REMEDIAL INVESTIGATION WORK PLAN

92 AVENUE OF THE AMERICAS
NEW YORK, NEW YORK 10013
NYSDEC BCP Site No. C231130

Prepared For:

THE RECTOR, CHURCH-WARDENS, AND VESTRYMEN OF TRINITY CHURCH, IN THE CITY OF NEW-YORK;
REMAINDERMAN 92 AOA LLC;
92 HH LLC
76 Trinity Place, 10th Floor
New York, NY 10006

Prepared By:

Langan Engineering, Environmental, Surveying
Landscape Architecture and Geology, D.P.C.
21 Penn Plaza
360 West 31st Street, 8th Floor
New York, New York 10001

Michael D. Burke

Michael Burke, PG, CHMM
Principal/Vice President

LANGAN

June 30, 2020
Langan Project No. 190044801

TABLE OF CONTENTS

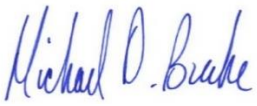
TABLES

FIGURES

APPENDICES

CERTIFICATION

I, Michael Burke, certify that I am currently a Qualified Environmental Professional as defined in 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 and that this Remedial Investigation Work Plan (RIWP) was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation.



Michael Burke, PG, CHMM

1.0 INTRODUCTION

This Remedial Investigation Work Plan (RIWP) was prepared on behalf of The Rector, Church-Wardens, and Vestrymen of Trinity Church, in the city of New-York ("Trinity"); 92 HH LLC; and Remainderman 92 AOA LLC (collectively, the Participants) for the property at 92 Avenue of the Americas in the SoHo neighborhood of New York, New York (the site). The Participants will implement the RIWP for New York State Brownfield Cleanup Program (BCP) Site No. C231130 pursuant to the Brownfield Cleanup Agreement (BCA) executed on August 29, 2019 with the New York State Department of Environmental Conservation (NYSDEC). NYSDEC's Project Manager for this BCP site, Steven Wu, granted an extension for Participants to submit this RIWP to NYSDEC on or by October 28, 2019.

The objective of the scope of work defined in the RIWP is to investigate and characterize the nature and extent of environmental impacts at and emanating from the site and to provide sufficient information to evaluate remedial alternatives and threats to human health and the environment, as required under the BCP. The proposed development project is in the early planning stages, but currently is anticipated to include a 7-story commercial office building spanning the site footprint (4,328 square feet), with one full cellar level at a depth of about 15 feet below grade surface (bgs). The results of the Remedial Investigation (RI) will be used to evaluate a Track 1 remedy and alternatively a Track 2 and/or Track 4 remedy. This RIWP was developed in accordance with the process and requirements identified in the NYSDEC "Division of Environmental Remediation (DER)-10: Technical Guidance for Site Investigation and Remediation" (May 2010), the New York State Department of Health (NYSDOH) "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October 2006), the NYSDEC "Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs" (June 2019), and the NYSDEC "Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs" (January 2020).

2.0 SITE BACKGROUND

2.1 Site Description

The site is located at 92 Avenue of the Americas (Sixth Avenue) in the SoHo neighborhood of New York, New York and is identified as Tax Block 476, Lot 1, on the NYC Manhattan Borough Tax Map. The site encompasses 4,328 square feet on the southwestern corner of the city block bounded by Watts Street to the north, Thompson Street to the east, Grand Street to the south, and Avenue of the Americas to the west. A site location map is provided as Figure 1. The site consists of a gravel-covered lot currently used for parking. A 16-story commercial office building (100 Avenue of the Americas) adjoins the site to the north, and two 6-story mixed-use commercial and residential buildings adjoin the site to the east. The New York City Transit (NYCT) A-C-E subway lines run west of the site below Avenue of the Americas. A site plan is provided as Figure 2.

According to New York City Planning Commission Zoning Map 12a, the site is located in an M1-5B zoning district. That district is designated for areas with light industrial uses adjacent to residential and commercial districts.

2.2 Surrounding Property Land Use

The site is located in a mixed-use area with multi-story industrial, commercial, and residential buildings, active construction sites, and vacant lots. The following is a summary of adjoining property usage:

Direction	Adjoining Properties			Surrounding Properties
	Block No.	Lot No.	Description	
North	476	7	Multi-story commercial building (100 Avenue of the Americas)	Watts Street followed by multi-story mixed-use commercial and residential buildings
East	476	42	Six-story mixed-use commercial and residential building (23 Thompson Street)	Thompson Street followed by multi-family residential buildings, multi-story mixed-use commercial and residential building, industrial building, a parking lot
		45	Six-story mixed-use commercial and residential building (30 Grand Street)	
South	227	50	One-story commercial building (23 Grand Street)	Public park followed by Canal Street

Direction	Adjoining Properties			Surrounding Properties
	Block No.	Lot No.	Description	
West	477	11	23-story commercial building (101 Avenue of the Americas)	Multi-story multi-family residential building followed by Varick Street
	227	63	Public park (Duarte Square)	

Public infrastructure (storm drains, sewers, underground utility lines, and NYCT subway lines) exists within the streets surrounding the site. A land use map showing the adjacent and surrounding properties is provided on Figure 3.

Land use within a half-mile radius is urban and includes residential, commercial, light industrial buildings and outdoor space. The nearest ecological receptor is the Hudson River, located about 0.4 miles west of the site. Sensitive receptors, as defined in DER-10, located within a half mile of the site include those listed below:

Number	Name (Approximate distance from site)	Address
1	Broome Street Academy (approximately 0.07 miles north of the site)	121 Sixth Avenue New York, NY 10013
2	NYC iSchool (approximately 0.08 miles north of the site)	131 Sixth Avenue New York, NY 10013
3	Chelsea High School (approximately 0.08 miles northeast of the site)	131 Sixth Avenue New York, NY 10013
4	Montessori Schools (approximately 0.10 miles northeast of the site)	75 Sullivan Street New York, NY 10012
5	Tribeca Early Childhood Learning Center (approximately 0.10 miles south of the site)	21 St Johns Lane New York, NY 10013
6	SoHo Child Care (approximately 0.19 miles northeast of the site)	69 Greene Street New York, NY 10012
7	Portfolio School (approximately 0.22 miles southwest of the site)	27 N Moore Street New York, NY 10012
8	TriBeCa Community School (approximately 0.22 miles west of the site)	22 Ericsson Place New York, NY 10013
9	LREI-High School (approximately 0.25 miles north of the site)	40 Charlton Street New York, NY 10014
10	Bright Horizons Childrens Center, Inc. (approximately 0.27 miles southeast of the site)	129 Hudson Street New York, NY 10013
11	Church St School for Music and Art (approximately 0.31 miles southeast of the site)	41 White Street New York, NY 10013

Number	Name (Approximate distance from site)	Address
12	Cookie Academy (approximately 0.33 miles northeast of the site)	60 MacDougal Street New York, NY 10012
13	Ross Global Academy Center (approximately 0.36 miles northeast of the site)	560 Broadway #301 New York, NY 10012
14	City-As-School (approximately 0.41 miles north of the site)	16 Clarkson Street New York, NY 10014
15	Buckle my Shoe Learning Center (approximately 0.42 miles southwest of the site)	40 Worth Street New York, NY 10013
16	Baxter St. After Day Care (approximately 0.44 miles east of the site)	143 Baxter street New York, NY 10013
17	Public School 130 (approximately 0.44 miles east of the site)	143 Baxter Street New York, NY 10013
18	Baxter St After School Daycare (approximately 0.44 miles southeast of the site)	143 Baxter Street New York, NY 10013
19	LREI – Lower and Middle School (approximately 0.45 miles north of the site)	272 Sixth Avenue New York, NY 10012
20	Public School 150 (approximately 0.46 miles southwest of the site)	334 Greenwich Street New York, NY 10013
21	Chung Pak Day Care Center (approximately 0.46 miles north of the site)	125 Walker Street #3 New York, NY 10013
22	Sompit Child Care Center (approximately 0.47 miles northeast of the site)	3 Washington Square Village New York, NY 10012
23	Creative Steps Early Care & Education (approximately 0.49 miles northeast of the site)	4 Washington Square Village New York, NY 10012

2.3 Site Physical Conditions

2.3.1 Topography

According to the October 30, 2018 American Land Title Association (ALTA) and National Society of Professional Surveyors (NSPS) Land Title Survey prepared by Langan, the site ground surface elevation (el) ranges from about 5.63 in the southeastern corner to 9.46[1] in the northeastern corner of the site. The NYCT A-C-E subway lines run west of the site below Avenue of the Americas. The NYCT subway infrastructure is about 20 feet west of the site property boundary and extends from about elevation -1 to -23, or about 8 to 30 feet bgs. A site location map is presented as Figure 1.

2.3.2 Geology

According to Langan's November 2018 Phase II Environmental Site Investigation (ESI) Report (Appendix A), historic fill was identified across the site extending to about 7 to 12 feet below

[1] Elevations herein are in feet and referenced to the North American Vertical Datum of 1988 (NAVD88)

grade surface (bgs). The historic fill generally consists of brown to red-brown fine-grained sand with varying amounts of medium sand, coarse sand, gravel, concrete, brick, glass, coal, coal ash, and metal fragments. A native sand layer consisting of reddish-brown fine- to medium-grained sand with trace gravel was encountered beneath the fill.

According to the United States Geological Survey (USGS) "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" (Baskerville, 1994), the site is underlain by Manhattan Schist bedrock described as gray sillimanite-muscovite-tourmaline schist. Langan's November 19, 2018 Preliminary Geotechnical Engineering Study documented bedrock at about 100 feet bgs. Encountered bedrock consisted of gray schist with coarse to fine particles of muscovite, quartz, and feldspar, with slight to no weathering and steep to shallow dipping fractures.

2.3.3 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 hydrogeologic 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, coverage by impervious surfaces, and subsurface structures. Other factors influencing groundwater include depth to bedrock, the presence of anthropogenic fill, and variability in local geology and groundwater sources or sinks.

During synoptic gauging on October 12, 2018, groundwater depth ranged from about 11.37 to 12.53 feet bgs, corresponding to about el -4. Regional groundwater flow is estimated to flow west toward the Hudson River. Local groundwater flow may also be influenced by the presence of NYCT subway structures west of the site. The NYCT subway infrastructure west of the site extends from about 8 to 30 feet bgs and likely prevents migration of contaminated groundwater further west across Avenue of the Americas. Groundwater elevations and flow direction will be confirmed during the RI.

2.3.4 Wetlands

The possible presence of wetlands on or near the site were evaluated by reviewing the National Wetlands Inventory and NYSDEC regulated wetlands map. There are no wetlands on or adjacent to the site.

2.4 Summary of Previous Environmental Investigations

Previous environmental reports were reviewed to inform this RIWP. These reports are summarized below and are included in Appendix A.

- *Phase I Environmental Site Assessment (ESA),* prepared by Langan, dated November 12, 2018
- *Phase II ESI Report,* prepared by Langan, dated November 21, 2018
- *Preliminary Geotechnical Engineering Report*, prepared by Langan, dated November 19, 2018

November 12, 2018 Phase I ESA prepared by Langan

Langan performed a Phase I ESA on behalf of The Rector, Church-Wardens, and Vestrymen of Trinity Church in the city of New-York, and identified the following recognized environmental conditions (REC):

REC 1 – Historical Use of Site and Petroleum Bulk Storage

Historical uses of the site included a chemical manufacturing facility (1922), a confectionary and malt products company (1927), a textile company (1973), automobile service station (1938-2005), and filling station with at least four underground storage tanks (UST) (1950-2005). Historical chemical manufacturing, automobile service, and gasoline filling station operations may have impacted the site's soil, groundwater, and soil vapor.

REC 2 – Current and Historical Use of Adjoining and Surrounding Properties

Current and historical industrial and manufacturing operations, petroleum bulk storage, and documented releases at adjoining and surrounding properties may have impacted groundwater and/or soil vapor at the site.

November 18, 2018 Phase II ESI Report prepared by Langan

This report summarizes the November 2018 Phase II ESI conducted on behalf of The Rector, Church-Wardens, and Vestrymen of Trinity Church in the city of New-York. The investigation included the following: performance of a geophysical survey; advancement of three soil borings; installation of three groundwater monitoring wells; collection of nine soil and three groundwater samples for laboratory analysis of volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), and metals; installation of two soil vapor points; and collection of two soil vapor samples and one ambient air sample for VOC analysis. Field observations and laboratory analytical results are summarized below:

- The geophysical survey identified two geophysical anomalies, one of which resembled a UST.
- Historic fill generally consisting of brown to red-brown fine-grained sand with varying amounts of medium sand, coarse sand, gravel, concrete, brick, glass, coal, coal ash, and metal fragments was encountered immediately beneath the surface to 7 to 12 feet bgs. A native sand layer consisting of reddish-brown fine- to medium-grained sand with trace gravel was encountered beneath the fill. Groundwater was observed at about 12 feet bgs.
- Visual, olfactory, and photoionization detector (PID) evidence of petroleum impacts was apparent in all three boring locations. Petroleum-related VOCs were present at concentrations above the Part 375 Unrestricted Use (UU) Soil Cleanup Objectives (SCO) in samples collected near the groundwater table.
- A petroleum-like sheen was apparent on groundwater purged from each of the three wells during groundwater sampling. Multiple petroleum-related VOCs were detected in each sample at concentrations above the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGV) for Class GA groundwater.

In light of the Phase II ESI field observations and subsurface investigation results, a spill was reported to NYSDEC and Spill No. 1808357 was assigned.

Summaries of Phase II soil, groundwater, and soil vapor sampling results are provided in Figures 4, 5 and 6, respectively.

November 19, 2018 Preliminary Geotechnical Engineering Report prepared by Langan

Langan completed a geotechnical subsurface investigation between October 8 and 10, 2018. Notable findings are summarized below:

- A layer of uncontrolled fill was encountered in all borings and extended to between 13.5 and 17 feet bgs, corresponding to about el -6.5 to -10, respectively. The fill layer was underlain by an about 11.5- to 15-foot-thick layer of loose sand with varying amounts of silt and gravel. Loose sands were underlain by peat, underlain by soft clay, underlain by medium to dense sands, which was overlying bedrock.
- Bedrock was encountered in one boring at about 100.5 feet bgs. Bedrock was cored from about 105 to 115 feet bgs and consisted of gray schist with coarse to fine particles of muscovite, quartz, and feldspar, with slight to no weathering and steep to shallow dipping fractures.

2.5 Areas of Concern

Based on the site history and the findings of the previous studies, the areas of concern (AOC) to be further investigated during the RI are described below and shown on Figure 7:

AOC 1: Historic Fill

Historic fill, generally consisting of brown to red-brown fine-grained sand with varying amounts of medium sand, coarse sand, gravel, concrete, brick, glass, coal, coal ash, and metal fragments, was observed extending to 7 to 12 feet bgs during the November 2018 Phase II ESI. Contaminants associated with historic fill, including SVOCs and metals, were detected at concentrations above the Part 375 UU SCOs.

The investigation of AOC 1 will characterize and delineate the historic fill layer on the site.

AOC 2: On-Site Petroleum Bulk Storage (PBS)

The NYSDEC Petroleum Bulk Storage (PBS) database identified the following documented PBS tanks on the site:

- One 2,000-gallon gasoline UST installed on May 1, 1970 was closed and converted to non-regulated use on June 1, 1994;
- Two 550-gallon gasoline USTs were closed-in-place on February 1, 1996; and
- One 550-gallon waste oil UST was closed and removed on December 1, 2003.

The geophysical survey conducted during the November 2018 Phase II ESI identified two geophysical anomalies on the site: one along the southern boundary and another along the western boundary. The southern anomaly was within the former building footprint and did not appear to be consistent with a UST. The western anomaly measured about 4 feet wide and 10 feet long and was consistent with a UST. Releases of petroleum impacts associated with historical PBS tanks may have adversely impacted soil, groundwater, and/or soil vapor.

The investigation of AOC 2 will determine the potential on-site source(s) of petroleum impacts.

AOC 3: NYSDEC Petroleum Spill No. 1808357

Petroleum-like impacts, as evidenced by staining, odors, and PID readings above background, were observed in all three borings advanced during the November 2018 Phase II ESI. Petroleum-related VOCs were detected in soil and groundwater samples at concentrations above the Part 375 UU SCOs and SGVs, respectively. Petroleum-related VOCs were also detected in soil vapor samples. In response to the observed petroleum-like impacts, a spill was reported to the NYSDEC and Spill No. 1808357 was assigned.

The investigation of AOC 3 will horizontally and vertically delineate the on- and off-site impacts related to Spill No. 1808357.

3.0 SCOPE OF WORK

The objective of this RIWP is to investigate and characterize "the nature and extent of the contamination at and/or emanating from the brownfield site," per Environmental Conservation Law (ECL) Article 27, Title 14 (Brownfield Cleanup Program). The rationale for each sampling location in relation to the AOCs and analytical parameters for each proposed sample is provided in Table 1. The field tasks are discussed in more detail in the following sections.

Geophysical Survey

- Perform a geophysical survey to clear sample locations and identify potential subsurface utilities and structures, including potential USTs. Sampling locations may be relocated as necessary based on the findings of the geophysical survey.

Soil Borings and Sampling

- Advance four off-site and five on-site soil borings to about 24 feet bgs or the termination of petroleum impacts, whichever is deeper.
- Collect up to two soil samples from each off-site boring and up to four soil samples from each on-site boring, for a total of up to 28 soil samples (plus quality assurance/quality control [QA/QC] samples) for laboratory analysis.
- Collect two soil samples for treatability parameters, one from within the observed petroleum plume and one downgradient of the plume.

Monitoring Well Installation and Sampling

- Install and develop four off-site and four on-site permanent monitoring wells.
- Collect one groundwater sample from each newly installed on- and off-site monitoring well plus one groundwater sample from each of the three existing on-site monitoring wells (plus QA/QC samples) for laboratory analysis.
- Survey and gauge monitoring wells to establish groundwater elevations and evaluate flow direction.
- Develop a groundwater contour map.

Soil Vapor and Ambient Air Sampling

- Install four soil vapor points about two feet above the water table.
- Collect 1 vapor sample from each vapor point and one ambient air sample for laboratory analysis

Modifications to this scope of work may be required: 1) due to site operations, equipment or other access restrictions; 2) in the event that unexpected contamination is detected and additional analytical data is needed; and 3) to attempt to confirm that impacts are adequately characterized and delineated in compliance with the Brownfield Law, regulations and applicable investigation guidance documents (e.g., DER-10). NYSDEC and NYSDOH will be contacted to obtain approval for any significant modifications.

The field investigation will be completed in accordance with NYSDEC DER-10 Guidance and the procedures specified in the Health and Safety Plan (HASP) and Quality Assurance Project Plan (QAPP) included as Appendices B and C, respectively. A Community Air Monitoring Plan (CAMP) will be implemented during this investigation (see Section 3.7.2 and Appendix B).

The names, contact information and roles of the principal personnel who will participate in the investigation, project managers, and subcontractors are listed below. The HASP contains emergency contact information and a map with a route to the nearest hospital. Resumes for Langan employees involved in the project are included in the QAPP (Appendix C).

Personnel	Investigation Role	Contact Information
Michael Burke, P.G., CHMM Langan	Qualified Environmental Professional	Phone – 212-479-5400 Email – mburke@langan.com
Jason Hayes, PE	New York State Licensed Professional Engineer	Phone – 212-479-5427 Email – jahayes@langan.com
Paul McMahon, P.E. Langan	Senior Project Manager	Phone – 212-479-5400 Email – pmcmahon@langan.com
Tony Moffa, CHMM Langan	Langan Health & Safety Officer	Phone – 215-491-6500 Email – tmoffa@langan.com
William Bohrer, P.G. Langan	Field Safety Officer	Phone – 212-479-5400 Email – wbohrer@langan.com
Ilkay Cam-Spanos Langan	Quality Assurance Officer	Phone – 212-479-5400 Email – icam@langan.com
Elizabeth Adkins Langan	Field Team Leader	Phone – 212-479-5400 Email – eadkins@langan.com
Ben Rao Alpha Analytical	Laboratory Subcontractor	Phone – 201-847-9100 Email – brao@alphalab.com
Emily Strake, CEP Langan	Program Quality Assurance Monitor/ Data Validator	Phone – 215-491-6500 Email – estrake@langan.com

3.1 Geophysical Survey

We will coordinate with a geophysical contractor to clear subsurface testing locations of potential subsurface utilities and locate any USTs. The geophysical survey will be completed using a collection of geophysical instruments, including electromagnetic and utility line locator instruments and ground-penetrating radar (GPR). Borings will be relocated as necessary to avoid subsurface utilities, infrastructure, or other impediments identified during the survey.

3.2 Soil Investigation

3.2.1 Drilling and Logging

An environmental drilling subcontractor will advance nine soil borings (designated EB04 through EB12) to investigate the AOCs identified in Section 2.5. A plan showing the proposed boring locations is included as Figure 7. A Langan engineer, geologist or scientist will document the work, screen the soil samples for environmental impacts, and collect environmental samples for laboratory analyses. Work will comply with the safety guidelines outlined in the HASP (Appendix D).

Soil borings EB04 through EB12 will be advanced to about 24 feet bgs or the termination of petroleum impacts (whichever is deeper) using direct-push drilling technology (Geoprobe®). Soil will be screened continuously to the boring termination depth with a PID equipped with a 10.6 electron volt (eV) bulb and for visual and olfactory evidence of environmental impacts (e.g., staining and odors). Soil descriptions will be recorded in a field boring log. Boring logs will be presented in the Remedial Investigation Report (RIR).

3.2.2 Soil Sampling and Analysis

Soil samples will be collected for laboratory analysis from each boring location to further investigate AOCs and to provide horizontal and vertical delineation of identified impacts.

Up to four grab soil samples will be collected for laboratory analysis from soil borings EB04 through EB08. The existing ground cover consists of about 6 inches of gravel overlying historic fill. The existing gravel cover will not be sampled separately. To investigate AOC 1 and near-surface soil conditions, one sample will be collected from the 6- to 30-inch bgs interval. The second sample will be collected from the native soil interval directly beneath historic fill to delineate the vertical extent of historic fill. To investigate AOCs 2 and 3, a third sample will be collected from the interval exhibiting the greatest degree of petroleum impacts or the groundwater interface. A fourth sample will be collected from the first underlying depth interval without evidence of petroleum impacts.

To investigate off-site impacts associated with AOC 3, two grab soil samples will be collected for laboratory analysis from soil borings EB09 through EB12. One sample will be collected from the interval exhibiting the greatest degree of impacts (based on the presence of staining, odors, and/or PID readings above background) or the groundwater interface. A second sample will be collected from the first underlying depth interval without evidence of impacts.

The proposed soil samples are summarized in Table 1. Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox® and water.

The samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in an ice-chilled cooler (to attempt to maintain a temperature of about 4°C) for delivery to a NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratory.

Soil samples collected to investigate AOC 1 (historic fill and native soil beneath historic fill) will be analyzed using the latest United States Environmental Protection Agency (USEPA) methods as follows:

- Part 375 List and Target Compound List (TCL) VOCs by USEPA methods 8260C/5035
- Part 375 List and TCL SVOCs by USEPA method 8270D
- Part 375 List PCBs by USEPA method 8082A
- Part 375 List pesticides and herbicides by USEPA methods 8081B and 8151A, respectively
- Part 375 List and Target Analyte List (TAL) metals (including cyanide and hexavalent chromium) by USEPA Methods 6010C/7471B/9010C/7196A.
- NYSDEC List PFAS by USEPA Method 537M
- 1,4-dioxane by USEPA Method 8270D with SIM isotope dilution if concentrations indicate it is necessary

Soil samples collected to investigate AOCs 2 and 3 (greatest degree of impacts/groundwater interface and clean endpoint) will be analyzed using the latest USEPA methods as follows:

- Part 375 List and TCL VOCs by USEPA methods 8260C/5035
- Part 375 List and TCL SVOCs by USEPA method 8270D

Additionally, two soil samples will be collected from two soil boring locations for assessment of in-situ remedial design parameters. One sample will be collected from a soil boring within the observed petroleum plume and one sample will be collected from a soil boring down-gradient of the petroleum plume. These soil samples will be analyzed for the following parameters:

- Part 375 List and TCL VOCs
- Nitrite
- Nitrate
- Ammonia
- Sulfate
- Phosphate
- Iron

- Manganese
- Total organic carbon (TOC)
- Biologic oxygen demand (BOD)
- Chemical oxygen demand (COD)
- Alkalinity

3.3 Groundwater Investigation

3.3.1 Monitoring Well Installation

Four on-site and four off-site soil borings will be converted to permanent groundwater monitoring wells. A plan showing the proposed well locations is included as Figure 7. Wells will be installed across the observed water table and will be constructed with 2-inch diameter, threaded, flush-joint, polyvinyl chloride (PVC) casing and 0.01-inch slot well screens (about 10 feet in length). Clean sand will be used to backfill the annulus around the screen to about two feet above the top of the screened interval. A two-foot bentonite seal will be installed above the sand and the borehole annulus will be grouted to the surface. The wells will be finished with locking well caps, protective cases, and flush-mounted steel manhole covers.

Following installation, the on-site wells will be developed using a surge block across the well screen to agitate and remove fines entrained within the sampling zone. The surge block will be moved within the well screen in 2- to 3-foot increments for approximately 2 minutes per increment. After surging, the well will be purged via pumping until the water becomes clear (having turbidity less than 50 Nephelometric Turbidity Units [NTU]). The well will then be allowed to sit for a minimum of one week prior to collecting groundwater samples. The existing on-site wells (MW01 through MW03) will also be sampled during the RI.

3.3.2 Monitoring Well Survey

The location and elevation of the groundwater monitoring wells (top of casing elevations) will be surveyed. This data will be used with the groundwater well gauging data to prepare a groundwater contour map to evaluate the direction of groundwater flow. Vertical control will be established by surveying performed relative to the NAVD88 datum by a New York State-licensed land surveyor. Elevations of the top of monitoring well casings and protective well casings will be surveyed to the nearest 0.01 foot.

3.3.3 Groundwater Sampling and Analysis

One groundwater sample will be collected from each of the eleven wells, as summarized in Table 1. Prior to sampling, the monitoring wells will be gauged for static water levels and purged.

Purging will consist of pumping, at a minimum, the stabilized drawdown volume plus the pump's tubing volume, and waiting until the physical and chemical parameters (e.g., temperature, dissolved oxygen, oxygen reduction potential, turbidity) stabilize within the ranges specified in the USEPA's Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells, dated July 30, 1996, and 4th revision September 19, 2017. Samples will be collected with a peristaltic pump and dedicated high density polyethylene tubing. Development and purge water will be containerized for off-site disposal.

The groundwater samples will be collected in laboratory-supplied containers and will be sealed, labeled, and placed in an ice-chilled cooler (to maintain a temperature of about 4°C) for delivery to the laboratory. Groundwater samples from newly installed on-site monitoring wells, MW04 through MW07 will be analyzed using the latest USEPA methods as follows:

- Part 375/TCL VOCs by USEPA method 8260C
- Part 375/TCL SVOCs by USEPA method 8270D
- Part 375/TCL PCBs by USEPA method 8082A
- Part 375/TAL Metals (filtered and unfiltered) by USEPA method 6010C/7470
- Part 375/TCL Pesticides and herbicides by USEPA methods 8081B and 8151A, respectively
- NYSDEC List PFAS by USEPA Method 537
- 1,4-dioxane by USEPA Method 8270 SIM isotope dilution

Groundwater samples collected from newly installed off-site monitoring wells MW09 through MW12 and existing on-site monitoring wells MW01 through MW03 will be analyzed using the latest USEPA methods as follows:

- Part 375/TCL VOCs by USEPA method 8260C
- Part 375/TCL SVOCs by USEPA method 8270D

A list of the emerging contaminants (1,4-dioxane and PFAS) for groundwater samples is provided in Table 2. QA/QC procedures to be followed are described in the QAPP in Appendix C.

3.4 Soil Vapor Investigation

3.4.1 Soil Vapor Point Installation

Three soil vapor points will be installed using direct-push technology in accordance with the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October 2006, updated May 2017). A plan showing the proposed soil vapor locations is included as Figure 7. Soil vapor points will be installed by advancing a vapor probe to 2 feet above the

groundwater table (about 9 feet bgs). The soil vapor collection points will consist of inert sample tubing (i.e., polyethylene) attached to a 1.875-inch polyethylene implant, to be installed at the sampling depth. The annulus (i.e., the sampling zone) around the installed implants will be filled with a clean, coarse sand pack followed by a hydrated bentonite seal to surface grade.

3.4.2 Soil Vapor Sampling and Analysis

Samples will be collected in general accordance with the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October 2006). The proposed vapor samples are summarized in Table 1. Before collecting vapor samples, a minimum of three vapor probe volumes (i.e., the volume of the sample implant and tubing) will be purged from each sample point at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE® meter. Purged soil vapor will be monitored for VOCs with the MultiRAE® during this process.

A helium tracer gas will be used in accordance with NYSDOH protocols to serve as a QA/QC technique to document the integrity of each soil vapor sampling point seal before and after sampling. The tracer gas will be introduced into a container surrounding the vapor point and seal. Helium will be measured from the sampling tube and inside the container. If the sample tubing contains more than 10% of the tracer gas concentration that was introduced into the container, then the seal is considered compromised and should be enhanced or reconstructed to reduce outside air infiltration.

After the integrity of each seal is confirmed, soil vapor samples will be collected into laboratory-supplied, batch-certified clean 2.7- or 6-liter Summa® canisters with calibrated flow controllers. Soil vapor samples will be collected over a 2-hour sampling period. All vapor samples will be analyzed for VOCs by USEPA Method TO-15.

A log sheet for each soil vapor sample will be completed to record sample identification, date and time of sample collection, sampling depth, name of the field personnel responsible for sampling, sampling methods and equipment, vapor purge volumes, volume of vapor extracted, flow rate, and vacuum of canisters before and after sample collection.

3.4.3 Ambient Air Sampling

An ambient air sample will be collected at a height above the ground to represent the breathing zone (about 3 to 5 feet). The ambient air sample will be collected concurrently with the soil vapor samples into a laboratory-supplied, batch-certified clean 2.7- or 6-liter Summa® canister with calibrated flow controller over a 2-hour sampling period. The sample will be analyzed for VOCs by USEPA TO-15 to evaluate potential outdoor air interferences with the sampling apparatus.

QA/QC procedures to be followed are described in the QAPP in Appendix C.

3.5 Data Management and Validation

Laboratory analyses of soil, groundwater, vapor, and air samples will be conducted by a NYSDOH ELAP-approved laboratory in accordance with USEPA SW-846 methods and NYSDEC Analytical Services Protocol (ASP) Category B deliverable format. Environmental data will be reported electronically using the database software application EQuIS as part of NYSDEC's Environmental Information Management System (EIMS).

Table 1 summarizes the proposed samples and laboratory analyses. QA/QC procedures required by the NYSDEC ASP and SW-846 methods, including initial and continuing instrument calibrations, standard compound spikes, surrogate compound spikes, and analysis of other samples (blanks, laboratory control samples, and matrix spikes/matrix spike duplicates), will be followed. The laboratory will provide sample bottles, which will be pre-cleaned and preserved in accordance with the SW-846 methods. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP shall take precedence.

Data validation will be performed in accordance with the USEPA validation guidelines for organic and inorganic data review. Validation will include the following:

- Verification of QC sample results (both qualitative and quantitative);
- Verification of sample results (both positive hits and non-detects);
- Recalculation of 10 percent of all investigative sample results; and
- Preparation of Data Usability Summary Reports (DUSR).

The DUSRs will be prepared and reviewed by the Program Quality Assurance Monitor. The DUSRs will present 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. A detailed assessment of each sample delivery group will follow. Additional details on the DUSRs are provided in the QAPP in Appendix C.

3.6 Management of Investigation-Derived Waste

Soil cuttings will be returned to the borehole unless:

- Free product or grossly-contaminated soil is present in the cuttings;
- Backfilling the borehole with cuttings will create a significant path for vertical movement of contaminants, in which case soil additives (bentonite) may be added to the cuttings to reduce permeability; and
- The soil cannot fit into the borehole.

Boreholes requiring disposal of drill cuttings will be filled with hydrated bentonite chips or clean sand and capped with asphalt or concrete. Excess investigation-derived waste (IDW), including soil cuttings, purged groundwater, and decontamination fluids, will be containerized in properly-labeled and sealed United Nations/Department of Transportation (UN/DOT)-approved 55-gallon drums and staged for future waste characterization and off-site disposal at a facility permitted to accept the waste. The drums will be staged in an area on-site, pending receipt of laboratory data and then will be disposed of off-site at an appropriate facility. The site will be secured during and after the investigation to prevent public access to the site.

3.7 Air Monitoring

Air monitoring will be conducted for site workers and the community (CAMP) during ground-intrusive field activities. Air monitoring results will be recorded in the field book during the investigation activities, downloaded from field instruments, and summarized in daily reports.

3.7.1 Worker Air Monitoring

Air monitoring of the breathing zone will be performed periodically during drilling and sampling activities to document health and safety protection for the work team. We will monitor VOCs with a PID in accordance with the HASP (Appendix D). If air monitoring during intrusive operations identifies the presence of VOCs, the field engineer will follow the guidelines outlined in the HASP regarding action levels, permissible exposure, engineering controls, and personal protective equipment. If the VOC action level is exceeded, work will cease and the work location will be evacuated. Monitoring will continue until the levels drops to permissible limits, at which point, work will resume with continued monitoring. If high levels persist, field activities will be halted and the work relocated to another area. If dust emissions are observed, work will stop and dust suppression measures (i.e., water spray) will be implemented.

3.7.2 Community Air Monitoring Plan

In addition to air monitoring in the worker breathing zone, community air monitoring will be performed in compliance with the NYSDOH Generic CAMP during any outdoor intrusive work. The CAMP is included in Appendix B and summarized below.

CAMP will consist of continuous monitoring for VOCs and dust emissions during ground-intrusive activities (i.e., soil boring, monitoring well, and soil vapor point installation). Upwind concentrations will be measured at the start of each workday, and periodically thereafter, to establish background concentrations. VOCs and dust emissions will be monitored at the downwind perimeter of the work zone, which will be established at a point on the site where the general public or site employees may be present. VOC Monitoring will be conducted with a PID equipped with a 10.6 eV lamp. VOC community air monitoring requirements will be conducted

until it is determined that the site is not a source of organic vapors. Dust emissions will be monitored using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM10) and capable of averaging a period of 15 minutes (or less) for comparison to the airborne particulate action level (e.g., DustTrak). If dust emissions are observed, work will stop and dust suppression measures will be used. The results will be presented in the daily reports (see DER-10 for details).

3.8 Qualitative Human Health Exposure Assessment

A Qualitative Human Health Exposure Assessment (QHHEA) will be conducted in accordance with Appendix 3B of the NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation. The assessment will be submitted in the RIR.

4.0 REPORTING

4.1 Remedial Investigation Report (RIR)

Following completion of the RI and receipt of analytical data, a Remedial Investigation Report (RIR) will be prepared. The report will include:

- A summary of the site history and previous investigations,
- A description of on- and off-site conditions,
- Sampling methodology and field observations,
- An evaluation of the results and findings, and
- Conclusions and recommendations for any further assessment (if warranted), and remedial action objectives.

The report will summarize the nature and extent of contamination at each area of concern and identify unacceptable exposure pathways (as determined through a QHHEA).

The report will include soil boring, monitoring well and soil vapor point construction logs, sampling logs, tabulated analytical results, figures, and laboratory data packages. The tabulated analytical results will include sample location, media sampled, sample depth, field/laboratory identification numbers, analytical results and the applicable Standards, Criteria, and Guidance (SCG) pertaining to the site and contaminants of concern for comparison. The report will include scaled figures showing the locations of soil borings, monitoring wells, and soil vapor points, sample concentrations above SCGs for each media, groundwater elevation contours and flow direction, and, if appropriate, groundwater contaminant concentration contours.

4.2 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers for each day of field work. The daily reports will be submitted the following day and will include:

- An update of progress made during the reporting day
- Locations of work and quantities of material imported and exported from the site
- References to alpha-numeric map for site activities
- A summary of any and all complaints with relevant details (names, phone numbers)
- A summary of CAMP findings, including exceedances
- An explanation of notable site conditions

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RIWP or other sensitive or time critical information. However, such conditions will also be included in the daily reports. Emergency conditions and changes to the RIWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily Reports will include a description of daily activities keyed to a map for the site that identifies work areas. These reports will include a summary of CAMP results, odor and dust problems and corrective actions, and all complaints received from the public.

The NYSDEC-assigned BCP Site number will appear on all reports.

4.3 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers by the 10th of each month and will include:

- Activities relative to the site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e. tons of material exported and imported, etc.)
- Description of approved activity modifications, including changes of work scope and/or schedule
- Sampling results received following internal data review and validation, as applicable
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays

4.4 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital format. Photos will illustrate remedial program elements and will be of acceptable quality. Representative photos will be provided of each contaminant source, source area and site structures before, during, and after remediation. Photos will be included in the daily reports as needed and a comprehensive collection of photos will be included in the Final Engineering Report.

Job-site record keeping for all investigatory and remedial work will be appropriately documented. These records will be maintained on-site at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

5.0 SCHEDULE

The table on the following page presents an anticipated schedule for the proposed RI and reporting. Following the approval of the RIWP and prior to the start of RI field work, bid packages, bid awarding, and subcontractor coordination will be conducted to schedule the field work. Field work will begin within 4 months following the approval of the RIWP. The schedule for field work and preparation/submission of the draft RIR is outlined below. If the schedule changes, it will be updated and submitted to the NYSDEC.

Activity	Month								
	1	2	3	4	5	6	7	8	9
Perform Geophysical Survey									
Install Soil Borings and Collect Soil Samples									
Install Soil Vapor Points									
Collect Soil Vapor and Ambient Air Samples									
Install Monitoring Wells									
Collect Groundwater Samples, Gauge and Survey Wells									
Receipt of Laboratory Results									
Data Validation									
Preparation and Submission of RIR									