan illustrating pertinent site features including, but not limited to, block and lot, parcel identification, property boundaries, LIRR and current buildings and structure layouts is provided on Figures 2 and 3.

The Inland Project Area includes 10 commercial/industrial properties between the LIRR and Review Avenue, approximately 1,000 feet southeast of the Greenpoint Avenue Bridge. Public utilities servicing the Inland Project Area include underground water, electric and telecommunication lines. Specific property descriptions and zoning are further described in Section 2.3, Current Property Use. Sanitary waste is stored on each parcel in what appear to be septic tanks; however, the construction of the structures was not confirmed. The results of a survey of the property boundaries and pertinent site features of the Inland Project Area are provided on Figure 2. Inland Project Area photos are provided as Appendix A.

There are currently 24 monitoring wells in the Project Area (MW-1 through MW-24) including 13 monitoring wells (MW-1 to MW-13) on the Waterfront Project Area and 11 monitoring wells (MW-14 through MW-24) on the Inland Project Area.

2.2 Historic Project Area Property Use

The development of the Project Area appears to have commenced in the early 1850's by the North American Kerosene Gas Lamp Company (Parsons, 2008). The Asphalt Mining and Kerosene Gas Company set up a factory along Newtown Creek, Long Island City in 1854. The company later changed names to North American Kerosene and Lighting Company (Dictionary of Canadian Biography).

On or about July 1876, Charles Pratt & Company acquired the property under the name of the Pratt Long Island Refinery (Pratt Oil Works). Historic information indicates a

Queens County Oil Works was present at the Project Area before the acquisition by Charles Pratt (Parsons, 2008). The FPOW operated primarily as a paraffin wax refinery. Standard Oil Company of New York (SOCONY), however, did not acquire the FPOW refinery until 1892. SOCONY ceased operations in approximately 1949 (Parsons, 2008). Figure 4 illustrates the layout of the Project Area in 1949; with descriptions of areas based from 1915, 1936 and 1950 Sanborn maps (The Sanborn Library, LLC).

2.2.1 Chain of Title Review Summary

A chain of title search was conducted for the Inland Project Area. The following is a summary of the sellers and buyers identified for each block and lot:

Parcel A, Block 312, Lot 1367, 38-40 Railroad Ave.

Date	Seller	Buyer
5/10/1998	Review Avenue Enterprises, Inc.	Waste Management of New York City
3/5/1996	Review Avenue Recycling Corp., as nominee for Tom Gesuale	Waste Management of New York City
3/5/1996	Review Avenue Enterprises, Inc.	Review Avenue Recycling Corp., as nominee for Tom Gesuale
3/14/1984	Nepco, Inc. (Successor in interest to Burns Bros., Inc.)	Review Avenue Enterprises, Inc.
11/27/1973	Peerless Petrochemicals, Inc. / Carey Terminal Corp. (Successor by merger to Carey Terminal Corp.)	Burns Bros., Inc.
3/25/1954	Com-Met Corp.	Carey Terminal Corp.
3/25/1954	Commercial Metals Co.	Com-Met Corp.
3/30/1954	Socony-Vacuum Oil Comp.,	Com-Met Corp.

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Parcel C, Block 312, Lot 348, 38-70 Review Avenue

Date	Seller	Buyer
6/3/1997	Richard Sherman, Realty Co., Inc.	Keane Realty, LLC
1/29/1992	Richard Sherman	Richard Sherman Realty Co., Inc.
6/19/1987	H.P. Sherman Co., Inc.	Richard Sherman
4/19/1984	Gulf & Western Manufacturing, Co.	H.P. Sherman Co., Inc.
4/22/1981	The Capitol Life Insurance Co.	Gulf & Western Manufacturing Co.
2/16/1979	Gulf & Western Industries, Inc.	The Capitol Life Insurance Co.
11/29/1976	Alyce M. Coleman	Beth N. Werwaiss
11/6/1975	Welsh Brothers Contracting Corp.	Alyce M. Coleman
11/5/1975	Welsh Brothers Contracting Corp.	Gulf & Western Industries, Inc.
11/29/1956	Richard J. Welsh	Welsh Brothers Contracting Corp.
8/3/1956	Richard J. Welsh	Welsh Brothers Contracting Corp.
1/29/1954	Com-Met Corp.	Richard J. Welsh
1/29/1954	Commercial Metals Co., Inc.	Com-Met Corp.

Parcel D, Block 312, Lot 1362, 38-84 Railroad Avenue

Date	Seller	Buyer
5/24/1982	Forte Realty Corp.	A&L Cesspool Service Corp.
9/15/1966	Livia Forte	Forte Realty Corp.
3/6/1953	Com-Met Corp.	Livia Forte
2/11/1953	Commercial Metals Co.	Com-Met Corp.

Parcel E, Block 312, Lot 362, 38-50 Review Avenue

Date	Seller	Buyer
8/3/1979	Wecro Realty Corp.	H.P. Sherman Co., Inc.
8/4/1952	Commercial Metals Co.	Wecro Realty Corp.

Parcel E, Block 312, Lot 500, 38-54 Railroad Avenue

Date	Seller	Buyer
7/10/1966	Herbert P. Sherman, Elmer A. Kleefield, Betty Kleefield (as executors of the estate of Benjamin Weinstein)	Boro Valve, Inc.
12/10/1965	3854 Corporation (formerly Review Avenue Corp.)	Herbert P. Sherman, Elmer A. Kleefield, Betty Kleefield (as executors of the estate of Benjamin Weinstein)
1/23/1953	Com-Met Corp.	Review Avenue Corp.
1/20/1953	Socony-Vacuum Oil Comp., Inc.	Com-Met Corp.

Parcel F, Block 312, Lot 343, 38-98 Review Avenue

Date	Seller	Buyer
12/1/2005	Grover Family Realty Associates	DG Properties LLC
12/1/2005	Grover Realty Associates	Grover Family Realty Associates
5/5/1999	New York City Industrial Development Agency	Grover Realty Associates
7/19/1984	Henry Levien	New York City Industrial Development Agency
10/7/1976	Substandard Realty Corp.	Henry Levien
10/7/1976	Henry Levien	Substandard Realty Corp.
12/17/1975	Substandard Realty Corp.	Henry Levien
11/24/1975	Henry Levien	Substandard Realty Corp.
12/12/1974	Substandard Realty Corp.	Henry Levien
12/12/1974	Henry Levien	Substandard Realty Corp.
9/21/1974	Substandard Realty Corp.	Henry Levien
9/14/1973	Henry Levien	Substandard Realty Corp.
11/19/1957	Michael J. Lembo and Lewis Lembo	Henry Levien
10/15/1957	39th Avenue Realty Corp.	Michael J. Lembo and Lewis Lembo
11/29/1956	Michael J. Lembo and Lewis Lembo	39th Avenue Realty Corp.
7/19/1955	Richard J. Welsh	Michael J. Lembo and Lewis Lembo
1/27/1954	Com-Met Corp.	Richard J. Welsh
1/27/1949	Commerical Metals Corp.	Com-Met Corp.

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Parcel G, Block 312, Lot 349, 38-78 Review Avenue

Date	Seller	Buyer
11/6/1975	Welsh Brothers Contracting Corp.	Alyce M. Coleman, Beth N. Werwaiss
11/5/1975	Welsh Brothers Contracting Corp.	Gulf & Western Industries, Inc.
11/29/1956	Richard J. Welsh	Welsh Brothers Contracting Corp.
8/3/1956	Richard J. Welsh	Welsh Brothers Contracting Corp.
1/29/1954	Com-Met Corp.	Richard J. Welsh
1/29/1954	Commercial Metals Co., Inc.	Com-Met Corp.

Parcel H, Block 312, Lot 330, 39-30 Review Avenue

Date	Seller	Buyer
10/14/1986	American Wax Company, Inc.	Pepatoba Corp.
5/23/1984	Gulf & Western Manufacturing, Co.	American Wax Company, Inc.
4/22/1981	The Capitol Life Insurance Co.	Gulf & Western Manufacturing Co.
2/16/1979	Gulf & Western Manufacturing, Co.	The Capitol Life Insurance Co.
X/XX/1960	727-729 Washington Street Corp.	Alloy Realty Corp.
7/18/1951	Commercial Metals Co.	727-729 Washington Street Corp.

Parcel I, Block 312, Lot 89, 38-20 Review Avenue

Date	Seller	Buyer
10/25/1984	Equitable Life Assurance Society of U.S.	Review Associates, LLC.
9/12/1978	Goodman Stanley, Esq.	Equitable Life Assurance Society of U.S.
11/6/1968	Star Industries, Inc.	46th Street Realty Corp.
12/6/1965	Jenab Realty	Star Industries, Inc.
9/2/1955	Com-Met Corp.	Jenab Realty
9/2/1955	Commercial Metals Co.	Com-Met Corp.

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Parcel J, Block 312, Lot 79, 37-88 Review Avenue

Date	Seller	Buyer
8/6/1970	Kaiser Associates, Inc. (F/K/A National Hardware Corp.)	Guinness Harp Corp.
12/30/1957	Kay Realty	National Hardware Corp.
1/19/1955	New England Transportation Comp.	Kay Realty
5/17/1954	Commercial Metals Co.	New England Transportation Comp.
4/3/1951	Branlon Corp.	Commerical Metals Co.
4/3/1951	Socony Vacuum Oil Comp., Inc. (F/K/A Standard Oil Comp.)	Branlon Corp.
8/3/1903		Boundary Line Agreement between Walter Douglas & George Piper and Standard Oil Company
5/2/1892	Pratt Manufacturing Comp.	Standard Oil Comp.
11/25/1891	New York Guarantee and Indemnity Comp.	Pratt Manufacturing Comp.
5/27/1887	George W. Nexsen	Pratt Manufacturing Comp.

Parcel K, Block 312, Lot 350, 38-60 Review Avenue

Date	Seller	Buyer
7/29/1998	Review Avenue Associates	Renari LLC
5/9/1985	38-60 Review Avenue Co.	Review Avenue Associates
7/31/1979	Horizon Equipment Resources Corp.	38-60 Review Avenue Co.
11/2/1978	National Bank of North America	Horizon Equipment Resources Corp.
8/7/1978	John T. Landers on behalf of Creek Equities, Inc.	National Bank of North America
8/29/1963	Abraham Schneider, Joseph Schwartz, Evelyn Buchbinder, David Stoll, Malcolm Stoll	Creek Equities, Inc.
6/18/1965	Review Realty Corp.	Abraham Schneider, Joseph Schwartz, Evelyn Buchbinder, David Stoll, Macolm Stoll
4/3/1953	Soreb Service Corp.	Review Realty Corp.
4/3/1953	Review Realty Corp.	Soreb Service Corp.
11/5/1902	Soreb Service Corp.	Review Realty Corp.
11/5/1952	Commercial Metals Co.	Soreb Service Corp.

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2.2.2 Sanborn Map Review Summary

Several Sanborn maps were reviewed to further evaluate Inland Project Area operations subsequent to 1949.

A review of 1970 Sanborn maps illustrate the operations of the Inland Project Area as follows:

- Parcel A, Lot 1367 operations included a chemical lab.
- Parcel C operations included a used valve storage yard.
- Parcel D occupied by Sawdust in Bags warehouse, with sawdust and burlap bag storage.
- Parcel E, Lot 362 occupied by Abrasive Blast Cleaning Corporation, with an iron works in the southern building.
- Parcel E, Lot 500 occupied by Boro Judd Valve Corporation, which rebuilt and manufactured valves.
- Parcel F operations included an office equipment warehouse.
- Parcel G operations included a furniture warehouse.
- Parcel H operations included drop forging, iron storage, storage and manufacturing, and a machine shop.
- Parcel I, operations are not described.
- Parcel J, operations included a motor freight station.
- Parcel K operations included various manufacturing or occupancies.

A review of 1977 Sanborn maps illustrate the operations of the Inland Project Area as follows:

- Parcel A, Lot 1367 occupied by a chemical lab.
- Parcel C operations included a used valve storage yard.
- Parcel D occupied by Sawdust in Bags warehouse, with sawdust and burlap bag storage.

- Parcel E, Lot 362 occupied by Abrasive Blast Cleaning Corporation, with an iron works in the southern building.
- Parcel E, Lot 500 occupied by Boro Judd Valve Corporation which rebuilt and manufactured valves.
- Parcel F occupied by National Casket Company, contained operations including manufacturing and warehousing.
- Parcel G operations included manufacturing.
- Parcel H operations included forging, iron storage, storage and manufacturing, and a machine shop.
- Parcel I, operations included a trucking warehouse with a loading ramp.
- Parcel J, occupied by McGuinness Harp Corporation as a warehouse.
- Parcel K operations included various manufacturing or other occupancies.

A review of 1985 Sanborn maps illustrate the operations of the Inland Project Area as follows:

- Parcel A, Lot 1367 occupied by a chemical lab.
- Parcel C operations are not described.
- Parcel D occupied by Sawdust in Bags warehouse, with sawdust and burlap bag storage.
- Parcel E, Lot 362 operations included a commercial warehouse.
- Parcel E, Lot 500 occupied by Boro Judd Valve Corporation which rebuilt and manufactured valves.
- Parcel F occupied by Penn Grover Envelope Corporation.
- Parcel G operations included manufacturing.
- Parcel H operations included forging, iron storage, storage and manufacturing, and machine shop.
- Parcel I, occupied by Standard Motor Products, a distribution and trucking warehouse.
- Parcel J, occupied by Guinness Harp Corporation as a warehouse.

- Parcel K operations included various manufacturing or occupancies.

A review of 1990 and 1996 Sanborn maps illustrates the operations of the Inland Project Area as follows:

- Parcel A, Lot 1367 occupied by a chemical lab.
- Parcel C operations are not described.
- Parcel D occupied by Sawdust in Bags warehouse, with sawdust and burlap bag storage.
- Parcel E occupied by William-Sherman Valve Supplies.
- Parcel F occupied by Penn Grover Envelope Corporation.
- Parcel G operations included manufacturing.
- Parcel H operations included forging, iron storage, and various manufacturing or occupancies.
- Parcel I, occupied by Standard Motor Products, a distribution and trucking warehouse. The 1996 Sanborn map does not include a description of occupancy; however, the map indicates the building was constructed in 1971.
- Parcel J, occupied by Guinness Harp Corporation as a warehouse.
- Parcel K does not include a description of occupancy.

2.2.3 Aerial Photo Review

Kleinfelder reviewed the following aerial photographs to evaluate historic Inland Project Area use as summarized below. The overall landscape and facilities have changed during the more than 150 years of industrial and petroleum-related operations on these parcels by various owners and operators. The aerial photographs are included on Figures 4 through 8. Some of the aerials were updated to include operational descriptions of site features obtained from available Sanborn maps.

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1949 Aerial Photograph – This aerial photograph illustrates the layout of the FPOW facility. Review Avenue and a cemetery were present north of the Project Area. The LIRR was present, transecting the center of the Project Area. Newtown Creek was present along the southern boundary of the Waterfront Project Area. Above ground storage tanks (AST) or AST-like structures are located in multiple locations on the Inland Project Area. The exact size and number of ASTs are currently unknown. Additionally located in the Inland Project Area was a smoke stack on Parcel D. A wax sweating house was identified on Parcel C. A machine shop, boiler and smith and press house were identified on Parcel E. Bleaching tanks were identified on Parcel G. The locations of these structures are illustrated on Figure 4.

1954 Aerial Photograph – This aerial photograph illustrates the FPOW facility was razed with the exception of four buildings and a smoke stack on Parcels D, E and K, and three structures on Parcel H. No ASTs or AST-like structures observed in the 1949 aerial photographs appear to be present on the 1954 aerial. The 1954 aerial photograph is provided as Figure 5.

1966 Aerial Photograph – This aerial photograph illustrates the addition of buildings on Parcel F and G. In addition, it appears trucks are stored on Parcel J and on Lot 1367 of Parcel A. The 1966 aerial photograph is provided as Figure 6.

1980 Aerial Photograph – This aerial photograph illustrates the development of infrastructure similar to that which currently exists today, including expansion/development of the buildings on Parcel H and construction of a warehouse on Parcel I. In addition, there appears to be storage of vehicles on Parcel C. The 1980 aerial photograph is provided as Figure 7.

2006 Aerial Photograph – No significant modifications to the Inland Project Area are identified since 1980, with the exception of the addition of an approximate

120x240 ft building located on the southwestern quadrant of Parcel J. The aerial appears to illustrate infrastructure similar to that which currently exists today. The 2006 aerial photograph is provided as Figure 8.

2.3 Current Property Use

The Inland Project Area is located in an industrial business zone. Below is a description of current property use per parcel:

- Parcel A is an additional lot owned by WMC used for parking by A&L Recycling.
- Parcel C is owned by Keane Realty LLC and used for vehicle storage associated with V.I.P. Towing Inc.
- Parcel D is owned by A&L Cesspool Services Company and currently operates as A&L Recycling which specializes in restaurant oil and grease recovery and recycling, as well as cesspool services (http://aandlrecycling.com).
- Parcel E is owned by HP Sherman Co. Inc. and operates as William E. Williams Valve Corporation which designs and manufactures valves for industrial and commercial applications (http://www.williamsvalve.com/).
- Parcel F is owned by DG Properties LLC and operates as J&S Supply Corporation, a wholesale stocking distributor of residential and commercial building insulation, insulation-foam boards, insulation accessories, sheets and board products, roofing materials, coatings and adhesives (www.jandssupply.com/).
- Parcel G is owned by Werwaiss Realty Company and operates as United Refrigeration Inc., a commercial refrigeration supply distributor (www.uri.com).
- Parcel H operates as American Cleaning Solutions, a division of American Wax Co., who manufactures and sells cleaning and maintenance products (http://www.cleaning-solutions.com/).
- Parcel I is owned by Review Associates and includes a warehouse building partially occupied by Lenoble Lumber on the east side. Lenoble Lumber is a retail lumber and building supply distribution facility (www.lenoblelumber.com).

On the west side of the warehouse is National Van Equipment Company Inc., a manufacturer of furniture pads and moving equipment (www.nationalvanequip.com).

- Parcel J is owned by Up from the Ashes, Inc. and occupied by Phoenix Beverage Inc., a wholesale beverage distributor.
- Parcel K is owned by Renari Realty LLC.

The Inland Project Area zoning is summarized in the following table:

Block	Lot	Zoning	Address	Current Owner
312	79	IBZ - Industrial Business Zone, E1-Warehouse	37-88 Review Avenue	Up From the Ashes, Inc.
312	89	IBZ - Industrial Business Zone, E1-Warehouse	38-20 Review Avenue	Review Associates
312	330	IBZ - Industrial Business Zone, F9-Factory/Industrial	39-30 Review Avenue	Pepatoba Corp.
312	343	IBZ - Industrial Business Zone, F4-Factory/Industrial	38-98 Review Avenue	Dg Properties LLC
312	348	G7 – Unlicensed Parking Lot	38-70 Review Avenue	Keane Realty LLC
312	349	IBZ - Industrial Business Zone, E9-Warehouse	38-78 Review Avenue	Werwaiss Realty Co.
312	350	IBZ - Industrial Business Zone, E9-Warehouse	38-60 Review Avenue	Renari LLC
312	362	IBZ - Industrial Business Zone, F4-Factory/Industrial	38-50 Review Avenue	HP Sherman Co. Inc.
312	500	IBZ - Industrial Business Zone, F9-Factory/Industrial	38-54 Railroad Avenue	Boro Valve Inc.
312	1362	IBZ - Industrial Business Zone, F9-Factory/Industrial	38-84 Railroad Avenue	A&L Recycling

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Block	Lot	Zoning	Address	Current Owner
312	1367	IBZ - Industrial Business Zone, V1-Vacant Land	38-40 Railroad Avenue	Waste Management

Source: The City of New York, NYCProperty - Account History Report
http://nycprop.nyc.gov/nycproperty/nynav/jsp/selectbbl.jsp

2.4 Surrounding Property Use

The Inland Project Area is bound to the northeast by Review Avenue. Further northeast is Calvary Cemetery. The Inland Project Area is bordered to the northwest by a former Quanta Resources site (state superfund site #2-41-005) (Quanta). Southwest of the Inland Project Area is the LIRR, followed by the Waterfront Project Area and Newtown Creek. Southeast is a former cement facility. A Local Area Plan and Regional Area Plan illustrating surrounding land use are provided as Figures 9 and 10, respectively.

2.5 Previous Investigations

The following section summarizes previous subsurface investigations conducted on the Project Area;

November 10, 1989 EEA, Inc. performed a subsurface investigation in response to a Phase I Audit conducted in October 1989 at 38-70 Review Avenue (Parcel C). The investigation included the drilling of five soil borings (SB-1 to SB-5) for the collection of 10 soil samples. Depth to groundwater in SB-1 was 26 fbg. Petroleum hydrocarbons were detected above laboratory reporting limits in soil samples collected from SB-1, SB-2 and SB-3 ranging from 50 milligrams per kilogram (mg/kg) in S-4A (2-4) to 100,000 mg/kg in S-1B (14-16). VOCs were not detected above laboratory reporting limits in samples collected from SB-1B and S-3B.

December 1989 EEA, Inc. prepared a *Subsurface Investigation of Property, Vacant Property Located on Review Avenue, Maspeth, Queens, New York* report documenting the findings and results of the subsurface investigation conducted in November 1989.

October 19, 2004 Haley & Aldrich, Inc (Haley & Aldrich) initiated a supplemental remedial site inspection (SRSI) in connection with Quanta on the Capasso south parcel and WMC properties (Waterfront Parcel A). The contents of a vault containing two suspected decommissioned barge loading lines from the Quanta operations was inspected. The vault was located in the eastern corner of the South Capasso property. Non-aqueous phase liquid (NAPL) and water were observed in the vault and NAPL was observed within the pipes. In addition, two 6-inch diameter pipes located at the bank of Newtown Creek were identified. The pipes were suspected to be the same pipes from the vault (Haley & Aldrich, 2005).

October 21, 2004 Haley & Aldrich initiated the excavation of test pits (TP-01, TP-02 and TP-03) on South Capasso as part of the Quanta investigation. Approximate test pit locations are illustrated on Figure 3. A summary of the test pit findings is as follows:

- TP-01 was excavated to 4.5 fbg. Petroleum odor and staining was observed between 3 and 4.5 fbg. Two 6-inch diameter pipes were observed at the bottom of the excavation.
- TP-02 was excavated to 9.5 fbg where water was encountered. Two 6-inch diameter pipes and additional piping was observed in the excavation.
- TP-03 was abandoned due to reinforced concrete encountered (Haley & Aldrich, 2005).

November 11, 2004

Haley & Aldrich initiated the excavation of test pits (TP-04, TP-05, TP-06 and TP-07) on the WMC property (Figure 3) as part of the Quanta investigation. A summary of the test pit findings is as follows:

- TP-04 was excavated to approximately 5 fbg where a reinforced concrete slab was encountered.
- TP-05 was excavated to approximately 7 fbg. A 10-inch diameter pipe was encountered approximately 4 fbg running parallel to Newtown Creek then turning north. An 8-inch diameter pipe was encountered approximately 4.5 fbg running perpendicular to Newtown Creek. NAPL was observed at 6 and 7 fbg in the test pit.
- TP-06 was excavated to 11.75 fbg where water/NAPL was encountered. A 10-inch diameter pipe was encountered at approximately 8.4 fbg and another pipe was encountered at approximately 11.75 fbg.
- TP-07 was excavated to approximately 9 fbg. NAPL was observed entering the sidewall at approximately 3.5 fbg.

(Haley & Aldrich, 2005)

June 2005

According to the Parsons August 2008 Work Plan, a site investigation was conducted in connection with the former Quanta Resources Site including a limited investigation on 37-88 Review Avenue (Parcel J). Lots 79 and 89 of the Inland Project Area were identified as the Phoenix Beverage properties (beverage distributor). The investigation and results are documented in the *Remedial Investigation Report* for the Quanta Resources Site (Golder Associates, June 2005).

3.0 GEOLOGY AND HYDROGEOLOGY

The following subsections discuss the regional topography, surface water, geology, and hydrogeology in the vicinity of the Inland Project Area.

3.1 Topography

The Inland Project Area is located within the United States Geological Survey (USGS) 7.5-Minute Topographic Map, Brooklyn, New York, Quadrangle (USGS, 1979). The Inland Project Area is approximately 30 feet above mean sea level (msl) along Review Avenue and slopes to approximately 15 feet along the southern portions along the LIRR. Topography in the vicinity of the Inland Project Area slopes to the southwest towards Newtown Creek. The topography of the Inland Project Area is illustrated on the Locus Plan provided on Figure 1.

3.2 Surface Water and Drainage Features

The predominant regional drainage feature is paved surface runoff into the New York City (NYC) sewer system. Groundwater infiltration in the vicinity of the Inland Project Area could occur at the cemetery located to the north and east, along the LIRR railroad tracks between the Waterfront and Inland Project Areas, and unpaved property easements. The average precipitation rate on Long Island is 44 inches per year (Franke and McClymonds). Approximately 50% of the precipitation transpires back into the atmosphere (Franke and McClymonds), the remainder either infiltrating into the subsurface or drained via surface runoff or sewer systems. Groundwater recharge rates from precipitation in Queens have been estimated to be approximately 35 percent (Buxton and Smolensky, 1999). Leaks from water mains and sewers are an additional source of groundwater recharge estimated at approximately 40 million gallons per day (Mgal/d) in Queens (Buxton and Shernoff, 1999).

The closest surface-water body to the Project Area is Newtown Creek. Newtown Creek is a 3.8 mile long creek oriented along the northern Brooklyn-Queens County border and connects to the East River to the northwest. Newtown Creek is an estuarine water body that flows to the East River with a semi-diurnal tidal cycle varying from approximately 5 and 7 feet and it has been dredged to approximately 16 feet below mean low water. Newtown Creek's watershed is approximately 12,000 acres; however, the Creek receives no freshwater surface flow, other than stormwater and combined sewer overflows (CSO). Newtown Creek is classified by the State of New York as Class SD saline surface water with a designated use of fishing. Newtown Creek was listed on New York State's 1998 Section 303(d) list as an impaired water body due to poor oxygen demand primarily resulting from the CSO discharges, but has since been de-listed (Hydroqual, 2004).

Surface water runoff on the Inland Project Area generally follows surficial topography to the southwest toward Newtown Creek. No stormwater catch basins were observed on-site, with the exception of Parcel G and along Review Avenue. Roof drains were observed to drain to the ground surface from several buildings.

3.3 Regional Geologic Setting

The following subsections describe the regional surficial geology and stratigraphy in the vicinity of the Project Area.

3.3.1 Surficial Geology

The regional, surficial geology in the vicinity of the Project Area consists of artificial fill and glacial moraine according to Plate 1 USGS Water-Supply Paper 2001-A. Typically, artificial fill across the New York, Queens, and Brooklyn regions consists of rocks, concrete fragments, ashes and rubbish (Soren, 1971). The use of coal ash as fill for wetland reclamation is further discussed in a landfill study by Walsh and LaFleur (Walsh and LaFleur, 1995). Solid waste has been used as fill material for wetland reclamation since the late 1800's. Coal ash made up more than 50% of the Municipal Solid Waste (MSW) volume in the late

19th and the early 20th century (Walsh and LaFleur 1995). Figure 2 from the study also shows landfills constructed between 1844 and 1891 were located in the area of the Project Area, along Newtown Creek.

3.3.2 Regional Geology

The Project Area is located in northwestern Queens County, Long Island. In general, Long Island was formed by the advancement and regression of glaciers during the Pleistocene epoch.

The Project Area is located in the Atlantic Coastal Plain Physiographic Province. The subsurface geology consists of unconsolidated sand, silt, and clay layers overlying crystalline bedrock. Outcrops of this bedrock are exposed near the East River in Astoria and Long Island City in Queens, New York and dip approximately 80 feet per mile to the southeast (Soren, 1971). Depth to bedrock beneath the Project Area is approximately 100 fbg. The unconsolidated sand, silt, and clay layers also dip to the southeast and generally follow the contours of the bedrock surface. From oldest (deepest) to youngest (shallowest), the following deposits have been divided into a series of hydrogeologic units:

- Lloyd aquifer
- Raritan clay confining unit
- Magothy aquifer
- Jameco aquifer
- Gardiners Clay
- Upper Glacial aquifer

However, the Lloyd aquifer, Magothy aquifer, Jameco aquifer, and Gardiners Clay may not be present beneath the Project Area (Buxton and Shernoff, 1999). Further description of the regional hydrogeology is included in section 3.4. This site characterization was limited to the Upper Glacial aquifer.

The Upper Glacial aquifer can be divided into geologic units of upper Pleistocene age and Holocene. The upper Pleistocene deposits (deepest) are glacial moraine (till), composed of unsorted clay, sand, gravel and boulders. These deposits may contain outwash deposits of stratified sand and gravel, with interbedded layers of silty sand and clay. The Holocene deposits are the more recent deposits (shallowest) and consist of sand, gravel, silt, clay, organic mud, peat, loam and shells. These deposits, which include undifferentiated artificial fill, salt-marsh and swamp deposits, stream alluvium and shore deposits, typically range in thickness from 5 to 50 feet (Soren, 1971).

3.4 Regional Hydrogeology

The regional hydrogeologic unit beneath the Project Area is the Upper Glacial aquifer. The Project Area is located between a groundwater recharge area to the east (USGS, 2001) and Newtown Creek to the southwest (a regional groundwater discharge area). Regional groundwater flow is west towards Newtown Creek. Regional groundwater beneath the Inland Project Area is approximately 10 to 25 fbg. The average horizontal hydraulic conductivity of the Upper Glacial aquifer is 270 feet per day (ft/d); and the average vertical hydraulic conductivity is 27 ft/d (Franke and Cohen, 1972). Figure 11 illustrates the location of the Project Area in relation to regional groundwater contours from a USGS investigation conducted in March and April, 2006.

4.0 INVESTIGATION METHODS

The following subsections describe the methods of the site characterization specific to:

- Site structures
- Site underground structures and utilities
- Air monitoring
- Soil quality
- Groundwater quality

The site characterization was initiated, following the obtainment of access from individual property owners and conducted pursuant to the Work Plan, associated FSP, QAPP and Work Plan Addendum.

In some instances, the locations or methods of investigation were limited due to access and modifications for which the requisite NYSDEC approval was received. Modifications and/or revisions to the methods from the Work Plan are described in the corresponding subsections.

4.1 Geophysical Investigation

Kleinfelder contracted and supervised Naeva Geophysics Inc. (Naeva) of Congers, New York, in the performance of a geophysical survey, including utility markout of the Inland Parcels A, D, E, and G from June 8 through 19, 2009 and Parcel C on September 2, 2009. A geophysical survey was conducted on the sidewalk north of Parcels H and I, in the vicinity of proposed monitoring well locations MW-20 and MW-21 on June 17 and June 18, 2009, respectively. The purpose of the investigation was to locate underground utilities, clear proposed intrusive work locations, and to investigate below ground structures, utilities and anomalies, if present. The equipment used in the investigation included an electromagnetic (EM)-61 metal-detector, ground penetrating radar system (GPR), Fisher TW-6 pipe locator, and Subsite 950 and Dynatel 2250 utility locators. The investigation was conducted in a 5-foot grid spacing of the open areas of each parcel outside the footprint of on-site structures and stored materials. The locations of underground utilities were spray painted on the surface of the Inland Project Area, using the American Public Works Association color code system. In addition, identified linear anomalies, piping of unknown origin and other anomalies including, but not limited to, conductive fill were painted in pink.

The locations of utilities, linear anomalies, pipes of unknown origin and anomalies were measured and recorded in the field on a site map. The geophysical investigation methods, grid establishment, equipment use and limitations are discussed in more detail in Naeva's Results of Geophysical Investigation Report provided as Appendix B.

4.2 Site Survey

Kleinfelder contracted and supervised Control Point Associates Inc. of Warren, New Jersey (Control Point) in the performance of professional survey services for the Inland Project Area. A boundary and utility survey was conducted to generate the Site Plan for the Inland Project Area provided as Figure 2. In addition, the location and elevation of soil borings, monitoring wells and test pits were professionally surveyed. The following subsections summarize the methods of the professional survey services.

4.2.1 Boundary and Utility Survey

The boundary and utility survey was conducted on Inland Parcels A, D, E, and G on June 19 and 22, 2009 and Parcel C on September 28, 2009. Prior to start of field activities, Control Point researched owner's names, tax maps, deeds of record, field maps, utility plans, and final section maps. In addition, a field survey was conducted, including the location of property corner evidence along the subject and adjacent property lines to generate the boundary survey. Major features such as buildings, fences, paved areas, concrete areas, area lighting, parking spaces, curbing, visible utilities and structures were surveyed. The survey was conducted relative to the New York / Long Island Plane Coordinate System and North American Datum (NAD) of 1983. Control Point surveyed identified utilities, and storm and sanitary sewer rims and grates. Results of the boundary and utility survey are illustrated on Figure 2.

4.2.2 Soil Boring, Test Pit, and Monitoring Well Survey

The locations of soil borings, monitoring wells and test pits were surveyed relative to the New York / Long Island Plane Coordinate System and NAD 1983 on September 28, 2009. In addition, Control Point surveyed the elevation of the soil borings, monitoring wells (rim and top of casing) and test pits relative to North American Vertical Datum (NAVD) of 1988. The surveyed locations of the soil borings, monitoring wells and test pits are illustrated on Figure 2.

4.3 Air Monitoring

Air monitoring was conducted within the work zones and at the perimeter of the work zones during drilling and test pit activities following the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP). The purpose of the air monitoring was to collect air quality data for fugitive dust and VOCs that may have been generated during these activities. The Health and Safety Plan (HASP) defines the action levels, permissible exposure limits (PELs), engineering controls and personal protective equipment (PPE) to be employed if airborne contaminants are detected above action levels. Equipment readings were recorded on Air Monitoring Data Observation Records. Data from equipment with data-logging capabilities was downloaded weekly as applicable. Air Monitoring Data Observation Records and data retrieved from data-logging equipment are available for review upon request. Air monitoring deviated from the Work Plan and CAMP by excluding community particulate monitoring as approved by NYSDEC in an e-mail dated June 8, 2009.

4.3.1 Worker Air Monitoring

Air monitoring of the worker breathing zone was conducted continuously during drilling and test-pitting for worker respiratory protection.

The following equipment and methods were used to perform work zone air monitoring:

- A MiniRae 2000 PID, manufactured by RAE Systems, was used to monitor for the presence of VOCs. This direct-read instrument was calibrated using 100 parts per million (ppm) isobutylene span gas to yield total VOCs in parts per million by volume (ppm_v) referenced to benzene prior to initiating intrusive activities at a location (soil boring, test pit, etc.). In addition, a baseline reading was recorded prior to the start of the intrusive activities at each location. Readings were recorded in concentrations of parts per ppm_v at approximately 15 minute intervals throughout the duration of the intrusive activity.

- A VRae multi-gas meter (VRae), manufactured by RAE Systems, was used to monitor the lower explosive limit (LEL), carbon monoxide (CO) oxygen, and hydrogen sulfide (H_2S) gas within the worker breathing zone, upwind and downwind from the intrusive activity. This direct-read instrument was calibrated and a baseline reading was recorded prior to the start of the intrusive activities at a location. Levels of LEL and oxygen were recorded as percentages (of total air) at approximately 15 minute intervals throughout the duration of the intrusive activity.
- A MIE Personal Data Ram 1000 portable aerosol monitor (pDR-1000), manufactured by Thermo Scientific, was used to monitor the respirable fraction of airborne dust, smoke, fumes and mist. Prior to initiating intrusive activities at a location, the aerosol monitor was "zeroed" at which time it internally seeks agreement with factory calibration by checking its optical background during the zeroing sequence. This direct-read instrument is a passive air sampler that has data-logging capabilities. A baseline reading was recorded prior to the initiating intrusive activities at each location. Levels of particulate dust and aerosols were recorded in concentrations of milligrams per cubic meter (mg/m^3) at approximately 15 minute intervals throughout the duration of the intrusive activity. Data-logged information including peak and average concentration values, were downloaded weekly.

4.3.2 Community Air Monitoring

Community air monitoring was conducted in accordance with guidelines established by the New York State Department of Health (NYSDOH) as indicated within their "Generic Community Air Monitoring Plan" (NYSDOH, 2000), with the

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exception of particulate monitoring. Community air monitoring was conducted to protect the downwind community, including occupants of the facilities located on the Inland Project Area. Community air monitoring involved the periodic monitoring of the work zone for VOCs, during non-intrusive activities; and continuous monitoring at the perimeter of the work areas for VOCs during intrusive work activities. Prior to initiating intrusive activities at a location, the weather and wind direction were recorded. Wind direction was used to locate air monitoring equipment upwind and downwind of the work zone. Wind direction was measured using a portable flag.

The following equipment and methods were used to conduct community air monitoring:

- A MiniRae 2000 PID, (see "worker air monitoring"), was used to monitor for the presence of VOCs. This direct-read instrument was calibrated using isobutylene span gas to yield total VOCs in ppm_v referenced to benzene and a baseline reading was recorded prior to initiating intrusive activities at a location. Readings were collected and recorded periodically during non-intrusive activities such as groundwater sampling.

4.4 Subsurface Clearance

Prior to initiating drilling of soil borings, monitoring wells and excavation of test pits, the following subsurface clearance process was completed.

- Public utilities were contacted through the New York City One Call Center in accordance with Industrial Code 53.
- A private utility locating contractor (Naeva) conducted a geophysical survey, located and marked out potential underground utilities or obstructions.

- A private utility locating contractor (Naeva) conducted a scan of proposed soil borings, monitoring wells and test pit locations using EM and/or GPR instruments individually to assess the potential presence of underground utilities.
- Proposed drilling and test pit locations were reviewed with property owner representatives.
- Each drilling location and test pit was hand-cleared or vacuum excavated to a minimum depth of approximately 4 fbg and a maximum of 8 fbg.

4.5 Equipment Decontamination

Drilling and test pit equipment was decontaminated following procedures outlined in Section 3 of the FSP. Temporary decontamination areas were created each day of intrusive activities and used for steam-cleaning activities. The temporary decontamination area was approximately 8-foot by 8-foot and 1-foot deep and constructed with wooden railroad ties and lined with a 6-mil thick polyethylene liner.

The following procedures were followed to decontaminate equipment used during the site characterization activities:

- Drilling equipment, including, but not limited to; augers, bits, rods, tools, and split-spoon samplers were cleaned with a high-pressure steam cleaning unit and Alconox® cleaning solution before use each day; between monitoring well locations; and prior to leaving the site.
- Split-spoon samplers and hand augers were decontaminated between soil samples using an Alconox® cleaning solution followed by a potable water rinse and a deionized water rinse.
- The bucket of the backhoe was cleaned with a high-pressure steam cleaning unit and Alconox® cleaning solution prior to work; between test pit locations; and prior to leaving the site.
- Tools, drill rods, and augers were placed on polyethylene plastic sheets or were placed on the drill rig racks following steam cleaning.

- Groundwater sampling equipment including, but not limited to, water level meters (WLM), electronic interface probes (EIP), flow through cells and hand tools were decontaminated using an Alconox® cleaning solution followed by a potable water rinse and a deionized water rinse between groundwater samples.

Rinseate collected from the decontamination activities was transferred using a transfer pump to 55-gallon drums. The drums were stored and managed as described in Section 5.0 pending characterization and disposal.

4.6 Soil Sample Laboratory Analysis

Selected soil samples collected from soil borings and test pits were submitted to Accutest Laboratories of Dayton, New Jersey, a NYSDOH approved laboratory (Environmental Laboratory Approval Program [ELAP] No. 10983) (Accutest) for laboratory analysis. Laboratory analysis was conducted in accordance with United States Environmental Protection Agency (USEPA) SW-846 methods and submitted under NYSDEC Analytical Services Protocol (ASP) Category B data deliverables. The soil samples were submitted for laboratory analysis of the following:

- Target Compound List (TCL) VOCs in accordance with USEPA Method 8260B;
- TCL SVOCs in accordance with USEPA Method 8270C;
- Target Analyte List (TAL) metals, including cyanide, in accordance with USEPA Methods 6010B, 7471A and 9012;
- TCL Pesticides in accordance with USEPA Method 8081; and
- TCL PCBs in accordance with USEPA Method 8082.

A summary of laboratory samples and analyses is provided as Table 1.

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4.7 Soil Borings

The following subsections describe the soil boring drilling and sampling methods. The following soil borings were modified from the Work Plan based on the following:

- Proposed soil boring SB-6 (renamed SB-13) was relocated approximately 20 feet south due to underground electric utility line identified. Modifications from the Work Plan regarding SB-13 were requested to the NYSDEC via email communication on June 23, 2009 and approved via email on June 23, 2009.
- Proposed soil boring SB-13 was relocated approximately 60 feet south and completed as a monitoring well (MW-24). Modifications from the Work Plan regarding SB-13 were requested to the NYSDEC via email communication on July 1, 2009 and approved via email on July 1, 2009.

4.7.1 Soil Sampling

Land Air Water Environmental Services of Center Moriches, New York (LAWES) under contract with and supervision of Kleinfelder, performed vacuum clearing and drilling activities during the site characterization. Soil boring and monitoring well locations were precleared to a minimum depth of approximately 4 fbg using an air-knife, air compressor and a tow behind "Vactron" vacuum unit due to the potential for shallow underground utility lines. Drilling activities were initiated on June 20, 2009 and completed September 14, 2009. A total of 12 soil borings including SB-13 through SB-15; MW-14 through MW-22 were drilled to investigate subsurface conditions. Figures 2 and 3 illustrate the soil boring locations.

Soil borings were drilled using either a truck-mounted drill rig and 6.625-inch inside diameter hollow-stem augers or a Geoprobe® rig equipped with direct push technology using either 2 or 3-inch diameter direct push rods. In some instances, access to soil boring locations dictated the drilling techniques used.

Soil borings SB-15, MW-14, MW-15, MW-16, MW-18, MW-19, MW-20, and MW-21 were drilled with 6.625-inch inside diameter hollow stem augers for the collection of soil samples to a maximum depth of approximately 25 to 30 fbg. Soil samples were collected continuously to the bottom of the borings using a 2-foot long, 2-inch diameter stainless steel split spoon sampler.

Soil borings SB-13/MW-24, SB-14/MW-23, MW-17, and MW-22 were drilled via direct-push methods, using a Geoprobe® unit equipped with direct push technology. Continuous soil samples were collected using a 5-foot long, 2-inch diameter macro-core® sampling device (2-inch outside diameter rods) from approximately 5 or 8 fbg to terminal depth of each soil boring.

Upon recovery, soil samples were segregated into three parts; one containerized for potential laboratory analysis; one containerized for field screening using a PID; and one to be visually classified for soil type, grain size, texture, moisture content, odor and visible evidence of staining or NAPL, and logged in the field. The sample headspace was screened for the presence of VOCs using a PID with a 10.6 electron volt (eV) lamp calibrated to an isobutylene span gas to yield total VOCs in ppm_v referenced to benzene. The PID screening values are for field screening, and may not be indicative of actual concentrations in soil, as determined by laboratory analysis.

At least one soil sample was collected from each soil boring for laboratory analysis of VOCs, SVOCs, metals, pesticides and PCBs as described in Section 4.6. Soil samples were collected as follows:

- One soil sample was collected from the zone with the highest PID readings or staining observed at or above the water table. In the absence of staining or PID readings above 10 ppm_v a soil sample was collected from above the water table.

- One soil sample was collected from below the zone with the highest PID readings or staining above the saturated zone, if applicable.

The soil samples were placed in laboratory-supplied jars, which were subsequently placed in storage/transportation coolers, preserved with ice, and shipped following chain of custody procedures via Federal Express or courier to the laboratory for analysis. If sufficient sample volume was available, a sample was sent for hydrocarbon compositional analysis (see Section 4.11).

Soil borings that were not converted into monitoring wells were grouted to the surface following completion and surface patched with concrete. Drill cuttings, decontamination water, and contaminated personal protective equipment (PPE) were drummed in accordance with procedures discussed in Section 5.0.

4.7.2 Soil Sample Geotechnical Analysis

A soil sample of fine-grained sand from soil boring MW-18 (29 to 33 fbg) was collected for grain size distribution analysis. The soil sample was placed in 8-ounce mason jar, which as subsequently placed in storage/transportation boxes, and shipped following chain of custody procedures via Federal Express. The sample was submitted to Kleinfelder's geotechnical laboratory in West Chester, Pennsylvania for grain size distribution analysis in accordance with American Society for Testing and Materials (ASTM) Methods D422, including sieve and hydrometer separation.

4.8 Test Pit Excavations

Test pits were precleared and excavated under the supervision of Kleinfelder personnel by Environmental Construction Services Inc. (ECS) of Patchogue, New York. The purpose of the test pits was to investigate the potential presence of underground structures, and investigate soil quality and geology. Test pitting was conducted from

July 15 through 17, 2009. A total of 3 test pits (TP-12 to TP-14) were excavated to investigate subsurface conditions. Figures 2 and 3 illustrate the test pit locations. Modifications to the work plan included omission of proposed test pit locations TP-1 (renamed TP-12) and TP-2 (renamed TP-13) due to numerous underground utilities identified in the main alley in the vicinity of monitoring wells MW-24 and MW-22, respectively. Test pits TP-12 and TP-13 were relocated as shallow test pits to investigate underground pipes of unknown origin/use observed during pre-clearing activities of MW-17 and SB-14/MW-23 respectively. Modifications from the Work Plan were requested to the NYSDEC via email communication on July 1, 2009. The NYSDEC approved the request on July 1, 2009.

The approximate size of the test pits ranged from 6-feet by 2-feet (TP-12 and TP-13) to 10-feet long by 3-feet wide (TP-14). Test pits TP-12, TP-13 and the first four vertical feet in TP-14 were excavated using a guzzler and/or hand tools in 1-foot intervals to minimize the potential for subsurface utility damage. Test pit TP-14 was continued with a backhoe in approximate 1-foot depth intervals. Soil samples were classified and examined at approximately 2-foot vertical intervals. Test pits TP-12 and TP-13 were limited to approximately 3 to 4 fbg due to piping of unknown origin encountered. Test pit TP-14 was completed vertically to approximately 10-feet due to undermining of adjacent concrete parking areas. Photo documentation was completed on each test pit and is shown in Appendix C. Test Pit Logs are provided in Appendix D.

Soil samples were collected via decontaminated, stainless steel hand auger or decontaminated backhoe bucket. Upon recovery, Kleinfelder segregated soil samples into three parts; one containerized for potential laboratory analysis; one containerized for field screening using a PID; and one to be visually classified for soil type, grain size, texture, moisture content, odor and visible evidence of staining or NAPL, and logged in the field. The sample headspace was screened for the presence of VOCs using a PID. The PID screening values are for field screening, and may not be necessarily indicative of actual concentrations in soil, as determined by laboratory analysis.

Soil samples were submitted and analyzed from test pit TP-13 and TP-14 for laboratory analysis of VOCs, SVOCs, metals, pesticides and PCBs as described in Section 4.6. One soil sample was collected from the zone with the highest PID readings or staining at or above the water table from the test pit. In the absence of staining or PID readings above 10 ppm_v, a soil sample was collected from above the water table or terminal depth of the test pit. Soil samples were not submitted from TP-12 due to the close proximity of samples previously collected from monitoring well MW-17.

Excavated soil generated from the test pits was stockpiled in a bermed containment area lined with 10-mil polyethylene sheeting and covered with 10-mil polyethylene sheeting pending characterization and disposal. Soil generated from TP-13 was later placed in four, 55-gallon drums.

Test pit TP-14 was backfilled from vertical terminal extent (approximately 10 fbg) to approximately 4 fbg with ¾-inch stone and tamped in place using the backhoe bucket. A geotechnical fabric was subsequently placed above the stone backfill throughout the excavation. Bank run sand was backfilled on top of the geotechnical fabric to approximately 2 fbg and compacted in 1-foot lifts using a plate compactor. The remainder of the excavated test pit area was backfilled with recycled concrete aggregate (RCA) and compacted using a plate compactor. Test pit TP-12 and TP-13 were backfilled with bank run sand from terminal depth (approximately 4 fbg) to 1 fbg. The remainder of the excavated test pit area was backfilled with RCA and compacted using a plate compactor. Test pits were restored at grade with concrete.

4.8.1 Pipe Investigation

In the event that subsurface piping of an unknown origin was encountered, the pipes were traced using geophysical methods in an attempt to investigate the terminal locations of the pipes.

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4.9 Monitoring Wells

The following subsections describe the monitoring well installation, construction and development methods. The following monitoring wells were modified from the Work Plan based on the following:

- Proposed monitoring well SB-11/MW-16 (renamed MW-19) was relocated approximately 80-feet west from Parcel F to Parcel C due to access limitations to Parcel F. In addition, a proposed monitoring well MW-10, located along the north side of the LIRR, south of Parcel I, was omitted due health and safety concerns associated with limited access along the LIRR. Modifications from the Work Plan regarding former MW-10 and MW-19 were requested to the NYSDEC via email communication on May 19, 2009 and approved via email on May 20, 2009.
- Proposed monitoring wells MW-20 and MW-21 were relocated approximately 40 feet west to avoid tractor trailer loading docks associated with 38-20 Review Avenue and an overhead utility pole, respectively. Modifications from the Work Plan were requested to the NYSDEC via email communication on June 8, 2009 and approved via email on June 8, 2009.
- Proposed monitoring wells MW-16, MW-17 and MW-22 were installed as 2-inch diameter wells using a driven casing due to site constraints and utilities. Modifications from the Work Plan were requested to the NYSDEC via email communication on June 23, 2009 and approved via email on June 23, 2009.
- Soil boring SB-14 was constructed as monitoring well MW-23 due to the presence of NAPL encountered.
- The screen length of the monitoring wells was increased from the 10-feet proposed in the Work Plan up to 20-feet in some wells in an attempt to better account for groundwater fluctuations.

4.9.1 Monitoring Well Installation

Eleven soil borings were completed as groundwater monitoring wells MW-14 through MW-24 between June 20, 2009 and September 14, 2009. Figures 2 and 3 illustrate the monitoring well locations.

Eight soil borings (MW-14, MW-15, MW-16, MW-18, MW-19, MW-20, MW-21, and MW-24) were completed as 4-inch inside diameter groundwater monitoring wells using a hydraulic drill rig with 6.625-inch inside diameter hollow stem augers. The monitoring wells are completed with approximately 20-feet of threaded, flush-joint 0.02-inch slot polyvinyl chloride (PVC) well screen, including approximately 10-feet above the water table and 10-feet below, with the exception of MW-15 and MW-21 completed with 15-feet of screen. The monitoring wells were drilled between 25 and 37 fbg.

LAWES completed groundwater monitoring wells MW-17, MW-22, and MW-23 as 2-inch diameter groundwater monitoring wells using a Geoprobe® unit equipped with direct push technology. Three-inch outside diameter drive rods were used to install the wells. These wells required the use of a smaller rig due to limited access including, but not limited to, narrow alleys, traffic, utilities and stored materials. The monitoring wells were completed with approximately 20-feet of threaded, flush-joint 0.02-inch slot PVC well screen, including approximately 10-feet above the water table and 10-feet below. The monitoring wells were drilled between 30 and 35 fbg.

The annulus around the monitoring well screens was backfilled with a Morie No. 2 sand/gravel pack to approximately 1 to 2-feet above the well screen. A 1 to 2-foot bentonite seal was placed above the gravel pack. The remaining annulus was backfilled with grout. Monitoring wells were completed at the surface with the installation of a 2-foot square concrete pad surrounding an 8-inch diameter, flush-mount manhole cover clearly embossed with the words "Monitoring Well." The concrete pad was raised slightly above surface grade and sloped to facilitate

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storm water runoff away from the monitoring well. Details of well construction are included in Appendix F Soil Boring/Monitoring Well Construction Diagrams. Drill cuttings generated during monitoring well installation were containerized in 55-gallon drums pending characterization and disposal.

4.9.2 Monitoring Well Development

On July 21, 2009 and September 17, 2009, monitoring wells, without detections of LNAPL, were surged and developed with a submersible pump to remove suspended particulates and establish hydraulic communication with surrounding formation. Monitoring wells MW-15, MW-18, MW-20, and MW-21 were developed until the wells were reasonably free of sediment (less than 50 nephelometric turbidity units [NTU] if possible) or until the pH, temperature and conductivity stabilized. Development water was contained in 55-gallon drums pending characterization and disposal. PPE, tubing and other disposable well development materials were containerized in 55-gallon drums pending disposal.

4.10 Groundwater Gauging and Sampling

The following subsections describe the groundwater gauging and sampling methods. Groundwater gauging and sampling were conducted for the Inland and Waterfront Project Areas.

4.10.1 Groundwater Gauging

The Project Area groundwater monitoring well network (MW-1 through MW-24, with the exception of MW-18 and MW-19) was gauged on July 29, 2009 during a neap low slack tide for Newtown Creek. Gauging during neap slack tide was preferred to minimize tidal fluctuations on gauging data. Neap tides are tides with lower than average tidal fluctuation with longer slack water times. Neap tides occur when the moon is at the first or third quarter. MW-18 and MW-19 were gauged on September 24, 2009 and MW-18 was sampled following installation. After removing the well cap, prior to groundwater gauging, the headspace of each well was screened for VOCs using a PID. The depth to product (DTP), depth to water (DTW) and depth to bottom (DTB) in each monitoring well was measured using a decontaminated EIP.

4.10.2 Groundwater Sampling

Groundwater samples were collected from monitoring wells MW-1, MW-8, MW-10, MW-11, MW-13, MW-15, MW-20, and MW-21 from July 28 to 30, 2009. Monitoring well MW-18 was sampled on September 24, 2009. The DTW and DTB measurements were used to calculate purge volumes for each monitoring well. Approximately three well volumes (with the exception of MW-15 due to slow recharge) were purged from each monitoring well using a low flow groundwater sample technique. Purge water was containerized in 55-gallon drums pending characterization and disposal. Groundwater was purged and sampled using a peristaltic pump equipped with ¼-inch diameter polyethylene tubing and a Horiba® flow-through cell water quality meter. The groundwater sample flow rate was maintained less than 0.5 liters per minute to prevent a groundwater drawdown greater than 0.33 feet during pumping. The following water quality parameters were recorded every three to five minutes on a Low-Flow Groundwater Sampling Record to monitor groundwater stabilization:

- Flow rate;
- Purge volume;
- pH recorded in su;
- Temperature recorded in degrees Celsius (°C);
- Conductivity recorded in milliSiemens per centimeter (mS/cm);
- Oxidation reduction potential (ORP) recorded in millivolts (mV);
- Dissolved oxygen (DO) recorded in milligrams per liter (mg/L);
- Turbidity recorded in ntu; and

- Salinity recorded in parts per thousand (ppt)

Groundwater samples were collected after a minimum of three well volumes (if sufficient recharge) of water was purged and stabilization of groundwater quality parameters observed. Stabilization was achieved after three consecutive readings within 0.1 pH, 3% conductivity, 10 mV for ORP, and 10% for turbidity and DO. Groundwater samples were collected into appropriate laboratory supplied bottleware. If the turbidity of a groundwater sample was measured greater than 50 NTU, then a field-filtered and unfiltered sample was collected for metals analysis per the Work Plan. Groundwater sample containers were labeled, logged, placed in coolers, preserved with ice, and transported under chain-of-custody procedures via Federal Express or laboratory courier to Accutest for laboratory analysis. PPE, tubing and other disposable groundwater sampling materials were containerized in 55-gallon drums pending disposal.

4.10.3 Groundwater Sample Laboratory Analysis

Groundwater samples collected were submitted to Accutest for laboratory analysis. Laboratory analysis was conducted in accordance with USEPA SW-846 methods and submitted under NYSDEC ASP Category B data deliverables. The groundwater samples were submitted for laboratory analysis of the following:

- TCL VOCs in accordance with USEPA Method 8260B;
- TCL SVOCs in accordance with USEPA Method 8270C;
- TAL metals, including cyanide, in accordance with USEPA Methods 6010B, 7470A and 335.4;
- TCL pesticides in accordance with USEPA Methods 8081; and
- TCL PCBs in accordance with USEPA Methods 8082.

In addition, groundwater samples collected from monitoring wells MW-20 and MW-21 were analyzed for formaldehyde in accordance with USEPA Method

SW846 8315 due to the presence of upgradient Calvary cemetery. Formaldehyde has a high water solubility and low carbon water partition coefficient and, therefore, dissolves in water readily and does not adsorb to soil as readily. A summary of laboratory samples and analyses are identified in Table 1.

4.11 Forensics Analysis

Forensics analysis of select soil and LNAPL samples was conducted to investigate the following:

- The nature of the hydrocarbons present in the subsurface soils and LNAPL (i.e., product type(s));
- Polycyclic aromatic hydrocarbon (PAH) concentrations in selected soils and LNAPL, and
- The potential origin of the hydrocarbons, specifically whether the hydrocarbons arise from petroleum sources (i.e., petrogenic), combustion sources (i.e., pyrogenic) derived from fill materials/ 'urban runoff', from naturally occurring sources (i.e., biogenic) such as plant waxes/peat or from some combination of these.

Biomarkers and lead speciation were not included in the forensics analysis. Nineteen soil and seven LNAPL samples were submitted for forensics analysis during the investigation. Additionally, one groundwater and one LNAPL sample collected from monitoring well MW-3 from Waterfront Parcel A was submitted for forensics analysis. The LNAPL was not detected during the initial gauging of MW-3 during the Waterfront Project Area investigation. The soil and LNAPL samples were submitted to Alpha Woods Hole Labs of Mansfield, Massachusetts (AWHL) (ELAP No. 11627) for hydrocarbon compositional analysis. Laboratory analysis was conducted in a tiered fashion using published methods of forensic hydrocarbon analysis (Douglas et al., 2007). The analysis included the following:

- Product-type analysis using a modified USEPA Method 8015B.
- Whole Oil analysis using a modified USEPA Methods 8015B in which the NAPLs (C4 to C44) were characterized by direct injection, high resolution gas chromatography-flame ionization detection (GC/FID) and gas chromatography-mass spectrometry (GC/MS) operated in the full scan acquisition mode.
- Analysis of Priority Pollutant polycyclic aromatic hydrocarbons (PAHs), alkylated PAHs, and sulfur-containing aromatics using a modified USEPA Method 8270C.

In addition, five LNAPL samples (MW-14, MW-17, MW-22, MW-23 and MW-24) were submitted to Triton Analytics Corp. of Houston, Texas for analysis of kinematic and dynamic viscosity and specific gravity (density) at various temperatures. A summary of the various temperatures analyzed is provided in Appendix G.

The following subsections summarize the samples submitted for analysis.

4.11.1 Soil Forensics Analysis

A split soil sample was sent to for hydrocarbon compositional analysis, if sufficient sample volume was available.

4.11.2 NAPL Forensics Analysis

If sufficient LNAPL was observed and/or detected in monitoring wells (approximately 20 ml), a sample was collected for product type analysis.

5.0 WASTE MANAGEMENT

Investigation-derived wastes (IDW) generated during the site investigation were containerized or stockpiled for removal. Soils were segregated by boring or monitoring well and placed in labeled 55-gallon United States Department of Transportation (USDOT)-approved drums. Plastic sheeting, used adsorbent pads, and disposable bailers were consolidated in DOT-approved drum(s). Fluids generated from decontamination and well development activities were placed in DOT-approved, fluid drums with closed tops. The drums from each parcel were stored on-site prior to waste characterization and disposal. A drum inventory was kept, documenting the number of drums stored and transported, the contents of the drums, and drum identification information. The number of drums and type generated are listed in the following table:

Drums Contents	**Number of Drums Generated**
Investigative Derived Soils	31
Investigative Derived Wastewater	8
PPE/ Sorbent Pads/ Disposable Bailers	3
Total	**42**

IDW was characterized as non-hazardous. Drums generated from Parcel A, in addition to drums of PPE/ Sorbent Pads/ Disposable Bailers generated from the Inland Project Area, were transported and disposed of by WMC and transported to its facility CWM Chemical Services L.L.C. located at 1550 Balmer Road in Model City, New York on October 29, 2009. Soil Drums generated from Parcels C, D, E, H, I were transported and disposed of by Soil Safe Incorporated (Soil Safe) in Logan Township, New Jersey on August 11, 2009. Wastewater drums were transported and disposed of by LORCO Petroleum Services Inc. of Elizabeth, New Jersey on September 2, 2009. Copies of the drum waste disposal documentation will be provided upon request.

Test pitting on Parcel C generated 15.22 tons of soil that was transported by Soil Safe on August 18, 2009 to its facility in Logan Township, New Jersey. Soils generated from test pitting on Parcel E were drummed and included in the table above. Copies of the waste disposal documentation are provided in Appendix H.

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6.0 DATA VALIDATION AND USABILITY SUMMARY

The following subsections summarize the findings of the data validation and usability assessment. The data validation and usability summary were performed in accordance with the QAPP (Parsons, 2008) and applicable sections of the *Draft DER-10 Technical Guidance for Site Investigations and Remediation* (NYSDEC, 2002).

6.1 Sample Delivery Groups

Field and laboratory personnel implemented quality assurance and quality control (QA/QC) procedures during the site characterization. Field QC consisted of the collection of trip blanks, field duplicates, matrix spike (MS)/matrix spike duplicate (MSD) pairs, equipment rinse blanks, and temperature blanks. A total of 29 field samples (20 soil samples and 9 groundwater samples), five trip blanks, two coded field duplicate samples (one soil sample and one groundwater sample), one soil and one groundwater sample MS/MSD pair, and one equipment blank were submitted to Accutest (ELAP No. 10983) for laboratory analysis. The samples were submitted to Accutest in 19 separate, sample delivery groups (SDGs) as follows:

- Parcel A soil samples collected June 22, 2009 through June 25, 2009 and groundwater samples collected July 28, 2009 through July 29, 2009 corresponding to SDG nos. JA21687, JA21926, JA24188, and JA24318.
- Parcel B groundwater samples collected July 30, 2009 corresponding to sample SDG no. JA24546.
- Parcel C soil samples collected September 11, 2009 through September 14, 2009 and groundwater samples collected September 24, 2009 corresponding to SDG nos. JA28028 and JA29115.
- Parcel D soil samples collected July 19, 2009 corresponding to SDG no. JA23671.
- Parcel E soil samples collected June 22, 2009, June 24, 2009, June 30, 2009, July 7, 2009, July 14, 2009, and July 21, 2009 corresponding to SDG nos. JA21685, JA21925, JA22130, JA22568, JA23122, and JA23664.

- Parcel G soil samples collected June 24, 2009 and July 15, 2009 corresponding to sample SDG nos. JA21927 and JA23498.
- Parcel H groundwater samples collected June 20, 2009, June 27, 2009, and July 27, 2009 corresponding to sample SDG nos. JA21684, JA22131, and JA24172.
- Parcel I soil samples collected June 20, 2009 and groundwater samples collected July 27, 2009 corresponding to sample SDG nos. JA21686 and JA24171.

The table below lists the laboratory identifications cross-referenced to sample identifications and their respective analysis.

Lab ID	Field Sample ID	Type	VOC	SVOC	Metal	CN	Pest	PCB
JA21684-1	MW-21 (4-5')	Soil	X	X	X	X	X	X
JA21685-1	MW-17 (3')	Soil	X	X	X	X	X	X
JA21686-1	MW-20 (17-21')	Soil	X	X	X	X	X	X
JA21687-1	MW-15 (3')	Soil	X	X	X	X	X	X
JA21925-1	SB-14 (10-15')	Soil	X	X	X	X	X	X
JA21925-2	MW-14 (5-9')	Soil	X	X	X	X	X	X
JA21926-1	MW-15 (7-9')	Soil	X	X	X	X	X	X
JA21927-1	SB-15 (5-10')	Soil	X	X	X	X	X	X
JA22130-1	MW-16 (17.5-20')	Soil	X	X	X	X	X	X
JA22131-1	MW-21 (10-14')	Soil	X	X	X	X	X	X
JA22568-1	MW-17 (7.5-10')	Soil	X	X	X	X	X	X
JA22568-2	MW-17 (12.5-17')	Soil	X	X	X	X	X	X
JA23122-1	MW-22 (17.5-22.5')	Soil	X	X	X	X	X	X
JA23122-2	DUP-1 [MW-22 (17.5-22.5')]	Soil/DUP	X	X	X	X	X	X
JA23498-1	TP-14 (10') (including MS/MSD)	Soil/ MS/MSD	X	X	X	X	X	X
JA23664-1	TP-13 (3')	Soil	X	X	X	X	X	X
JA23671-1	MW-24 (10-14')	Soil	X	X	X	X	X	X
JA23671-2	Rinse Blank	EB	X	X	X	X	X	X
JA28028-1	MW-19 (19-21')	Soil	X	X	X	X	X	X
JA28028-2	MW-19 (5-9')	Soil	X	X	X	X	X	X

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Lab ID	Field Sample ID	Type	VOC	SVOC	Metal	CN	Pest	PCB
JA28028-3	MW-18 (5-9')	Soil	X	X	X	X	X	X
JA28028-4	MW-18 (23-27')	Soil	X	X	X	X	X	X
JA24171-1	MW-20	GW	X	X	X	X	X	X
JA24171-2	Trip-1	TB	X					
JA24172-1	MW-21	GW	X	X	X	X	X	X
JA24172-2	Trip-1	TB	X					
JA24188-1	MW-8 (including MS/MSD)	GW/ MS/MSD	X	X	X	X	X	X
JA24188-2	MW-15	GW	X	X	X	X	X	X
JA24188-3	Trip-1	TB	X					
JA24318-1	MW-1	GW	X	X	X	X	X	X
JA24318-2	Trip-1	TB	x					
JA24546-1	MW-10	GW	X	X	X	X	X	X
JA24546-2	MW-11	GW	X	X	X	X	X	X
JA24546-3	MW-13	GW	X	X	X	X	X	X
JA24546-4	DUP-1 [MW-10]	GW/DUP	X	X	X	X	X	X
JA24546-5	Trip-1	TB	X					
JA29115-1	MW-18	GW	X	X	X	X	X	X

NOTES: GW=groundwater, TB=trip blank, EB=equipment blank, DUP=coded field duplicate, VOC=TCL volatile organic by SW846 Method 8260, SVOC=TCL semi-volatile organics by SW846 Method 8270, Metal =TAL metals by SW846 Methods 6010, 7470, and 7471, CN=cyanide by SW846 Method 9012 or USEPA Method 335.4, Pest=Pesticides by SW846 Method 8081, PCB=polychlorinated biphenyls by SW846 Method 8082

6.2 Data Validation

The analytical laboratories performed an internal validation of the raw data prior to reporting. Laboratory personnel identified deficiencies or compliance issues before reporting the data. Deficiencies that resulted from errors found during internal data validation were also identified and corrected, where possible. Discrepancies that could not be attributed to errors in analysis, transcription, or calculation were identified in the case narrative section of the laboratory data report, and may have been qualified with a laboratory data flag.

Upon completion of the laboratory analysis, data validation was conducted on 100 percent of the analytical data by an independent, third-party data validation subcontractor, L.A.B. Validation Corp. (LAB), to evaluate the NYSDEC ASP Category B data deliverables. Data validation was performed in accordance with USEPA Region II National Functional Guidelines for Organic and Inorganic Data Review. The Data Usability Summary Reports (DUSRs) prepared by LAB and, a tabulated summary of the data validation issues, are provided as Table 1, Appendix I. The following parameters were evaluated during the data validation:

- Technical holding times
- Proper preservation methods
- Proper reporting of TCL
- Initial and continuing calibration
- Laboratory and field blanks
- Laboratory duplicate or field duplicate samples
- Surrogate compounds
- Internal Standards
- Laboratory Control Sample (LCS) or blank spikes
- MS and MSD
- Compound Identification
- Compound Quantitation and Sample Reporting Limits

The following qualifiers were assigned, if necessary, to the data during the validation process:

U/< – The analyte was analyzed for, but was not detected above, the sample reporting quantitation limit.

J – The result is an estimated value. The associated value is the approximate concentration of the analyte in the sample.

UJ – The analyte was analyzed for, but was not detected above, the reported sample quantitation limit. The reported quantitation limit is approximate and may be inaccurate or imprecise.

R – The result is unusable. The sample result is rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.

N – The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification."

NJ – The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification" and the associated numerical value represents its approximate quantity.

The data quality objectives (DQOs) defined for the project are summarized in the subsections below.

6.2.1 Precision

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value. Precision is usually stated in terms of standard deviation, but other estimates such as relative percent difference (RPD) and percent difference (%D) are also used (Parsons, 2008). Data precision for this project was assessed through the use of duplicate (field and laboratory), blank spikes/blank spike duplicates, MS/MSDs, continuing calibrations, and serial dilutions (for metals).

No laboratory duplicates were performed by Accutest. No significant blank spike/blank spike duplicate or MS/MSD RPD issues were identified by LAB. Coded field duplicate samples were collected, packaged, and transported in the same manner as the primary sample at a frequency consistent with the QAPP. A summary of the field duplicate samples follows:

- A duplicate soil sample was collected from soil boring MW-22 on July 11, 2009. No detectable concentrations of VOCs, SVOCs, pesticides, PCBs, or cyanide were reported in the original or duplicate samples. Several metals were detected in the original or duplicate samples and LAB reported acceptable RPDs for these constituents.
- A duplicate water sample was collected from well MW-10 on July 30, 2009. No detectable concentrations of pesticides or PCBs were reported in the original or duplicate samples. Estimated values of VOCs and SVOCs, specifically cis-1,2-dichloroethylene, acenaphthene, and pyrene, were reported in the original and duplicate samples. RPDs were not calculated for these compounds due to the analytical uncertainty of the estimated concentrations; however, the same compounds were detected at similar concentrations in both the original and duplicate samples. Various metals and cyanide were detected in both the original or duplicate samples. LAB reported acceptable RPDs for these constituents, with the exception of cadmium. Cadmium was detected in the original sample, but not the field duplicate; however, it should be noted that high spike recoveries (accuracy issues) for cadmium were reported in both the MS and MSD associated with this original groundwater sample, thus, LAB qualified the reported value as estimated "J".

No results were rejected; however, the results of various metals and several VOCs and SVOCs were qualified by LAB as approximate "J" or "UJ" due to serial dilution and continuing calibration issues, respectively.

6.2.2 Accuracy

Accuracy is a measure of the degree of agreement of a measure value with the true or expected value. Accuracy is typically measured as the percent recovery (%R) of a known analyte (spike) added to a sample or a blank (Parsons, 2008).

Accuracy was assessed using blank spike, MS, and MSD samples, surrogate data, internal standards, response factors, and initial calibrations.

No significant blank spike issues were identified by LAB. The results of various VOCs, SVOCs, pesticides, and metals were qualified by LAB due to MS and/or MSD recovery issues. Most of these issues were qualified as approximate "J" or "UJ"; however, the following results were rejected "R" due to low or no recovery:

- 1,1,2,2-tetrachloroethane in soil samples MW-18 (5-9'), MW-18 (23-27'), MW-19 (5-9'), and SB-14 (10-15');
- 1,2,4-trichlorobenzene in soil samples MW-18 (5-9'), MW-18 (23-27'), and MW-19 (5-9');
- methyl acetate in soil sample SB-14 (10-15');
- hexachlorocyclopentadiene in soil samples MW-18 (5-9'), MW-18 (23-27'), MW-19 (5-9'), and MW-19 (19-21');
- benzaldehyde in soil sample MW-24 (10-14');
- 3,3'-dichlorobenzidine in the equipment blank collected on July 19, 2009 and in the groundwater samples collected from monitoring wells MW-1, MW-18, MW-20, and MW-21; and,
- endrin aldehyde in the groundwater sample collected from monitoring well MW-21.

In general, surrogate spike data, internal standards, response factors, and initial calibrations were deemed acceptable by LAB. Most of the issues related to these QC indicators were qualified as approximate "J" or "UJ"; however, the following results were rejected "R":

- acid SVOCs in the groundwater sample collected from well MW-10 due to low surrogate recoveries;
- acetone in soil samples MW-14 (5-9'), MW-15 (3'), MW-15 (7-9'), MW-16 (17.5-20'), MW-20 (17-21'), MW-21 (10-14'), MW-21 (4-5'), MW-22 (17.5-

22.5')(including duplicate DUP-1), SB-14 (10-15'), and TP-13 (3') and in the equipment blank collected on July 19, 2009 due to low response factors; and,

- 2-butanone in soil samples MW-15 (3'), MW-15 (7-9'), MW-16 (17.5-20'), MW-20 (17-21'), MW-21 (10-14'), MW-21 (4-5'), MW-22 (17.5-22.5')(including duplicate DUP-1), SB-14 (10-15'), and TP-13 (3') due to low response factors.

6.2.3 Representativeness

Representativeness is the reliability with which a measurement or measurement system reflects the true conditions under investigation. Representativeness is influenced by the number and location of the sampling points, sampling timing and frequency, and the field and laboratory procedures.

Representativeness of data was maintained through the consistent application of established field and laboratory procedures by properly trained field and laboratory personnel and use of field and laboratory QC samples. Representativeness was evaluated using duplicate field samples, which provide information pertaining to both precision and representativeness, sample preservation, sample analyses performed within method-required holding, and laboratory and field blanks. No discussion of field representativeness, e.g., number and location of sampling points, sampling frequency, etc., has been provided.

The soil and groundwater samples, along with accompanying field QC samples arrived at the analytical laboratory using proper chain-of-custody documentation. Proper preservation was also met for the samples. The coolers were received by the laboratory at temperatures ranging from 2.2°C and 5.6°C, which were within the typical 2-6°C range. Samples were extracted and analyzed within the method-specific holding times, with the exception of the trip blank submitted with

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sample MW-1 in SDG no. JA24318. This trip blank was prepared on April 29, 2009 and, thus, exceeded the 12 day holding time for VOCs specified in the QAPP. The VOC results for this trip blank were rejected "R". No significant laboratory or field blank issues were identified by LAB.

6.2.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions. To be considered complete, the data set must contain all the samples from the sample locations and depths, valid analytical results and field data proposed for the project. In addition, data were compared to project requirements to ascertain whether specifications were met. Completeness was evaluated by comparing the project objectives to the quality and quantity of the data collected to evaluate if deficiencies exist. The following calculation was used for determining completeness: Percent complete = number of valid field measurements (V) / total number of field measurements (T) * 100.

A total of 1,040 VOC soil and 468 VOC groundwater sample analytical results were generated under this investigation. At total of 31 analyte results were rejected "R" during the data validation process. The VOC data set is considered 97.9% complete.

A total of 1,340 SVOC soil and 603 SVOC groundwater sample analytical results were generated under this investigation. At total of 24 analyte results were rejected "R" during the data validation process. The SVOC data set is considered 98.8% complete.

A total of 420 pesticide soil and 189 pesticide groundwater sample analytical results were generated under this investigation. One result was rejected "R" during the data validation process, e.g., endrin aldehyde in the groundwater

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sample collected from well MW-21. The pesticide data set is considered 99.8% complete.

A total of 460 metals in soil and 207 metals in groundwater sample analytical results were generated under this investigation. None were deemed unusable during the data validation process. Similarly, all cyanide (20 soil results and 9 groundwater results) and PCB (180 soil and 81 groundwater results) were deemed usable under this investigation. As a result, 100% of the metals, cyanide, and PCBs data sets are considered complete.

6.2.5 Comparability

Comparability is a qualitative measure that expresses the confidence with which one data set can be compared to another data set. Comparability of data for this investigation was achieved by following standard techniques (EPA-approved methods and procedures) to collect and analyze representative samples with analytical results reported in similar units. The comparability of data was maintained through the use of well-documented methods and procedures, standard reference materials, and QC samples and surrogates, and consistent reporting units for each of the soil and groundwater analyses.

6.3 Usability Assessment

The usability assessment process is used to assess and document the usability of the data by considering the project DQOs, and whether the data are suitable as a basis for the decision. The assessment should consider each type of data, the relationship to the entire data set, and the adequacy of the data to fulfill the data quality goals of the project. Data sets are assessed for completeness and compliance to method-specific or project-specific QA/QC requirements, including the results of the independent data validation process.

Overall, a total of 3,460 soil and 1,557 groundwater samples were analyzed by the laboratory for VOCs, SVOCs, metals, pesticides and PCBs. LAB qualified 249 of these results (<5%) as approximate "J" or "UJ" and 56 of the results (<2%) as rejected "R. Data were most commonly qualified due to sample matrix effects. Instances of reporting limits above applicable regulatory criteria were apparent in samples. However, since many of the samples also contained concentrations of other constituents that were above regulatory criteria, these issues did not affect data usability. Eight soil samples[1] and two groundwater samples[2] had no detectable concentrations of constituents above regulatory criteria, but did have reporting limits of one or more constituents above regulatory criteria. Data from these samples should be considered usable for qualitative purposes only.

The purpose of the site characterization was to investigate the soil and groundwater quality at the Inland Project Area to better understand the origin, nature, and extent of identified environmental conditions, if present. Based on the data quality assessment and the intended purposes of the investigation, the majority of the soil and groundwater analytical data are deemed usable for this project.

7.0 FINDINGS AND RESULTS

The findings and results of the site characterization are described in the following subsections.

7.1 Geophysical Investigation

Subsurface utilities identified via geophysical methods include, but are not limited to, water lines, electric lines, gas lines, stormwater and sanitary structures, and telecommunication lines. In addition, metal-detector anomalies and suspected utilities of unknown use/origin were identified. An active petroleum pipeline was identified

[1] MW-14 (5-9'), MW-16 (17.5-20'), MW-17 (7.5-10'), MW-18 (23-27'), MW-20 (17-21'), MW-21 (10-14'), MW-22 (17.-22.5), and MW-24 (10-14')
[2] MW-8, MW-10, and MW-21

through the New York City One Call Center. The pipeline is owned by Buckeye and runs east to west along the south-side of the LIRR. The locations of underground utilities, pipeline and linear metal anomalies identified are illustrated on Figures 2 and 3.

The processed EM-61 data displayed 102 anomalies, and the GPR identified 117 anomalies. The GPR was limited to a maximum penetration depth of approximately 2-feet potentially due to conductive fill which tends to adsorb the GPR signal.

Conductive fill additionally limited EM-61 follow-up investigations using handheld metal detectors and fisher TW-6 piped cable locator. However, no conclusive data were obtained to aid in further characterizing the sources of many of these anomalies. Naeva reported that many of the subsurface anomalies may be caused by conductive fill material (coal ash or slag) present across the Inland Project Area. In addition, there may not be a practicable approach to assess the over 117 anomalies identified. Linear anomalies identified were further traced with a hand-held metal detector and utility line locater and marked out on-site. A full description of the geophysical investigation results, including figures illustrating EM-61 and GPR anomalies, are included in the Geophysical Investigation Report provided as Appendix B.

7.2 Air Monitoring

The following subsections describe the results of the worker and community air monitoring conducted during drilling and test pitting activities at the Inland Project Area.

7.2.1 Worker Air Monitoring

VOCs, respirable dust, LEL, and oxygen were continuously monitored in the worker breathing zone during drilling and test pitting.

The results of the worker air monitoring reported VOCs concentrations ranging from 0.0 to 3.0 ppm_v. The VOC concentrations detected did not exceed the action level of 5.0 ppm_v.

Portable aerosol monitoring detected dust and fumes at concentrations ranging from 0.000 to 3.407 mg/m^3. The alarm level for respirable dust and fumes was set for 0.100 mg/m^3 consistent with the CAMP. Detections of dust and fumes concentrations were most often attributed to saw-cutting activities and heavy vehicular traffic and were sustained for less than 15 minutes as noted in the Air Monitoring Data Observation Records. The highest dust recordings attributed to subsurface activities (saw-cutting) occurred on June 23, 2009, July 16, 2009 and July 17, 2009. Dust suppression was subsequently employed by wetting the soils within the work area.

Worker air monitoring reported that LEL detections ranged from 0.0 % to 1.0 %, below the action level of 10.0%. Oxygen measurements ranged from 20.3% to 23.2%, within the range of 19.5% to 23.5% total air.

Worker air monitoring VOC and dust readings were below action levels for time periods established in the CAMP and were complicated by background sources of dust from third party operations.

7.2.2 Community Air Monitoring

VOCs were monitored at downwind and upwind locations at the perimeter of work areas as part of the community air monitoring plan.

VOCs were detected at upwind and downwind locations at concentrations ranging from 0.0 ppm_v to 0.9 ppm_v. The VOC concentrations detected did not exceed the action level of 5.0 ppm_v and were a result of atmospheric wind changes, heavy vehicular traffic, and airborne discharges from local industries.

Community air monitoring VOC readings were below action levels for time periods established in the CAMP and were complicated by background sources of VOCs from third party operations.

7.3 Site Geology

The Inland Project Area geology observed in samples collected is generally heterogeneous, consisting of deposits of sands, silt, peat, gravel, cobbles, and urban fill material. Bedrock was not encountered during this investigation. Generalized geologic cross sections extending northwest-southeast on the northern (C-C') and southern (D-D') portions of the Inland Project Area, and southwest-northeast (E-E') traversing the Project Area are included as Figure 12, Figure 13, and Figure 14, respectively. Cross sections extending northwest-southeast on the northern (A-A') and southern portion (B-B') of the Waterfront Project Area are included in the *Interim Site Characterization Report* for the Waterfront Parcels. Photographs illustrating the geology observed in test pits and soil borings are provided as Appendix C and E, respectively. Test Pit logs and Soil Boring Log/Monitoring Well Construction Diagrams are provided as Appendix D and F respectively describing the subsurface geology.

Urban fill was observed in samples throughout the Waterfront Project Area and the southern portion of the Inland Project Area (MW-15 and MW-18) to depths ranging from one to 18 fbg. A greater thickness of fill material associated with foundations, brick, and concrete debris was observed on Waterfront Parcel A. The fill contains layers of material consisting of coal ash that extend through the northern portion of Waterfront Parcel A and Parcel B and onto the central portion of the Inland Project Area. The coal ash ranges in thickness from 2 to 8 feet. Discontinuous coal ash material is also present on the southern portions of Waterfront Project Area.

The deposits observed in soil samples beneath the Inland Project Area are predominantly composed of sand of unknown thickness, observed to the maximum depth of investigation (25 to 37 fbg). Fill material is absent from the northeastern portion of the Inland Project Area. Sporadic lenses of silt, gravels and cobbles were observed in borings on the Inland Project Area.

Heterogeneity of the subsurface deposits observed in samples increases from the center of the Inland Project Area towards Newtown Creek. A silt layer approximately 2 to 5 feet thick is present in the central portion of the Inland Project Area, extending to the southwestern portion of the Waterfront Project Area (Figure 14). The silt layer appears to dip towards the southwest, with its highest observed elevation at approximately 10 ft-msl in the center of the Inland Project Area (MW-24) and the lowest observed elevation approximately -18 ft-msl along Newtown Creek (MW-8). The silt is present throughout samples collected from the western portions of the Waterfront Project Area.

A deposit of peat/organic silt, ranging in thickness from less than one foot to four feet, was observed in samples beneath the fill material throughout the northern section of Waterfront Parcel A and onto the western section of Waterfront Parcel B. The peat/organic silt deposit is underlain by the aforementioned silt layer. A sand deposit of unknown thickness underlies the silt layer. On the northern portion of Parcel B, where the peat/organic silt and silt are not present, the sand deposit is located immediately beneath the fill material. This is consistent with conditions on the eastern Inland Project Area. Lenses of silt and gravel are present sporadically throughout the Inland Project Area.

Results of sieve analysis of a soil sample collected from 29 to 33 fbg from soil boring MW-18, within a deposit field characterized as fine sand, is tabulated as follows:

SAMPLE ID (Depth)	% GRAVEL	% SAND	% SILT	% CLAY
MW-18(29-33)	0.9	87.7	5.2	6.2

The grain size distribution curve is included as Appendix J.

7.4 Site Hydrogeology

Groundwater is present beneath the Project Area in perched, water table and semi-confined conditions. The water table is present beneath the Project Area at depths ranging from approximately 3 feet along Newtown Creek to approximately 25 fbg in the northernmost portions of the Inland Project Area.

On the Inland Project Area, the water table is present in the sand deposit. On the Waterfront Project Area, the water table is located in the fill material. Semi-confined conditions exist in the sand unit beneath the low permeability silt layer on the northern section of Waterfront Parcel A.

On July 29, 2009, a synoptic round of liquid level gauging was conducted on the monitoring well network MW-1 through MW-24, with the exception of MW-18 and MW-19, at low slack water during a neap tide event in Newtown Creek. Monitoring well gauging data are summarized on Table 2 and NAPL Distribution and a Groundwater Elevation Contour map is included on Figure 15. Groundwater flow direction at the water table during the neap tide on July 29, 2009 was generally towards Newtown Creek. The average water table gradient between the northern and southern boundaries of the Project Area was calculated to be approximately 0.009 feet per foot (ft/ft).

7.5 Test Pit Excavations

Test pits were excavated at three locations (TP-12 through TP-14) to investigate the potential presence of underground structures, and investigate soil quality and geology.

A summary of the observations from each test pit is provided as follows:

- TP-12 was excavated to approximately 4 fbg covering an area approximately 6 feet by 2 feet. Seven pipes of unknown use/origin were observed from approximately 1 to 4 fbg. The following is a summary of the pipes encountered:

  - Two 10-inch diameter steel pipes orientated north to south located approximately 1 and 1.5 fbg.
  - One 12-inch diameter clay pipe orientated north to south located approximately 2.7 fbg.
  - Two 10-inch diameter clay pipes orientated northwest to southeast and northeast to southwest located approximately 3 and 3.5 fbg, respectively.
  - One 10-inch diameter clay pipe orientated north to south which was formerly broken and filled with concrete.
  - One 1.5-inch steel pipe orientated east to west located approximately 2.7 fbg. The pipe connected to the 12-inch diameter clay pipe.
- TP-13 was excavated to approximately 4 fbg covering an area of approximately 6 feet by 2 feet. Five pipes of unknown use/origin were observed from approximately 2 to 3.5 fbg. The following is a summary of the pipes encountered:
  - Two 4-inch diameter steel pipes orientated north to south located approximately 2 fbg;
  - One 3-inch diameter steel pipe orientated north to south located approximately 2 fbg.
  - One 6-inch diameter steel pipe orientated north to south located approximately 2 fbg.
- One 12-inch diameter clay pipe orientated north to south located approximately 3.5 fbg.
- TP-14 was excavated to approximately 10 fbg. No subsurface anomalies were observed. Moist soils were observed approximately 10 fbg. Excavation ceased due to sidewall collapse.

Photo documentation of test pits is provided in Appendix C. Test pit logs summarizing the test pit dimensions, surface elevation, geology and PID field screening values are provided as Appendix D.

7.5.1 Piping Investigation

During the preclearing of test pits TP-12 and TP13 on July 16 and 17, 2009, respectively, clay and steel were observed as listed in section 7.5. On July 17, 2009, Naeva traced the steel pipes using a Ditchwitch Subsite utility line locator. Results from the pipe tracing were inconclusive in identifying the origin, use, or terminal ends of the pipes. Limiting factors were the limited open surface space for tracing to stored materials, poor signal strength frequency, and the jumping of signal to other locations due to interference from adjacent underground infrastructure. Therefore, addition investigation of the pipe contents was not conducted. Details of the investigation are provided in Geophysical Investigation Appendix B. Photo documentation of test pits is provided in Appendix C.

7.6 Soil Field Screening Data

Soil field screening PID measurements during the drilling of soil borings ranged from below the instrument detection limit (BDL) to 378 ppm_v in SB-14/MW-23 (11 to 15 fbg). Soil field screening PID measurements during the excavation of test pits ranged from BDL to 327 ppm_v in TP-13 (3 fbg). Screening results are presented in the Soil Boring Log/Monitoring Well Construction Diagrams (Appendix F) and Test Pit Logs (Appendix D).

7.7 LNAPL Distribution

Below, and in subsequent sections of this ISCR, the terms NAPL or LNAPL may be used. "LNAPL" is used where laboratory specific gravity data was analyzed or LNAPL was observed floating on groundwater. Throughout the site characterization of the Inland Project Area, five LNAPL samples (identified in Section 4.11) were collected and sent to Triton Analytics Corp. for forensic laboratory analysis, including viscosity and specific gravity. Kinematic viscosity results ranged from 64.78 centistokes (cst) in MW-22 to 92.18 cst in MW-19 at 50°F. Specific gravity results ranged from 0.9046 grams per milliliter (g/mL) in monitoring well MW-22 to 0.9087 g/mL in MW-19 analyzed at

50°F. With specific gravity reported <1 g/mL, the LNAPL samples are less dense than water and, therefore, classified as LNAPL. Viscosity and specific gravity data is summarized on Tables 2 and 3 for LNAPL detected in monitoring wells. A summary of the viscosity and specific gravity analytical results is provided as Appendix G.

During the site characterization, LNAPL was detected in soil samples collected during the drilling/excavation of the following soil borings, and monitoring wells at the corresponding depths:

- MW-14 - Yellow LNAPL was observed from approximately 25 to 27 fbg.
- MW-15 – Trace of yellowish-brown LNAPL was observed from approximately 9 to 11 fbg.
- MW-17 – brown LNAPL was observed from approximately 13 to 15, 17.5 to 20, and 22.5 to 25 fbg.
- MW-18 – A wax-like substance was observed between 23 and 27 fbg.
- SB-14/MW-23 – Brown LNAPL was observed from approximately 20 to 35 fbg.
- SB-15 – Trace of LNAPL was observed from approximately 15 to 20 fbg.

Note that LNAPL observed in the soil borings was recorded from field observation of the split spoon or macro-core soil sampling devices and may not be representative of actual LNAPL thickness or depth in soil. LNAPL observed during installation of soil borings, and monitoring wells is recorded in the Soil Boring Log/Monitoring Well Boring Construction Diagrams provided as Appendix F.

LNAPL was detected during the groundwater gauging event on July 29, 2009 in monitoring wells MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-9, MW-14, MW-16, MW-17, MW-19, MW-22, MW-23, and MW-24, with LNAPL thickness ranging from 0.09 ft in MW-16 to 11.83 ft in MW-5. Monitoring wells MW-5 and MW-6 are screened beneath a semi-confining layer and LNAPL thickness is not indicative of actual levels across the water-table interface. Confining pressures appear to be enhancing LNAPL transport into the wells resulting in greater LNAPL thickness in MW-5 and MW-6 relative

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to water table wells. Furthermore, LNAPL thickness observed in monitoring wells may not be indicative of actual levels in the subsurface as discussed in ASTM E 2531-06, *Standard Guide for Development of Conceptual Site Models and Remediation Strategies for Light Nonaqueous-Phase Liquids Released to the Subsurface* and USEPA, *How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites*, September 1996.

Monitoring wells MW-18 and MW-19 were gauged on September 24, 2009, after access was granted and the wells installed,. LNAPL was detected in monitoring well MW-19 with a thickness of 0.60 ft. A summary of LNAPL thicknesses observed in monitoring wells during groundwater gauging is provided in Table 2. LNAPL distribution is illustrated in Figure 15.

7.8 Soil Analytical Data

The following subsections summarize soil sample laboratory analytical results for VOCs, SVOCs, metals, including cyanide, pesticides, and PCBs for 20 soil samples collected from soil borings (SB-13 through SB-15), monitoring wells (MW-14 through MW-22), and test pits (TP-13 and TP-14) collected between June 20, 2009 and September 14, 2009. Soil sample laboratory analytical results are summarized in Tables 4 through 10 and compared to NYSDEC Technical Administrative Guidance Memorandum (TAGM) 4046, January 24, 1994, Recommended Soil Cleanup Objectives (RSCOs). In addition, the soil concentrations are compared to NYSDEC New York Codes Rules and Regulations (NYCRR) Part 375-6, Remedial Program, Restricted Use Soil Cleanup Objectives Protection of Public Health Industrial (RUSCO-PPH Industrial) dated December 14, 2006. Laboratory analytical reports and chain-of-custody documentation are provided in Appendix K.

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7.8.1 Volatile Organic Compounds

Laboratory analysis reported VOC concentrations below available NYSDEC RUSCO-PPH Industrial guidance values in the 20 soil samples submitted. Four VOCs were detected above their respective RSCOs listed below:

- Acetone was detected above its RSCO of 0.2 mg/kg in one sample MW-17 (12.5-17 fbg) at 0.210J mg/kg.
- Tetrachloroethene was detected above its RSCO of 1.4 mg/kg in one sample MW-17 (3 fbg) at 1.99 mg/kg, below its RUSCO-PPH Industrial of 300 mg/kg.
- Trichloroethene was detected above its RSCO of 0.7 mg/kg in one sample MW-17 (3 fbg) at 1.15 mg/kg, below its RUSCO-PPH Industrial of 400 mg/kg.
- Total Xylenes was detected above its RSCO of 1.2 mg/kg in one sample MW-17 (12.5-17 fbg) at 1.71J mg/kg, below its RUSCO-PPH Industrial of 1,000 mg/kg.

VOC analytical results are summarized on Table 4. The spatial distributions of VOCs detected above RSCOs in soil are illustrated on Figure16.

7.8.2 Semi-Volatile Organic Compounds

Laboratory analysis reported TCL SVOC concentrations above NYSDEC RUSCO-PPH Industrial limits in three samples. Seven SVOCs were detected above their respective RSCOs listed below:

- Benzo(a)anthracene was detected above its RSCO of 0.224 mg/kg in six samples, ranging from 0.234 mg/kg in TP-13 (3 fbg) to 4.64 mg/kg in MW-19 (19-21 fbg). Concentrations were below NYSDEC RUSCO-PPH Industrial limits.
- Benzo(a)pyrene was detected above its RSCO of 0.061 mg/kg in 10 samples, ranging from 0.0806 mg/kg in SB-14 (10-15 fbg) to 6.41 mg/kg in MW-15 (3 fbg). Concentrations were above NYSDEC RUSCO-PPH Industrial limits in MW-15 (3 fbg) at 6.41 mg/kg and MW-18 (5-9 fbg) at 2.62 mg/kg.

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- Benzo(b)fluoranthene was detected above its RSCO of 0.22 mg/kg in four samples, ranging from 0.242 mg/kg in TP-14 (10 fbg) to 2.89 mg/kg in MW-18 (5-9 fbg). Concentrations were below NYSDEC RUSCO-PPH Industrial limits.
- Benzo(k)fluoranthene was detected above its RSCO of 0.22 mg/kg in three samples, ranging from 0.342 mg/kg in MW-17 (12.5-17 fbg) to 1.62 mg/kg in MW-15 (3 fbg). Concentrations were below NYSDEC RUSCO-PPH Industrial limits.
- Chrysene was detected above its RSCO of 0.4 mg/kg in five samples, ranging from 1.19 mg/kg in SB-14 (10-15 fbg) to 7.43 mg/kg in MW-19 (19-21 fbg). Concentrations were below NYSDEC RUSCO-PPH Industrial limits.
- Dibenzo(a,h)anthracene was detected above its RSCO of 0.0143 mg/kg in nine samples, ranging from 0.0262J mg/kg in MW-21 (4-5 fbg) to 7.41 mg/kg in MW-15 (3 fbg). Concentrations were above NYSDEC RUSCO-PPH Industrial limits in MW-15 (3 fbg).
- Indeno(1,2,3-cd)pyrene was detected above its RSCO of 3.2 mg/kg in one sample at 3.26 mg/kg in MW-15 (3 fbg) below NYSDEC RUSCO-PPH Industrial limits.

SVOC analytical results are summarized on Table 5. The spatial distribution of SVOCs in soil is illustrated on Figure 17.

7.8.3 Metals and Cyanide

One or more TAL metals were detected above RSCOs (if applicable) in the soil samples analyzed. However 17 of the 20 soil samples had reported concentrations of metals below eastern USA background guidance values. The metals detected above RSCOs and eastern USA background guidance values (if applicable) are listed below:

- Arsenic was detected above its eastern background value of 12 mg/kg in four samples ranging from 12.4 mg/kg in MW-17 (3 fbg) to 106 mg/kg in MW-18 (5-9 fbg). Concentrations were above NYSDEC RUSCO-PPH Industrial limits in MW-18 (5-9 fbg) and TP-14 (10 fbg) at 21.7J mg/kg.

- Cadmium was detected above its eastern background value of 1 mg/kg in MW-18 (5-9 fbg) at 2.3 mg/kg below NYSDEC RUSCO-PPH Industrial limits.
- Copper was detected above its eastern background value of 50 mg/kg in MW-18 (5-9 fbg) at 370J mg/kg, below NYSDEC RUSCO-PPH Industrial limits.
- Lead was detected above its eastern background value of 500 mg/kg in MW-18 (5-9 fbg) at 530 mg/kg, below NYSDEC RUSCO-PPH Industrial limits.
- Magnesium was detected above its eastern background value of 5,000 mg/kg in MW-19 (5-9 fbg) at 10,600J mg/kg, below NYSDEC RUSCO-PPH Industrial limits.
- Mercury was detected above its eastern background value of 0.2 mg/kg in MW-18 (5-9 fbg) at 0.64 mg/kg, below NYSDEC RUSCO-PPH Industrial limits.
- Nickel was detected above its eastern background value of 25 mg/kg in MW-18 (5-9 fbg) at 34.8J mg/kg, below NYSDEC RUSCO-PPH Industrial limits.
- Selenium was detected above its eastern background value of 3.9 mg/kg in MW-18 (5-9 fbg) at 4.8 mg/kg, below NYSDEC RUSCO-PPH Industrial limits.
- Zinc was detected above its eastern background value of 50 mg/kg in five samples, ranging from 69.3J mg/kg in TP-14 (10 fbg) to 1,470J mg/kg in MW-18 (5-9 fbg). Concentrations were below NYSDEC RUSCO-PPH Industrial limits.

Cyanide was detected in one soil sample MW-21 (4-5 fbg) with concentrations reported at 0.30 mg/kg below NYSDEC RUSCO-PPH Industrial. Metal analytical results are summarized on Table 6. The spatial distribution of Metals in soil is illustrated on Figure 18.

7.8.4 Pesticides and Polychlorinated Biphenyls

Laboratory analysis reported pesticide concentrations below NYSDEC RSCOs in the 20 soil samples submitted. Of the 20 samples analyzed, two samples had detections of one or more of the 21 pesticide analytes. Methoxychlor was detected in soil sample MW-17 (12.5-17 fbg) at 0.0018J mg/kg. Rhotane (4,4'-DDD) and DDE,P,P' was detected in soil sample MW-18 (5-9 fbg) at 0.0435 and 0.0054 mg/kg, respectively.

Laboratory analysis reported PCB concentrations below NYSDEC RSCOs in the 20 soil samples submitted. Of the 20 samples analyzed, two samples had detections of one or more of the nine PCB analytes below RSCOs. PCBs were detected in soil samples MW-18 (5-9 fbg) and MW-19 (5-9 fbg). Analytical results for pesticides and PCBs are summarized on Tables 7 and 8, respectively.

7.9 Groundwater Analytical Data

The following subsections summarize the groundwater sample field parameters and laboratory analytical results for VOCs, SVOCs, metals, including cyanide, pesticides, and PCBs for groundwater samples collected from the Project Area. Groundwater samples were collected from monitoring wells MW-1, MW-8, MW-10, MW-11, MW-13, MW-15, MW-20 and MW-21 between July 27 and 30, 2009. Monitoring well MW-18 was sampled on September 24, 2009. Groundwater samples were not collected from monitoring wells MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-9, MW-14, MW-16, MW-17, MW-19, MW-23 and MW-24 due to detections of sheen or LNAPL. Monitoring well MW-12 was not accessible due to stored materials and, therefore, not sampled on July 29, 2009. Groundwater sample laboratory analytical results are summarized in Tables 11 through 18 and compared to the NYSDEC Water Quality Standards (WQS) as published in the Division of Water *Technical and Operational Guidance Series (TOGS) 1.1.1, Ambient Water Quality Standards and Guidance Values Memorandum* dated June 1998 (Addendum June 2000). Laboratory analytical reports and chain-of-custody documentation are provided in Appendix L.

7.9.1 Field Parameters

The following summarizes the results of the field parameters measured in groundwater samples collected from the monitoring wells sampled using a flow through cell prior to groundwater sampling:

- Groundwater temperatures ranged from 17.97°C in monitoring well MW-1 to 28.95°C in monitoring well MW-8.
- Groundwater conductivity ranged from 0.54 mS/cm in monitoring well MW-10 to 27.4 mS/cm in monitoring well MW-8.
- Groundwater ORP ranged from -330 mV in monitoring well MW-8 to 190 mV in monitoring well MW-21.
- Groundwater DO ranged from 0.00 mg/L in monitoring well MW-20 to 5.49 mg/L in monitoring well MW-11.
- Groundwater turbidity ranged from 0.0 ntu in monitoring well MW-10 to 786 ntu in monitoring well MW-15.

The field parameters are summarized on Table 2.

7.9.2 Volatile Organic Compounds

The following summarizes the TCL VOCs detected above groundwater standards or guidance values in the groundwater samples collected in July and September, 2009:

- Benzene was detected in MW-1 (27.0 micrograms per liter [µg/L]) and MW-13 (2.7 µg/L).
- 1,1-Dichloroethane was detected in MW-1 (27.4 µg/L).
- Cis-1,2-dichloroethene was detected in MW-1 (20.9 µg/L).
- Methyl tertiary butyl ether (MTBE) was detected in MW-18 (26.2 µg/L).
- Vinyl chloride was detected in MW-1 (19.1 µg/L).
- Total xylenes were detected in MW-13 (8.1 µg/L).

VOC groundwater analytical results are summarized on Table 9. The spatial distributions of dissolved VOCs are illustrated on Figure 19.

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7.9.3 Semi-Volatile Organic Compounds

The following summarizes the TCL SVOCs detected above groundwater standards or guidance values in the groundwater samples collected in July and September, 2009:

- Bis(2-ethylhexyl)phthalate was detected in MW-11 (5.8 µg/L).
- Benzo(a)anthracene was detected in MW-15 (12.9 µg/L), MW-18 (0.47J µg/L) and MW-20 (5.5 µg/L).
- Benzo(a)pyrene was detected in MW-15 (3.0 µg/L),
- Benzo(b)fluoranthene was detected in MW-15 (3.4 µg/L),
- Benzo(k)fluoranthene was detected in MW-15 (0.95J µg/L),
- Chrysene was detected in MW-15 (18.2 µg/L), MW-18 (0.47J µg/L) and MW-20 (6.8 µg/L).

SVOC groundwater analytical results are summarized on Table 10. The spatial distributions of dissolved SVOCs are illustrated on Figure 20.

7.9.4 Metals and Cyanide

Where turbidity was recorded below 50 NTU, no field-filtered groundwater sample was collected. Turbidity was measured greater than 50 NTU during collection of groundwater samples from MW-8, MW-15, and MW-20. Therefore, a filtered sample and unfiltered sample were collected. Laboratory analysis reported the following TAL metals concentrations above groundwater standards and/or guidance values in samples collected.

- Aluminum was detected in MW-15 (9,320 µg/L), MW-18 (255 µg/L), and MW-20 (3,030 µg/L). Concentrations decreased to <200 µg/L in a filtered sample for MW-15 and MW-20.
- Arsenic was detected in MW-15 (34.8 µg/L). However, concentrations decreased to 17.3 µg/L (below standards) in a filtered sample.

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- Iron was detected in eight samples, ranging from 579J µg/L in MW-11 to 50,800 µg/L in MW-18.
- Magnesium was detected in five samples, ranging from 36,600 µg/L in MW-20 to 711,000 µg/L in MW-8;
- Manganese was detected in seven samples, ranging from 410 µg/L in MW-13 to 4,010 µg/L in MW-20;
- Selenium was detected in MW-21 (11.2 µg/L);
- Sodium was detected in nine samples, ranging from 21,000 µg/L in MW-10 to 5,240,000 µg/L in MW-18;

Cyanide was analyzed only on the unfiltered groundwater samples. Laboratory analysis detected concentrations of cyanide in samples collected from monitoring wells MW-10 (37 µg/L) and MW-13 (16 µg/L) below NYSDEC standard of 200 µg/L. Total metals and cyanide groundwater analytical results are summarized on Table 11 and dissolved metal analytical results are summarized on Table 12. The spatial distributions of dissolved metals are illustrated on Figure 21.

7.9.5 Pesticides and Polychlorinated Biphenyls

Laboratory analysis reported concentrations of pesticides and PCBs below reporting limits (BRL) in the groundwater samples collected. Pesticide and PCB groundwater analytical results are summarized on Tables 13 and 14, respectively.

7.9.6 Formaldehyde

Laboratory analysis reported concentrations of formaldehyde BRL in the groundwater samples collected from monitoring well MW-20 and MW-21. Formaldehyde groundwater analytical results are summarized on Table 15.

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7.10 Forensics Analysis

Forensic laboratory analysis of soil and LNAPL samples was conducted by Alpha Woods Hole laboratory. Copies of the laboratory analytical reports are not included with this ISCR due to the large volume of data, but are available upon request. Based on the forensic analysis, soil and LNAPL samples submitted were classified into one of five groups based on the dominant product type detected in the sample. The five groups included:

- Broad cut distillates, variably weathered;
- Waxes;
- Light distillate, weathered;
- Lube oil range material; and
- Hydraulic fluid/Grease.

The following subsections discuss the sample group characteristics, and list the samples assigned to each group. Soil Boring and Test Pit Logs were reviewed to determine which of the soil samples contained evidence of NAPL, if any. Soil samples containing NAPL are indicated as such in the sample lists under each group.

7.10.1 Broad Cut Distillates, Variably Weathered

The following samples were characterized as broad cut distillates of petrogenic origin, which have been weathered to varying degrees.

Sample Location	Sample Depth (fbg)	Matrix
SB-14 (10-15')	10-15	Soil
MW-14 (5-9')	5-9	Soil
MW-15 (7-9')	7-9	Soil
MW-17 (3')	3	Soil
MW-17 (12.5-17')	12.5-17	Soil
MW-18 (5-9')	5-9	Soil

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Sample Location	Sample Depth (fbg)	Matrix
MW-19 (5-9')	5-9	Soil
MW-19 (19-21')	19-21	Soil
MW-21 (10-14')	10-14	Soil
MW-24 (10-14')	10-14	Soil
TP-13 (3')	3	Soil
TP-14 (10')	10'	Soil
MW-14	Sampled from Well	LNAPL
MW-16	Sampled from Well	LNAPL
MW-17	Sampled from Well	LNAPL
MW-19	Sampled from Well	LNAPL
MW-22	Sampled from Well	LNAPL
MW-23	Sampled from Well	LNAPL
MW-24	Sampled from Well	LNAPL

Soil samples MW-18 [5-9'], MW-19 [5-9'], and TP-13 [3'] contained secondary components consisting of waxes. The seven LNAPL samples contained the same product type, in a similar weathering state, and appear to be source-related.

7.10.2 Waxes

The following samples were characterized as containing wax as the dominant hydrocarbon component.

Sample Location	Sample Depth (fbg)	Matrix
MW-18 (23-27')	23-27	Soil
MW-18 (35')	35	Soil

7.10.3 Light Distillate, Weathered

The following samples were characterized as containing a weathered, light distillate as the sole hydrocarbon component. The chemical signature of the sample is consistent with material such as kerosene or fuel oil No. 1.

Sample Location	Sample Depth (fbg)	Matrix
MW-17 (7.5-10')	7.5-10	Soil

7.10.4 Lube Oil Range Material

The following samples were characterized as containing the signature of lubricating oil range product as the sole hydrocarbon signature. The samples differ from similar "range" product types present in that they lack isoprenoid compounds.

Sample Location	Sample Depth (fbg)	Matrix
MW-15 (3')	3	Soil
MW-20 (17-21')	17-21	Soil
MW-21 (4-5')	4-5	Soil

In addition, secondary components were detected in samples, including pyrogenic PAHs (MW-15 [3']) and waxes (MW-21 [4-5']).

7.10.5 Hydraulic Fluid/Grease

The LNAPL and groundwater samples collected from monitoring well MW-3 are not characteristic of a typical fuel or refined petroleum product and do not have a chemical signature that is consistent with known, power-generation fuel type. The samples did reveal chemical constituent distributions that are characteristic

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of heavy grease. In addition, wax was detected as a secondary component in both samples.

8.0 CONCEPTUAL SITE MODEL

A preliminary site conceptual model will be developed, following additional Project Area characterization work so that a comprehensive evaluation can be performed. In the interim, a preliminary evaluation of potential sensitive receptors is provided below.

8.1 Preliminary Potential Receptors Evaluation

This evaluation was conducted per the boundary conditions set forth in the Consent Order. Thus, potential receptors identified at the Project Area include commercial and industrial workers associated with commercial and industrial use on site and surrounding properties. Based on visual observations, there are commercial and industrial properties on-site and within a half mile of the Project Area to the east and west (cross-gradient) and south across Newtown Creek. The majority of the ground surface in the vicinity of the Project Area is paved with asphalt or concrete or is developed with a building, with the exception of the LIRR. The closest residential structure to the Project Area containing a basement is located approximately 780 feet north-northwest (up-gradient). The closest commercial buildings with basements are located on the Inland Project Area including: 37-88 Review Avenue, 38-20 Review Avenue, 38-60 Review Avenue, and 38-54 Railroad Avenue. No schools, daycare centers, hospitals, or parks were identified within a half-mile of the Project Area.

According to USGS Fact Sheet 134-97, there are no municipal water supply wells within a half-mile of the Project Area. The water supply to the Project Area and surrounding area is provided by the New York City Department of Environmental Protection (NYCDEP) Bureau of Water and Sewer Operations, and the sources of water are the Catskills and Delaware reservoir systems located in upstate New York. Pumping of groundwater for public supply in western Queens County stopped in 1974 (Buxton and Shernoff, 1999).

9.0 SUMMARY AND CONCLUSIONS

Kleinfelder conducted this investigation in order to investigate the soil and groundwater quality beneath the Inland Project Area to better understand the origin, nature, and extent of identified environmental conditions, if present.

The Inland Project Area geology consists predominately of glacial till composed primarily of sand. Urban fill including coal ash, brick, concrete, wood, with sand and gravel, was observed beneath the Waterfront Project Area and along the southern portion of the Inland Project Area. The thickness of the fill ranges from approximately 2 to 18 fbg. Unconsolidated layers and lenses of sand, silt, clay, peat and gravel underlie the fill material. Groundwater is present beneath the Project Area in perched, water table and semi-confined conditions. Groundwater was observed at depths ranging from 3 to 25 fbg. Groundwater flow was measured in the direction of Newtown Creek at an approximate hydraulic gradient of 0.009 to 0.022 feet per foot (ft/ft).

NAPL with specific gravity less than one has been identified on the Project Area. Its spatial distribution is sporadic on the southern portion of the Waterfront Project Area and is more widely distributed on the northern portions of the Waterfront Project Area and central Inland Project Area. LNAPL was identified in the zone above the water table in the capillary fringe, at or below the water table, and below semi-confining stratigraphic layers, indicating that a combination of water table fluctuation and hydrostratigraphic framework may control the vertical distribution of LNAPL. LNAPL mobility is expected to be inhibited by the removal of potential historic sources, the attainment of steady-state conditions, adsorption to the soil matrix, interfacial tension and capillary forces within pore spaces, and relatively high (64.78 to 92.18 cst) kinematic viscosity (Cole, 1994).

LNAPL characterized as broad cut distillates, was identified at multiple sampling locations throughout Waterfront Parcel A, in the northwest corner of Parcel B and in soil and LNAPL samples collected throughout the Inland Project Area.

Wax-like substances were identified at three locations: one on Waterfront Parcel A (TP-5), one at the east end of Parcel B (TP-11) and during the drilling of MW-18 on Parcel C. Wax-like substances were additionally identified as a secondary component of soil samples collected from MW-19, MW-21, TP-13 and water and LNAPL samples collected from MW-3.

The Project Area, including the area in which broad cut distillates were identified, is punctuated by various detections of hydraulic fluid/greases, lube oil range material, light and middle distillate material, chlorinated VOCs, and gasoline constituents that potentially originated from non-FPOW sources. The presence of pyrogenic PAHs in soil samples is attributed to the coal ash fill material, which is present along the northern and southern portions of Waterfront Parcel A and Parcel B and onto the central portion of the Inland Project Area. This historic fill material appears to pre-date the FPOW operations.

Chlorinated VOCs were detected in soil samples collected from the west and northwest portion of Parcel A, near the water table in proximity to where these compounds were detected in groundwater. Chlorinated VOCs were detected in soil samples near the water table in the eastern portion of Parcel A. According to Sanborn maps, this area was historically occupied by solvent tanks between the period of 1970 and 1980 during Peerless operations. In addition, chlorinated VOCs were detected in soil samples collected from MW-14, MW-17 and MW-21 and in groundwater samples collected from MW-21. The source(s) of chlorinated VOCs are unknown.

VOCs were detected in soil samples collected from the Project Area. Benzene and, to a lesser extent, toluene, ethylbenzene and xylenes were detected in soil samples throughout Parcel A. Isopropylbenzene and acetone were detected above RSCOs in soil samples collected from the Waterfront Project Area. VOCs were not detected in soil samples collected from the Inland Project Area above RSCOs with the exception of MW-17 (12.5-17'). Benzene was detected in groundwater samples from MW-1, MW-13 and MW-18. Benzene detections in groundwater were not consistently associated with benzene concentrations in soil samples collected. MTBE was detected in groundwater samples collected from MW-3 and MW-18. MTBE is not associated with FPOW operations.

SVOCs, in the form of PAHs, were detected above RSCOs in the soil samples collected with the exception of SB-11, MW-16, MW-20, MW-22, and SB-13/MW-24. SVOCs were detected above RUSCO-PPH Industrial limits in 22 sample locations from the Waterfront Project Area and two locations (MW-15 and MW-18) from the Inland Project Area. In general, SVOCs were detected at lower concentrations in samples collected from the Inland Project Area, than the Waterfront Project Area. SVOCs were minimally detected in groundwater throughout the Project Area, which is consistent with the fact that SVOCs include high molecular weight hydrocarbons that tend sorb to soils and have low solubility. Metals were detected above RSCOs in soil samples collected from the Project Area. The majority of metals were detected in the fill material at or above the water table. The distribution of metals decreased in soil samples collected below the water table. The lower distribution of metals in groundwater, relative to the distribution of metals in soil, suggests the fill material as a likely source. Urban fill material has been demonstrated to contain metals. Furthermore, atmospheric deposition of metals is also a potential source. Natural background concentrations of metals may be elevated due to the mineral composition of the soil, proximity to Newtown Creek, and the general urban setting of the Project Area. The limited presence of metals in groundwater, compared to their distribution in soils throughout the Project Area, indicates that the metals may be bound to the mineral matrix of the soils, reducing their leachabilty to groundwater. Furthermore, distribution of metals suggests that they originated from a non-point source, such as the fill material. Historical site information does not suggest that the metals detected were used in FPOW operations.

Soil samples collected from soil boring MW-3 contained pH values of <1 su suggesting the presence of an acidic compound. This boring was located on the south side of Waterfront Parcel A. The source of the low pH in soil near MW-3 is unknown.

The closest residential structure to the Project Area is located approximately 780 feet north-northwest (up-gradient). The closest commercial buildings with basements are located on the Inland Project Area including: 37-88 Review Avenue, 38-20 Review Avenue, 38-60 Review Avenue, and 38-54 Railroad Avenue. No schools, daycare centers, hospitals, or parks were identified within a half mile of the Project Area. The nearest surface water body is Newtown Creek, located adjacent to the southern property boundary (downgradient) of the Waterfront Project Area. There are no known municipal water supply wells within a half-mile of the Project Area. Water to the area is supplied by NYCDEP Bureau of Water and Sewer Operations, the sources of which are Catskills and Delaware reservoir systems located in upstate New York.

10.0 RECOMMENDATIONS

Based on the information gathered from this and the Waterfront Project Area site characterization, additional investigation of the extent of LNAPL detected is proposed using laser induced fluorescence (LIF) technology. A LIF soil boring program is proposed in an effort to better characterize horizontal and vertical distribution of LNAPL observed and minimize disruption to surrounding businesses, contingent upon site access. A key objective of the proposed investigation is to evaluate potential sources of LNAPL accumulations, if present. In addition to the LIF borings, drilling of soil borings in the vicinity of monitoring well MW-3, using direct push technology, is proposed for the collection of soil and groundwater samples. The purpose of the additional soil borings is to further investigate the horizontal extent of the low pH condition identified, while minimizing worker exposure and waste generation. A description of the proposed methods and implementation schedule are proposed for submittal to the NYSDEC within 90-days of NYSDEC approval of this ISCR.

A tidal study and slug testing of several monitoring wells is proposed to evaluate the hydraulic conductivity of the water-bearing sediments beneath the Project Area and to evaluate the influence, if any, Newtown Creek tidal fluctuations may have on groundwater flow, elevation and gradient beneath the Project Area. A description of the proposed methods and schedule are proposed for submittal to the NYSDEC within 90-days of NYSDEC approval of this ISCR.

Continued quarterly groundwater monitoring and sampling of the monitoring well network (MW-1 through MW-24) are proposed. Quarterly monitoring and sampling are proposed to continue for 24 months, at which time an evaluation will be conducted to evaluate the need for continued and/or focused monitoring. Proposed quarterly monitoring includes, but may not be limited to, an evaluation of hydrocarbon thickness, if present, groundwater elevations, flow direction and fluctuations in dissolved-phase VOCs, SVOCs, metals and cyanide. Monitoring and sampling will continue following the methods described in the ISCR, with the following exceptions:

- Purging and sampling using low flow groundwater sampling methods following USEPA Region II, *Ground water Sampling Procedure Low Stress (Low Flow) Purging and Sampling*, methods based on stabilization of groundwater monitoring indicator parameters (turbidity, temperature, specific conductance, pH, Eh and DO), rather than purging three to five well volumes of groundwater prior to groundwater sample collection.
- Groundwater samples would not be analyzed for Pesticides and PCBs; and
- Category B data deliverables, with electronic copies of data only, without data validation.

The methods, findings and results of the groundwater sampling events would be summarized in Site Status Update Reports (SSURs) submitted to NYSDEC within 90-days of receipt of final laboratory analytical reports. In addition, it is proposed to summarize quarterly interim remedial measure (IRM) activities in the SSURs, rather than in a separate submittal.

11.0 LIMITATIONS

Kleinfelder performed the services for this project under the Standard Procurement Agreement with Procurement, a division of ExxonMobil Global Services Company (signed on June 21, 2007). Kleinfelder states that the services performed are consistent with professional standard of care defined as that level of services provided by similar professionals under like circumstances. This Report is based on the regulatory standards in effect on the date of this Report. It has been produced for the primary benefit of Exxon Mobil Global Services Company and its affiliates.

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