REMEDIAL INVESTIGATION REPORT

for

Kasser Scrap Metal and Rector Cleaners Site
111 Washington Street
New York, New York
NYSDEC BCP Site No. C231153

Prepared for:

Carlisle New York Apartments, LLC
c/o Grubb Properties
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LANGAN

CERTIFICATION

I, Jason J. Hayes, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Jason J. Hayes, P.E., LEED AP

2/15/2023

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LIST OF ACRONYMS

Acronym	Definition
Alpha	Alpha Analytical Inc.
AOC	Area of Concern
ASP	Analytical Services Protocol
AST	Aboveground Storage Tank
BCP	Brownfield Cleanup Program
bgs	Below grade surface
CAMP	Community Air Monitoring Program
CP-51	Commissioner's Policy-51
CSM	Conceptual Site Model
CVOC	Chlorinated Volatile Organic Compounds
DER	Division of Environmental Remediation
DER-10	Technical Guidance for Site Investigation and Remediation
DUSR	Data Usability Summary Report
EC	Engineering Controls
el.	Elevation (NAVD88)
ELAP	Environmental Laboratory Approval Program
ESA	Environmental Site Assessment
eV	Electron volt
FEMA	Federal Emergency Management Agency
FWRIA	Fish and Wildlife Resources Impact Analysis
GPR	Ground Penetrating Radar
HASP	Health and Safety Plan
IC	Institutional Controls
IDW	Investigation Derived Waste
Langan	Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
MCL	Maximum contaminant level
mg/kg	Milligram per kilogram
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
NAVD88	North American Vertical Datum of 1988
NOVA	NOVA Geophysical Engineering
NYCDCP	New York City Department of City Planning
NYCDEP	New York City Department of Environmental Protection
NYCDPR	New York City Department of Parks and Recreation
NYCDOB	New York City Department of Buildings
NYCTA	New York City Transit Authority
NYSDEC	New York State Department of Environmental Conservation

Acronym	Definition
NYSDEC SGVs	NYSDEC TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values for Class GA water
NYSDOH	New York State Department of Health
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene
PFAS	Perfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctanesulfonic acid
PGW	Protection of Groundwater
PID	Photoionization Detector
PPE	Personal Protective Equipment
ppm	Parts per million
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
RIR	Remedial Investigation Report
RL	Reporting limit
RPD	Relative percent differences
RURR	Restricted Use Restricted-Residential Use
SCL	Soil Cleanup Levels
SCO	Soil Cleanup Objective
SMMP	Soil Materials/Management Plan
SMP	Site Management Plan
SVOC	Semivolatile organic compound
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TOGS	Technical and Operational Guidance Series
UN/DOT	United Nations/Department of Transportation
USEPA	United State Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tanks
UU	Unrestricted Use
VOC	Volatile Organic Compound
Volunteer	Carlisle New York Apartments, LLC
µg/L	Micrograms per liter
µg/m^3	Micrograms per cubic meter
York	Analytical Laboratories, Inc.
6 NYCRR	Title 6 of the New York Codes, Rules, and Regulations

1.0 INTRODUCTION

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan) prepared this Remedial Investigation Report (RIR) on behalf of Carlisle New York Apartments, LLC c/o Grubb Properties (the Volunteer) for the property located at 111 Washington Street in the Financial District of New York, New York (the site). The Volunteer submitted a Brownfield Cleanup Program (BCP) application to the New York State Department of Environmental Conservation (NYSDEC) on April 8, 2022.

This RIR presents environmental data and findings from the Remedial Investigation (RI) that was implemented by Langan in January and February 2022. The investigation was conducted in accordance with Title 6 New York Codes, Rules and Regulations (NYCRR) Part 375-1, 3.8, 6.8, "DER-10: Technical Guidance for Site Investigation and Remediation" (May 2010), New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" (October 2006) with subsequent updates (NYSDOH Soil Vapor Guidance), and the NYSDEC "Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs" (June 2021).

The objectives and goals of this RIR are to:

- Define the nature and extent of contamination in all subsurface media at the site;
- Evaluate whether subsurface contamination is emanating from the site;
- Generate sufficient data to evaluate the remedial action alternatives and prepare a Remedial Action Work Plan (RAWP) to be implemented concurrently with site redevelopment; and
- Generate sufficient data (both on-site and off-site, as necessary) to evaluate the actual and potential corresponding threats to human health and the environment.

The remainder of this report is organized as follows:

- Section 2.0 describes the setting and physical characteristics of the site.
- Section 3.0 describes the site background, including results of previous investigations and identified areas of concern (AOCs).
- Section 4.0 presents the investigation field procedures.
- Section 5.0 describes the field observations and analytical results.
- Section 6.0 presents an assessment of the exposure risks of site contaminants to human, fish, and wildlife receptors.
- Section 7.0 presents the nature and extent of contamination in site media as determined through the field investigation and analysis of environmental samples.

- Section 8.0 summarizes the results of the investigation and presents conclusions based on field observations and analytical results.
- Section 9.0 presents the references used in preparation of this report.

2.0 SITE PHYSICAL CHARACTERISTICS

2.1 Site Description

The site is located at 111 Washington Street in the Financial District of New York, New York and is identified as Block 53, Lot 12 on the Manhattan Borough Tax Map. The site is about 11,255 square feet and is currently a vacant lot with overgrown vegetation and an asphalt-paved driveway in the northwestern part of the property. A site location map is presented as Figure 1. The site plan is presented as Figure 2.

The site is bound by Carlisle Street followed by a multi-story mixed use commercial and residential building to the north (Block 53, Lot 7502), three multi-story residential and/or commercial buildings to the east (Block 53, Lots 33, 35, and 36), a multi-story residential building to the south (Block 53, Lot 6), and Washington Street followed by two multi-story residential and/or commercial buildings to the west (Block 55, Lots 14 and 7501). A 1-line New York City Transit Authority (NYCTA) subway tunnel structure is present under Greenwich Street within 200 feet to the east of the site.

2.1.1 Description of Surrounding Properties

According to the New York City Department of City Planning (NYCDCP) Zoning Map 12b, dated March 20, 2013, the site is currently located in a C6-9 commercial zoning district. The following is a summary of surrounding property usage:

Direction	Adjoining and Adjacent Properties			Surrounding Properties
	Block No.	Lot No.	Description	
North	Carlisle Street			Albany Street followed by commercial and institutional properties
	53	7502	Multi-story mixed use commercial and residential building	
East	53	33	Multi-story, multi-family residential building	Greenwich Street followed by commercial and institutional properties
		35	Seven-story commercial building	
		36	Multi-story, multi-family residential building	

Direction	Adjoining and Adjacent Properties			Surrounding Properties
	Block No.	Lot No.	Description	
South	53	6	Multi-story, multi-family residential building	Institutional, mixed use commercial and residential, and commercial buildings
West	55	14	Multi-story, multi-family residential building	West Street followed by the Hudson River Park and mixed-use commercial and residential properties
		7501	Multi-story commercial building	

Land use within a half-mile radius includes multi-story residential buildings, multi-story mixed use commercial and residential buildings, institutional and commercial buildings, and park land owned and operated by the New York City Department of Parks and Recreation (NYCDPR). The Hudson River is the closest ecological receptor, located about 1,300 feet west of the site.

No schools or day care facilities are on the site. Sensitive receptors, as defined in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (DER-10), within a half mile of the site include those listed below:

Number	Name (Approximate distance from site)	Address
1	Metropolitan College of New York (approximately 0.04 miles southwest of the site)	60 West Street, New York, NY 10006
2	Leadership and Public Service High School (approximately 0.06 miles northeast of the site)	90 Trinity Place, New York, NY 10006
3	High School of Economics and Finance (approximately 0.07 miles northeast of the site)	100 Trinity Place, New York, NY 10006
4	Little Minds Montessori (approximately 0.08 miles south of the site)	40 Washington Street, New York, NY 10006
5	Metrokids Preschool – Battery Park City School (approximately 0.15 miles southwest of the site)	2 South End Ave, New York, NY 10280
6	Battery Park City School – PS IS276 (approximately 0.16 miles west of the site)	55 Battery Place, New York, NY 10004
8	The Learning Experience – Manhattan (approximately 0.18 miles southwest of the site)	28 Washington Street, New York, NY 10004

Number	Name (Approximate distance from site)	Address
9	Leman Manhattan Preparatory School – Morris Street Campus (approximately 0.18 miles southeast of the site)	1 Morris Street, New York, NY 10004
10	District 2 Pre-K Center (approximately 0.20 miles southwest of the site)	26 Washington Street, New York, NY 10004
11	Nyack College (approximately 0.22 miles southwest of the site)	2 Washington Street, New York, NY 10004
12	Pine Street School (approximately 0.22 miles east of the site)	25 Pine Street, New York, NY 10005
13	Bright Horizons at 20 Pine (approximately 0.22 miles southeast)	20 Pine Street, New York, NY 10005
14	The Lang School (approximately 0.22 miles southeast of the site)	26 Broadway Suite 900, New York, NY 10004
15	Leman Manhattan Preparatory School – Broad Street Campus (approximately 0.24 miles southeast of the site)	41 Broad Street, New York, NY 10004
16	New York City Charter School of Arts (approximately 0.24 miles southeast of the site)	26 Broadway, New York, NY 10004
17	The School for Young Performers (approximately 0.31 miles northeast of the site)	222 Broadway, 21st Floor, New York, NY 10038
18	Millennium High School (approximately 0.31 miles southeast of the site)	75 Broad Street, 13th Floor, New York, NY 10004
19	The Quad Preparatory School – Upper School (approximately 0.34 miles east of the site)	80 Maiden Lane, New York, NY 10038
20	The Downtown Little School (approximately 0.35 miles northeast of the site)	15 Dutch Street #A, New York, NY 10038
21	Richard R. Green High School of Teaching (approximately 0.35 miles southeast of the site)	7 Beaver Street, New York, NY 10004
22	KinderCare FiDi NYC (approximately 0.39 miles east of the site)	101 John Street, New York, NY 10038
23	Blue School – Upper Primary and Middle School (approximately 0.43 miles northeast of the site)	156 Williams Street, New York, NY 10038
24	Hawthorne Country Day School (approximately 0.45 miles northeast of the site)	156 William Street, New York, NY 10038
25	Spruce Street School (approximately 0.47 miles northeast of the site)	12 Spruce Street, New York, NY 10038

A map showing the surrounding land uses with descriptions of the adjoining properties is included as Figure 3.

2.1.2 Topography

According to the 2014 United States Geological Survey (USGS) 7.5-minute series topographic quadrangle map for Jersey City, the elevation of the site is approximately 8 feet above mean sea level. Based on a groundwater monitoring well elevation survey completed as part of the RI, ground elevations at the site range from an elevation (el.) of about el. 7.7 feet[1] in the northern part of the site to about el. 9.6 in the southern part of the site.

2.1.3 Stormwater Runoff and Drainage

The majority site footprint consists of urban land with overgrown vegetation including trees, shrubs and grasses. An asphalt-paved driveway is present in the northwestern part of the site. Any stormwater runoff from the site is expected to drain to the city sewers via catch basins located along the street curbs to the north and west of the site along Washington and Carlisle Streets.

2.1.4 Wetlands

Wetlands on and near the site were evaluated by reviewing the National Wetlands Inventory and NYSDEC regulated wetlands map. There are no wetlands on the site. The nearest wetland is the Hudson River, located approximately 1,300 feet west of the site.

According to the Effective National Flood Insurance Rate map for the City of New York published by the Federal Emergency Management Agency (FEMA) (Preliminary Map Panel No. 3604970184G, dated December 5, 2013), the site falls within Zone AE, which is subject to inundation by the 1% annual chance flood.

2.2 Geology and Hydrogeology

2.2.1 Regional and Site Geology

The surficial geology in the vicinity of the site generally consists of outwash deposits, as well as manmade fill. The glacial deposits, commonly referred to as ground moraine or till, are a widespread dense layer typically consisting of heterogeneous mixtures of clay, silt, sand, gravel, and boulders.

According to review of the “Bedrock and Engineering Geology Maps of New York County, and parts of Kings and Queens Counties, New York, and parts of Bergen and Hudson Counties, New Jersey”, bedrock stratigraphy in the area consists of the Manhattan Formation, which is comprised of metamorphic rock including marble, gneiss, schist, and amphibolite. Bedrock was not encountered during the investigation or previous environmental investigations conducted at

[1] Datum refers to the North American Vertical Datum of 1988 (NAVD88) which is approximately 1.1 feet above mean sea level datum at Sandy Hook, New Jersey as defined by the United States Geologic Survey (USGS NGVD 1929).

the site. Bedrock consisting of mica schist was observed during a 2004 geotechnical investigation conducted by Langan at depths of 46 to 53 feet below grade surface (bgs).

Based on RI observations, the subsurface profile generally consists of historic fill overlying medium-grained sand with varying amounts of gravel and silt followed by a dark grey to black clay layer. Historic fill thickness was generally measured to vary between about 10 and 22 feet. The fill generally consists of brown to grey fine- to medium-grained sand with varying amounts of gravel, silt, brick, metal, concrete, coal ash, wood, glass, slag, and coal.

2.2.2 Regional and Site Hydrogeology

Groundwater flow is typically topographically influenced, as shallow groundwater tends to originate in areas of topographic highs and flows toward areas of topographic lows, such as rivers, stream valleys, ponds, and wetlands. A broader, interconnected hydrogeological network often governs groundwater flow at depth or in the bedrock aquifer. Groundwater depth and flow direction are also subject to hydrogeologic and anthropogenic variables such as precipitation, evaporation, extent of vegetation cover, and coverage by impervious surfaces. Other factors influencing groundwater include depth to bedrock, the presence of artificial fill, and variability in local geology and groundwater sources or sinks.

Infiltration of precipitation to the water table is likely because of presence of pervious surfaces throughout the majority of the site. An impervious, asphalt-paved driveway is present in the northwestern part of the site. Any stormwater runoff from the site and surrounding area is expected to drain to the city sewers via catch basins located along the street curbs along Washington and Carlisle Streets. Groundwater in New York City is not used as a potable water source. Potable water provided to New York City is derived from surface impoundments in the Croton, Catskill, and Delaware watersheds.

Groundwater was observed at depths between 10.49 to 13.32 feet bgs with elevations ranging from el. -0.52 to -2.85 feet NAVD88 during synoptic groundwater level measurements collected from nine wells during the RI. Three of the wells (MW07, MW08, and MW09) were 4-inch monitoring wells installed by others. Installation dates and details for the three 4-inch monitoring wells are unknown.

Groundwater at the site generally flows to the north-northeast. A groundwater elevation contour map is presented as Figure 4.

3.0 SITE BACKGROUND

This section describes historical site uses, the proposed redevelopment plans, and the findings from previous environmental investigations. Based on this information, AOCs were established and are detailed at the end of the section.

3.1 Historical Site Use

The site was developed with residential dwellings from about 1894 to 1931 and operated as a scrap metal dealer in 1934, a warehouse in 1950, a six-story parking garage from 1977 to 2006, a rental car facility with on-site refueling of vehicles from 1978 to 1983, a drycleaner from 2001 to 2006, and a maintenance support yard in 2012.

3.2 Redevelopment Plan

The planned redevelopment project includes the construction of one mixed-use residential and commercial building with affordable housing units and ground floor commercial space. The new building will comprise commercial retail space, residential units, mechanical floors, and a partial cellar in the northern part of the site. The building footprint is about 9,771 square feet and the remainder of the lot will be comprised of sidewalk entranceways and a rear yard with a mixture of hardscaped and landscaped areas.

3.3 Previous Environmental Reports

Environmental reports prepared for the site include the following:

1. *Phase I Environmental Site Assessment for 105 – 121 Washington Street, prepared by Merritt Environmental Consulting Corp. (Merritt), dated October 29, 2010*
2. *Phase I Environmental Site Assessment for 105 – 107 Washington Street (Lot 4) and 111 – 121 Washington Street (Lot 12), prepared by Langan, dated January 13, 2012*
3. *Supplemental Geotechnical Recommendations for Proposed 111 Washington Street Development, prepared by Langan, dated January 13, 2012*
4. *Limited Phase II Environmental Site Investigation, prepared by Langan, dated January 30, 2012*
5. *Phase I Environmental Site Assessment, prepared by Langan, dated September 9, 2021*
6. *Phase II Environmental Site Investigation, prepared by Langan, dated November 23, 2021*

Reports are summarized below and available reports are included in Appendix A.

Previous Phase I ESAs completed between 2010 and 2012 were conducted for the site and the southern-adjoining property and surrounding properties. The site was historically used by residential occupants (1894 to 1950), a warehouse (1950), a six-story parking garage (1977 to 2006), a rental car facility with on-site refueling of vehicles (1978 to 1983), a dry cleaners (2006), and a maintenance support yard (2012).

Previous Phase I ESA reports identified the following RECs and BERs in relation to the site:

- Based on available New York City Department of Building (NYCDOB) records and regulatory database information, an approximately 3,000-gallon gasoline underground storage tank (UST) was closed-in-place at the site in 1997; however, documentation related to the UST closure was not available for review.
- The site was previously occupied by Rector Cleaners, a drycleaner.
- The potential of presence of heating oil USTs beneath the site or adjacent sidewalks associated with the historical residential structures at the site
- Historic fill, including construction and demolition debris, associated with reclaiming the eastern shoreline of the Hudson River in the late 1800s
- Potential impacts from current and historical operations at adjoining and nearby properties related to aboveground storage tanks (ASTs), USTs, and spills.

<u>Limited Phase II ESI, prepared by Langan, dated January 30, 2012</u>

Langan conducted a limited environmental investigation in 2011 consisting of the completion of a test pit in the area of the closed-in-place UST. According to the report, the UST reportedly had an associated fuel pump island located directly adjacent to the east of the tank and a remote fill port line that extended west to the curb line of Washington Street.

The test pit uncovered a 3,000-gallon UST encased in an approximately 1-foot-thick concrete vault that was located approximately 3 feet bgs. During excavation, soil exhibiting petroleum-like staining and odors was observed at the base of the tank vault in the southwestern corner of the vault. The petroleum-like staining was observed from about 9 feet bgs to the bottom of the test pit at about 12 feet bgs.

During test pit completion, soil directly underlying surface cover was reported as brown sand from surface grade to about 9 feet bgs; this material was suspected to be fill sand from the vault installation. An about 1-foot-thick layer of historic fill, primarily consisting of brick demolition debris, was observed underlying the surficial brown sand layer. The fill layer was underlain by a 1-foot-thick layer of gravel and red-brown silty sand.

Two soil samples were collected along the western side of the vault within the test pit and were analyzed for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs). In addition, a groundwater sample was collected from a piezometer located on the northern-adjoining sidewalk along Carlisle Street. Analytical results are summarized below.

- Soil:
  - Six VOCs, including 1,2,4-trimethylbenzene, ethylbenzene, isopropylbenzene, naphthalene, n-propylbenzene, and xylenes, were detected at concentrations exceeding the Commissioner's Policy (CP)-51 Soil Cleanup Levels (SCL) for gasoline contaminated soils.
  - The following VOCs were also detected at concentrations above the Title 6 of the

New York Codes, Rules, and Regulations (6 NYCRR) Part 375 Unrestricted Use (UU) Soil Cleanup Objectives (SCOs) and/or the 6 NYCRR Restricted Use Restricted – Residential SCOs (RURR) SCOs:

  - 1,2,4-trimethylbenzene was detected at a concentration (86.3 milligrams per kilogram [mg/kg]) exceeding the UU SCO (3.6 mg/kg) and RURR SCO (52 mg/kg) in one soil sample
  - Ethylbenzene was detected at a concentration (10.4 mg/kg) exceeding the UU SCO (1 mg/kg) in one soil sample
  - Naphthalene was detected at a concentration (14.8 mg/kg) exceeding the UU SCO (12 mg/kg) in one soil sample
  - N-propylene was detected at a concentration (12.9 mg/kg) exceeding the UU SCO (3.9 mg/kg) in one soil sample
  - Xylene (mixed) was detected at a concentration (14.6 mg/kg) exceeding the UU SCO (0.26 mg/kg) in one soil sample

- Groundwater:
  - VOCs and SVOCs were detected at concentrations below the NYSDEC Title 6 NYCRR Part 703.5 and the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values for Class GA water (collectively referred to as NYSDEC SGVs) in the groundwater sample collected.

The presence of VOCs above applicable criteria, staining, and petroleum-like odors in soil located in the southern part of the site was identified as a REC.

<u>Supplemental Geotechnical Recommendations for Proposed 111 Washington Street Development, prepared by Langan, dated January 13, 2012</u>

In November 2004, Langan advanced one boring along the Carlisle Street sidewalk as part of a preliminary subsurface investigation at the site with results of the boring documented in a January 2005 Geotechnical Report. Three additional borings were advanced in June 2005 and were summarized in this report.

Surficial historic fill, primarily comprised of sand with varying amounts of silt, clay, gravel, brick, concrete, lumber/wood, glass, and root fibers, was observed to depths ranging from approximately 19 to 25 feet bgs. Native material, identified as former river bottom deposits and consisting of successive layers of silt or clay, fine- to coarse-grained sand, and peat, was observed underlying the historic fill to depths of 36 to 41 feet bgs. Underlying the river bottom deposits, a mixture of sand, silt, clay, gravel, and cobbles/boulders was observed to depths of 43 to 50 feet bgs. Bedrock consisting of mica schist was observed underlying the native material at depths of 46 to 53 feet bgs.

Groundwater was encountered at the site at about 10.5 to 14.5 feet bgs.

Phase I Environmental Site Assessment, prepared by Langan, dated September 7, 2021

The 2021 Phase I ESA was conducted for the site and identified the following RECs and BERs in relation to the site:

- A 2011 Limited Phase II Environmental Site Investigation identified petroleum-impacted soil, including staining, petroleum-like odors, and concentrations of VOCs above the CP-51 SCLs for gasoline contaminated soils and the UU and/or RURR SCOs. The documented presence of VOCs above applicable criteria, staining, and petroleum-like odors in soil located in the southern part of the site was considered a REC.
- Historical use of the site, including a scrap metal dealer in 1934, a rental car facility with on-site refueling of vehicles from 1978 to 1983, and a drycleaner from 2001 to 2006, may have resulted in spills and/or releases of petroleum products and/or hazardous substances. Prior studies also indicate the potential for heating oil USTs to be present on the site. The potential for undocumented impacts to soil, groundwater, and/or soil vapor from historical operations of potential buried USTs at the site was considered a REC.
- The historical use and operations at adjoining and surrounding properties, including a laundromat a drycleaner, a gasoline service station, an auto a coal yard, an auto export, an iron and steel works, a chemicals facility, and a metals facility, may have resulted in spills and/or releases of petroleum products and/or hazardous substances and were considered a REC.
- Historic fill documented at the site was considered a BER.
- The presence of the site within a FEMA flood zone was considered a BER.
- Groundwater monitoring wells observed at the site during the site reconnaissance were considered a BER.

Phase II Environmental Site Investigation, prepared by Langan, dated November 23, 2021

The Phase II ESI was conducted at the site in October 2021. The Phase II ESI made the following conclusions:

- Geophysical Survey: The geophysical survey identified various scattered anomalies throughout the site and an anomaly consistent with a UST in the southern part of the site.
- Stratigraphy: A historic fill layer was observed from surface grade to between 16 and 20 feet bgs (boring termination depth) throughout the site and generally consisted of tan to brown, fine- to medium-grained sand with varying amounts of gravel, silt, brick, wood, coal ash, slag, glass, metal, and organics. The historic fill layer is underlain by native soil consisting of dark brown to gray silt with varying amounts of fine-grained sand and shell fragments. Bedrock was not encountered during the Phase II ESI; however, bedrock was encountered at depths ranging from 46 to 53 feet bgs during previous geotechnical investigations.

- Hydrogeology: Depth to groundwater ranges from 11.63 feet bgs in the south-central part of the site to 12.19 feet in the southeastern part of the site based on groundwater measurements collected before well purging and sampling. Groundwater flow at the site was not evaluated during the Phase II ESI, but likely flows to the west and/or the southwest in the direction of the Hudson River/Upper New York Bay based on hydrogeological principles.
- Soil Sample Analytical Results:
  - Historic fill contains contaminants including VOCs, SVOCs, pesticides, and metals exceeding the UU and/or RURR SCOs. The presence of SVOCs, pesticides, and metals was attributed to the quality of the historic fill. The presence of VOCs was attributed to historical site use, including refueling operations and the use of a UST.
- Groundwater Sample Analytical Results:
  - Groundwater contains iron, magnesium, and sodium at total and dissolved concentrations exceeding the NYSDEC SGVs. These metals are commonly detected in groundwater above the NYSDEC SGVs and their presence in groundwater at the site is representative of naturally-occurring and/or regional groundwater conditions.
- Soil Vapor Sample Analytical Results:
  - 1,1,1-trichloroethane, methylene chloride, and tetrachloroethene (PCE) were detected in soil vapor samples at concentrations for which the New York State Department of Health (NYSDOH) Decision Matrices recommendations range from no further action to identify the source(s) and resample or mitigate. The presence of these VOCs within soil vapor at the site are attributed to an unidentified source.
- Petroleum Contamination:
  - Evidence of petroleum impacts, including odors, photoionization detector (PID) readings above background, and/or concentrations of petroleum-related VOCs exceeding regulatory standards, were observed in nine of thirteen borings (SB01, SB03, SB04, SB05, SB06, SB08, SB09, SB12, and SB13). Analytical soil data identified the presence of petroleum-related VOCs and SVOCs in soil. The residual contamination is attributed to historical site use, including refueling operations and the use of a UST.
  - Based on observations of a petroleum release at the site, a spill was reported to the NYSDEC on November 12, 2021. Spill No. 2107485 was assigned to the release. The spill remains open because of the residual petroleum contamination observed in soil and groundwater at the site.

3.4 Summary of Areas of Concern

The following AOCs represent portions of the site that required further investigation and were developed based on site observations, the site history, and the findings of the previous environmental reports. The AOCs that were investigated during the RI include the following:

AOC 1: Historic Fill

Historic fill was identified from below surface grade to depths ranging from about 10 to 22 feet bgs across the site. Contaminants associated with historic fill were identified in soil samples collected during the November 2021 Phase II ESI, including SVOCs and metals exceeding the NYSDEC Part 375 UU and/or RURR Soil Cleanup Objectives SCOs.

AOC 2: Residual Petroleum and Petroleum-Impacted Soil

A 3,000-gallon UST was closed–in-place at the site in 1997. The 2011 Limited Environmental Investigation and November 2021 Phase II ESI identified evidence of petroleum impacts, including odors, PID readings above background, and/or concentrations of petroleum-related VOCs exceeding regulatory standards in soil samples collected in the vicinity of the closed-in-place UST in the southern part of the site.

AOC 3: Chlorinated VOCs in Soil Vapor

The November 2021 Phase II ESI identified chlorinated VOCs (CVOCs), including 1,1,1-trichloroethane, methylene chloride, and PCE, in soil vapor at the site.

4.0 FIELD INVESTIGATION

The RI was conducted between January 25 and February 18, 2022 to investigate AOCs and to determine the nature and extent of contamination in soil, groundwater, and sub-slab vapor at the site. The RI was completed to the extent necessary to design a remedy that will be protective of human health and the environment. The RI included advancement of soil borings; installation of groundwater monitoring wells and sub-slab vapor probes; and collection of soil, groundwater and sub-slab vapor samples.

The RI consisted of the following:

- Geophysical survey to identify subsurface anomalies consistent with utilities, substructures, physical obstructions, and USTs, and to pre-clear soil boring locations;
- Advancement of 10 soil borings (SB14 through SB23) and collection of 30 soil samples plus quality assurance/quality control (QA/QC) samples;
- Advancement of 12 delineation soil borings (SB2A, SB24 through SB31, SB24_DB01, SB24_DB02, and SB24_DB03) and collection of 17 soil samples;
- Installation of six groundwater monitoring wells and collection of seven groundwater samples; including one sample from each of the six newly installed monitoring wells and one sample from an existing monitoring well (installed by others), plus QA/QC samples;
- Installation of six soil vapor points and collection of six soil vapor samples plus QA/QC samples;
- Survey and synoptic groundwater gauging of newly installed and three existing monitoring wells at the site to evaluate the elevation and flow of site groundwater.

A summary of the samples collected for laboratory analysis is provided as Table 1. Sample locations are shown on Figure 5 through 8. Each component of the RI is further described in the following sections. A photograph log documenting this investigation is included as Appendix B.

4.1 Geophysical Investigation and Utility Location

On January 25, 2022, prior to ground-intrusive field activities, NOVA Geophysical Engineering (NOVA) of Douglaston, New York conducted a geophysical survey. The survey used ground-penetrating radar (GPR) to identify potential USTs and locate buried utilities and subsurface structures in the vicinity of each boring location. Borings were relocated as necessary to avoid subsurface utilities and other subsurface impediments. A copy of the geophysical survey reports are is included in Appendix C.

4.2 Soil Investigation

4.2.1 Soil Investigation Methodology

A total of 10 soil borings (SB14 throughout SB23) and 12 delineation soil borings (SB24 through SB31, SB2A, and SB24_DB01 through SB24_DB03) were advanced by Lakewood Environmental Services Corp. (Lakewood) between January 25 and February 15, 2022. Soil boring locations were selected to provide sufficient site coverage, evaluate the AOCs listed in Section 3.4, and delineate subsurface impacts identified in the field. Geoprobe® 54LT and Geoprobe® 6610 drilling rigs were used to advance borings to depths ranging from 20 to 28 feet bgs.

Soil was collected continuously from surface grade to the final depth of each soil boring into 4-foot-long acetate liners using a 2-inch diameter closed-point MacroCore® sampler. Recovered soil was screened for visual, olfactory, and instrumental evidence of environmental impacts and was visually classified for soil type, grain size, color, texture, and moisture content. Instrument screening for the presence of VOCs was performed with a PID equipped with a 10.6 electron volt (eV) lamp. Soil boring logs are included in Appendix D. Soil boring locations are shown on Figure 5, Figure 6A, Figure 6B, and Figure 6C.

Non-disposable, down-hole drilling equipment and sampling apparatuses were decontaminated between locations with Alconox® and water. After sample collection, soil borings were either backfilled with clean sand or soil cuttings, or converted to groundwater monitoring wells. Excess soil cuttings were placed into sealed and labeled 55-gallon drums pending off-site disposal.

4.2.2 Soil Sampling and Analysis

Forty-nine soil samples (plus QA/QC samples) were collected from the soil borings for laboratory analysis. Soil samples were collected as follows:

- One to two representative historic fill samples were collected above the groundwater table in borings SB2A, SB14 through SB23, SB30, and SB31.
- In borings SB14, SB19, SB20, SB21, SB22, SB23, SB30, and SB31, one to two soil samples were collected from native soil.
- One sample was collected from the interval exhibiting the greatest degree of petroleum contamination, where observed (based on the presence of staining, odor, and/or PID readings above background) in borings SB17, SB18, SB20, and SB24.
- In borings SB17, SB18, and SB24, one sample was collected from clean soil below the interval exhibiting the greatest degree of contamination in petroleum-impacted soil borings (based on lack of staining, odor, and/or PID readings above background).

Soil borings SB25, SB24_DB01, and SB24_DB02 were installed to visually delineate petroleum impacts based on field observations; soil samples were not collected.

The table below identifies the borings associated with each AOC.

Area of Concern	Associated Soil Borings
AOC 1 – Historic Fill	SB14 through SB28, SB30, and SB31
AOC 2 – Residual Petroleum and Petroleum-Impacted Soil	SB2A, SB17, SB18, SB20, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, and SB30
AOC 3 - CVOCs in Soil Vapor	SV04 through SV09

Grab samples submitted for VOC analysis were collected directly from the acetate sleeves via laboratory-supplied Terra Core® soil sample kits. The remaining sample volume was homogenized and placed into laboratory-supplied glassware. The sample containers were labeled, placed in a laboratory-supplied cooler, and packed with ice (to maintain a temperature of 4 ±2°C). The samples were relinquished, under standard chain-of-custody protocol, to a courier for delivery to Alpha Analytical Inc. (Alpha), a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory (ELAP ID #11148) located in Westborough, Massachusetts. Soil samples were analyzed for one or more of the following parameters using United States Environmental Protection Agency (USEPA) methods:

- Target Compound List (TCL) VOCs by USEPA methods 8260C
- TCL SVOCs by USEPA method 8270D
- Pesticides by USEPA method 8081B
- Herbicides by USEPA method 8151A
- Polychlorinated biphenyls (PCBs) by USEPA method 8082A
- Target Analyte List (TAL) metals by USEPA methods 6010D/7471B
- Hexavalent/trivalent chromium by USEPA method 7196A
- Total cyanide by USEPA method 9010C
- Per- and poly-fluoroalkyl substances (PFAS) (21-compound list) by USEPA method 537 Rev. 1.15
- 1,4-dioxane by USEPA method 8270 with SIM isotope dilution

A soil sample collection summary is included in Table 1.

4.3 Groundwater Investigation

Groundwater monitoring wells were installed and sampled to characterize groundwater conditions and to investigate potential impacts to groundwater associated with the identified AOCs.

4.3.1 Monitoring Well Installation and Development

Three permanent groundwater monitoring wells (MW01, MW02, and MW03) were installed at the same locations where temporary groundwater monitoring wells were installed during the 2021 Phase II ESI and three soil borings were converted into permanent groundwater monitoring wells (SB14, SB15, and SB24 were converted to MW04, MW05, and MW06, respectively). The wells were installed with 10-foot long, 2-inch-diameter, threaded, flush-joint, polyvinyl chloride (PVC) casing and 0.010-inch-slot well screens set to straddle the groundwater table. The screens were set between 20 to 24 feet bgs; solid PVC risers were installed above the screens to extend the well to grade. The annulus of each well was filled with No. 2 sand to about 2 feet above the top of the screen. Hydrated bentonite well seals were installed above the filter sand, and the wells were finished with flush-mounted access covers. Monitoring well construction logs are included in Appendix E.

Following installation, Lakewood developed each well by surging using a surge block and purging at least 3 well volumes with a peristaltic pump. Development water was containerized into one United Nations/Department of Transportation (UN/DOT)-approved 55-gallon drum, labeled, and staged for off-site disposal.

The top of casing for each monitoring well was surveyed by Langan on February 10, 2022. Groundwater levels were measured using a Solinst® oil-water interface probe on February 14, 2022.

4.3.2 Groundwater Sampling and Analysis

Groundwater samples were collected from each newly installed well and one existing 4-inch monitoring well previously installed by others (identified as MW07) in accordance with NYSDEC DER-10, USEPA's Low Flow Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells (EQASOP-GW4 Revised Sep. 2017) and NYDSEC's Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances Under NYSDEC's Part 375 Remedial Programs" (June 2021).

Before the groundwater samples were collected, wells were continuously purged until groundwater quality parameters (pH, conductivity, turbidity, dissolved oxygen, temperature, and oxidation-reduction potential) stabilized, to the extent practical, in accordance with the USEPA low-flow guidance. A multi-parameter water-quality system was used to monitor the groundwater-quality parameters during sampling. Samples were collected with a peristaltic pump and dedicated high-density polyethylene tubing. The pump was decontaminated with Alconox® and water between each sample location. Purge water was containerized into one UN/DOT-approved 55-gallon drum, labeled, and staged for off-site disposal.

Seven groundwater samples plus QA/QC samples were collected (one from each of the six newly installed wells [MW01 through MW06], and one from an existing well [MW07]). Samples were collected into laboratory-supplied glassware and delivered via courier service to Eurofins for analysis of one or more of the following parameters using USEPA methods:

- TCL VOCs by USEPA method 8260C
- TCL SVOCs (lab-filtered in MW07) by USEPA method 8270D
- PCBs by USEPA method 8082A

- TAL Metals (field-filtered and unfiltered) by USEPA method 6010C/7470
- Pesticides by USEPA method 8081B
- Herbicides by USEPA method 8151A
- PFAS (21-compound list) by USEPA method 537 Rev. 1.15
- 1,4-dioxane by USEPA method 8270 with SIM isotope dilution

A groundwater sample collection summary is included in Table 1. Groundwater elevations are presented in Table 2. A groundwater elevation contour map is presented as Figure 4. Groundwater sampling logs are included in Appendix E.

4.4 Soil Vapor Investigation

4.4.1 Soil Vapor Point Installation

Six soil vapor points (SV-04 through SV-09) were installed with a Geoprobe® 54LT drilling rig to about 5 feet bgs in accordance with the NYSDOH's *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). The soil vapor points were constructed with a dedicated 1-7/8-inch polyethylene implant threaded into 3/16-inch-diameter inert polyethylene tubing that extended to surface grade. A clean sand filter pack was placed around the screen implant to about 0.5 feet bgs and the remaining annular space was sealed with hydrated bentonite to the surface.

4.4.2 Soil Vapor Sampling and Analysis

Seven soil vapor samples (one from each of the six newly installed soil vapor points, including one duplicate) were collected in general accordance with the NYSDOH Guidance. The soil vapor samples collected for laboratory analysis are summarized in Table 1. Before collecting vapor samples, three soil vapor point volumes were purged from each sample location at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE® meter set at a low flow setting. The purged soil vapor was monitored for VOCs with the MultiRAE® during purging.

A helium tracer gas was used in accordance with the NYSDOH guidance to serve as a QA/QC technique to document the integrity of each soil vapor point seal before and after sampling. The tracer gas was introduced into a container, which shrouded the soil vapor point and seal. Helium was measured from the sampling tube and inside the container. Direct readings of less than 10% helium in the sampling tube were considered sufficient to verify a tight seal at each sample point.

One ambient air sample (designated AA02_012822) was collected concurrently with soil vapor samples SV04 through SV08. Soil vapor and ambient air samples were collected using laboratory-provided, batch-certified clean, 2.7-liter and 6-liter air canisters equipped with 8-hour sample interval flow controllers. Soil vapor and ambient air samples were sealed, labeled, and transported via courier service to Alpha and York Analytical Laboratories, Inc. (York), a NYSDOH ELAP laboratory (ELAP ID #10854) located in Stratford, Connecticut to be analyzed. The samples were analyzed for VOCs by USEPA Method TO-15.

A soil vapor sample collection summary is included in Table 1. Soil vapor point construction and sampling logs are included as Appendix F.

4.5 Quality Assurance/Quality Control Sampling

Trip blanks, field blanks, field duplicate samples, and matrix spike/matrix spike duplicate (MS/MSD) samples were collected and submitted for laboratory analysis for QA/QC purposes. A QA/QC sample collection summary is included in Table 1. Matrix-specific QA/QC samples that were collected for the RI are summarized below:

Soil QA/QC Samples

- Two field duplicate samples;
- Two MS/MSD samples; and
- Two field blank samples.

Groundwater QA/QC Samples

- One field duplicate sample;
- One MS/MSD sample;
- One field blank sample; and
- Two trip blanks.

Soil Vapor QA/QC Samples

- One ambient air sample; and
- One field duplicate sample.

MS/MSD samples were collected to assess the effect of the sample matrix on the recovery of target compounds or target analytes.

Field duplicate samples were collected to assess the precision of the analytical methods relative to the sample matrix. The soil duplicates were collected from the same material as the primary sample by splitting the volume of homogenized sample collected in the field into two sample containers.

Trip blank samples were collected to assess the potential for contamination of the sample containers and samples during transport from the laboratory, to the field, and back to the laboratory for analysis. Trip blanks contain about 40 milliliters of acidic water (doped with hydrochloric acid) that is prepared and sealed by the laboratory when the empty sample containers are shipped to the field, and then unsealed and analyzed for VOCs by the laboratory when the sample shipment is received from the field.

Field blanks were collected to determine the effectiveness of the decontamination procedures for the groundwater sampling equipment train and the cleanliness of unused neoprene gloves and acetate liners used to collect soil samples. Field blank samples consisted of deionized, distilled water provided by the laboratory that passed through/over decontaminated sampling equipment. Field blank samples were analyzed for the same list of analytes as the corresponding sampling event and sample matrix.

An ambient air sample was collected to assess ambient air conditions and determine whether conditions during soil vapor sampling could have potentially interfered with sampling results. The ambient air sample was analyzed for the same parameter list as the soil vapor samples.

4.6 Data Validation

Analytical data was validated by a Langan validator in accordance with USEPA and NYSDEC validation protocols. Copies of the data usability summary reports (DUSR) and the data validator's credentials are provided in Appendix G.

4.6.1 Data Usability Summary Report Preparation

A DUSR was prepared for each sampling matrix. The DUSR presents the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain of custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

For the soil and groundwater samples, the following items were assessed:

- Hold times
- Sample preservation
- Sample extraction and digestion
- Laboratory blanks
- Laboratory control samples
- System monitoring compounds
- MS/MSD recoveries
- Field duplicate, trip blank, and field blank sample results

For the soil vapor samples, the following items were assessed:

- Holding times
- Canister certification
- Laboratory blanks
- Laboratory control samples

- System monitoring compounds
- Target compound identification and qualification

Based on the results of data validation, the following qualifiers may be assigned to the data in accordance with the USEPA's guidelines and best professional judgment:

- R – The sample results are unusable because certain criteria were not met when generating the data. The analyte may or may not be present in the sample.
- J – The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.
- UJ – The analyte was not detected at a level greater than or equal to the reporting limit; however, the reported reporting limit is approximate and may be inaccurate or imprecise.
- U – The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the reporting limit (RL) or the sample concentration for results impacted by blank contamination.
- NJ – The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.

No major deficiencies were identified for this data set, and data was judged to be 100% valid, as qualified. After data validation activities were complete, validated data was used to prepare the tables and figures included in this report.

4.7 Air Monitoring

The work area was observed for dust emissions and screened with a PID. Environmental media was also screened with a PID. No visible dust emissions or elevated PID readings were observed in the work areas during the RI.

4.8 Field Equipment Decontamination

Handheld sampling equipment, including oil/water interface probes and water quality meters were decontaminated using an Alconox®-based solution and triple rinsed with distilled water. Down-hole drilling equipment was decontaminated between each boring by rinsing with an Alconox®-based solution. Decontamination wastewater was placed into 55-gallon drums for future off-site disposal.

4.9 Investigation-Derived Waste Management

Minimal investigation-derived waste (IDW) was generated during the RI. Minimal soil impacts were observed and after sample collection soil borings were backfilled with non-impacted soil cuttings.

5.0 FIELD OBSERVATIONS AND ANALYTICAL RESULTS

This section summarizes the RI field observations and laboratory analytical results. Soil analytical results are compared to the Part 375 UU and RURR SCOs. Groundwater analytical results are compared to the NYSDEC SGVs. PFAS soil sample results were compared to the NYSDEC Part 375 Remedial Programs Guidelines for Sampling and Analysis of PFAS UU and RURR Guidance Values (June 2021) for perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). Sub-slab vapor and ambient air results were evaluated using the NYSDOH Soil Vapor Guidance. The nature and extent of contamination are discussed in Section 7.0.

A summary of the soil, groundwater, and sub-slab vapor samples is included in Table 1. Copies of the laboratory analytical reports are included in Appendix H. Summaries of the analytical results for the soil, groundwater, and soil vapor samples are provided in the following tables:

- Table 3A: Soil Sample Analytical Results
- Table 3B: Soil Sample Analytical Results – Quality Assurance/Quality Control
- Table 4A: Groundwater Sample Analytical Results
- Table 4B: Groundwater Sample Analytical Results – Quality Assurance/Quality Control
- Table 5: Sub-Slab Vapor Sample Analytical Results

The following sections describe the RI field observations and analytical data.

5.1 Geophysical Investigation Findings

NOVA identified two anomalies consistent with USTs in the southern part of the site. NOVA also identified a scattered, unknown anomaly in the northern part of the site, electric utilities through the central part of the site, and former utilities along the northern and western boundary of the site. A copy of the geophysical report is included in Appendix C.

5.2 Geology and Hydrogeology

Geologic and hydrogeologic observations are described below. A groundwater elevation contour map is included as Figure 4 and soil boring logs are provided in Appendix D.

5.2.1 Historic Fill

The site is underlain by a layer of historic fill ranging in depth from about 10 (SB23) to 22 feet bgs (SB27). The layer is predominately characterized as brown to grey, fine- to medium-grained sand with varying amounts of gravel, silt, brick, metal, concrete, coal ash, wood, glass, slag, and coal.

5.2.2 Native Soil Layers

The fill layer is underlain by brown to gray fine- to medium-grained sand with varying amounts of gravel and silt. This stratigraphic unit was generally consistent across the site. A 0.5 to 4 foot thick dark grey to black clay layer was encountered at about 20 to 24 feet bgs in soil borings

SB2A, SB15, SB18, SB20, SB25, SB26, and SB30. In one soil boring (SB24), the clay layer was underlain by a gray fine- to medium-grained sand with shell fragments from 24 to 28 feet bgs.

5.2.3 Bedrock

The Bedrock and Engineering Geologic Maps of New York County and Parts of Kings and Queens Counties, New York and Parts of Bergen and Hudson Counties New Jersey, by Charles A. Baskerville, dated 1994, indicates that the bedrock formation underlying the site is the Manhattan Formation, which is comprised of metamorphic rock including marble, gneiss, schist, and amphibolite. Bedrock was not encountered during this RI or during previous environmental site investigations. Bedrock was encountered during a 2004 geotechnical investigation, conducted by Langan, at about 46 to 53 feet bgs.

5.2.4 Hydrogeology

Groundwater was observed at depths between 10.49 to 13.32 feet bgs with elevations ranging from el. -0.52 to -2.85 feet NAVD88 during synoptic groundwater level measurements collected from nine wells during the RI, including three monitoring wells previously installed by others. Groundwater at the site was evaluated and determined to generally flow to the north-northeast. Groundwater elevations are shown in Table 2. A map showing groundwater elevation contours and flow direction is provided as Figure 4.

5.3 Soil Findings

5.3.1 Field Observations

Creosote and/or petroleum impacts, evidenced by odors, staining, and/or PID readings above background levels, were observed in the borings summarized in the table below.

Boring	Depth of Observed Impacts (feet bgs)	Highest Recorded PID Reading (parts per million [ppm])
SB2A	10 to 12	0.7
SB17	10 to 11.5	22.4
SB18	9 to 12 and 16 to 20	1,128
SB20	12	1.0
SB24	20 to 24	124.2
SB25	13 to 14.5	3.9
SB24_DB01	18 to 24	1.1
SB24_DB02	11.5	26.8

Boring	Depth of Observed Impacts (feet bgs)	Highest Recorded PID Reading (parts per million [ppm])
SB24_DB03	14 to 16	90.7
SB30	10.5 to 12	484.5

Non-aqueous phase liquid (NAPL) was observed in soil boring SB24 from 20 to 24 feet bgs. No NAPL was observed in delineation borings or other soil borings advanced at the site. Based on field observations, the NAPL appears isolated to a single boring and is highly localized at SB24 in the southern-central part of the site.

The PID readings above background observed in the remaining soil borings are likely associated with the residual petroleum impacts observed in the vicinity of a historical UST in the southern part of the site.

Chemical impacts, including creosote-like odors, were observed in SB14 from 16 to 17 feet bgs, SB15 from 6 to 7 feet bgs, SB17 at 10.5 feet bgs, SB24_DB02 at 12 feet bgs, SB24_DB03 from 12 to 16 feet bgs, and SB30 at 11 feet bgs. Wood fragments were also observed in soil borings SB14, SB17, SB24_DB02, SB24_DB03, and SB30 at depths where creosote-like odors were observed.

5.3.2 Analytical Results

A summary of laboratory detections for RI soil samples, with comparisons to NYSDEC Part 375 UU and RURR SCOs, is provided in Table 3. Soil sample results that exceed UU and RURR SCOs for samples collected during the RI are shown on Figures 6A, 6B, and 6C. Comparison to the NYSDEC Part 375 Protection of Groundwater (PGW) SCOs was completed for analytes that also exceeded groundwater regulatory standards in groundwater samples collected from the site. Six VOCs, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, n-propylbenzene, and total xylenes, and four SVOCs, benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and naphthalene, were detected in groundwater above the NYSDEC SGVs and in soil above the PGW SCOs. Laboratory analytical data reports are included in Appendix H.

The following sections present summaries of RI soil sample results that exceeded PGW, UU, and/or RURR SCOs and are organized by analytical parameter.

VOCs

Acetone was detected at concentrations above the UU SCOs in 9 soil samples collected from soil borings SB2A, SB14, SB24_DB03, SB26, SB28, SB30, and SB31. One or more of up to eight creosote- and/or petroleum-related VOCs were detected at concentrations above the UU SCOs in soil samples collected from 10 to 12 feet bgs in soil boring SB18, 20 to 22 feet in soil boring

SB24, 14 to 16 feet in soil boring SB24_DB03, and from 10 to 12 feet in soil boring SB30. One VOC, 1,2,4-trimethylbenzene, was also detected in one soil sample from soil boring SB18 at a concentration above the RURR SCO. The table below provides concentration ranges of VOCs that were detected above the UU SCOs. VOC concentrations that were detected above the PGW SCOs are shown in *italic and* VOC concentrations that were also detected above the RURR SCOs are also shown in **bold**.

Parameter	Range of Concentrations Detected above UU SCOs		UU, PGW and RURR SCOs
	Low	High	
1,2,4-Trimethylbenzene	*40 mg/kg* in SB30_10-12	***62 mg/kg*** in SB18_10-12	PGW/UU: 3.6 mg/kg RURR: 52 mg/kg
1,3,5-Trimethylbenzene (Mesitylene)	*10 mg/kg* in SB30_10-12	*17 mg/kg* in SB18_10-12	PGW/UU: 8.4 mg/kg RURR: 52 mg/kg
Acetone*	*0.062 mg/kg* in SB28_10-12	*2.4 mg/kg* in SB24_DB03_14-16	PGW/UU: 0.05 mg/kg RURR:100 mg/kg
Benzene	*0.11 mg/kg* in SB30_10-12	*0.19 mg/kg* in SB24_DB03_14-16 and SB18_10-12	PGW/UU: 0.06 mg/kg RURR: 4.8 mg/kg
Ethylbenzene	*3.4 mg/kg* in SB30_10-12	*12 mg/kg* in SB24_DB03_14-16	PGW/UU: 1 mg/kg RURR: 41 mg/kg
n-Butylbenzene	*15 mg/kg* in SB30_10-12		PGW/UU: 12 mg/kg RURR: 100 mg/kg
n-Propylbenzene	*8.8 mg/kg* in DUP02_012622**	*57 mg/kg* in SB30_10-12	PGW/UU: 3.9 mg/kg RURR: 100 mg/kg
Total Xylenes	0.41 mg/kg in SB24_20-22	*36 mg/kg* in SB24_DB03_14-16	UU: 0.26 mg/kg PGW: 1.6 mg/kg RURR: 100 mg/kg

*Acetone was not present in laboratory batch blanks, but is a common laboratory contaminant and therefore, its presence in soil results is not likely representative of site conditions.

** DUP02_012622 is a duplicate of the parent sample SB18_10-12.

SVOCs

One or more of up to fifteen SVOCs were detected at concentrations above UU and/or RURR SCOs in three soil samples collected from depths ranging from 2 to 4 feet bgs in soil borings SB15 and SB16 and 20 to 22 feet bgs in SB24. The table below provides concentration ranges of SVOCs that were detected above the UU SCOs. SVOC concentrations that were detected above the PGW SCOs are shown in *italic* and SVOC concentrations that were also detected above the RURR SCOs are also shown in **bold**.

Parameter	Range of Concentrations Detected above UU SCOs		UU, PGW and RURR SCOs
	Low	**High**	
Acenaphthene	*500 mg/kg* in SB24_20-22		UU: 20 mg/kg PGW: 98 mg/kg RURR: 100 mg/kg
Anthracene	**110 mg/kg** in SB24_20-22		UU: 100 mg/kg PGW: 1,000 mg/kg RURR: 100 mg/kg
Benzo(a)Anthracene	***2.2 mg/kg*** in SB15_2-4	***62 mg/kg*** in SB24_20-22	UU: 1 mg/kg PGW: 1 mg/kg RURR: 1 mg/kg
Benzo(a)Pyrene	**17 mg/kg** in SB24_20-22		UU: 1 mg/kg PGW: 22 mg/kg RURR: 1 mg/kg
Benzo(b)Fluoranthene	**1.1 mg/kg** in SB16_2-4	***29 mg/kg*** in SB24_20-22	UU: 1 mg/kg PGW: 1.7 mg/kg RURR: 1 mg/kg
Benzo(k)Fluoranthene	***8.4 mg/kg*** in SB24_20-22		UU: 0.8 mg/kg PGW: 1.7 mg/kg RURR: 3.9 mg/kg
Chrysene	*2.4 mg/kg* in SB15_2-4	***52 mg/kg*** in SB24_20-22	UU: 1 mg/kg PGW: 1 mg/kg RURR: 3.9 mg/kg
Dibenz(a,h)Anthracene	**1.2 mg/kg** in SB24_20-22		UU: 0.33 mg/kg PGW: 1,000 mg/kg RURR: 0.33 mg/kg
Dibenzofuran	***340 mg/kg*** in SB24_20-22		UU: 7 mg/kg PGW: 210 mg/kg RURR: 59 mg/kg
Fluoranthene	**340 mg/kg** in SB24_20-22		UU: 100 mg/kg PGW: 1,000 mg/kg RURR: 100 mg/kg
Fluorene	**370 mg/kg** in SB24_20-22		UU: 30 mg/kg PGW: 386 mg/kg RURR: 100 mg/kg
Indeno(1,2,3-c,d)Pyrene	**0.51 mg/kg** in SB15_2-4	**5 mg/kg** in SB24_20-22	UU: 0.5 mg/kg PGW: 8.2 mg/kg RURR: 0.5 mg/kg
Naphthalene	***420 mg/kg*** in SB24_20-22		UU: 12 mg/kg PGW: 12 mg/kg RURR: 100 mg/kg
Phenanthrene	**860 mg/kg** in SB24_20-22		UU: 100 mg/kg PGW: 1,000 mg/kg RURR: 100 mg/kg
Pyrene	**230 mg/kg** in SB24_20-22		UU: 100 mg/kg PGW: 1,000 mg/kg RURR: 100 mg/kg

Pesticides

Two pesticides were detected at concentrations above the UU SCOs in a soil sample collected from 0 to 2 feet bgs in soil boring SB19. The table below provides the concentration of the pesticides that were detected above the UU SCOs. Pesticides were not detected above the PGW or RURR SCOs.

Parameter	Concentration Detected above UU SCO	UU, PGW and RURR SCOs
4,4'-DDE	0.0088 mg/kg in SB19_0-2	UU: 0.0033 mg/kg PGW: 17 mg/kg RURR: 8.9 mg/kg
4,4'-DDT	0.0144 mg/kg in SB19_0-2	UU: 0.0033 mg/kg PGW: 136 mg/kg RURR: 7.9 mg/kg

Herbicides and PCBs

Herbicides and PCBs were not detected at concentrations above the UU, PGW or RURR SCOs in RI soil samples.

Metals

One or more of five metals were detected at concentrations above the UU and/or RURR SCOs in soil samples ranging from 2 to 16 feet bgs in soil borings SB14, SB15, SB16, SB17, SB18, SB19, SB20, SB21, SB22, and SB23. One metal, mercury, was detected in one soil sample from 6 to 8 feet bgs in soil boring SB15 (field duplicate) at a concentration above the RURR SCO. The table below provides concentration ranges of metals that were detected above the UU and RURR SCOs. Metals concentrations that were detected above the PGW SCOs are shown in *italic* and SVOC concentrations that were that were also detected above the RURR SCOs are also shown in **bold**.

Parameter	Range of Concentrations Detected above UU SCO		UU, PGW and RURR SCOs
	Low	High	
Copper	51.6 mg/kg in SB22_10-12	80.9 mg/kg in DUP01_012522*	UU: 50 mg/kg PGW: 1,720 mg/kg RURR: 270 mg/kg
Lead	108 mg/kg in SB15_6-8	376 mg/kg in SB20_14-16	UU: 63 mg/kg PGW: 450 mg/kg RURR: 400 mg/kg

Parameter	Range of Concentrations Detected above UU SCO		UU, PGW and RURR SCOs
	Low	High	
Mercury	0.183 mg/kg in SB14_2-4	***1.42 mg/kg*** in DUP01_012522	UU: 0.18 mg/kg PGW: 0.73 mg/kg RURR: 0.81 mg/kg
Nickel	31.5 mg/kg in SB16_10-12	49.6 mg/kg in SB17_10-12	UU: 30 mg/kg PGW: 130 mg/kg RURR: 310 mg/kg
Zinc	125 mg/kg in SB22_10-12		UU: 109 mg/kg PGW: 2,480 mg/kg RURR: 10,000 mg/kg

* DUP01_012522 is a duplicate of the parent sample SB15_6-8.

PFAS (21-Compound List) and 1,4-Dioxane

Soil PFAS and 1,4-dioxane analytical results were compared to the NYSDEC Part 375 Remedial Programs Guidelines for Sampling and Analysis of PFAS UU and RURR Guidance Values (June 2021) for perflourooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS). PFOA and PFOS were not detected in soil samples at concentrations above the UU or RURR Guidance Values. 1,4-dioxane was not detected in soil samples.

5.4 Groundwater Findings

5.4.1 Field Observations

Newly installed monitoring wells were gauged for light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) with an oil-water interface probe. During the installation of MW06, LNAPL was observed within the monitoring well; however, LNAPL was not encountered during the sampling of MW06. No DNAPL was encountered in the monitoring wells. Prior to sampling, monitoring well headspaces were measured with a PID. Monitoring well headspace PID measurements ranged from 0.0 to 19.6 ppm (highest reading in MW06) during sampling. A petroleum-like odor was observed in monitoring wells MW01 and MW06.

5.4.2 Analytical Results

A summary of laboratory detections for RI groundwater samples, with comparisons to NYSDEC SGVs, is presented in Table 4. Groundwater sample results that exceeded NYSDEC SGVs for RI samples are shown on Figures 7A and 7B. Groundwater sampling logs are included in Appendix E. Laboratory analytical data reports are included in Appendix H.

The following sections present summaries of RI groundwater sample results that exceeded NYSDEC SGVs and are organized by analytical parameter.

VOCs

One or more of thirteen VOCs were detected above the NYSDEC SGVs in groundwater samples collected from monitoring wells MW01 and MW06. The table below provides concentrations of VOCs above the NYSDEC SGVs.

Parameter	Range of Concentrations Detected above the NYSDEC SGV		NYSDEC SGV
	Low	High	
1,2,4,5-tetramethylbenzene	29 µg/L in MW06	140 µg/L in MW01	5 micrograms per liter (µg/L)
1,2,4-trimethylbezene	50 µg/L in MW06		5 µg/L
1,3,5-trimethylbenzene (mesitylene)	6.4 µg/L in MW06		5 µg/L
Benzene	1.5 µg/L in MW01	9.2 µg/L in MW06	1 µg/L
Ethylbenzene	11 µg/L in MW06		5 µg/L
Isopropylbenzene (cumene)	13 µg/L in MW01	16 µg/L in MW06	5 µg/L
m,p-Xylene	19 µg/L in MW06		5 µg/L
Naphthalene	440 µg/L in MW06		10 µg/L
n-Butylbezene	8.7 µg/L in MW06		5 µg/L
n-Propylbenzene	6.9 µg/L in MW01	43 µg/L in MW06	5 µg/L
o-Xylene (1,2-dimethylbenezene)	8.4 µg/L in MW06		5 µg/L
Sec-butylbenzene	5.3 µg/L in MW06	7.6 µg/L in MW01	5 µg/L
Toluene	5.4 µg/L in MW06		5 µg/L
Total xylenes	27 µg/L in MW 06		5 µg/L

SVOCs

One or more of nine SVOCs were detected above the NYSDEC SGVs in groundwater samples collected from monitoring wells MW03, MW04, MW06, and MW07. The table below provides concentrations of SVOCs above the NYSDEC SGVs.

Parameter	Range of Concentrations Detected above the NYSDEC SGV		NYSDEC SGV
	Low	High	
2,4-Dimethylphenol	7.5 µg/L in MW06		1 µg/L
Acenaphthene	21 µg/L in GWDUP01_021722*	92 µg/L in MW06	20 µg/L
Benzo(a)anthracene	0.02 µg/L in MW03 and MW07	0.29 µg/L in MW06	0.002 µg/L
Benzo(a)pyrene	0.03 µg/L in MW04	0.09 µg/L in GWDUP01_021722	0.002 µg/L
Benzo(b)fluoranthene	0.04 µg/L in MW04	0.1 µg/L in GWDUP01_021722 and MW06	0.002 µg/L
Benzo(k)fluoranthene	0.01 µg/L in MW04	0.03 µg/L in GWDUP01_021722 and MW06	0.002 µg/L
Biphenyl (Diphenyl)	7.9 µg/L in MW06		5 µg/L
Chrysene	0.03 µg/L in MW04	0.22 µg/L in MW06	0.002 µg/L
Indeno(1,2,3-cd)pyrene	0.02 in MW04	0.06 µg/L in GWDUP01_021722	0.002 µg/L

* GWDUP01_021722 is a duplicate of the parent sample MW04_021722.

Total Metals

One or more of four total metals were detected above the NYSDEC SGVs in all groundwater samples analyzed. The table below provides concentrations of total metals above the NYSDEC SGVs.

Parameter	Range of Concentrations Detected above the NYSDEC SGV		NYSDEC SGV
	Low	High	
Iron	334 µg/L in MW03	4,640 µg/L in MW06	300 µg/L
Magnesium	44,100 µg/L in MW06	70,100 µg/L in MW04	35,000 µg/L
Manganese	1,115 µg/L in MW02	3,706 µg/L in GWDUP01_021722*	300 µg/L
Sodium	48,000 µg/L in MW01	322,000 µg/L inMW04	20,000 µg/L

* GWDUP01_021722 is a duplicate of the parent sample MW04_021722.

Dissolved Metals

One or more of four dissolved metals were detected above the NYSDEC SGVs in all groundwater samples analyzed. The table below provides concentrations of total metals above the NYSDEC SGVs.

Parameter	Range of Concentrations Detected above the NYSDEC SGV		NYSDEC SGV
	Low	High	
Iron	912 µg/L in MW02	4,150 µg/L in MW04	300 µg/L
Magnesium	42,500 µg/L in MW06	54,200 µg/L in MW04	35,000 µg/L
Manganese	1,012 µg/L in MW05	3,121 µg/L in MW04	300 µg/L
Sodium	32,300 µg/L in MW01	225,000 µg/L in MW04	20,000 µg/L

* GWDUP01_021722 is a duplicate of the parent sample MW04_021722.

PCBs

PCBs were not detected in groundwater samples.

Pesticides and Herbicides

Pesticides and herbicides were not detected in groundwater samples.

PFAS (21-Compound List) and 1,4-Dioxane

Groundwater PFAS and 1,4-dioxane analytical results were compared to the NYSDEC Part 375 Remedial Programs Guidelines for Sampling and Analysis of PFAS (June 2021) and the drinking water maximum contaminant level (MCL) for 1,4-dioxane adopted by New York State for public water systems (July 2020), respectively. Two PFAS compounds, PFOA and PFOS, were detected above the Guidance Values in a groundwater sample collected from all monitoring wells analyzed. 1,4-Dioxane was not detected at concentrations above the MCL. The table below provides concentration ranges of PFAS compounds that were detected above the Guidance Values.

Parameter	Range of Concentrations Detected above the PFAS Guidance Values		NYSDEC January 2021 Guidance Values
	Low	High	
PFOS	0.0158 µg/L in MW06	0.0732 µg/L in MW01	0.01 µg/L
PFOA	0.0443 µg/L in MW02	0.0730 µg/L in MW06	0.01 µg/L

5.5 Soil Vapor Findings

5.5.1 Field Observations

Post-purge PID readings were measured at 0.0 ppm at all soil vapor points.

5.5.2 Analytical Results

Soil vapor samples are summarized in Table 5 and shown on Figure 8. No standards currently exists for soil vapor in New York State. The samples were evaluated using the 2006 NYSDOH Soil Vapor Intrusion Guidance (updated in 2017). In the absence of indoor air samples, soil vapor sample results were applied to the lowest concentration for which monitoring or mitigation is recommended in Decision Matrices A, B, and C of the NYSDOH Guidance. The Decision Matrices provide guidance on eight VOCs: carbon tetrachloride, 1,1-dichloroethene, cis-1,2-dichloroethene, trichloroethene (TCE), methylene chloride, PCE, 1,1,1-TCA, and vinyl chloride. Six of the eight VOCs evaluated under the Decision Matrices were not detected in soil vapor samples. The highest detected concentrations of methylene chloride and PCE are summarized below:

- Methylene chloride was detected in soil vapor sample SV09 and its duplicate sample at concentrations of 14 micrograms per cubic meter (μg/m^3) and 7.3 μg/m^3, respectively, below the minimum concentration for which mitigation is recommended.
- PCE was detected in soil vapor sample SV09 and its duplicate at concentrations of 6.4 μg/m^3 and 5.6 μg/m^3, respectively, below the minimum concentration for which mitigation is recommended.

In addition, creosote- and/or petroleum-related VOCs, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 4-ethyltoluene, benzene, cyclohexane, ethylbenzene, m,p-xylene, o-xylene, methyl ethyl ketone, n-heptane, n-hexane, and toluene, were identified in soil vapor samples across the site.

5.6 QA/QC Sample Results

Quality control sample results were evaluated during data validation. Duplicate, field blank, emerging contaminant field blank, MS/MSD, and trip blank samples collected during the RI are detailed in Table 1. Duplicate, field blank, and MS/MSD samples were generally collected at a frequency of 1 per 20 primary samples. Trip blank samples were generally collected at a frequency of 1 per day of VOC sampling. The relative percent differences (RPD) between the primary samples and field duplicate results did not meet the precision criteria for select compounds in soil and groundwater. The trip blank results demonstrated the absence of cross-contamination during sample transport.

5.7 Data Usability

New York Analytical Services Protocols (ASP) Category B laboratory reports for the soil, groundwater, and soil vapor samples collected during the RI were provided by Alpha and York and were reviewed by a Langan data validator. Data qualifiers were updated following completion of the DUSRs. Copies of the DUSRs are provided in Appendix G.

The data were determined to be usable, as qualified. Completeness, defined as the percentage of analytical results that are judged to be valid, is 100% for soil, groundwater and soil vapor.

5.8 Evaluation of Areas of Concern

This section discusses the results of the RI and previous investigations with respect to the AOCs described in Section 3.4 (AOC 1, 2, and 3) and one AOC identified based on the results of the RI (AOC 4). AOCs are shown on Figure 5.

5.8.1 AOC 1: Historic Fill

Historic fill was identified from below surface grade to depths ranging from about 10 to 22 feet bgs throughout the site. This is a site-wide AOC and investigation locations included all borings and monitoring wells. Contaminants of concern associated with AOC 1 include SVOCs and metals. VOCs were detected in the historic fill layer in soil borings in the southern part of the site; however, the detected VOCs are attributed to residual petroleum impacts, as discussed further under AOC 2. A summary of findings for AOC 1 is presented below.

AOC 1 Findings Summary

Investigation of AOC 1 included completion of all soil borings and monitoring wells. Historic fill was identified from below surface grade to depths between about 10 feet to 22 feet bgs. The layer is predominately characterized as brown to grey, fine- to medium-grained sand with varying amounts of gravel, silt, brick, metal, concrete, coal ash, wood, glass, slag, and coal.

Four SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) were detected above UU SCOs in historic fill samples from the western part of the site. Three SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, and indeno[1,2,3-cd]pyrene) were detected above RURR SCOs in historic fill samples from 2 to 4 feet bgs in the western part of the site. Five metals (copper, lead, mercury, nickel, and zinc) were detected above UU SCOs in historic fill samples from across the site. One metal, mercury, was detected the PGW and RURR SCO in soil boring SB15 from 6 to 8 feet bgs in the western part of the site. SVOCs and metals above the PGW and/or RURR SCOs were detected within the historic fill layer. With exception of SVOCs detected in soil boring SB24 from 20 to 22 feet bgs associated with NAPL contamination (AOC 4), no SVOCs or metals exceeded the UU, PGW or RURR SCOs in native soil.

The groundwater interface ranges from 10.49 to 13.32 feet bgs and lies within the historic fill layer. The SVOCs benzo(a)anthracene, benzo(b)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene were also detected in groundwater samples above the NYSDEC SGVs in four of seven monitoring wells. Copper, lead, mercury, nickel, and zinc, were not detected in groundwater samples above the NYSDEC SGVs at total or dissolved concentrations.

AOC 1 Conclusions

Based on the analytical results and field observations, historic fill was identified from below surface grade to depths between of about 10 feet to 22 feet bgs. Field observations of brick, metal, concrete, coal ash, wood, glass, slag, and coal are consistent with historic fill identified in the NYC urban environment. SVOCs and metals above the UU, PGW and/or RURR SCOs were identified within the historic fill layer.

Detections of the four SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) in groundwater samples at concentrations above the NYSDEC SGVs is attributed to the presence of suspended solids derived from historic fill within the groundwater samples collected.

5.8.2 AOC 2: Residual Petroleum-Impacted Soil and Groundwater

A 3,000-gallon gallon gasoline UST was closed in place in the southern part of the site in 1997. The 2011 Limited Environmental Investigation and November 2021 Phase II Investigation identified evidence of petroleum impacts, including odors, PID readings above background, and/or concentrations of petroleum-related VOCs exceeding UU and/or RURR in soil samples collected in the vicinity of the closed-in-place gasoline UST and former fuel dispenser. Contaminants of concern associated with AOC 2 include petroleum-related VOCs and SVOCs. A summary of findings associated with AOC 2 is presented below.

AOC 2 Findings Summary

Investigation of AOC 2 included the completion of soil borings SB2A, SB17, SB18, SB20, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, and SB30, monitoring well MW01 and MW06, and soil vapor point SV08.

Petroleum-like odors, staining, and/or elevated PID readings were observed in ten soil borings (SB2A, SB17, SB18, SB20, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, and SB30) from 9 to 24 feet bgs. The highest PID reading observed was 1,128 ppm at 10.5 feet bgs in SB18 located in the southern-central part of the site. Impacts observed in soil borings SB24, SB24_DB01, SB24_DB02, SB24_DB03 were determined to be related to a localized NAPL contamination in soil and discussed further as part of AOC 4.

Six petroleum-related VOCs (1,3,5-trimethylbenzene, benzene, ethylbenzene, n-butylbenzene, n-propylbenzene, and total xylenes) were detected at concentrations above the UU and PGW SCOs, but below the RURR SCOs in soil samples collected from 10 to 12 feet bgs in soil boring SB18 and from 10 to 12 feet in soil boring SB30. One VOC, 1,2,4, trimethylbenzene, was detected above the PGW and RURR SCO in a soil sample collected from 10 to 12 feet bgs in soil boring SB18.

Petroleum-like odors and PID readings of 0.1 ppm and 19.6 ppm were observed in the monitoring well headspaces of MW01 and MW06, respectively. Petroleum-related VOCs (1,2,4,5-tetramethylbenzene, 1,2,4, trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, n-butylbenzene, n-propylbenzene, o-xylene, sec-butylbenzene, toluene, and total xylenes) were identified in groundwater samples from MW01 and MW06 at concentrations above the NYSDEC SGVs.

Petroleum-related VOCs, including 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, and toluene, were detected in soil vapor sample SV08.

AOC 2 Conclusions

Based on observations of a petroleum release at the site, a spill was reported to the NYSDEC on November 12, 2021. Spill No. 2107485 was assigned to the release. Based on the analytical results and field observations, subsurface, residual petroleum impacts encompass an about 1,300-square-foot area in the southern part of the site and were present from 9 to 24 feet bgs. Petroleum impacts, as evidenced by staining, odors, PID readings above background, and/or analytical data were identified in borings SB2A, SB17, SB18, SB20, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, and SB30. The vertical endpoint of petroleum impacts were identified in each soil boring where petroleum impacts were observed. The horizontal extent of petroleum impacts was delineated by the absence of petroleum impacts in soil borings SB16, SB19, SB26, SB27, SB28, and SB31. The source of petroleum impacts at the site is likely related to a historical release from the UST, its lines, and the former fuel dispenser. Spill No. 2107485 remains open based on analytical results and the presence of petroleum-related VOCs in soil and groundwater above the NYSDEC SGVs, which indicate residual petroleum impacts are impacting groundwater quality at the site.

5.8.3 AOC 3: CVOCs in Soil Vapor

The November 2021 Phase II ESI identified CVOCs including 1,1,1-trichloroethane, methylene chloride, and PCE, in soil vapor at the site. A summary of findings associated with AOC 3 is presented below.

AOC 3 Findings Summary

Methylene chloride and PCE were detected in one soil vapor sample at the site. No CVOCs exceeded the minimum concentrations for which mitigation is recommended by the NYSDOH Decision Matrices in the seven soil vapor samples collected during the RI.

AOC 3 Conclusions

Based on analytical results, no CVOCs exceeded applicable criteria in soil vapor, soil and groundwater samples collected during the RI. The analytical data does not support a vapor intrusion risk at the site.

5.8.4 AOC 4: Localized NAPL Contamination in Soil

NAPL, identified as coal tar/creosote by laboratory hydrocarbon identification analysis, sorbed to soil was found in a highly localized area in the southern-central part of the site. Contaminants of concern associated with the NAPL include VOCs and SVOCs. A summary of findings associated with AOC-3 is presented below.

AOC 4 Findings Summary

Creosote and/or petroleum-like odors, staining, elevated PID readings and NAPL were observed in soil boring SB24 from 20 to 24 feet bgs. Horizontal and vertical delineation of the impacts included the completion of soil borings SB2A, SB18, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, SB26, SB27, SB28, and SB30 and monitoring wells MW02, MW06 and MW07.

Total xylenes were detected at a concentration above the UU SCO, but below the RURR SCO in a soil sample collected from 20 to 22 feet in soil boring SB24. Fifteen creosote- and/or petroleum-related SVOCs (acenaphthene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[k]fluoranthene, benzo[b]fluoranthene, chrysene, diben[a,h]anthracene, dibenzofuran, fluoranthene, fluorine, indeno[1,2,3-cd]pyrene, naphthalene, phenanthrene, and pyrene) were detected at concentrations above the UU, PGW and/or RURR SCOs in a soil sample collected from 20 to 22 feet bgs in soil boring SB24.

Odors and a PID reading of 19.6 ppm were observed in the monitoring well headspace of MW06. During the installation of MW06, NAPL was observed within the monitoring well; however, NAPL was not encountered during the sampling of MW06. Creosote- and/or petroleum-related VOCs (1,2,4,5-tetramethylbenzene, 1,2,4, trimethylbenzene, 1,3,5-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene, m,p-xylene, n-butylbenzene, n-propylbenzene, o-xylene, sec-butylbenzene, toluene, and total xylenes) and SVOCs (acenaphthene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, biphenyl [diphenyl], and chrysene) were identified at concentrations above the NYSDEC SGVs in the groundwater sample from MW06.

AOC 4 Conclusions

Based on the analytical results and field observations, NAPL and associated impacts observed in soil boring SB24 from 20 to 24 feet bgs are highly localized, with no NAPL observed past 24 feet bgs in soil boring SB24. The horizontal extent of NAPL contamination was delineated by the absence of NAPL in soil borings SB2A, SB18, SB24_DB01, SB24_DB02, SB24_DB03, and SB27.

During the installation of MW06, NAPL was observed within the monitoring well; however, NAPL was not encountered during the sampling of MW06. Based on analytes detected in MW06, including creosote- and/or petroleum-related VOCs and SVOCs, there is potential for NAPL soil contamination to be impacting groundwater quality at the site. Creosote- and/or petroleum-related VOCs were identified in soil vapor samples. SVOCs are not highly volatile and are therefore not associated with a soil vapor intrusion risk.

No discrete on-site source of the NAPL (identified as coal tar/creosote) were found during the RI. Wood fragments were identified in many borings at the groundwater table across the site and may be remnants of treated/preserved wood products that may have been used for structural piles or other timber-based structures. The NAPL appears isolated to a single boring. Historical site uses are not consistent with those commonly associated with coal tar waste (i.e., manufactured gas plants). Therefore, the most plausible conclusion may be that the NAPL is a result of weathering of buried treated/preserved wood products that induced leaching of creosote, a commonly-used wood preservative.

6.0 QUALITATIVE HUMAN AND FISH/WILDLIFE EXPOSURE ASSESSMENT

Human health exposure risk was evaluated for current and future site and off-site conditions, in accordance with the May 2010 NYSDEC Final DER-10 Technical Guidance for site Investigation and Remediation. The assessment includes an evaluation of potential sources and migration pathways of site contamination, potential receptors, exposure media, and receptor intake routes and exposure pathways.

In addition to the human health exposure assessment, NYSDEC DER-10 requires an on-site and off-site Fish and Wildlife Resources Impact Analysis (FWRIA) if certain criteria are met. Based on the requirements stipulated in Section 3.10 and Appendix 3C of DER-10, there was no need to prepare an FWRIA for the site. A completed copy of the DER-10 Appendix 3C decision key is included as Appendix I.

6.1 Current Conditions

The site encompasses an area of about 11,255 square feet and is currently a vacant lot with overgrown vegetation and an asphalt-paved driveway in the northwestern part of the property.

6.2 Post Redevelopment Conditions

The planned redevelopment project includes the construction of one mixed-use residential and commercial building with affordable housing units and ground floor commercial space. The new building will comprise commercial retail space, residential units, mechanical floors, and a partial cellar in the northern part of the site. The building footprint is about 9,771 square feet in area and the remainder of the lot will be comprised of sidewalk entranceways and a rear yard with a mixture of hardscaped and landscaped areas.

6.3 Conceptual Site Model

A conceptual site model (CSM) was developed based on the RI findings and previous investigations to produce a simplified framework for understanding the distribution of impacted materials, potential migration pathways, and potentially complete exposure pathways.

6.3.1 Potential Sources of Contamination

Potential sources of contamination include historic fill, a historical release of petroleum, and localized NAPL contamination.

Historic Fill - The site-wide presence of historic fill was established as a source of SVOCs and metals in soil and SVOCs in groundwater.

Residual Petroleum-Impacted Soil and Groundwater – A historical gasoline release from the UST, its lines, or the former fuel dispenser was established as a source of VOCs and SVOCs in soil and groundwater (under Spill No. 2107485). Physical indicators of petroleum impacts (staining, odors, and PID readings) in soil also support this conclusion.

Localized NAPL Contamination – NAPL, identified as coal tar/creosote by laboratory hydrocarbon identification analysis, was established as a source of VOCs and SVOCs in soil and groundwater in the southern-central part of the site.

6.3.2 Exposure Media and Contaminants of Concern

The contaminated media include soil and groundwater. The contaminants in the media include: 1) VOCs and SVOCs in soil and groundwater and 2) Metals in soil.

6.3.3 Receptor Populations

Site access is currently limited to authorized personnel and visitors throughout the site. Under future construction conditions, human receptors may include construction and remediation workers, authorized guests, and the public adjacent to the site. Under future use conditions, human receptors include residents, visitors and customers at the mixed-used residential and commercial building and the nearby community, including children.

6.4 Potential Exposure Pathways – On-Site

6.4.1 Current Conditions

The site footprint is covered in part with impervious surfaces, including an asphalt-paved driveway in the northwestern part of the property; however, the remainder of the site includes vegetated areas with exposed soil/fill. Because of site access restrictions, including a locked construction gate, human exposure to contaminated soil through ingestion or direct contact is possible, but limited. Groundwater in this area of New York City is not used as a potable water source.

There is a potential exposure pathway to contaminated soil/fill, groundwater and soil vapor during site investigation through dermal absorption, inhalation, and/or ingestion. Activity is limited to trained investigation personnel and is performed under a site-specific Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) with provisions to minimize exposure risk, including vapor and dust suppression techniques.

6.4.2 Construction/Remediation Condition

Construction and remediation may result in potential exposures to contaminated soil, groundwater or soil vapor. The implementation of a HASP and CAMP, as well as vapor and dust suppression techniques, will limit the exposure pathways presented by potential dermal absorption, ingestion, and inhalation.

6.4.3 Proposed Future Conditions

The proposed development will encompass the entire site footprint and include residential and commercial use. Upon completion of the new development, historic fill and contaminated soil will be excavated to accommodate the cellar level and as required for at-grade concrete foundations. The foundation for the cellar level will include a waterproofing membrane system. Exposure pathways to residual soil contamination will be incomplete unless the composite cover system is disturbed. There is no pathway for ingesting groundwater since the site and surrounding areas obtain their drinking water supply from surface water reservoirs located upstate. There is no or limited potential for accumulation of contaminated vapors below the new building at the site based on the RI data compared to the NYSDOH Guidance Document. Regardless, the lowest level slabs of the building will be constructed with a waterproofing/vapor barrier membrane system. In addition, deed restrictions on use of groundwater, allowable uses of the site, and vegetable farming will be placed on the property as part of remediation; these institutional controls will promote incomplete exposure pathways.

6.5 Potential Exposure Pathways – Off-Site

The potential off-site migration of site soil, groundwater, and/or soil vapor contaminants is not expected to result in a complete exposure pathway for current, construction-phase, or future conditions for the following reasons:

- The site is located in an urban area
- During site excavation, foundation construction, and remediation the following protective measures will be implemented:
  - Air monitoring will be conducted for particulates (dust) and VOCs during ground-intrusive work as part of a CAMP. Dust and/or vapor suppression techniques will be employed to limit the potential for off-site migration of soil and vapors.
  - Vehicle tires and undercarriages will be washed as necessary prior to leaving the site to prevent tracking material off-site.
  - A soil erosion/sediment control plan will be implemented during construction to control off-site migration of soil.
  - Removal of source material will prevent future off-site migration of contaminants.
- The asphalt-paved roadways and concrete sidewalk prevent direct exposure to the off-site subsurface.
- Groundwater extracted during remediation activities and/or construction dewatering, if required, will be treated before it is discharged to the municipal sewer system under a New York City Department of Environmental Protection (NYCDEP) permit.
- Groundwater in New York City is not used as a potable water source and the nearest ecological receptor, the Hudson River, is located about 1,300 feet south of the site.
- There is no or limited potential for soil vapor migrating from the site into adjacent structures based on the RI data.

6.6 Evaluation of Human Health Exposure

Based upon the CSM and the exposure evaluation above, complete exposure pathways to both on- and off-site receptors:

- Do not exist under current use conditions
- Would be avoided under investigation/construction/remediation use conditions through implementation of a CHASP and CAMP and other construction measures (dust suppression, soil/erosion sediment control plan, etc.); and
- Would be mitigated through the use of planned engineering controls and institutional controls (ECs/ICs) under future use conditions as part of a Track 4 remedy.

7.0 NATURE AND EXTENT OF CONTAMINATION

This section evaluates the nature and extent of soil, groundwater, and soil vapor contamination as derived from a combination of field observations and analytical data that were discussed in Section 5.0.

7.1 Soil Contamination

Historic fill contains SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) and metals (copper, lead, mercury, nickel, and zinc) at concentrations above the UU, PGW and/or RURR SCOs. Historic fill was identified site-wide and ranges in depth from about 10 feet to 22 feet bgs based on visual observations and analytical results. SVOCs and metals above the PGW and/or RURR SCOs were detected within the historic fill layer. With the exception of SVOCs detected in soil boring SB24 from 20 to 22 feet bgs associated with NAPL contamination, no SVOCs or metals exceeded the UU, PGW, and/or RURR SCOs in native soil. The SVOCs and metals detected at concentrations above the UU, PGW, and/or RURR SCOs across the site are attributed to historic fill quality.

Residual petroleum contamination (as evidenced by PID readings above background, odors, staining, and/or analytical data) were observed in ten soil borings from 9 to 24 feet bgs in the southern part of the site encompassing an area of about 1,300 square feet. Petroleum impacts were delineated horizontally and vertically (as evidenced by the field observations and analytical data). The source of the petroleum contamination in soil is likely a historical release from the UST, its lines, and the former fuel dispenser. Based on the presence of residual petroleum contamination in soil and groundwater at the site, Spill No. 2107845 remains open.

The NAPL, identified as coal tar/creosote by laboratory hydrocarbon identification analysis, observed in soil boring SB24 from 20 to 24 feet bgs was horizontally and vertically delineated by soil borings SB2A, SB18, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, SB26, SB27, SB28, and SB30 and appears to be highly localized and confined to one soil boring. NAPL-impacted soil in SB24 exhibited SVOCs above the PGW and/or RURR SCOs at depths of 20 to 22 feet bgs.

Based on analytical results and field observations, no discrete on-site source of the NAPL (identified as coal tar/creosote) were found during the RI. Wood fragments were identified in many borings at the groundwater table and may be remnants of treated/preserved wood products that may have been used for structural piles or other timber-based structures. The NAPL appears isolated to a single boring and is highly localized. Historical site uses are not consistent with those commonly associated with coal tar waste (i.e., manufactured gas plants). Therefore, the most plausible conclusion may be that the NAPL is a result of weathering of buried treated/preserved wood products that induced leaching of creosote, a commonly-used wood preservative.

7.2 Groundwater Contamination

Field observations and/or analytical data identified PFAS, and creosote- and/or petroleum-related VOCs, and SVOCs in groundwater; impacts were delineated horizontally (as evidenced by field observations and analytical data) in all monitoring wells.

Creosote- and/or petroleum-related VOCs were identified in groundwater above the NYSDEC SGVs in two monitoring wells (MW01 and MW06) in the southern part of the site. The sources of the creosote- and/or petroleum-related VOCs in groundwater are likely a historical release from the UST, its lines, or the former fuel dispenser and/or the coal tar/creosote NAPL.

SVOCs were identified in groundwater above the NYSDEC SGVs in four monitoring wells (MW03, MW04, MW06 and MW07) across the site. The source of SVOCs in groundwater is likely suspended solids derived from historic fill (MW03, MW04, and MW07) and the coal tar/creosote NAPL observed in SB24 (MW06).

PFAS were identified in six monitoring wells (MW01, MW02, MW03, MW04, MW05, and MW06) across the site. The PFAS in groundwater is attributed to an unidentified off-site source or regional groundwater condition as no PFAS was detected in soil on-site.

7.3 Soil Vapor Contamination

Creosote- and/or petroleum-related VOCs were identified in soil vapor samples across the site and are likely related to a historical release from the UST, its lines, or the former fuel dispenser and/or the coal tar/creosote NAPL. No CVOCs exceeded the minimum concentrations for which mitigation is recommended by the NYSDOH Decision Matrices in the seven soil vapor samples collected during the RI. No CVOCs exceeded applicable criteria in soil and groundwater samples collected during the Phase II ESI or the RI. The analytical data does not support a vapor intrusion risk at the site.

8.0 CONCLUSIONS

The RI was completed in January and February 2022. The findings summarized herein are based on both qualitative data (field observations and instrumental readings) and soil, groundwater, and vapor laboratory analytical results. Findings and conclusions are as follows:

1. Stratigraphy: A historic fill layer was observed from surface grade to depths ranging from about 10 to 22 feet bgs, and consisted primarily of brown to grey, fine- to medium-grained sand with varying amounts of gravel, silt, brick, metal, concrete, coal ash, wood, glass, slag, and coal. The fill layer is underlain by native soils consisting of brown to gray fine- to medium-grained sand with varying amounts of gravel and silt. A 0.5 to 4 foot thick dark grey to black clay layer was encountered at about 20 to 24 feet bgs in soil borings SB2A, SB15, SB18, SB20, SB25, SB26, and SB30. In one soil boring (SB24), the clay layer was underlain by a gray fine- to medium-grained sand with shell fragments from 24 to 28 feet bgs. Bedrock was not encountered during the RI or previous environmental investigation conducted at the site. Bedrock was encountered on the site during a 2004 geotechnical investigation, conducted by Langan, at about 46 to 53 feet bgs.

2. Hydrogeology: Groundwater was observed at depths between 10.49 to 13.32 feet bgs with elevations ranging from el. -0.52 to -2.85 feet during synoptic groundwater level measurements collected from nine wells during the RI, including three monitoring wells previously installed by others. Groundwater was calculated to generally flow to the north-northeast at the site.

3. Historic Fill Quality: Historic fill contains SVOCs (benzo[a]anthracene, benzo[b]fluoranthene, chrysene, and indeno[1,2,3-cd]pyrene) and metals (copper, lead, mercury, nickel, and zinc) at concentrations above the UU, PGW, and/or RURR SCOs.

4. Petroleum- and/or Creosote -Impacted Soil and Groundwater:

    a. Soil - Residual petroleum contamination (as evidenced by PID readings above background, odors, staining, and/or analytical data) were observed in ten soil borings (SB2A, SB17, SB18, SB20, SB24, SB24_DB01, SB24_DB02, SB24_DB03, SB25, and SB30) from 9 to 24 feet bgs in the southern part of the site encompassing an area of about 1,300 square feet. Petroleum impacts were delineated horizontally and vertically (as evidenced by the field observations and analytical data). Based on the presence of residual petroleum contamination in soil and groundwater at the site, Spill No. 2107845 remains open. NAPL, identified as coal tar/creosote by laboratory hydrocarbon analysis, was observed in soil boring SB24 from 20 to 24 feet bgs. NAPL-impacted soil in SB24 exhibited SVOCs above the PGW and RURR SCOs at depths of 20 to 22 feet bgs.

b. Groundwater – During the installation of MW06, coal tar/creosote NAPL was observed within the monitoring well; however, NAPL was not encountered during the sampling of MW06. Creosote- and/or petroleum-related VOCs were identified above the NYSDEC SGVs in groundwater samples collected from the southern part of the site.

c. The source of petroleum impacts at the site is likely related to a historical release from the UST, its lines, and the former fuel dispenser.

d. No discrete on-site source of the coal tar/creosote NAPL were found during the RI. Wood fragments were identified in many borings at the groundwater table across the site and may be remnants of treated/preserved wood products that may have been used for structural piles or other timber-based structures. The NAPL appears isolated to a single boring and is highly localized. Historical site uses are not consistent with those commonly associated with coal tar waste (i.e., manufactured gas plants). Therefore, the most plausible conclusion may be that the NAPL is a result of weathering of buried treated/preserved wood products that induced leaching of creosote, a commonly-used wood preservative.

5. Soil Vapor Impacts: Creosote- and/or petroleum-related VOCs and CVOCs were identified in soil vapor samples at the site. No CVOCs exceeded the minimum concentrations for which mitigation is recommended by the NYSDOH Decision Matrices in the seven soil vapor samples collected during the RI. No CVOCs exceeded applicable criteria in soil and groundwater samples collected during the Phase II ESI or the RI. The analytical data does not support a vapor intrusion risk at the site.

6. Sufficient analytical data were gathered during the RI to establish site-specific soil cleanup levels and to develop a remedy for the site. The final remedy will be described and evaluated in a RAWP to be prepared in accordance with BCP guidelines. The remedy will address historic fill, petroleum-impacted soil and groundwater, and localized NAPL contamination.

9.0 REFERENCES

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