DRAFT REMEDIAL ACTION WORK PLAN

for

250 WATER STREET
New York, New York
NYSDEC BCP No.: C231127

Prepared for:

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LANGAN

CERTIFICATION

I, Jason J. Hayes, certify that I am currently a New York State (NYS) registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

NYS Professional Engineer #089491	Date	Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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LIST OF ACRONYMS

Acronym	Definition
Alpha	Alpha Analytical, Inc.
ALTA	American Land Title Association
AOC	Area of Concern
ASTM	ASTM International
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
bgs	Below grade surface
BMP	Best Management Practices
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
C&D	Construction and Demolition
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
COC	Contaminants of Concern
COD	Chemical Oxygen Demand
CQAP	Construction Quality Assurance Plan
CSM	Conceptual Site Model
CVOC	Chlorinated Volatile Organic Compounds
DER	Division of Environmental Remediation
DRO	Diesel Range Organic
DUSR	Data Usability Summary Report
EC	Engineering Control
EDD	Electronic Data Deliverable
el	Elevation
ELAP	Environmental Laboratory Approval Program
En-Zone	Environmental Zone
EPC	Exposure Point Concentration
ESA	Environmental Site Assessment
ESI	Environmental Site Investigation
Eurofins	Eurofins Lancaster Laboratories Environmental, Inc.
eV	Electron Volt
FEMA	Federal Emergency Management Agency
FER	Final Engineering Report
FWRIA	Fish and Wildlife Resources Impact Analysis
GPR	Ground Penetrating Radar
GRO	Gasoline Range Organics
HASP	Health and Safety Plan

Acronym	Definition
HDPE	High-Density Polyethylene
HRG	Hager-Richter Geoscience, Inc.
IC	Institutional Control
Langan	Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
mg/kg	Milligram per kilogram
mg/l	Milligram per liter
NSPS	National Society of Professional Surveyors
NYCDCP	New York City Department of City Planning
NYCDEP	New York City Department of Environmental Protection
NYCDOB	New York City Department of Buildings
NYCDOT	New York City Department of Transportation
NYCOER	New York City Mayor's Office of Environmental Remediation
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
PAOC	Potential Area of Concern
PBS	Petroleum Bulk Storage
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene/Tetrachloroethylene
PE	Professional Engineer
PFAS	Per- and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
PGW	Protection of Groundwater
PID	Photoionization Detector
PM10	Particulate matter less than 10 micrometers in diameter
PPE	Personal Protective Equipment
ppm	Parts per million
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCA	Recycled Concrete Aggregate
RE	Remediation Engineer
REC	Recognized Environmental Condition
RI	Remedial Investigation
RIR	Remedial Investigation Report

Acronym	Definition
RIWP	Remedial Investigation Work Plan
RR	Restricted Use – Restricted Residential
SBS	Small Business Services
SCG	Standards, Criteria, and Guidance
SCO	Soil Cleanup Objective
SGV	Standards and Guidance Values
the Site	250 Water Street, New York, New York
SFMP	Soil/Fill Management Plan
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SVOC	Semivolatile Organic Compound
SWPPP	Stormwater Pollution Prevention Plan
TAL	Target Analyte List
TCL	Target Compound List
TCE	Trichloroethene/Trichloroethylene
TOC	Total Organic Carbon
TOGS	Technical and Operational Guidance Series
TOV	Total Organic Vapor
TPH	Total Petroleum Hydrocarbons
UIR	Underground Injection/Recirculation
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
UU	Unrestricted Use
VOC	Volatile Organic Compound
The Volunteer	250 Seaport District, LLC
XRF	X-ray Fluorescence
$\mu g/m^3$	Micrograms per cubic meter

EXECUTIVE SUMMARY

250 Seaport District, LLC is a Volunteer in the New York State Brownfield Cleanup Program (BCP) and is responsible for the investigation and remediation of the property located at 250 Water Street, New York, New York (the site). The Brownfield Cleanup Agreement (BCA) was fully executed on 1 August 2019 (Index No. C231127-04-19) and BCP Site No. C231127 was assigned. One multi-story mixed-use building with one cellar level that encompasses the site footprint is planned. The proposed uses of each floor are still in the early planning stages; however, the proposed building would likely house a parking garage, utility rooms, storage areas, locker rooms, and property operations offices in the cellar, with commercial and residential spaces on the floors above.

This Remedial Action Work Plan (RAWP) identifies and evaluates remedial action alternatives and presents a recommendation for a Track 2 remedy. The proposed remedy was developed based on data gathered during the 2020 Remedial Investigation (RI) by Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan). The remedy described in this document is consistent with the procedures defined in the New York State Department of Environmental Conservation (NYSDEC) Program Policy DER-10: Technical Guide for Site Investigation and Remediation (DER-10) and complies with applicable federal, state, and local laws, regulations, and requirements.

Site Description/Physical Setting/Site History

The site is located at 250 Water Street in the South Street Seaport neighborhood of New York, New York (Block 98, Lot 1 on the Borough of Manhattan tax map) and is about 48,057 square feet (±1.10 acres) in area. The site occupies the entire city block bordered by Pearl Street to the northwest (project north), Peck Slip to the northeast (project east), Water Street to the southeast (project south), and Beekman Street to the southwest (project west). It is used as an open-air, asphalt-covered commercial parking lot; a parking attendant kiosk and temporary storage shed are located near the center of the lot. The perimeter of the site is fenced with one automated barrier ingress/egress gate on Pearl Street.

The "project north" is perpendicular with Water Street and points towards Pearl Street. All directions described herein are referenced to the project north arrow unless otherwise noted.

The site was historically operated with various types of factories (about 1894 and 1927 to 1954), an oil company (about 1920 to 1927), a printer (about 1920 to 1927 and 1950), metal works (about 1923 to 1927), a chemicals and glue company (about 1927), a chemical company (about 1923), a thermometer factory and workshop (about 1833 to 1927), a machine shop (about 1950), and a gasoline service station (about 1953). A garage with two 550-gallon underground storage tanks (UST) was located along Peck Slip from about 1950 to 1996.

Summary of the Remedial Investigation

The findings and conclusions of the RI are as follows:

1. Stratigraphy: Site stratigraphy consists of historic fill underlain by sand with varying amounts of silt, gravel and clay. Historic fill, characterized as grey to brown fine sand with varying proportions of silt, gravel, brick, concrete, wood, ceramic, and coal, was encountered to depths ranging from about 5 to 17 feet below grade surface (bgs). Bedrock was not encountered and is expected to be about 125 feet bgs. The historical shoreline ran through the center of the site, parallel with Water and Pearl Streets.
2. Hydrogeology: Groundwater was observed at elevations in reference to the North American Vertical Datum of 1988 (NAV88) ranging from about -0.65 to -1.10 (about 15.5 to 8.9 feet bgs) during the RI. The groundwater flow direction is to the southeast. Based on the results collected from pressure transducers, groundwater does not appear to be significantly tidally influenced. The tidal cycle fluctuation is about ±0.1 feet.
3. Historic Fill: Historic fill was encountered in all soil borings beneath the asphalt cover to depths ranging from about 5 to 17 feet bgs. Historic fill impacts include semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals in soil at concentrations above Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 Unrestricted Use (UU), Protection of Groundwater (PGW), and/or Restricted Use Restricted-Residential (RURR) Soil Cleanup Objectives (SCO).
4. Petroleum and Tar Impacts: Petroleum- and tar-related impacts, as evidenced by field observations and/or analytical data, were identified and are attributed to the potential USTs and associated open spill, historical site uses, and treated timber pile/cribbing.
    a. Petroleum impacts attributed to the open spill (Spill No. 1507371) were identified in the southeastern part of the site. An anomaly indicative of four USTs was identified in this area. Field observations within the capillary fringe and below the groundwater interface include petroleum-like odor, staining and/or photoionization detector (PID) readings above background. Petroleum-related volatile organic compounds (VOC) and/or SVOC were detected in soil samples at concentrations above UU, PGW, and/or RURR SCOs and in groundwater samples at concentrations above NYSDEC Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs). Petroleum-related VOCs were also detected in all soil vapor samples, with the highest benzene, toluene, ethylbenzene, and xylenes (BTEX) concentration in the southeastern part of the site in soil vapor sample SV32.
    b. Petroleum impacts attributed to the historical site use as an oil company and garage with two 550-gallon USTs were identified in soil borings and monitoring

wells in the northeastern part of the site. Field observations in unsaturated soil, the capillary fringe, and below the groundwater interface include petroleum-like odor, staining and PID readings above background. Petroleum-related VOCs and/or SVOCs were detected in soil samples at concentrations above UU and/or RURR SCOs and in groundwater samples at concentrations above SGVs. Petroleum-related VOCs were detected in soil vapor samples in this area.

c. Creosote impacts attributed to treated timber piles or cribbing were identified in soil borings and a monitoring well in the southern and central parts of the site. Wood/timber was observed in several soil borings. Field observations within the capillary fringe and below the groundwater interface include tar-like odor, staining and/or PID readings above background were observed in soil borings. No petroleum-related VOCs and SVOCs were detected above UU SCOs in the soil borings. One petroleum-related VOC was detected at concentrations above the NYSDEC SGV in temporary monitoring well MW03 in the southcentral part of the site. Petroleum/creosote-related VOCs were detected in soil vapor samples in this area of the site.

5. Mercury Impacts Related to Historical Site Uses: Mercury impacts to soil related to historical site use, including a thermometer factory and three additional thermometer factories/workshops, were identified. The highest mercury concentrations in soil were detected primarily within the historical fill layer in and around the former thermometer factory located at 302 Pearl Street (mercury-impacted hotspot) and, to a lesser extent, within the three additional thermometer factories/workshops. Mercury detections outside of these areas are most likely associated with the quality of historic fill at the site. The major mercury species identified were mercury salts. Elemental mercury made up 0.01% to 10.87% of the total mercury concentrations in speciated samples. Mercury was not detected in groundwater samples. Mercury vapor was not detected in on-site soil vapor samples; however mercury vapor was detected in soil vapor samples collected from 15 feet below the Pearl Street sidewalk adjoining the site at concentrations of 0.222 micrograms per cubic meter ($\mu g/m^3$) in SV39 and 0.271 $\mu g/m^3$ in SV38. The source of mercury contamination in soil is likely from the use of mercury-impacted building materials used as backfill within the historic fill layer in and around the former factory/workshop footprints.

6. PCB Impacts Related to Historical Site Uses: PCB-impacted soil was identified and may be related to historical site uses. PCB impacts to soil were observed primarily within the historical fill layer in and around the former oil company in the northeastern part of the site and the former oil company and factory on the western part of the site.

7. CVOC in Soil Vapor: The soil vapor samples collected at the site contained tetrachloroethene (PCE) and trichloroethene (TCE). Soil vapor samples from the center of the site and from near the northeastern corner of the site contained the highest concentrations of Chlorinated VOCs (CVOC). CVOCs were detected in soil and groundwater samples below regulatory criteria. A site source of CVOCs was not identified.
8. PFAS in Soil and Groundwater: Per- and polyfluoroalkyl substances (PFAS) -impacted soil and groundwater was identified at the site. No historical use consistent with PFAS use was identified. Based on the evaluation of the soil guidance values, per NYSDECs PFAS guidance document, no site source of PFAS was identified.
9. Sufficient analytical data were gathered during the RI to determine cleanup objectives and to develop a remedy for the site. The remedy is described and evaluated in this RAWP was prepared in accordance with New York State BCP guidelines. The remedy will address impacts to soil, groundwater, and soil vapor described in the RIR.

Qualitative Human Health Exposure Assessment

Complete exposure pathways have the following five elements: (1) a contaminant source; (2) a contaminant release and transport mechanism; (3) a point of exposure; (4) a route of exposure; and (5) a receptor population. A discussion of the five elements comprising a complete pathway as they pertain to the site is provided below.

Current Conditions

Under current conditions contaminant sources include 1) historic fill with varying levels of SVOCs, pesticides, PCBs, and metals; 2) an on-site spill resulting in petroleum-impacted soil, groundwater and soil vapor; 3) historical site uses, including thermometer factory/workshops and oil companies/factories, resulting in mercury-impacted soil and VOC- and PCB-impacted soil, respectively, 4) Unidentified historical on- or off-site uses that may have contributed to the presence of PFAS in soil and groundwater, and 5) historical uses of the adjacent and surrounding sites that may have contributed CVOCs impacts to soil vapor.

Contaminant release and transport mechanisms from the sources above include contaminated soil transported as dust, or overland flow in areas of exposed soil, contaminated groundwater flow and volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase, and transport of existing soil vapor contaminants.

Under the current site conditions, the likelihood of exposure to humans is limited because the points of exposure are controlled by the sites impervious surface, the fact that potable water is obtained from an off-site source, and on-site accumulation sources of soil vapor (i.e., buildings, excluding the parking lot kiosk) are not present. CAMP action levels were not exceeded during

the RI and sinkhole repairs. Subsurface investigations, where exposure to humans is more likely, were conducted in accordance with the Remedial Investigation Work Plan (RIWP) and a Health and Safety Plan (HASP) to minimize exposure risk. The use of personal protective equipment (PPE) and other controls, including CAMP and vapor mitigation and dust suppression measures, will mitigate potential exposure pathways to site workers performing subsurface repairs.

As described in section 2.7, there is no complete exposure pathway for mercury vapor under current conditions. Vapor accumulation within the parking lot kiosk is possible; however, the kiosk is not a continuously occupied space and has a loose building envelope (i.e. well ventilated).

Construction/Remediation Activities

During remediation and/or development, sources of contamination are the same as under the current conditions; however, the points of exposures change due to disturbed and exposed soil during excavation, dust and organic vapors generated during excavation, and contaminated groundwater that may be encountered during excavation and/or localized dewatering operations.

Routes of exposure include ingestion and dermal absorption of contaminated soil and groundwater, inhalation of organic vapors volatilizing from contaminated soil and groundwater (specifically in the areas of petroleum impacts) or impacted vapors already in the vadose zone from an off-site source, and inhalation of dust arising from contaminated soil. The receptor population includes construction and remediation workers, authorized visitors to the site, and the public adjacent to the site.

The implementation of appropriate health and safety measures during construction and remediation, such as air monitoring, using vapor and dust suppression measures, cleaning trucks prior to exiting the site to prevent off-site soil tracking, maintaining site security, and wearing the appropriate PPE will mitigate potential exposure pathways during remediation and/or development.

In accordance with the RAWP, which includes a CHASP, Soil/Fill Management Plan (SFMP), and a CAMP, measures such as conducting an air-monitoring program, donning PPE, covering soil stockpiles, altering work sequencing, maintaining a secure construction entrance, proper housekeeping, and applying vapor and dust suppression measures to prevent off-site migration of contaminants during construction will be implemented to prevent completion of these potential on- and off-site exposure pathways.

P*roposed Future Conditions*

Residual contaminants may remain on-site, depending on the remedy, and will, to a lesser extent, include those listed under current conditions. Contaminant release and transport mechanisms include contaminated soil transported as dust, contaminated groundwater flow and volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase, and transport

of existing soil vapor contaminants. However, a composite cover system (e.g., concrete building foundations and asphalt paving) will be installed, which will eliminate exposure to remaining potentially contaminated soil and groundwater in New York City is not used as a potable water. The use of Institutional Controls (IC) and/or Engineering Controls (EC) will mitigate points of potential exposure, including potential cracks in the foundation or slab of the proposed development and exposure during any future soil-disturbing activities. Routes of exposure include inhalation of vapors entering the building and direct contact with residual impacted soil during future soil-disturbing activities. The receptor population includes the building occupants and employees, visitors, maintenance workers, and the nearby community, including sensitive receptors. The possible routes of exposure can be addressed or mitigated by proper installation of soil vapor mitigation measures (i.e., sub-slab depressurization system), construction and maintenance of a site cover system (i.e., concrete foundation with a waterproofing/vapor barrier membrane) and implementation of a Site Management Plan (SMP) to manage institutional and engineering controls, if residual contamination is left in place. A soil vapor evaluation that may include sampling would be conducted after building construction.

The potential off-site migration of site contaminants in soil and groundwater is not expected to result in a complete exposure pathway. The potential for off-site migration of site contaminates will be addressed by the removal of the source material in soil and groundwater and/or mitigated by the use of ICs and ECs described above. The potential off-site migration of site contaminants in soil vapor is not an exposure concern.

Human Health Exposure Assessment Conclusions

1. Human exposure to site contaminants is controlled under current conditions on the site because the site is entirely covered by asphalt, groundwater is not potable and there are no on-site accumulation sources of soil vapor (i.e., buildings). There is no exposure risk to mercury vapor under the current conditions. The primary exposure pathways are for dermal contact, ingestion, and inhalation of soil, soil vapor, and/or groundwater by site investigation or repair workers. The exposure risks can be avoided or minimized by following the appropriate health and safety measures outlined in the site-specific CAMP and HASP during investigation and remedial/ground-intrusive activities and by PPE use by repair workers.
2. In the absence of ICs and ECs, there are potentially complete exposure pathways during construction and remediation activities. The primary exposure pathways are:
    a. Dermal contact, ingestion and/or inhalation of contaminated soil, groundwater and/or soil vapor by construction workers.
    b. Dermal contact, ingestion and inhalation of soil (dust) and inhalation of soil vapor by the community in the vicinity of the site.

These exposure risks can be avoided or mitigated by performing community air monitoring and by following the appropriate health and safety, vapor and dust suppression and site security measures outlined in the RAWP and site-specific CHASP.

3. The existence of a complete exposure pathway for site contaminants to human receptors during proposed future conditions is unlikely, as a significant volume of contaminant sources will be removed from the site through excavation and dewatering/pre-treatment, the building foundation will be constructed at or below the water table and will include a waterproofing/vapor barrier membrane, the lowest level use of the building includes actively ventilated parking, any exposure to remaining soil and groundwater will be controlled with an impermeable cover, regional groundwater is not used as a potable water source and ICs will be in place to maintain ECs at the site.
4. Monitoring and control measures will be used during ground-intrusive activities (i.e. investigation and construction) to prevent community exposure to contaminated dust and vapors.

Summary of the Remedy

A Track 2 remedy is proposed and will include implementation of the following remedial elements:

1) Development and implementation of a CHASP and CAMP for the protection of on-site workers, visitors, and the environment during remediation activities
2) As a pre-requisite to site remediation, removal of the surficial asphalt cover by the contractor and management of removed asphalt as construction and demolition (C&D) debris in accordance with Part 360 and 361 regulations.
3) A remedial design investigation including waste characterization and supplemental delineation
4) Excavation and removal of the mercury-impacted soil/fill hotspot at 302 Peal Street
5) Excavation and removal of historic fill/soil across the site to meet RURR SCOs, including excavation below 15 feet for removal or treatment of grossly contaminated media (i.e. petroleum source material)
6) Decommissioning and removal of USTs, in accordance with NYSDEC DER-10 5.4(b)(5)
7) Appropriate off-site disposal of historic fill and soil removed from the site in accordance with federal, state, and local rules and regulations for handling, transport, and disposal
8) Installation of support of excavation (SOE) necessary to facilitate remedial excavation

9) Dewatering, as necessary, to accommodate remedial excavation and remediation of petroleum-impacted groundwater

10) Screening for indications of contamination source areas during any intrusive site work by visual, olfactory, or instrumental methods

11) Collection and analysis of confirmation soil samples, in accordance with DER-10, at the completion of the remedial excavation to document post-remediation soil quality

12) Import of materials for backfill, where required, in compliance with: a) RURR or PGW SCOs, whichever is more stringent; b) 6 NYCRR Part 360 regulations; and c) federal, state, and local rules and regulations for handling and transport of material

13) Completion of a soil vapor intrusion (SVI) evaluation

14) Recording of an Environmental Easement (EE) to memorialize the remedial action and the institutional controls to ensure that future owners of the site continue to maintain these controls as required

15) Preparation of an SMP that describes management of the ICs – Implementation of the SMP following completion of the remedy will be stipulated by the EE.

1.0 INTRODUCTION

This Remedial Action Work Plan (RAWP) was prepared on behalf of 250 Seaport District, LLC (The Volunteer) for the property located at 250 Water Street in the South Street Seaport neighborhood of New York, New York (the site). The Volunteer was accepted into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) to investigate and remediate the site pursuant to the NYSDEC Brownfield Cleanup Agreement (BCA) executed on 1 August 2019 (Index No. C231127-04-19). BCP Site No. C231127 was assigned to the site.

This RAWP identifies and evaluates remedial action alternatives and presents the preferred Track 2 remedy. The proposed remedy was developed based on data gathered during the Remedial Investigation (RI) completed by Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. (Langan) between June 15 and October 12, 2020. The remedy described in this document is consistent with the procedures defined in the NYSDEC Program Policy DER-10: Technical Guide for Site Investigation and Remediation (DER-10) and complies with applicable federal, state, and local laws, regulations, and requirements.

1.1 Site Location and Description

The site is approximately 48,057 square feet (1.10 acres) in area and is located at 250 Water Street in the South Street Seaport neighborhood of New York, New York (Block 98, Lot 1 on the Borough of Manhattan tax map). The site occupies the entire city block bordered by Pearl Street to the northwest (project north), Peck Slip to the northeast (project east), Water Street to the southeast (project south), and Beekman Street to the southwest (project west). It is used as an open-air, asphalt-covered commercial parking lot; a parking attendant kiosk and temporary storage shed are located near the center of the lot. The perimeter of the site is fenced with one automated barrier ingress/egress gate on Pearl Street.

The "project north" is perpendicular to Water Street and points towards Pearl Street. All directions described herein are referenced to the project north arrow unless otherwise noted. A site location map is provided as Figure 1 and a site plan is provided as Figure 2.

According to the New York City Zoning Map 12b, the site is located in a C6-2A commercial district. The C6-2A district is mapped within the South Street Seaport Subdistrict of the Special Lower Manhattan District. C6 districts allow for a wide range of mixed residential and commercial uses. According to the New York City Landmarks Preservation Commission, the site is located in the South Street Seaport Historic District. A site survey is included in Appendix A.

1.2 Redevelopment Plan

The proposed remedy is intended to make the site protective of human health and the environment consistent with the contemplated end use. The proposed redevelopment plan and end use are described here to provide the basis for this assessment; however, the contemplated remedy may be implemented independent of the proposed redevelopment plan.

The proposed development includes construction of a mixed-use commercial and residential building with one cellar level encompassing the entire site footprint. The proposed uses of each floor are still in the early planning stages; however, the proposed building cellar would likely house a parking garage, utility rooms, storage areas, locker rooms, and property operations offices, with commercial and residential spaces on the floors above. Conceptual cellar plans are included as Appendix B.

1.3 Description of Surrounding Properties

The site is located in an urban setting that is characterized by commercial, institutional, and residential properties. The site is bordered by Pearl Street followed by multiple-story residential buildings (at least one with a first-floor parking garage) known as Southbridge Towers and Bright Beginnings NYC (a preschool and child care facility) to the north, Peck Slip followed by the seven-story Peck Slip School (P.S. 343) building to the east, Water Street followed by multiple five- and six-story residential and commercial buildings and the Blue School Elementary School to the south, and Beekman Street followed by a seven-story residential and commercial building to the west. The following is a summary of surrounding property use:

Direction	Adjoining Properties			Surrounding Properties
	Block	Lot No.	Description	
North, across Pearl Street	94	1	Multiple-story residential buildings (at least one with first-floor parking garage) - Southbridge Towers	Multiple-story residential and commercial buildings, including Bright Beginnings NYC
East, across Peck Slip	106	9	Seven-story institutional building (Peck Slip School - P.S. 343)	Multiple-story residential and commercial buildings

Direction	Adjoining Properties			Surrounding Properties
	Block	Lot No.	Description	
South, across Water Street	97	49, 55, 57, 7501, 7502, and 7505	Blue School Elementary School and multiple five- and six-story residential and commercial buildings	Multiple-story residential and commercial buildings
West, across Beekman Street	95	7501	Seven-story residential and commercial building	Public parkland, multiple-story residential and commercial buildings

Major infrastructure (storm drains, sewers, and underground utility lines) exists within the streets surrounding the site. Land use within a half mile of the site is urbanized and includes mixed-use buildings, subway tunnels, parkland, and school facilities. The closest ecological receptor, the East River, is located about 550 feet south of the site.

Sensitive receptors (as defined in DER-10) located within a half mile of the site are listed below:

Number	Name (Approximate distance from site)	Address
1	The Peck Slip School (approximately 30 feet northeast)	1 Peck Slip New York, NY 10038
2	Blue School (approximately 30 feet southeast)	241 Water Street New York, NY 10038
3	Bright Beginnings NYC (approximately 200 feet northwest)	80 Beekman Street New York, NY 10038
4	St. Margaret's House (approximately 400 feet northwest)	49 Fulton Street New York, NY 10038
5	Smarter Toddler Nursery & Preschool (approximately 700 feet west)	101 John Street New York, NY 10038
6	Kidville FiDi (approximately 700 feet west)	40 Gold Street New York, NY 10038
7	Sitter's Studio (approximately 1,000 feet southwest)	125 Maiden Lane New York, NY 10038
8	Spruce Street School P.S. 397 (approximately 1,100 feet northwest)	8 Spruce Street New York, NY 10038

Number	Name (Approximate distance from site)	Address
9	Murry Bergtraum High School For Business Careers (approximately 1,150 feet north)	411 Pearl Street New York, NY 10038
10	Montessori School of Manhattan (approximately 1,200 feet west)	2 Gold Street New York, NY 10038
11	Downtown Little School (approximately 1,300 feet northwest)	15 Dutch Street New York, NY 10038
12	New York City Housing Authority's Smith Day Care Center (approximately 1,500 feet east)	10 Catherine Slip New York, NY 10038
13	Hamilton-Madison House (approximately 1,700 feet northeast)	50 Madison Street New York, NY 10038
14	Paradigm Kids (approximately 1,700 feet west)	8 Liberty Place, New York, NY 10045
15	Bright Horizons at 20 Pine (approximately 1,700 feet west)	20 Pine Street 1st floor New York, NY 10005
16	Jacob August Riis P.S. 126 (approximately 1,800 feet northeast)	80 Catherine Street, New York, NY, 10038
17	Alfred E Smith P.S. 001 (approximately 2,000 feet northeast)	8 Henry Street New York, NY 10038
18	The Quad Preparatory School (approximately 2,000 feet west)	25 Pine Street New York, NY 10005
19	Mei Wah Day Care Center (approximately 2,100 feet northeast)	69 Madison Street New York, NY 10002
20	Leman Manhattan Preparatory School (approximately 2,300 feet southwest)	41 Broad Street New York, NY 10004
21	High School of Economics & Finance (approximately 2,500 feet northwest)	100 Trinity Place New York, NY 10006
22	Leadership and Public Service High School (approximately 2,500 feet northwest)	90 Trinity Place New York, NY 10006
23	Downtown Dance Factory (approximately 2,600 feet northwest)	291 Broadway 5th Floor New York, NY 10007
24	Preschool of America (approximately 2,600 feet east)	25 Market Street New York, NY 10002
25	Southbridge Towers (approximately 100 feet northwest)	90 Beekman Street New York, NY 10038

Number	Name (Approximate distance from site)	Address
26	The Titus School (approximately 870 feet west)	90 John Street New York, NY 10038
Not Numbered	Other residences on adjoining streets	Beekman Street, Water Street, Pearl Street, Peck Slip

1.4 Environmental History

The site and surrounding area are located in an urban setting historically characterized by residential, commercial, and industrial development. Historical uses of the site include a factory (cast-iron stoves, boilers, radiators, and other unknown uses), an oil company, a printer, a metal works, a chemicals and glue company, a chemical company, thermometer factories/workshops, a garage with two 550-gallon underground storage tanks (USTs), a machine shop, and a gasoline service station.

Historical uses of the site listed below are based on the findings of the September 2015 and June 2018 Phase I Environmental Site Assessments (ESAs) prepared by Langan in accordance with the ASTM standards. Additional historical resources supplemented the site history identified by these documents.

Historical Site Use	Historical Address	Approximate Dates of Occupation
Factories (cast-iron stoves, boilers, radiators, and other unknown uses)	106 to 116 Beekman Street 12 Peck Slip 234 Water Street	1894 and 1927 to 1954
An oil company	306 Pearl Street 254 Water Street 246 Water Street 116 Beekman Street 12 Peck Slip	1920 to 1927
Printers	8-12 Peck Slip	1920 to 1927 and 1950
Metal works	234 Water Street	1923 to 1927
Chemicals and glue company	300 Pearl Street	1927
Chemical company	246 Water Street	1923
Thermometer factory	302 Pearl Street	1868* to 1927
Thermometer factory/workshop*	236 Water Street* 240 Water Street* 298 Pearl Street*	1833* to 1868*
Garage with two 550-gallon USTs	304 to 312 Pearl Street	1950 to 1996
Machine shop	238 Water Street	1950
Gasoline service station	292-294 pearl street	1953

* Historical information was obtained from resources outside of those required by the ASTM E1527-13 Standard for Phase I ESAs.

1.4.1 Previous Environmental Reports

Previous environmental reports were reviewed as part of the RIR and are summarized in chronological order below. Previous environmental reports are included in the draft RIR in Appendix C, and include the following:

- *Phase I Environmental Site Assessment, dated September 2015, prepared by Langan*
- *Phase II Environmental Site Investigation Report, dated November 2015, prepared by Langan*
- *Phase I Environmental Site Assessment, dated June 2018, prepared by Langan*

Phase I Environmental Site Assessment, dated September 2015, prepared by Langan

Langan prepared a Phase I ESA in accordance with the ASTM E-1527-13 standard for the previous owner of the site, Peck Slip Associates, LLC. The following summarizes the recognized environmental conditions (RECs) identified in this Phase I ESA:

- Historical use of the site as a factory, an oil company, a printer, a metal works, a chemicals and glue company, a chemical company, a trucking company, a thermometer factory, a garage with two 550-gallon USTs, a machine shop, and a gasoline service station.
- The presence of historic fill at the site.
- Historical use of adjoining and surrounding properties as a metals works, an "oils" facility, trucking companies, a garage, a machine shop, a printer, a substation, an automobile repair facility, a mercury warehouse[1], and facilities with petroleum bulk storage.

Based on additional research conducted by Langan after the completion of the Phase I ESA, the historical site use as a trucking company was determined to be located off-site.

Phase II Environmental Site Investigation Report, dated November 2015, prepared by Langan

In preparation for the future sale of the site, the previous owner commissioned a Phase II ESI to investigate the findings of the September 2015 Phase I ESA prepared by Langan. The Phase II ESI was designed as a preliminary due diligence type of investigation to provide some subsurface data to potential future purchasers and was not intended to fully characterize subsurface conditions. The Phase II ESI included a geophysical survey, advancement and sampling of 10 soil borings (21 soil samples), installation and sampling of 5 temporary groundwater monitoring wells (5 groundwater samples), and installation and sampling of 5 temporary soil vapor points (5 soil vapor and 1 ambient air sample). The following summarizes the findings of the Phase II ESI:

- Stratigraphy: A historic fill layer, predominantly consisting of loose grey to brown, fine to medium sand with varying proportions of silt, gravel, brick, concrete, wood and ash, extends from sidewalk grade to depths ranging from about 6 to 14.5 feet bgs. Native soil consisting of sand with varying proportions of gravel and silt underlies the historic fill.
- Hydrogeology: Groundwater was encountered at depths ranging from about 7 feet bgs in the southeastern portion of the site to about 14 feet bgs in the northwestern portion of the site.
- Potential USTs: The geophysical survey identified an anomaly consistent with a UST inside the eastern boundary of the site along Peck Slip.
- Petroleum Spill: Based on field observations and analytical results from soil and groundwater samples, a spill was reported to the NYSDEC on October 13, 2015 and Spill No. 1507371 was assigned.

[1] The business "Mercury Warehouse & Storage Co Inc" was identified in the Environmental Data Resources Inc. City Directory sourced from R.L. Polk & Company for 245 Water Street in 1920.

- Soil: Petroleum impacts were observed in four soil borings on the eastern portion of the site (near Peck Slip) in the vicinity of the potential UST. Petroleum-related compounds (volatile organic compounds [VOC] and Semivolatile Organic Compound [SVOC]); total polychlorinated biphenyl (PCB); and nine metals, including mercury, were detected at concentrations above the 6 NYCRR Part 375 Unrestricted Use (UU) Soil Cleanup Objectives (SCO) and/or Restricted Use Restricted Residential (RURR) SCOs. The highest detections of mercury (63 milligrams per kilogram [mg/kg] to 120 mg/kg) were identified in one soil boring that, based on historic mapping and the current site survey, was determined to have been advanced within the limits of a historical on-site thermometer factory (302 Pearl Street).
- Groundwater: Petroleum-related VOCs and SVOCs were identified in groundwater at concentrations above NYSDEC Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs) in the eastern and northwestern portions of the site. A total of 14 VOCs and 9 SVOCs were detected above SGVs. A petroleum-like odor and sheen were observed in purge water from two monitoring wells. Eleven metals were detected in total concentrations exceeding SGVs. Dissolved antimony, iron, magnesium, manganese, and sodium were detected in filtered samples at concentrations exceeding SGVs. These metals are likely related to area-wide and naturally-occurring brackish groundwater conditions.
- Soil Vapor: Soil vapor sampling results indicated the presence of several VOCs, including chlorinated solvents and petroleum-related compounds, above ambient air concentrations. When the detected concentrations of trichloroethene (TCE) in soil vapor were applied to the NYSDOH decision matrices (in the absence of a co-located indoor air sample), the recommended actions ranged from "no further action" to "mitigate".

Soil, groundwater, and sub-slab vapor sample locations and analytical results from the Phase II ESI are included with the RI results figures and tables.

Phase I Environmental Site Assessment, dated September 2018, prepared by Langan

Langan prepared a Phase I ESA for the site for the current property owner prior to purchase in accordance with ASTM E-1527-13 standards, which took account of the November 2015 Phase II ESI. The following summarizes the findings specific to the site:

- One REC was identified as Hazardous Substances and Petroleum on the site; this was based on the Phase II ESI, which identified the following:
    - A petroleum release in the eastern portion of the site
    - Mercury above regulatory criteria in soil

- Chlorinated solvents and petroleum-related compounds in soil vapor

Petroleum, mercury and chlorinated solvent impacts may relate to historical use of the site and/or adjoining properties.

- One Business Environmental Risk was identified as Historic Fill:

Contaminants associated with historic fill, specifically SVOCs and metals at potentially hazardous concentrations, were detected in soil across the site.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The RI was completed between June 15 and October 12, 2020 to investigate potential areas of concern (PAOCs) and to determine, to the extent practical, the nature and extent of contamination in soil, groundwater, and soil vapor. The data from the RI was used to define the areas of concern (AOCs) that are addressed by this RAWP and are summarized in Section 2.1. The RI included the advancement of soil borings; installation of groundwater monitoring wells and soil-vapor probes; and collection of soil, groundwater, and soil-vapor samples. Sample locations are presented on Figure 3.

The RI consisted of the following:

- A baseline community air monitoring event, conducted before intrusive activities began, to establish background concentrations for total volatile organic compounds (VOCs), particulates, and mercury vapor.
- A geophysical survey to clear boring locations and to identify potential subsurface utilities, structures, and significant subsurface anomalies
- Advancement of 29 site-wide soil borings and collection of 100 soil samples (including quality assurance/quality control [QA/QC] samples) for laboratory analysis
- Advancement of 16 mercury delineation soil borings around Phase II Environmental Site Investigation (ESI) boring SB4 and collection of 136 soil samples (including QA/QC samples) for laboratory analysis
- Installation and development of 11 permanent groundwater monitoring wells and collection of 11 groundwater samples (plus QA/QC samples) for laboratory analysis
- Surveying and gauging monitoring wells to calculate groundwater elevation and establish flow direction, and installation of pressure transducers to determine tidal influence
- Installation of 17 soil vapor points (14 soil vapor points were installed to depths ranging from 7 to 15 feet bgs, three soil vapor points were installed within void spaces at about 1.5 feet bgs) plus QA/QC samples and one outdoor ambient air sample for laboratory analysis

The RI was conducted in accordance with the NYSDEC-approved May 13, 2020 Remedial Investigation Work Plan (RIWP); Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375-1, 3.8, 6.8 (Part 375); NYSDEC DER-10; and the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006, with updates in 2017.

2.1 Areas of Concern

The following areas of concerns (AOC) were identified and are described below.

AOC-1: Historic Fill Material

Historic fill was identified beneath asphalt to depths up to 17 feet bgs across the site. SVOC, pesticide, PCB, and metal in soil were attributed to the historic fill quality. SVOCs, PCBs, and total metals were detected in groundwater samples above SGVs and are attributed to sample turbidity based on several of the samples not meeting the turbidity goal of 5 NTUs; however, historic fill may be a contributing source of dissolved PCBs/SVOCs in groundwater. Dissolved metals, excluding arsenic and barium, are attributed to regional groundwater quality. Dissolved arsenic and barium in groundwater are associated with historic fill.

AOC-2: Petroleum-Like Impacts and Open Spill (Spill No. 1507371)

Petroleum-related VOCs and SVOCs were only detected above UU, Projection of Groundwater (PGW), and/or RURR SCO in soil samples collected from four of the five soil borings advanced around the potential UST near the eastern site boundary (Peck Slip) and two soil borings SB8 and SB36 (hydraulically upgradient from the potential USTs). In addition, stained or odorous soil was identified across the larger southern and eastern parts of the site. The highest concentrations of petroleum-related VOCs and/or SVOCs above NYSDEC SGVs were identified in TMW09 and MW31 installed to the west of the potential UST and monitoring well MW30 (hydraulically upgradient from the potential USTs). Based on the field observation of petroleum like impacts, petroleum-related VOCs and SVOCs in soil and groundwater above SGVs, and the inferred groundwater flow directions, three sources of petroleum- and creosote-related contamination exist at the site:

- Petroleum-related impacts to soil, groundwater and soil vapor in the southeastern part of the site (around the potential UST) are attributed to the open spill.
- Petroleum-related impacts to soil, groundwater and soil vapor in the northeastern part of the site (AOC 4) are attributed to historical site use and further discussed in AOC 4.
- All other occurrences of stained or odorous soil (generally located in the southern half of the site) are likely attributed to creosote-treated timber piles or cribbing.

AOC-3: Historical Thermometer Factories/Workshops

Mercury was detected in soil samples at concentrations above UU and RURR SCOs across the site, and mercury concentrations were highest in and around the former thermometer factory located at 302 Pearl Street and, to a lesser extent, in the three additional thermometer factories/workshops. Mercury impacts were predominantly limited to the historic fill layer, with maximum concentrations in the 2 to 4 feet bgs interval. The former factory and workshop buildings were likely contaminated by mercury through spills and/or mercury vaporization and

absorption onto building materials from the historical use. Historically, when buildings in Manhattan were demolished, the building materials would be re-used to backfill the former lots to grade. The source of mercury contamination is, therefore, suspected to be from the mercury-impacted building material used as backfill within the historic fill layer.

AOC-4: Historical Uses of the Site and Surrounding Properties

PCBs and petroleum-related VOCs were detected at concentrations above UU, PGW, and RURR SCOs in the northeastern part of the site near the corner of Pearl Street and Peck Slip. PCBs were detected at concentrations above UU, PGW, and RURR SCOs near the Beekman Street site boundary. PCBs and petroleum impacts are attributed to the historical site uses as an oil company and garage with two 550-gallon USTs on the northeastern part of the site near the corner of Pearl Street and Peck Slip, and an oil company/factory near the site boundary along Beekman Street.

PFAS were detected in soil samples at concentrations above the UU and Protection of Groundwater (PGW) SCOs and in groundwater samples above the NYSDEC screening levels. The two samples with PFAS above the PGW guidance values were detected in surficial soil samples (0 to 2 feet bgs) above the groundwater table. PFAS have been used in various industries and products since the 1940s and the historical site use as an oil company pre-dates the use of PFAS in firefighting systems. No historical use consistent with PFAS use was identified for the site. Based on the evaluation of the soil guidance values, per NYSDECs PFAS guidance document, no site source of PFAS was identified.

Chlorinated VOCs (CVOC) were not detected in soil above the UU SCOs or in groundwater samples above the SGVs; however, CVOCs, including 1,1,1–trichloroethane (1,1,1-TCA), cis-1,2-dichloroethene (cis-1,2-DCE), methylene chloride, tetrachloroethene (PCE), and TCE, were detected in soil vapor samples. A source of CVOCs in soil vapor was not identified.

2.2 Summary of the Remedial Investigation

The RI is documented in the Draft Remedial Investigation Report (RIR), dated February 4, 2021 and prepared by Langan. Soil boring, monitoring well, and soil vapor probe locations are shown on Figure 3. Soil sample analytical results are presented on Figures 4A and 4B. Groundwater sample analytical results are presented on Figure 5. Soil vapor sample analytical results are presented on Figure 6. Groundwater elevation data is summarized in Figures 7A and 7B.

The findings and conclusions of the RI are as follows:

1. Stratigraphy: Site stratigraphy consists of historic fill underlain by sand with varying amounts of silt, gravel and clay. Historic fill, characterized as grey to brown fine sand with varying proportions of silt, gravel, brick, concrete, wood, ceramic, and coal, was encountered to depths ranging from about 5 to 17 feet bgs. Bedrock was not

encountered and is expected to be about 125 feet bgs. The historical shoreline ran through the center of the site, parallel with Water and Pearl Streets.

2. Hydrogeology: Groundwater was observed at elevations ranging from about -0.65 to -1.10 (about 15.5 to 8.9 feet bgs) during the RI. The groundwater flow direction is to the southeast. Based on the results collected from pressure transducers, groundwater does not appear to be significantly tidally influenced. The tidal cycle fluctuation is about ±0.1 feet.

3. Historic Fill: Historic fill was encountered in all soil borings beneath the asphalt cover to depths ranging from about 5 to 17 feet bgs. Historic fill impacts include SVOCs, pesticides, PCBs, and metals in soil at concentrations above UU, PGW, and/or RURR SCOs.

4. Petroleum and Tar Impacts: Petroleum- and tar-related impacts, as evidenced by field observations and/or analytical data, were identified and are attributed to the potential USTs and associated open spill, historical site uses, and treated timber pile/cribbing.

    a. Petroleum impacts attributed to the open spill (Spill No. 1507371) were identified in soil borings SB9, SB10, and SB31 through SB34 and in monitoring wells TMW09 and MW31 through MW34. An anomaly indicative of four USTs was identified in this area. Field observations within the capillary fringe and below the groundwater interface include petroleum-like odor, staining and/or PID readings above background. Petroleum-related VOCs and/or SVOCs were detected in soil samples at concentrations above UU, PGW, and/or RURR SCOs and in groundwater samples at concentrations above SGVs. Petroleum-related VOCs were also detected in all soil vapor samples, with the highest benzene, toluene, ethylbenzene, and xylenes (BTEX) concentration in soil vapor locations in this area (SV32).

    b. Petroleum impacts attributed to the historical site use as an oil company and garage with two 550-gallon USTs were identified within the northeast corner of the site in borings SB8, SB29, SB30, and SB36 and monitoring well TMW08 and MW30. Field observations in unsaturated soil, the capillary fringe, and below the groundwater interface include petroleum-like odor, staining and PID readings above background. Petroleum-related VOCs and/or SVOCs were detected in soil samples at concentrations above UU and/or RURR SCOs and in groundwater samples at concentrations above SGVs. Petroleum-related VOCs were detected in soil vapor samples in this area.

    c. Creosote impacts attributed to treated timber piles or cribbing were generally identified within the southern half of the site in soil borings SB3, SB17, SB20, SB21, SB23, SB27, SB35, SB4NE3, SB4S3, SB4SE3, and SB4S2 and in monitoring well

TMW03. Wood/timber was observed in several soil borings. Field observations within the capillary fringe and below the groundwater interface include tar-like odor, staining and/or PID readings above background were observed in soil borings. No petroleum-related VOCs and SVOCs were detected above UU SCOs in the soil borings. One petroleum-related VOC was detected at concentrations above the NYSDEC SGV in temporary monitoring well MW03. Petroleum/creosote-related VOCs were detected in soil vapor samples in this area of the site.

5. Mercury Impacts Related to Historical Site Uses: Mercury impacts to soil are related to historical site use, including a thermometer factory and three additional thermometer factories/workshops. The highest mercury concentrations in soil were detected primarily within the historical fill layer in and around the former thermometer factory located at 302 Pearl Street and, to a lesser extent, within the three additional thermometer factories/workshops. The major mercury species identified were mercury salts. Elemental mercury made up 0.01% to 10.87% of the total mercury concentrations in speciated samples. Mercury was not detected in groundwater samples. Mercury vapor was not detected in on-site soil vapor samples; however mercury vapor was detected in soil vapor samples collected from 15 feet below the Pearl Street sidewalk adjoining the site at concentrations of 0.222 micrograms per cubic meter ($\mu g/m^3$) in SV39 and 0.271 $\mu g/m^3$ in SV38. The source of mercury contamination in soil is likely from the use of mercury-impacted building materials used as backfill within the historic fill layer in and around the former factory/workshop footprints.

6. PCB Impacts Related to Historical Site Uses: PCB-impacted soil was identified and may be related to historical site uses. PCB impacts to soil were observed primarily within the historical fill layer in and around the former oil company in the northeastern part of the site and the former oil company and factory on the western part of the site.

7. CVOCs in Soil Vapor: The soil vapor samples collected at the site contained PCE and TCE. Soil vapor samples from the center of the site and from near the northeastern corner of the site contained the highest concentrations of CVOCs. CVOCs were detected in soil and groundwater sample below regulatory criteria. A site source of CVOCs was not identified.

8. PFAS in Soil and Groundwater: Per- and polyfluoroalkyl substances (PFAS)-impacted soil and groundwater was identified at the site. No historical use consistent with PFAS use was identified for the site. Based on the evaluation of the soil guidance values, per NYSDECs PFAS guidance document, no site source of PFAS was identified.

9. Sufficient analytical data were gathered during the RI to determine cleanup objectives and to develop a remedy for the site. The remedy is described and evaluated in this RAWP

was prepared in accordance with New York State BCP guidelines. The remedy will address impacts to soil, groundwater, and soil vapor described in the RIR.

2.3 Significant Threat Determination

NYSDEC and NYSDOH have determined that the site does not pose a significant threat to human health and the environment.

2.4 Geological Conditions

2.4.1 Regional and Site Geology

According to the Sanitary and Topographical Map of the City and Island of New York created by Egbert L. Viele in 1865 (Viele Map), the site is within a former meadow on the edge of the historical shoreline of the East River. The area was infilled for development purposes in the 1700s. According to a historical map obtained from the New York Public Library online Digital Collections, the historical shoreline ran through the center of the site, parallel with Water and Pearl Streets.

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, dated 1994" indicates that the bedrock underlying the site is Manhattan Schist, and is comprised primarily of gray, medium- to coarse grained, layered sillimanite-muscovite-biotite-kyanite schist and gneiss interlayered with layered tourmaline-garnet-plagioclase-biotite-quartz schist and gneiss with blank amphibolite layers. Bedrock is expected to be about 125 feet below grade surface (bgs).

Site stratigraphy consists of historic fill underlain by sand with varying amounts of silt, gravel, and clay. Historic fill, predominantly consisting of grey to brown fine sand with varying proportions of silt, gravel, brick, concrete, wood, ceramic, and coal, was encountered from immediately below the asphalt pavement to depths ranging from about 5 to 17 feet bgs.

2.4.2 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 flow include depth to bedrock, the presence of artificial fill, and variability in local geology and groundwater sources or sinks. The majority of runoff in this area drains to the city sewers, which connect to one of the several wastewater treatment plants servicing the

city. Groundwater in New York City is not used as a potable water source. Potable water provided to New York City is sourced from reservoirs in the Catskill and Delaware watersheds.

Groundwater was observed at elevations ranging from about el -0.65 to -1.10 (about 8.9 to 15.5 feet bgs) on 10 October 2020. Groundwater flow direction was evaluated during the RI and was determined to flow to the southeast. Tidal influence on groundwater elevations resulted in a maximum fluctuation between about 0.1 to 0.2 feet per cycle across the site.

2.5 Contamination Conditions

2.5.1 Conceptual Model of Site Contamination

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, as discussed below.

2.5.1.1 Sources of Contamination

Potential sources of contamination have been identified and include historic fill, potential USTs, and historical uses of the site and surrounding properties. The site-wide presence of historic fill has been established as a source of SVOCs, pesticides, PCBs, and metals, including mercury, in soil and/or groundwater. The suspected USTs have been established as a source of petroleum-related VOCs and/or SVOCs in soil, groundwater, and/or soil vapor. Historical site uses as a thermometer factory and workshops have been established as a source of mercury impacts in soil. Historical site uses as an oil company and factory have been established as a source of petroleum and PCBs in soil within the former oil company and factory footprints. The uses of adjacent and surrounding properties for industrial and commercial uses are a potential source of CVOCs (PCE and TCE) in soil vapor. Historical uses of the site, adjoining, and surrounding properties included various unknown manufacturers and factories. No historical use consistent with PFAS use was identified for the site. Based on the evaluation of the soil guidance values, per NYSDECs PFAS guidance document, a site source of PFAS was not identified.

2.5.1.2 Exposure Media and Contaminants of Concern

Impacted media include the following:

- Soil: VOCs, SVOCs, PCBs, pesticides, and metals
- Groundwater: VOCs, SVOCs, PCBs, and metals
- Soil vapor: VOCs

2.5.1.3 Receptor Populations

The site is currently used as an open-air commercial parking lot. Current receptor populations include the parking lot staff, customers, and staff completing inspections or investigations at the site, and the public and pedestrians, including children, staff and teachers, adjacent to the site.

During site development, human receptors will be limited to construction and remediation workers, authorized guests visiting the site, and the public and pedestrians adjacent to the site.

Under future conditions, receptors will include the residential and commercial use occupants, building employees, and the public and pedestrians adjacent to the site.

2.5.2 Nature and Extent of Contamination

This section evaluates the nature and extent of soil, groundwater and soil vapor contamination.

2.5.2.1 Soil Contamination

Soil contamination at the site, characterized by field observations and soil sample analytical results exceeding UU, PGW, and/or RURR SCOs, is attributed to the presence of historic fill, potential USTs, and historical site uses (thermometer factory/workshops, oil company/factory, and industrial/manufacturing). Based on the results of the RI, contaminated soil is not migrating off-site.

Historic Fill Material

Historic fill, predominantly consisting of grey to brown fine grained sand with varying amounts of silt, gravel, brick, concrete, wood, ceramic, ash, and coal, was encountered across the site to depths ranging from about 5 to 17 feet bgs.

The site-wide historic fill impacts include SVOCs, pesticides, PCBs, and metals detected at concentrations above the Part 375 UU, PGW, and/or RURR SCOs. Higher concentrations of mercury and PCBs were identified within the historic fill layer in specific areas associated with historical site uses as oil companies and a thermometer factory, respectively. Historic fill impacts are delineated vertically by native soil in RI soil borings, except for borings SB16, SB17, SB21, and SB29 due to refusal. Vertical delineation of borings SB16, SB17, SB21, and SB29 by native soil is assumed to be within two feet of the refusal depths at each location based on observations at surrounding soil borings (SB2, SB3, SB4S3, SB10, SB13, SB14, SB15, SB17, SB20, SB23, SB26, SB28, SB26, and SB36).

Petroleum-Impacted Soil

Open Spill (Spill No. 1507371)

Petroleum-like impacts on the southeastern part of the site, evidenced by odor, staining, PID readings above background levels and by petroleum-related VOCs and SVOCs detected above

UU, PGW, and/or RURR SCOs in soil, are attributed to the open spill associated with anomalies indicative of four USTs near the Peck Slip site boundary. Petroleum impacts attributed to the open spill were identified in borings SB9, SB10, and SB31 through SB34 at depths ranging from about 7.5 to 28 feet bgs.

The on-site petroleum-impacted area attributed to the open spill is roughly 3,700 square feet. Petroleum-related VOCs and SVOCs detected above UU, PGW, and/or RURR SCOs in soil were delineated vertically in all boring locations, with the exception of boring SB31, where total xylene exceeded the UU SCO at 32 feet bgs (0.66 mg/kg compared to UU SCO of 0.26 mg/kg). The horizontal extent of petroleum-related VOCs and SVOCs detected above UU, PGW, and/or RURR SCOs were delineated to the north by SB7 and SB30; to the east by SB34; to the south by SB10 and SB35; and to the west by SB5, SB6, and SB27.

Historical Site Use

Petroleum-related impacts on the northeastern part of the site, evidenced by odor, staining, and PID readings above background levels and by VOCs detected above UU and/or RURR SCOs in soil, are attributed to the historical site use as an oil company and garage with two 550-gallon USTs. Petroleum-like impacts attributed to this historical site use were observed in soil borings SB8, SB29, SB30, and SB36 at depths ranging from about 2 to 28 feet bgs.

Petroleum-related VOCs detected above UU and/or RURR SCOs in soil were delineated vertically in all boring locations. The horizontal extent of petroleum-related VOCs detected above UU and/or RURR SCOs were delineated to the north and east by the Pearl Street and Peck Slip site boundaries, to the south by SB7, and to the west by SB24 and SB25.

Treated Timber Piles or Cribbing

Creosote-like impacts, evidenced by odor, staining, and PID readings above background levels were attributed to treated timber piles or cribbing in borings SB3, SB17, SB20, SB21, SB23, SB27, SB35, SB4NE3, SB4S3, SB4SE3, and SB4S2 at depths ranging from about 6 to 28 feet bgs. Wood/timber was observed in soil borings SB23 from about 2 to 10 feet bgs (including tar-like impacts at 7 feet bgs), SB35 from about 10 to 15 feet bgs, and the refusal depths of SB16, SB21, and SB22. Petroleum-related VOCs or SVOCs were not detected above UU SCOs in soil borings with odors and stained soils related to treated timber piles or cribbing.

<u>Mercury-impacted Soil from Historical Thermometer Factories/Workshops</u>

Mercury associated with historical on-site uses as a thermometer factory and workshops was generally identified within the historic fill layer in and around the former thermometer factory located at 302 Pearl Street (mercury-impacted hotspot) and, to a lesser extent, in the three additional thermometer factories/workshops in soil samples at concentration above UU and RURR SCOs. However, lower concentrations of mercury were identified in historic fill at other

areas across the site. Evidence of free liquid-phase elemental mercury was not observed during field investigations; however 0.01% to 10.87% elemental mercury was identified to be present in select soil analyzed through speciation. The table below includes maximum and average mercury concentrations of historic fill samples within and adjacent to 302 Pearl Street, within the three thermometer workshop footprints, and all other site-wide mercury samples collected from the historic fill layer:

Area	Average Hg Conc.	Maximum Hg Conc.
302 Pearl Street (within and adjacent to)	32.6 mg/kg	730 mg/kg
Three Historical Thermometer Workshops	4.1 mg/kg	13 mg/kg
All Other Site-Wide Samples	1.4 mg/kg	11 mg/kg

The source of mercury contamination is likely from incidental releases of mercury during historical thermometer factory/workshop operations or from the mercury-impacted building material used as backfill within the historic fill layer. Soil borings associated with the mercury delineation at 302 Pearl Street include SB4, SB4R, SB24, SB25, SB4N1, SB4N3, SB4E1, SB4E2, SB4S2, SB4S3, SB4W1, SB4W2, SB4W3, SB4NW3, SB4NE3, SB4SE3, and SB4SW3. Soil borings advanced within the three former thermometer factory/workshops include SB3, SB16, and SB17 at 236 Water Street; SB18, SB19, SB20, and SB38 at 298 Pearl Street; and SB21, SB22 and SB23 at 240 Water Street.

302 Pearl Street Hotspot

The highest mercury concentrations were identified within the historic fill layer in soil borings SB4, SB4R, SB24, SB25, SB4N1, SB4S2, SB4W2, SB4S3, and SB39, in and around the former thermometer factory at 302 Pearl Street. Based on the results of mercury selective sequential extraction, mercury salts are the predominant mercury species present. Vertical delineation of the hotspot was achieved at the former thermometer factory located at 302 Pearl Street at all boring locations from about 0 to 20 feet bgs. Horizontal extent of mercury impacts of the hotspot from the former thermometer factory were limited to the historical footprint of 302 Pearl Street (which extends off-site to the north) and to about 20 feet southeast. The horizontal extent of the mercury hotspot is delineated by soil borings SB4N3, SB4E2, SB4W3, SB4NW3, SB4NE3, SB4SE3, SB4SW3, and SB26.

298 Pearl Street and 236 and 240 Water Street

The average mercury concentration from within the three additional thermometer factories/workshops (4.1 mg/kg) was an order of magnitude lower than the average mercury concentration from the thermometer factory at 302 Pearl Street. Vertical delineation of mercury impacts was achieved at all boring locations from about 0 to 15 feet bgs, except for SB16, SB17, and SB21, where refusal was encountered before native soil was reached. Soil samples collected from the native layer within the three footprints demonstrated that mercury impacts are confined

to the historic fill layer. The horizontal extent of mercury impacts from the former workshops are delineated to the north by soil boring SB38; to the west by SB29, SB36, and SB27; to the south SB17 and SB23; and to the east by SB13, SB14, and SB15.

Other Mercury Results

Mercury was detected at concentrations above UU and RURR SCOs in samples collected from soil borings outside of the former thermometer factory/workshop footprints. The average mercury concentration in historic fill samples outside of the thermometer factory/workshop footprints is 1.4 mg/kg and the highest mercury concentration is 11 mg/kg in soil boring SB26 (near the center of the site). Mercury impacts are delineated vertically in RI soil borings from 0 to 20 feet bgs, except for borings SB16, SB17, and SB21 due to refusal.

PCB-impacted Soil

Historical on-site uses included an oil company and garage with two 550-gallon USTs on the northeastern part of the site (corner of Peck Slip and Pearl Street) and an oil company/factory near the site boundary along Beekman Street. PCBs were detected at concentrations above UU, PGW, and RURR SCOs in samples collected from soil borings SB1, SB29, SB36, and SB37 from within the two former footprints. Petroleum-like impacts and petroleum-related VOCs were detected at concentrations above UU and RURR SCOs in soil borings SB8 and SB36 near the corner of Pearl Street and Peck Slip.

The vertical extent of petroleum and PCB impacts was delineated in all soil borings from 0 to 15 feet bgs. Soil boring SB29 encountered refusal at 15 feet bgs. Based on soil boring SB36 that was completed in close proximity to SB29, native soil is estimated to be at or near the refusal depth. Horizontal extent of PCB impacts in the northeastern part of the site are delineated to the north by the Water Street site boundary; to the east by SB8 and SB30; to the south by SB5; and to the west by SB24 and SB25. Horizontal extent of PCB impacts near the western site boundary are delineated to the north the SB12; to the east by SB13; to the south by SB11 and SB14; and to the west by the Beekman Street site boundary.

PFAS-Impacted Soil

Historical use of the site, adjoining, and surrounding properties included various unknown manufacturers and factories. PFAS were detected at various depths in soil throughout the site at concentrations above UU guidance values but below RURR guidance values. The two samples with PFAS above the PGW guidance values were detected in surficial soil samples (0 to 2 feet bgs) above the groundwater table. PFAS in soil are at concentrations below the guidance values for the reasonably anticipated site uses.

The vertical extent of PFAS impacts were delineated in all soil borings from 0 to 15 feet bgs, except for borings SB16, SB21, SB22, and SB29 due to refusal. Vertical delineation of borings

SB21, SB22, and SB29 by native soil is assumed to be within two feet of the refusal depths at each location based on observations at surrounding soil borings (SB3, SB16, SB17, SB20, SB23, SB26, and SB36).

2.5.2.2 Groundwater Contamination

Evaluation of the groundwater analytical results identified two petroleum-related compounds (1,2,4-trimethylbenzene and naphthalene) in one monitoring well and site-wide presence of SVOCs and metals above applicable regulatory standards. The source of 1,2,4-trimethylbenzene and naphthalene is residual petroleum associated with historic fill from unknown sources and/or an unidentified source; this impact has been delineated by the lack of petroleum-related compounds in surrounding groundwater samples. SVOCs and metals concentrations detected above SGVs in groundwater are likely related to entrained sediments, and dissolved metals (including iron, magnesium, manganese, and sodium) are characteristic of naturally-occurring conditions. Emerging contaminants (including perfluorooctanoic acid [PFOA] and perfluorooctanesulfonic acid [PFOS]) were detected in groundwater samples across the site at concentrations above the NYSDEC screening levels. Based on the results of the RI, contaminated groundwater has a potential to migrate off-site.

Groundwater contamination, characterized by field observations and groundwater sample analytical results exceeding SGVs, is attributed to the potential USTs, historical uses of the site and to off-site sources.

<u>Petroleum-Impacted Groundwater</u>

Petroleum-like odors, PID readings above background, and/or petroleum-related VOC and/or SVOC concentrations above SGVs were identified within the southeast corner of the site at temporary monitoring wells TMW08, TMW09, TMW10 and monitoring wells MW30, MW31, MW32, MW33, and MW34. 0.01 inches of LNAPL was observed in monitoring well MW31 during placement of a pressure transducer.

Petroleum impacts in TMW08 and MW30 are related to the historical site uses as an oil company and garage with two 550-gallon USTs. Total VOC concentrations were 0.068 milligrams per liter (mg/l) in TMW08 and 0.24 to 0.257 mg/l in the parent and duplicate samples at MW30.

The greatest degree of petroleum impacts to groundwater was observed on the west side of the potential USTs within the southeast corner of the site in temporary monitoring well TMW09. Total VOCs in TMW09 (about 32.6 mg/l) were one to two orders of magnitude higher than surrounding monitoring wells (MW31 [4.0 mg/l] and MW32 [about 0.127 mg/l], MW33 [about 0.208 mg/l], and MW34 [about 0.148 mg/l], respectively). The horizontal extent of the open spill is about a 25- to 50-foot radius around the potential USTs.

Metals-Impacted Groundwater

Total and dissolved metals concentrations above SGVs were identified in groundwater samples collected across the site. Total metals in unfiltered samples are likely the result of suspended solids in groundwater derived from historic fill as these compounds are not readily dissolvable in groundwater. Dissolved metals, excluding arsenic and barium, are attributed to regional groundwater conditions. Arsenic and barium in dissolved groundwater samples are likely associated with historic fill material.

PFAS-Impacted Groundwater

PFAS concentrations above SGVs were observed in groundwater samples collected across the site. The highest concentrations of PFOA and PFOS in groundwater were in monitoring wells MW25 and MW30, located within the northeast corner of the site. Historical use of the site, adjoining, and surrounding properties included various unknown manufacturers and factories. PFAS were detected in groundwater above the MCL; however based on the evaluation of the soil guidance values, per NYSDEC's PFAS guidance document, no site source of PFAS was identified.

2.5.2.3 Soil Vapor Contamination

Twenty-eight VOCs, including petroleum-related VOCs and CVOCs (1,1,1–TCA, cis-1,2-DCE, methylene chloride, PCE, and TCE) were detected in soil vapor samples. Total VOC concentrations ranged from about 386 µg/m^3 in SV19 to 39,300 µg/m^3 in SV32. BTEX concentrations detected in soil vapor ranged from 15.8 µg/m^3 in SV17 to 6,030 µg/m^3 in SV32. PCE concentrations detected in soil vapor ranged from 3.36 µg/m^3 in SV01 to 827 µg/m^3 in SV28. TCE concentrations detected in soil vapor ranged from 1.09 µg/m^3 in SV08 to 27.3 µg/m^3 in SV28. Petroleum-related VOCs are associated with the open spill and timber piles/cribbing and were highest near the UST along the eastern site boundary. Concentrations of TCE and PCE in soil vapor samples were highest in the central part and northeastern corner of the site. Soil and groundwater samples in these areas had detections of CVOCs but were below the soil and groundwater regulatory criteria. An on-site source of CVOCs was not identified in soil or groundwater at the site. Based on the results of the RI, contaminated soil vapor has a potential to migrate off-site.

Soil analytical results are presented on Figures 4A and 4B. Groundwater analytical results are presented on Figure 5. Soil vapor analytical results are presented on Figure 6. A groundwater elevation contour map and groundwater elevation over time are presented on Figures 7A and 7B, respectively.

2.6 Qualitative Human Health Exposure Assessment

Human health exposure risk was evaluated in the RIR for both current and future site and off-site conditions, in accordance with DER-10. 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, 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, an FWRIA is not needed for the site.

Complete exposure pathways have the following five elements: 1) a contaminant source; 2) a contaminant release and transport mechanism; 3) a point of exposure; 4) a route of exposure; and 5) a receptor population. A discussion of the five elements comprising a complete pathway as they pertain to the site is provided below.

2.6.1 Current Conditions

Under current conditions contaminant sources include 1) historic fill with varying levels of SVOCs, pesticides, PCBs, and metals; 2) an on-site spill resulting in petroleum-impacted soil, groundwater and soil vapor; 3) historical site uses, including thermometer factory/workshops and oil companies/factories, resulting in mercury-impacted soil and VOC- and PCB-impacted soil, respectively, 4) Unidentified historical on- or off-site uses that may have contributed to the presence of PFAS in soil and groundwater, and 5) historical uses of the adjacent and surrounding sites that may have contributed CVOCs impacts to soil vapor.

Contaminant release and transport mechanisms from the sources above include contaminated soil transported as dust or overland flow in areas of exposed soil, contaminated groundwater flow and volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase, and transport of existing soil vapor contaminants.

Under the current site conditions, the likelihood of exposure to humans is limited because the points of exposure are controlled by the sites impervious surface, the fact that potable water is obtained from an off-site source, and on-site accumulation sources of soil vapor (i.e., buildings, excluding the parking lot kiosk) are not present. Action levels established for VOCs in the RIWP were not exceeded during the RI. The mercury vapor action level was not exceeded during the RI, with the exception of one instance due to suspected equipment malfunction. Subsurface investigations, where exposure to humans is more likely, were conducted in accordance with the RIWP and a HASP to minimize exposure risk. The use of PPE and other controls, including CAMP and vapor mitigation and dust suppression measures, mitigates potential exposure pathways to site workers performing subsurface repairs. There is no complete exposure pathway for mercury vapor under current conditions.

2.6.2 Construction/Remediation Activities

During remediation and/or development, sources of contamination are the same as under the current conditions; however, the points of exposures change due to disturbed and exposed soil during excavation, dust and organic vapors generated during excavation, and contaminated groundwater that may be encountered during excavation and/or localized dewatering operations.

Routes of exposure include ingestion and dermal absorption of contaminated soil and groundwater, inhalation of organic vapors volatilizing from contaminated soil and groundwater (specifically in the areas of petroleum impacts) or impacted vapors already in the vadose zone from an off-site source, and inhalation of dust arising from contaminated soil. The receptor population includes construction and remediation workers, authorized visitors to the site, and the public adjacent to the site.

The implementation of appropriate health and safety measures during construction and remediation, such as air monitoring, using vapor and dust suppression measures, cleaning trucks prior to exiting the site to prevent off-site soil tracking, maintaining site security, and wearing the appropriate personal protective equipment (PPE) will mitigate potential exposure pathways during remediation and/or development.

In accordance with this RAWP, which includes a CHASP, SFMP, and a CAMP, measures such as conducting an air-monitoring program, donning PPE, covering soil stockpiles, altering work sequencing, maintaining a secure construction entrance, proper housekeeping, and applying vapor and dust suppression measures to prevent off-site migration of contaminants during construction will be implemented to prevent completion of these potential on- and off-site exposure pathways.

2.6.3 Proposed Future Conditions

Residual contaminants may remain on-site, depending on the remedy, and will, to a lesser extent, include those listed under current conditions. Contaminant release and transport mechanisms include contaminated soil transported as dust, contaminated groundwater flow and volatilization of contaminants from the soil and groundwater matrices to the soil vapor phase, and transport of existing soil vapor contaminants. However, a composite cover system (e.g., concrete building foundations and asphalt paving) will be installed, which will eliminate exposure to remaining potentially contaminated soil and groundwater in New York City is not used as a potable water. The use of institutional and/or engineering controls will mitigate points of exposure include potential cracks in the foundation or slab of the proposed development and exposure during any future soil-disturbing activities. Routes of exposure include inhalation of vapors entering the building and direct contact with residual impacted soil during future soil-disturbing activities. The receptor population includes the building occupants and employees, visitors, maintenance workers, and the nearby community, including sensitive receptors.

The possible routes of exposure can be addressed or mitigated by proper installation of soil vapor mitigation measures (i.e. sub-slab depressurization system), construction and maintenance of a site cover system (i.e., concrete foundation with a waterproofing/vapor barrier membrane) and implementation of a Site Management Plan (SMP) to manage institutional and engineering controls, if residual contamination is left in place. A soil vapor evaluation that may include sampling would be conducted after building construction.

The potential off-site migration of site contaminants in soil and groundwater is not expected to result in a complete exposure pathway. The potential for off-site migration of site contaminates will be addressed by the removal of the source material in soil and groundwater and/or mitigated by the use of ICs and ECs described above. The potential off-site migration of site contaminants in soil vapor is not an exposure concern.

2.6.4 Human Health Exposure Assessment Conclusions

1. Human exposure to site contaminants is controlled under current conditions on the site because the site is entirely covered by asphalt, groundwater is not potable and there are no on-site accumulation sources of soil vapor (i.e., buildings). There is no exposure risk to mercury vapor under the current conditions. The primary exposure pathways are for dermal contact, ingestion, and inhalation of soil, soil vapor, and/or groundwater by site investigation or repair workers. The potential exposure to site contaminants will be addressed by following the appropriate health and safety measures outlined in the site-specific CAMP and HASP during investigation and remedial/ground-intrusive activities and by PPE use by repair workers.
2. In the absence of institutional and engineering controls, there are complete exposure pathways during construction and remediation activities. The primary exposure pathways are:
    a. Dermal contact, ingestion and/or inhalation of contaminated soil, groundwater and/or soil vapor by construction workers.
    b. Dermal contact, ingestion and inhalation of soil (dust) and inhalation of soil vapor by the community in the vicinity of the site.

    These exposure risks will be addressed by performing community air monitoring and by following the appropriate health and safety, vapor and dust suppression and site security measures outlined in this RAWP and the CHASP (Appendix D).
3. The existence of a complete exposure pathway for site contaminants to human receptors during proposed future conditions is unlikely, as a significant volume of contaminant sources will be removed from the site through excavation and dewatering/pre-treatment, the building foundation will be constructed at or below the water table and will include a

waterproofing/vapor barrier membrane, the lowest level use of the building includes actively ventilated parking, any exposure to remaining soil and groundwater will be controlled with an impermeable cover, regional groundwater is not used as a potable water source and institutional controls will be in place to maintain engineering controls at the site.

4. Monitoring and control measures will be used during ground-intrusive (i.e. investigation and construction) to prevent community exposure to contaminated dust and vapors.

2.7 Remedial Action Objectives

Based on the results of previous investigations and the RI, the following Remedial Action Objectives (RAO) were identified:

2.7.1 Soil

RAOs for Public Health Protection:

- Prevent ingestion/direct contact/inhalation (dust) of contaminated soil
- Prevent inhalation exposure to contaminants volatilizing from soil

RAOs for Environmental Protection:

- Prevent migration of contaminants that would result in groundwater or surface water contamination

2.7.2 Groundwater

RAOs for Public Health Protection:

- Prevent ingestion of groundwater with contamination levels exceeding drinking water standards
- Prevent contact with, or inhalation of volatiles, from contaminated groundwater

RAOs for Environmental Protection:

- Restore the on-site groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable
- Remove the on-site source of groundwater contamination

2.7.3 Soil Vapor

RAOs for Public Health Protection:

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at the site

3.0 DESCRIPTION OF REMEDIAL ACTION

This section presents an evaluation of the proposed remedial action. The proposed remedial alternatives are a Track 1 remedy for Alternative I, a Track 2 remedy for Alternative II, and a Track 4 remedy for Alternative III. All three alternatives are expected to achieve the established RAOs.

This section is organized as follows:

- Section 3.1 provides an explanation of the Standards, Criteria, and Guidance
- Sections 3.2 through 3.4 provide technical descriptions of:
    - Alternative I, a Track 1/Unrestricted Use remedy
    - Alternative II, a Track 2/Restricted Use – Restricted Residential remedy
    - Alternative III, a Track 4/ Restricted Use – Restricted Residential remedy
- Section 3.5 evaluates the remedial alternatives based on the BCP Remedy Selection Evaluation Criteria
- Section 3.6 summarizes the recommended remedial alternative

3.1 Alternative I – Technical Description

Alternative I, a Track 1 remedy, will include implementation of the following remedial elements:

1) Development and implementation of a CHASP and CAMP for the protection of on-site workers, visitors, and the environment during remediation activities
2) As a pre-requisite to site remediation, removal of the surficial asphalt cover by the contractor and management of removed asphalt as construction and demolition (C&D) debris in accordance with Part 360 and 361 regulations.
3) A remedial design investigation including waste characterization and supplemental delineation.
4) Excavation and removal of the mercury-impacted soil/fill hotspot at 302 Peal Street
5) Excavation and removal of all historic fill/soil exceeding UU SCOs to depths up to about 34 feet bgs or until UU SCOs are achieved,
6) Screening for indications of contamination source areas during any intrusive site work by visual, olfactory, or instrumental methods
7) Decommissioning and removal of USTs in accordance with NYSDEC DER-10 5.4(b)(5)
8) Appropriate off-site disposal of soil and historic fill removed from the site in accordance with federal, state, and local rules and regulations for handling, transport, and disposal
9) Installation of support of excavation necessary to facilitate remedial excavation

10) Dewatering, as necessary, to accommodate remedial excavation and remediation of petroleum impacted groundwater

11) Collection and analysis of confirmation soil samples in accordance with DER-10 to evaluate the performance of the remedy with respect to attainment of Track 1 SCOs

12) Import of materials for backfill, where required, in compliance with: a) UU SCOs b) Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 360 regulations; and c) federal, state, and local rules and regulations for handling and transport of material

The requirements for each of the Track 1 tasks are described below.

3.1.1 Remedial Design Investigation

Prior to the start of remediation, a remedial design investigation work plan will be submitted to the NYSDEC for approval. The remedial design investigation is anticipated to consist of waste characterization sampling. The remedial design investigation will be implemented to refine the proposed remedial elements and obtain a soil dataset for off-site disposal facility approvals.

The full scope of the remedial design investigation will be summarized in a Remedial Design Investigation Work Plan and submitted to NYSDEC and NYSDOH for review. Following the remedial design investigation implementation, a Remedial Design Memorandum (RDM) will be prepared to describe the results and findings of the remedial design investigation. The RDM will include a review of the site data and may also include a refinement of the remedial elements for the selected remedy. The RDM will supplement this RAWP.

3.1.2 On-Site Worker, Public Health and Environmental Protection

A site-specific CHASP was developed and will be enforced to protect on-site workers from accidents and acute and chronic exposures from the identified contaminated media. The site CHASP is included as Appendix D. Each contractor performing RAWP operations on the site will have and enforce a HASP that, at a minimum, meets the CHASP criteria. Public health will be protected by implementing and enforcing dust, odor, and vapor control as specified in the CAMP. The CAMP includes continuous perimeter monitoring of dust, organic vapors, and mercury vapor, as discussed in section 5.4.10, using DustTrak aerosol monitors, PIDs, and Jerome mercury vapor analyzers capable of recording data and calculating 15-minute averages. Field personnel, supervised by the RE, will monitor site perimeters for visible dust and odors. In addition, field personnel will be equipped with a handheld PID and Jerome J505 mercury vapor analyzer during excavation. The environment will be protected by implementing and enforcing the appropriate soil erosion prevention measures.

3.1.3 Mercury-Impacted Soil Hotspot

The mercury-impacted soil hotspot will be remediated through excavation and off-site disposal. The hotspot was identified in the former location of the thermometer factory at 302 Pearl Street and was delineated during the remedial investigation. The estimated depth of excavation required to remove the hotspot ranges from about 4 to 16 feet bgs. The mercury-impacted soil hotspot will be removed as the first step of the remedial excavation. The extent of the hotspot removal is shown on Figure 8. During excavation of the hotspot, the CAMP will include mercury vapor monitoring.

3.1.4 Fill and Soil Removal

Remedial excavation will include the removal of historic fill/soil exceeding the UU SCOs across the site. The estimated volume of historic fill and soil requiring removal and off-site disposal for a Track 1 cleanup is about 28,300 cubic yards. This estimate is based on the complete removal of historic fill and soil exceeding UU SCOs across the site. The estimated depth of excavation required to achieve a Track 1 ranges from about 8 to 34 feet bgs (el. 6 to -24.5). The extent of the Track 1 remedial excavation is shown on Figure 9. A support of excavation (SOE) system and a dewatering system will be designed, constructed and operated (dewatering only) to accommodate Track 1 excavation depths. See Section 3.1.6 for more detail on dewatering.

3.1.5 UST System Removal

Four potential USTs were identified underneath a reinforced concrete slab near the Peck Slip site boundary and an additional potential UST was identified near the corner of Beekman Street and Water Street. Any USTs, and/or associated appurtenances will be decommissioned, disposed of off-site, and registered with the NYSDEC Petroleum Bulk Storage (PBS) unit. If encountered, petroleum-impacted soil in the unsaturated zone will be excavated. Petroleum-impacts at the groundwater table will be addressed through excavation and dewatering. Excavated petroleum-impacted historic fill and soil will be stockpiled separately from historic fill, characterized, and disposed of off-site at a permitted disposal facility in accordance with applicable regulations.

3.1.6 Excavation Dewatering and Treatment

Dewatering of groundwater will be required to accommodate excavation of soil exceeding UU SCOs and will also act as a method of groundwater remediation through source removal. Prior to mobilization, the contractor will follow the Rules of the City of New York (RCNY) Title 15, Chapter 19, Use of the Public Sewers and the NYCDEP "Procedure for Obtaining Letter of Approval for Groundwater Discharge to Sanitary or Combined Sewer" and will use the approval to obtain a Temporary Discharge of Groundwater into the City Sewer System Permit. The dewatering system will include pretreatment (e.g., bag filters, carbon filtration) to reduce contaminant concentrations below NYCDEP effluent limitations prior to discharge to the New

York City Sewer system. If the contractor will discharge more than 10,000 gallons per day, they will also have to obtain approval from the NYCDEP's Bureau of Water and Sewer Operations, Chief of Permitting and Compliance. The dewatering and treatment system will be designed, operated and maintained by the Contractor's New York State-licensed Professional Engineer. If the dewatering system has a capacity to withdraw 100,000 gallons per day or more, the contractor will have to obtain a Water Withdrawal Permit or its equivalent from the NYCDEC.

Once excavation and dewatering activities are completed, groundwater samples will be collected to confirm achievement of groundwater RAOs. If the RAOs are not achieved, an in-situ remedy will be implemented to achieve the groundwater RAOs. Groundwater will be sampled from within the treatment area within 2 to 3 months following any in-situ groundwater treatment to confirm achievement of groundwater RAOs.

3.1.7 Excavation Backfill

In areas that are excavated deeper than development grade for remedial purposes, the excavation areas will be backfilled to raise the site to development grade. Backfill material will consist of soil/fill meeting the UU SCOs. All imported fill material must be sourced from appropriately licensed facilities with no history of environmental contamination. If sampling of the proposed soil/fill is required, qualified environmental personnel will collect representative samples at a frequency consistent with DER-10. The samples will be analyzed for 6 NYCRR Part 375 VOCs, SVOCs, pesticides/herbicides, PCBs, metals, and emerging contaminants, including PFAS, and 1,4-dioxane, by a NYSDOH ELAP-certified laboratory. Virgin crushed stone with less than 10% by weight passing through a No. 10 sieve will not require sampling prior to import.

An estimated 3,800 cubic yards of backfill would be required to raise the site to development grade upon completion of the Track 1 remediation.

3.1.8 Confirmation Soil Sampling

Confirmation soil samples will be collected from the excavation base at a frequency of one per 900 square feet per NYSDEC DER-10 5.4(b)(5)(ii). Sidewall samples will be collected from within the building footprint unless SOE measures (e.g., sheeting, lagging or sloping) preclude access to soil sidewalls. An estimated 54 confirmation endpoint soil samples, plus QA/QC samples, will be collected to confirm remedial performance and will be analyzed for the Part 375 list of VOCs, SVOCs, PCBs, pesticides, metals including hexavalent and trivalent chromium, PFAS, and 1,4-dioxane. Over-excavation may be required as necessary to remove soil that does not comply with the SCOs. If over-excavation is completed, additional confirmation samples will be required.

Considering that groundwater is shallower than the remedial excavation depth in most places, samples may be collected in-situ prior to excavation during the remedial design investigation. A reduced-frequency endpoint sampling plan may be proposed, with supporting rationale, in accordance with DER-10 Section 1.6.

3.2 Alternative II – Technical Description

Alternative II, a Track 2 remedy, will include implementation of the following remedial elements:

1) Development and implementation of a CHASP and CAMP for the protection of on-site workers, visitors, and the environment during remediation activities
2) As a pre-requisite to site remediation, removal of the surficial asphalt cover by the contractor and management of removed asphalt as construction and demolition (C&D) debris in accordance with Part 360 and 361 regulations.
3) A remedial design investigation including waste characterization and supplemental delineation
4) Excavation and removal of the mercury-impacted soil/fill hotspot at 302 Peal Street
5) Excavation and removal of historic fill/soil across the site to meet RURR SCOs, including excavation below 15 feet for removal or treatment of grossly contaminated media (i.e. source material)
6) Decommissioning and removal of USTs in accordance with NYSDEC DER-10 5.4(b)(5)
7) Appropriate off-site disposal of historic fill and soil removed from the site in accordance with federal, state, and local rules and regulations for handling, transport, and disposal
8) Installation of support of excavation necessary to facilitate remedial excavation
9) Dewatering, as necessary, to accommodate remedial excavation and remediation of petroleum impacted groundwater
10) Screening for indications of contamination source areas during any intrusive site work by visual, olfactory, or instrumental methods
11) Collection and analysis of confirmation soil samples in accordance with DER-10 at the completion of the remedial excavation to document post-remediation soil quality
12) Import of materials for backfill, where required, in compliance with: a) RURR or PGW SCOs, whichever is more stringent; b) 6 NYCRR Part 360 regulations; and c) federal, state, and local rules and regulations for handling and transport of material
13) Completion of a soil vapor intrusion (SVI) evaluation
14) Recording of an Environmental Easement (EE) to memorialize the remedial action and the institutional controls to ensure that future owners of the site continue to maintain these controls as required
15) Preparation of an SMP that describes management of the ICs – Implementation of the SMP following completion of the remedy will be stipulated by the EE.

The requirements for each of the Track 2 tasks are described below.

3.2.1 Remedial Design Investigation

Prior to the start of remediation, a remedial design investigation work plan will be submitted to the NYSDEC for approval. The remedial design investigation is anticipated to consist of waste characterization sampling. The remedial design investigation will be implemented to refine the proposed remedial elements and obtain a soil dataset for off-site disposal facility approvals.

The full scope of the remedial design investigation will be summarized in a Remedial Design Investigation Work Plan and submitted to NYSDEC and NYSDOH for review. Following the remedial design investigation implementation, an RDM will be prepared to describe the results and findings of the remedial design investigation. The RDM will include a review of the site data and may also include a refinement of the remedial elements for the selected remedy. The RDM will supplement this RAWP.

3.2.2 On-Site Worker, Public Health and Environmental Protection

A site-specific CHASP was developed and will be enforced to protect on-site workers from accidents and acute and chronic exposures from the identified contaminated media. The site CHASP is included as Appendix D. Each contractor performing RAWP operations will have and enforce a HASP that, at a minimum, meets the CHASP criteria. Public health will be protected by implementing and enforcing dust, odor, and vapor control as specified in the CAMP. The CAMP includes continuous perimeter monitoring of dust, organic vapors, and mercury vapor, as discussed in section 5.4.10, using DustTrak aerosol monitors, PIDs, and Jerome mercury vapor analyzers capable of recording data and calculating 15-minute averages. Field personnel, supervised by the RE, will monitor site perimeters for visible dust and odors. In addition, field personnel will be equipped with a handheld PID and Jerome J505 mercury vapor analyzer during excavation. The environment will be protected by implementing and enforcing the appropriate soil erosion prevention measures.

3.2.3 Mercury-Impacted Soil Hotspot

The mercury-impacted soil hotspot will be remediated through excavation and off-site disposal. The hotspot was identified in the former location of the thermometer factory at 302 Pearl Street and was delineated during the remedial investigation. The estimated depth of excavation required to remove the hotspot ranges from about 4 to 16 feet bgs. The extent of the hotspot removal is shown on Figure 8. The mercury-impacted soil hotspot will be removed as the first step of the remedial excavation. During excavation of the hotspot, the CAMP will include mercury vapor monitoring.

3.2.4 Fill and Soil Removal

To achieve a Track 2 RURR cleanup, site-wide excavation will extend to between about 6 to 15 feet bgs across the site. Excavation below 15 feet bgs is anticipated on the eastern side of the site to remove petroleum-impacted soil associated with the open spill. Source material, as defined in NYCRR Part 375, encountered during remedial excavation will be excavated and disposed of off-site to the extent practical.

The estimated volume of historic fill and soil requiring removal and off-site disposal for a Track 2 cleanup is about 21,700 cubic yards. This estimate is based on site-wide excavation to remove historic fill and soil exceeding Track 2 RURR SCOs to a maximum of 15 feet bgs, and excavation to about 18 feet bgs (about el -7 to -8) in the petroleum-impacted area. The extent of the Track 2 remedial excavation is shown on Figure 10.

3.2.5 UST System Removal

Four potential USTs were identified underneath a reinforced concrete slab near the Peck Slip site boundary and an additional potential UST was identified near the corner of Beekman Street and Water Street. Any USTs, and/or associated appurtenances will be decommissioned, disposed of off-site, and registered with the NYSDEC PBS unit. If encountered, petroleum-impacted soil in the unsaturated zone will be excavated. Petroleum-impacts at the groundwater table will be addressed through excavation and dewatering, and if required in-situ treatment. Excavated petroleum-impacted historic fill and soil will be stockpiled separately from historic fill, characterized, and disposed of off-site at a permitted disposal facility in accordance with applicable regulations.

3.2.6 Excavation Dewatering and Treatment

Dewatering of groundwater will be required to accommodate excavation of soil exceeding RURR SCOs and will also act as a method of groundwater remediation in conjunction with source removal. Prior to mobilization, the contractor will follow the Rules of the City of New York (RCNY) Title 15, Chapter 19, Use of the Public Sewers and the NYCDEP "Procedure for Obtaining Letter of Approval for Groundwater Discharge to Sanitary or Combined Sewer" and will use the approval to obtain a Temporary Discharge of Groundwater into the City Sewer System Permit. The dewatering system will include pretreatment (e.g., bag filters, carbon filtration) to reduce contaminant concentrations below NYCDEP effluent limitations prior to discharge to the New York City Sewer system. If the contractor will discharge more than 10,000 gallons per day, they will also have to obtain approval from the NYCDEP's Bureau of Water and Sewer Operations, Chief of Permitting and Compliance. The dewatering and treatment system will be designed, operated and maintained by the Contractor's New York State-licensed Professional Engineer. If the dewatering system has a capacity to withdraw 100,000 gallons per day or more, the contractor will have to obtain a Water Withdrawal Permit or its equivalent from the NYCDEC.

After excavation and dewatering activities are completed, groundwater samples will be collected to confirm achievement of groundwater RAOs. If the RAOs are not achievement an in-situ remedy will be implemented at the site to achieve the groundwater RAOs. Groundwater will be sampled from within the treatment area within 2 to 3 months following the in-situ groundwater treatment to confirm achievement of groundwater RAOs.

3.2.7 Confirmation Soil Sampling

Confirmation soil samples will be collected from the excavation base at a frequency of one per 900 square feet per NYSDEC DER-10 5.4(b)(5)(ii). Sidewall samples will be collected from within the building footprint unless SOE measures (e.g., sheeting, lagging or sloping) preclude access to soil sidewalls. An estimated 54 confirmation endpoint soil samples, plus QA/QC samples, will be collected to confirm remedial performance and will be analyzed for the Part 375 list of VOCs, SVOCs, PCBs, pesticides, metals including hexavalent and trivalent chromium, PFAS, and 1,4-dioxane. Over-excavation may be required as necessary to remove soil that does not comply with the SCOs. If over-excavation is completed, additional confirmation samples will be required.

Considering that groundwater is shallower than the remedial excavation depth in most places, samples may be collected in-situ prior to excavation during the remedial design investigation. A reduced-frequency endpoint sampling plan may be proposed, with supporting rationale, in accordance with DER-10 Section 1.6.

3.2.8 Excavation Backfill

In areas that are excavated deeper than development grade for remedial purposes, the excavation areas will be backfilled to raise the site to development grade. Backfill material will consist of soil/fill meeting the RURR or PGW SCOs, whichever is more stringent. All imported fill material must be sourced from appropriately licensed facilities with no history of environmental contamination. If sampling of the proposed soil/fill is required, qualified environmental personnel will collect representative samples at a frequency consistent with DER-10. The samples will be analyzed for 6 NYCRR Part 375 VOCs, SVOCs, pesticides/herbicides, PCBs, metals, and emerging contaminants, including PFAS, and 1,4-dioxane, by a NYSDOH ELAP-certified laboratory. Virgin crushed stone with less than 10% by weight passing through a No. 10 sieve will not require sampling prior to import.

An estimated 650 cubic yards of backfill would be required to raise the site to development grade upon completion of the Track 2 remediation.

3.2.9 Soil Vapor Intrusion Evaluation

An SVI evaluation will be conducted after remedial elements are completed. The method of remediation and development construction (i.e., removal of all site soil, concrete foundation below the water table, monolithic waterproofing/vapor barrier membrane, and cellar mechanical

ventilation) will mitigate the potential for SVI. The SVI evaluation will include documentation of the installation of the above-listed construction measures. The objective of the SVI evaluation is to confirm that the development-specific construction elements are implemented.

3.2.10 Site Management Plan and Environmental Easement

An EE would be recorded referencing institutional controls that are part of the selected remedy, which would be binding upon all subsequent owners and occupants of the property. The institutional controls would: 1) restrict the site use of the site to restricted-residential, commercial and industrial uses, although land use is subject to local zoning laws; 2) restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDEC or NYSDOH; 3) require the completion and submission to the NYSDEC of periodic certifications of institutional controls in accordance with Part 375; and 4) include notice-of-use restrictions of the site soil. As a construction element, a vapor barrier/waterproofing membrane and ventilated parking garage will be installed and will serve to mitigate potential soil vapor intrusion into the planned building. The SMP would identify all use restrictions and long-term monitoring and maintenance requirements to ensure the institutional controls remain in place and are effective.

3.3 Alternative III – Technical Description

Alternative III, a Track 4 remedy, will include implementation of the following remedial elements:

1) Development and implementation of a CHASP and CAMP for the protection of on-site workers, visitors, and the environment during remediation activities
2) As a pre-requisite to site remediation, removal of the surficial asphalt cover by the contractor and management of removed asphalt as construction and demolition (C&D) debris in accordance with Part 360 and 361 regulations.
3) A remedial design investigation including waste characterization and supplemental hot spot delineation
4) Excavation and removal of the mercury-impacted soil/fill Hotspot at 302 Peal Street
5) Site-wide excavation to a minimum of 2 feet bgs to install a cover system, and deeper excavation of petroleum impacted soil and PCB-impacted soil,
6) Decommissioning and removal of USTs in accordance with NYSDEC DER-10 5.4(b)(5)
7) Appropriate off-site disposal of historic fill and soil removed from the site in accordance with federal, state, and local rules and regulations for handling, transport, and disposal
8) Installation of support of excavation that is necessary to facilitate remedial excavation

9) Dewatering, as necessary, to accommodate remedial excavation and remediation of petroleum impacted groundwater

10) Screening for indications of contamination source areas during any intrusive site work by visual, olfactory, or instrumental methods

11) Collection and analysis of documentation soil samples in accordance with DER-10 at the completion of the remedial excavation to document post-remediation soil quality

12) Import of materials for backfill, where required, in compliance with: a) RURR or PGW SCOs, whichever is more stringent; b) 6 NYCRR Part 360 regulations; and c) federal, state, and local rules and regulations for handling and transport of material

13) Completion of an SVI evaluation

14) Recording of an EE to memorialize the remedial action and the engineering and institutional controls to ensure that future owners of the site continue to maintain these controls as required

15) Preparation of an SMP that describes management of the ECs and ICs – implementation of the SMP following completion of the remedy will be stipulated by the EE.

The requirements for each of the Track 4 tasks are described below.

3.3.1 Remedial Design Investigation

Prior to the start of remediation, a remedial design investigation work plan will be submitted to the NYSDEC for approval. The remedial design investigation is anticipated to consist of waste characterization sampling. The remedial design investigation will be implemented to refine the proposed remedial elements and obtain a soil dataset for off-site disposal facility approvals.

The full scope of the remedial design investigation will be summarized in a Remedial Design Investigation Work Plan and submitted to NYSDEC and NYSDOH for review. Following the remedial design investigation implementation, an RDM will be prepared to describe the results and findings of the remedial design investigation. The RDM will include a review of the site data and may also include a refinement of the remedial elements for the selected remedy. The RDM will supplement this RAWP.

3.3.2 On-Site Worker, Public Health and Environmental Protection

A site-specific CHASP was developed and will be enforced to protect on-site workers from accidents and acute and chronic exposures from the identified contaminated media. The site CHASP is included as Appendix D. Each contractor performing RAWP operations will have and enforce a HASP that, at a minimum, meets the CHASP criteria. Public health will be protected by implementing and enforcing dust, odor, and vapor control as specified in the CAMP. The CAMP includes continuous perimeter monitoring of dust, organic vapors, and mercury vapor, as

discussed in section 5.4.10, using DustTrak aerosol monitors, PIDs, and Jerome mercury vapor analyzers capable of recording data and calculating 15-minute averages. Field personnel, supervised by the RE, will monitor site perimeters for visible dust and odors. In addition, field personnel will be equipped with a handheld PID and Jerome J505 mercury vapor analyzer during excavation. The environment will be protected by implementing and enforcing the appropriate soil erosion prevention measures.

3.3.3 Mercury-Impacted Soil Hotspot

The mercury-impacted soil hotspot will be remediated through excavation and off-site disposal. The hotspot was identified in the former location of the thermometer factory at 302 Pearl Street and was delineated during the remedial investigation. The estimated depth of excavation required to remove the hotspot ranges from about 4 to 16 feet bgs. The extent of the hotspot removal is shown on Figure 8. The mercury-impacted soil hotspot will be removed as the first step of the remedial excavation. During excavation of the hotspot, the CAMP will include mercury vapor monitoring.

3.3.4 Fill and Soil Removal

To achieve a Track 4 remedy, remedial excavation will extend across the entire site footprint to a minimum of 2 feet bgs for remediation purposes to accommodate the 2-foot thick cover system. Deeper excavations will extend to about 18 feet bgs to remove petroleum-impacted soil and about 10 feet bgs to remove PCB-impacted soil. Any source material encountered during remedial excavation will be excavated and disposed of off-site to the extent practical. The estimated volume of historic fill and soil requiring removal and off-site disposal for a Track 4 cleanup is about 11,100 cubic yards. The extent of the Track 4 remedial excavation is shown on Figure 11.

3.3.5 UST System Removal

Four potential USTs were identified underneath a reinforced concrete slab near the Peck Slip site boundary and an additional potential UST was identified near the corner of Beekman Street and Water Street. Any USTs, and/or associated appurtenances will be decommissioned, disposed of off-site, and registered with the NYSDEC PBS unit. If encountered, petroleum-impacted soil in the unsaturated zone will be excavated. Petroleum-impacts at the groundwater table will be addressed through excavation and in-situ treatment. Excavated petroleum-impacted historic fill and soil will be stockpiled separately from historic fill, characterized, and disposed of off-site at a permitted disposal facility in accordance with applicable regulations.

3.3.6 Excavation Dewatering and Treatment

Dewatering of groundwater will be required to accommodate excavation of petroleum-impacted soil and will also act as a method of groundwater remediation in conjunction with source removal.

Prior to mobilization, the contractor will follow the Rules of the City of New York (RCNY) Title 15, Chapter 19, Use of the Public Sewers and the NYCDEP "Procedure for Obtaining Letter of Approval for Groundwater Discharge to Sanitary or Combined Sewer" and will use the approval to obtain a Temporary Discharge of Groundwater into the City Sewer System Permit. The dewatering system will include pretreatment (e.g., bag filters, carbon filtration) to reduce contaminant concentrations below NYCDEP effluent limitations prior to discharge to the New York City Sewer system. If the contractor will discharge more than 10,000 gallons per day, they will also have to obtain approval from the NYCDEP's Bureau of Water and Sewer Operations, Chief of Permitting and Compliance. The dewatering and treatment system will be designed, operated and maintained by the Contractor's New York State-licensed Professional Engineer. If the dewatering system has a capacity to withdraw 100,000 gallons per day or more, the contractor will have to obtain a Water Withdrawal Permit or its equivalent from the NYCDEC.

Once excavation and dewatering activities are completed, groundwater samples will be collected to confirm achievement of groundwater RAOs. If the RAOs are not achievement an in-situ remedy will be implemented at the site to achieve the groundwater RAOs. Groundwater will be sampled from within the treatment area within 2 to 3 months following the in-situ groundwater treatment to confirm achievement of groundwater RAOs.

3.3.7 Excavation Backfill

In areas that are excavated deeper than development grade for remedial purposes, the excavation areas will be backfilled to raise the site to development grade. Backfill material will consist of soil/fill meeting the RURR or PGW SCOs, whichever is more stringent. All imported fill material must be sourced from appropriately licensed facilities with no history of environmental contamination. If sampling of the proposed soil/fill is required, qualified environmental personnel will collect representative samples at a frequency consistent with DER-10. The samples will be analyzed for 6 NYCRR Part 375 VOCs, SVOCs, pesticides/herbicides, PCBs, metals, and emerging contaminants, including PFAS, and 1,4-dioxane, by a NYSDOH ELAP-certified laboratory. Virgin crushed stone with less than 10% by weight passing through a No. 10 sieve will not require sampling prior to import.

An estimated 650 cubic yards of backfill would be required to raise the site to development grade upon completion of the Track 4 remediation.

3.3.8 Documentation Soil Sampling

Documentation soil samples will be collected from the excavation base at a frequency of one per 900 square feet per NYSDEC DER-10 5.4(b)(5)(ii). Sidewall samples will be collected if SOE measures consist of sloping. An estimated 54 confirmation endpoint soil samples, plus QA/QC samples, will be collected to document remedial performance and will be analyzed for the Part

375 list of VOCs, SVOCs, PCBs, pesticides, metals including hexavalent and trivalent chromium, PFAS, and 1,4-dioxane.

Documentation soil samples will be collected after the excavation is complete, except in the hot spot excavation areas that extend below the groundwater table. Samples may be collected in-situ prior to excavation during the remedial design investigation in the hot spot areas because the excavation sidewalls may collapse upon reaching the final depth within the saturated zone. A reduced-frequency endpoint sampling plan may be proposed, with supporting rationale, in accordance with DER-10 Section 1.6.

3.3.9 Composite Cover System

Under a Track 4 scenario, a composite cover system will be installed to allow for mixed-use commercial and residential use of the site. The composite cover system will consist of concrete extending across the entire footprint of the site. The composite cover system will serve as an EC for the protection of human health by preventing direct contact with remaining contaminated soil.

3.3.10 Soil Vapor Intrusion Evaluation

An SVI evaluation will be conducted after the remedial elements are completed. The method of remediation and development construction (i.e., removal of all site soil, concrete foundation below the water table, monolithic waterproofing/vapor barrier membrane, and cellar mechanical ventilation) will mitigate the potential for SVI. The SVI evaluation will include documentation composite cover system. The objective of the SVI evaluation is to confirm that the development-specific construction elements, specifically the building foundation, vapor barrier and ventilated parking garage, are implemented.

3.3.11 Site Management Plan and Environmental Easement

An EE would be recorded referencing institutional controls that are part of the selected remedy, which would be binding upon all subsequent owners and occupants of the property. The institutional controls would: 1) restrict the site's use to restricted-residential, commercial and industrial uses, although land use is subject to local zoning laws; 2) restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDEC or NYSDOH; 3) require the completion and submission to the NYSDEC a periodic certification of institutional controls in accordance with Part 375; and 4) include notice-of-use restrictions of the site's soil. The composite cover system will serve as an EC for the protection of human health by establishing an incomplete exposure pathway to residual contaminated soil on-site. As a construction element, a vapor barrier/waterproofing membrane and ventilated parking garage will be installed and will serve to mitigate potential soil vapor intrusion into the planned building. The SMP would identify all use restrictions and long-

term monitoring and maintenance requirements to ensure the institutional controls and remain in place and are effective.

3.4 Evaluation of Remedial Alternatives

The following is an evaluation of the proposed remedy based on the NYSDEC BCP remedy evaluation criteria listed below. The first two criteria are considered "threshold criteria" and the remaining criteria are "balancing criteria". A remedial alternative must meet the threshold criteria to be considered and evaluated further under the balancing criteria.

A. Protection of human health and the environment;

B. Compliance with standards, criteria, and guidance;

C. Short-term effectiveness and impacts;

D. Long-term effectiveness and permanence;

E. Reduction of toxicity, mobility, or volume of contaminated material;

F. Implementability;

G. Cost effectiveness;

H. Community acceptance; and

I. Land use.

3.4.1 Protection of Public Health and the Environment

Alternative I – The Track 1 remedy will completely mitigate the potential for complete exposure pathways through the complete removal of all on-site contaminated media. Remediating the site to Track 1 standards will result in the removal of soil exceeding Track 1 SCOs. Groundwater contamination will also be remediated through dewatering and possible treatment of residual impacts after the remedial excavation is complete. It is anticipated that soil vapor will be remediated through the removal of contaminated soil and groundwater source areas. The RAOs for public health and environmental protection will be met through the complete removal of contaminated soil and remediation of groundwater, which will eliminate any possibility for ingestion and inhalation of or dermal contact with contaminated soil groundwater and/or soil vapor.

Alternative II – Under Alternative II, future exposure will be limited by the establishment of an EE, governed by an SMP. The RAOs for public health and environmental protection will be met through a combination of contaminant removal and institutional controls (including an EE and SMP). Remediating the site to Track 2 standards will result in the removal of site soil that exceeds RURR (to a maximum depth of 15 feet bgs) and the removal of grossly impacted petroleum soil

associated with the open spill below 15 feet bgs. Potential exposure pathways from soil vapor will be mitigated by constructing the building foundation below the water table, vapor barrier, and ventilated parking garage.

Alternative III – Under Alternative III, future exposure will be limited by the establishment of an EE, governed by an SMP. The RAOs for public health and environmental protection will be met through the combination of contaminant removal and institutional controls (including an EE and SMP). The remedy will mitigate exposure pathways to on-site contaminated media by removing surficial historic fill from across the site and grossly impacted petroleum soil associated with the open spill, mercury-impacted soil, and PCB-impacted soil below the surficial 2 foot bgs cut. A composite cover will preclude direct contact, ingestion and inhalation of contaminated soil particles. Potential exposure pathways from soil vapor will be mitigated by constructing the building foundation below the water table, vapor barrier, and ventilated parking garaged.

Public health will be protected during remediation activities under all remedial alternatives by implementing and enforcing dust, odor, and organic vapor control and mitigation procedures when needed. The environment will be protected by implementing and enforcing the selected soil erosion plans.

3.4.2 Compliance with Standards, Criteria, and Guidance

Alternative I – Remediating the site to Track 1 Unrestricted Use standards will demonstrate compliance with all applicable SCGs through the removal of impacted on-site soil and groundwater treatment.

Alternative II – The Track 2 remedy includes removal of soil exceeding the RURR SCOs, as set forth in DER-10 Technical Guidance for Site Investigation and Remediation, CP-51 and 6 NYCRR Part 375 and groundwater treatment. Soil vapor will be mitigated by constructing the building foundation below the water table, vapor barrier, and ventilated parking garaged. Alternative II complies with the SCGs.

Alternative III – This remedy was designed to achieve a Track 4 Restricted Use – Restricted-Residential cleanup. To meet the requirements of applicable SCGs the remedy will include removal of the top two feet of historic fill across the site, engineering controls to prevent contact with remaining soil contamination exceeding RURR SCOs, removal of hotspots of petroleum-, mercury- and PCB-impacted soil with the potential to impact groundwater and soil vapor, and/or treatment of contaminated groundwater. Soil vapor will be mitigated by constructing the building foundation below the water table, vapor barrier, and ventilated parking garaged. Alternative III complies with the SCGs.

All remedial alternatives will also comply with SCGs that involve protection of the public health and environment during the remedial action by implementing and enforcing a site-specific

CHASP. Occupational Safety and Health Administration (OSHA) requirements for on-site construction safety will be followed by the site contractors.

3.4.3 Short-Term Effectiveness and Impacts

All Alternatives – Short-term adverse impacts from migration of contaminants carried in dewatering fluid, soil, vapor and dust to the community, site workers and the environment will be minimized by implementing appropriate control plans (including the CHASP, CAMP, SFMP, and dust, odor and vapor control measures). Additional short-term adverse impacts include increased noise, potential obstructions on roadway, and pedestrian traffic associated with construction. A Track 1 will require a longer duration than the Track 2 and Track 4 remedies.

All alternatives will require 25-cubic-yard capacity truck trips to haul excavated fill required for the baseline remediation program. A Track 1 remedy will require about 1,280 25-cubic yard truck trips, a Track 2 remedy will require about 900 25-cubic yard truck trips, and a Track 4 remedy will require about 440 25-cubic yard truck trips. The volume of dewatering fluid for a Track 1 remedy will also be greater due to the site-wide excavation extent and depth. Truck traffic under all remedies will be routed on the most direct course by the Contractor using major thoroughfares where possible and flaggers will be used to protect pedestrians at site entrances and exits.

3.4.4 Long-Term Effectiveness and Impacts

Alternative I – The Track I remedy will remove all historic fill and soil exceeding UU SCOs from the site and remediate impacted groundwater through the dewatering system. Because an EE and SMP are not required as part of the Track 1 remedy, Article 141 of the NYSDOH code will be relied upon to prevent ingestion of groundwater, which prohibits potable use of groundwater without prior approval. Future site use will be unrestricted; therefore, the long-term effectiveness of this remedy will eliminate potential environmental exposure and satisfy the objectives of this criterion.

Alternative II – Under a Track 2 remedy, all soil above RURR SCOs will be removed down to 15 feet bgs and the removal of grossly impacted petroleum soil associated with the open spill below 15 feet bgs. Contaminated groundwater will be treated in the same manner as Alternative I – treatment through dewatering. An SMP and environmental easement will restrict the use of groundwater on the site and Soil vapor intrusion is not a concern considering the building foundation slab is located at or below the groundwater table and the building construction will include a vapor barrier and ventilated parking garage. Long-term effectiveness and permanence of this alternative will be achieved through the implementation of the SMP and through enforcement of an EE, which will require annual inspections and reporting in perpetuity.

Alternative III – Residual soil contamination left in place under a Track 4 remedy will be addressed with the composite site cover system. Contaminated groundwater will be treated in the same manner as Alternatives I and II. The exposure pathways to residual soil contaminants will be

controlled by installation of the composite cover system and potential exposure to soil vapor intrusion will be prevented by installation of a concrete foundation below the groundwater table, vapor barrier, and ventilated parking garage. Long-term management of these ECs and the ICs will be accomplished through adherence to the SMP and EE. The long-term effectiveness of the Track 4 remedy will mitigate potential exposure to site contaminants and satisfy the objectives of this criterion.

3.4.5 Reduction of Toxicity, Mobility, or Volume of Contaminated Material

Alternative I – The Track 1 remedy will permanently and completely reduce the toxicity, mobility, and volume of contamination through excavation and removal of all on-site historic fill exceeding the UU SCOs. Extensive dewatering required by this remedy will be expected to also remediate VOCs in groundwater above SGVs. Extensive removal of soil and groundwater from the site under a Track 1 remedy is expected to significantly reduce soil vapor contamination. Therefore, Alternative I provides the greatest reduction of the toxicity, mobility, and volume of contaminated historic fill and soil.

Alternative II – The Track 2 remedy will also reduce the toxicity, mobility, and volume of soil contamination across the site through the excavation of soil exceeding RURR SCOs to 15 feet bgs and mercury and petroleum source areas below 15 feet. Extensive dewatering required by this remedy will be expected to also remediate VOCs in groundwater above SGVs, though potentially to a somewhat lesser extent than under Alternative I. The removal of contaminated soil and groundwater from the site under the Track 2 remedy is expected to improve soil vapor conditions at the site.

Alternative III – The Track 4 remedy will also reduce the toxicity, mobility, and volume of soil contamination across the site through the excavation of 2 feet of historic fill from across the surface of the site plus removal of deeper petroleum-, PCB- and mercury-impacted source areas. The Track 4 remedy will reduce the toxicity, mobility and volume of VOCs in groundwater above SGVs, but potentially to a lesser extent than under Alternatives I and II. The removal of contaminated soil and groundwater from the site under the Track 4 remedy is expected to improve soil vapor conditions, but potentially to a lesser extent than under Alternatives I and II.

3.4.6 Implementability

Alternative I – Implementing the Track 1 remedy is feasible; however, it is more technically challenging to design and achieve because of the significant increase in excavation depth/volume and backfill volume required for the Track 1 remedial excavation, and significant increase in dewatering and support of excavation to reach the excavation depths (up to 34 feet bgs compared to 18 feet bgs). Due to these technical challenges, the duration of a Track 1 remedy would be greater than a Track 2 or Track 4 remedy.

Alternatives II and III – Implementing the Track 2 and Track 4 remedies are feasible and more easily implementable because the depth of remedial excavation is shallower than a Track 1 excavation, therefore less excavation support and less dewatering is necessary. The resulting duration and costs of the cleanup are less. For these reasons the Track 2 and 4 remedies are easier to implement than the Track 1 remedy.

Contractors experienced in implementing all described remedies are readily available in the area of the site.

3.4.7 Cost Effectiveness

The estimated remediation cost of each cleanup track is as follows:

- Track 1 remedy: about $19.0 million
- Track 2 remedy: about $11.7 million
- Track 4 remedy: about $9.4 million

Tables 2 (Track 1), 3 (Track 2), and 4 (Track 4) detail the estimated costs of the engineering and contractor individual components needed to achieve each remedy.

Based on the assumptions detailed for Alternative I, including much greater depth of excavation, support, dewatering and removal of petroleum and mercury source areas, all historic fill and soil exceeding UU SCOs, and dewatering, the estimated remediation cost of a Track 1 cleanup is $19.0 million. As the site will be remediated to an UU level, there will not be any long-term operations, maintenance, or monitoring costs associated with the proposed remedy.

Based on the assumptions detailed for Alternative II, including removal of the petroleum spill and mercury hot spots, soil exceeding RURR SCOs above 15 feet bgs, dewatering, and implementation of ICs, the estimated remediation cost of a Track 2 cleanup is $11.7 million. In this scenario, long-term operations, maintenance, or monitoring costs associated with ICs are required.

Based on the assumptions detailed for Alternative III, including removal of 2 feet of historic fill from across the surface of the site plus removal of deeper petroleum, PCB, and mercury source areas, dewatering, and implementation of ECs and ICs, the estimated remediation cost of a Track 4 is $9.4 million. In this scenario, long-term operations, maintenance, or monitoring costs associated with ECs and ICs are required.

3.4.8 Community Acceptance

All alternatives should be acceptable to the community because the potential complete exposure pathways will be eliminated through source removal and/or mitigated upon completion of the remedial actions. The Track 1 remedy may be less acceptable to the community because of the increased short-term impacts and remediation duration associated with complete removal of soil

above Track 1 SCOs. The Track 2 and Track 4 remedies may be more acceptable to the community because of decreased short-term impacts and remediation duration and achieve the RAOs through removal of contaminated fill and the use of ECs and/or ICs.

The selected remedy will be subject to a 45-day public comment period. Any substantive public comments received will be addressed before the remedy is approved.

3.4.9 Land Use

The current, intended, and reasonably anticipated future land use of the site and its surroundings are compatible with the selected remedy. The future proposed development is a mixed-use commercial and residential buildings with one cellar level. Review of previous environmental and public documents for the site reflect to the following conclusions:

1. The current and proposed use of the site and its surroundings will be compatible with the selected remedy.
2. The proposed site use conforms to applicable zoning requirements.
3. The proposed site use conforms to historical and/or recent development patterns in the area.
4. The site does not fall within the boundaries of an existing Brownfield Opportunity Area (BOA) and New York State Environmental Zone (En-Zone).
5. The site is located in an urban area characterized by mixed-use commercial, institutional, and residential uses.
6. According to the New York City Landmarks Preservation Commission, the site is located in the South Street Seaport historic district.
7. There are no federal or state land designations.
8. The population growth patterns and projections support the proposed land use.
9. The site is accessible to existing infrastructure.
10. Groundwater is not used as a potable water source in New York City. Potable water provided to the City of New York is derived from surface impoundments in the Croton, Catskill, and Delaware watersheds.
11. According to the Effective National Flood Insurance Rate map for the City of New York published by the Federal Emergency Management Agency (FEMA) (Community Panel No. 3604970184F, dated September 5, 2007), the southern portion of the Subject Property falls within the advisory limit of the 0.1 percent Annual Chance Flood Hazard Area "special flood hazard", as defined by the 2014 New York City Building Code. The northern part of the site is located within Zone X, which is defined as 0.2% annual chance flood areas.

3.5 Summary of the Proposed Remedy

The Track 2 (Alternative II) RURR remedy achieves the remedial action objectives established for the project, and is effective in the short- and long-terms. The selected remedy effectively reduces mobility, toxicity, and volume of contaminants. Potential vapor intrusion into the building will be controlled through construction of the future building foundation at or within the water table and by the vapor barrier/waterproofing membrane and ventilated parking garage. ICs are designed to make the remedy protective of human health and the environment in the future. The remedy is considered feasible and cost effective because the excavation depths do not present significant technical challenges (e.g., depth of excavation, support and dewatering), and can be achieved through conventional construction measures. Alternative II can be feasibly and practically implemented, while providing protection to human health and the environment, should be acceptable to the community because it eliminates complete exposure pathways. Alternative II is the recommended remedial alternative for this site.

4.0 REMEDIAL ACTION PROGRAM

4.1 Governing Documents

The primary documents governing the remedial action are summarized in this section. Where referenced, copies of the full plans are provided in the appendices.

4.1.1 Standards, Criteria and Guidance

The parts following standards, criteria, and guidance are typically applicable to Remedial Action projects in New York State, and will be consulted and adhered to as applicable:

- NYSDEC Title 6 of the New York Codes, Rules and Regulations
- NYSDEC CP-51- Soil Cleanup Guidance (2010)
- EPA Title 40, Code of Federal Regulations
- NYSDEC Sampling, Analysis and Assessment of PFAS Substances under NYSDEC's Part 375 Remedial Programs, dated January 2020, Revised January 2021

4.1.1.1 Standards and criteria typically applicable to UST closures

- 6 NYCRR Part 613 - Petroleum Bulk Storage
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes
- 6 NYCRR Subpart 374-2 - Standards for the Management of Used Oil
- 6 NYCRR Parts 700-706 - Water Quality Standards
- 40 CFR Part 280 - Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks

4.1.1.2 Guidance typically applicable to UST closures

- STARS #1 - Petroleum-Contaminated Soil Guidance Policy (1992) (Sections III and IV have been replaced CP-51)
- CP-51- Soil Cleanup Guidance (2010)
- Spill Response Guidance Manual (1995)
- Permanent Closure of Petroleum Storage Tanks (2003)
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels (August 1997)
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations (1998, Addenda 2000 and 2004)
- DAR-1 (formerly Air Guide 1) (1997) - Guidelines for the Control of Toxic Ambient Air Contaminants

4.1.1.3 Standards and Criteria Typically Applicable to Remedial Actions

- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes
- 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities
- 6 NYCRR Subpart 374-1 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
- 6 NYCRR Subpart 374-3 - Standards for Universal Waste
- 6 NYCRR Part 375 - Environmental Remediation Programs
- 6 NYCRR Part 376 - Land Disposal Restrictions
- 6 NYCRR Parts 700-706 - Classifications and Standards of Quality and Purity
- 6 NYCRR Part 750 - State Pollutant Discharge Elimination System (SPDES) Permits

4.1.1.4 Guidance Typically Applicable to Remedial Actions

- CP-51 - Soil Cleanup Guidance (2010)
- DER-2 - Making Changes To Selected Remedies (Revised April, 2008)
- STARS #1 - Petroleum-Contaminated Soil Guidance Policy (1992) (Sections III and IV have been replaced by CP-51)
- TAGM 3028 - "Contained In" Criteria for Environmental Media: Soil Action Levels (August 1997)
- DER-23 – Citizen Participation Handbook for Remedial Programs (March, 2010)
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations
- TOGS 1.3.8 - New Discharges to Publicly Owned Treatment Works
- TOGS 2.1.2 - Underground Injection/Recirculation (UIR) at Groundwater Remediation Sites
- DAR-1 (formerly Air Guide 1) - Guidelines for the Control of Toxic Ambient Air Contaminants (1997)
- U.S. EPA OSWER Directive 9200.4-17 - Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (December 1997)
- CP-43 – Commissioner Policy on Groundwater Monitoring Well Decommissioning (December 2009)

- NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006, with updates in 2017)
- New York State Department of Environmental Conservation Sampling, Analysis and Assessment of Per and Polyfluorinated Alkyl Substances (PFAS) under NYSDEC's Part 375 Remedial Programs, dated January 2020, Revised January 2021

4.1.2 Site-Specific Construction Health & Safety Plan (CHASP)

The RE prepared a site-specific CHASP (Appendix D). The CHASP will apply to all remedial and construction-related work on site. The CHASP provides a mechanism for establishing a site safety office, on-site safe working conditions, safety organization, procedures, and PPE requirements. The CHASP meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). The CHASP includes, but is not limited to, the following components:

- Organization and identification of key personnel;
- Training requirements;
- Medical surveillance requirements;
- List of site hazards;
- Excavation safety;
- Work zone descriptions;
- Personal safety equipment and protective clothing requirements;
- Decontamination requirements;
- Standard operating procedures;
- Protective measure plan;
- CAMP; and
- Safety Data Sheets (SDS).

Remedial work performed under this plan will be in full compliance with governmental requirements, including site and worker safety requirements mandated by OSHA.

The Volunteer and associated parties preparing the remedial documents submitted to the State and those performing the construction work are responsible for the preparation of an appropriate CHASP and for the appropriate performance of work according to the CHASP and applicable laws. All contractors performing work on the site must prepare their own CHASP that, at a minimum, meets the requirements of the CHASP in Appendix D.

The CHASP and requirements defined in this RAWP pertain to all remedial and invasive work performed at the site until the issuance of a Certificate of Completion. Confined space entry will

comply with all OSHA requirements to address the potential exposure posed by combustible and toxic gases.

4.1.3 Quality Assurance Project Plan (QAPP)

The RE prepared a Quality Assurance Project Plan (QAPP) that describes the quality control components employed so that the proposed remedy accomplishes the remedial goals, remedial action objectives, and is completed in accordance with the design specifications. The QAPP is provided as Appendix E and includes:

- Responsibilities of key personnel and their organizations for the proposed remedy;
- Qualifications of the quality assurance officer;
- Sampling requirements including methodologies, quantity, volume, locations, frequency, and acceptance and rejection criteria; and
- Description of the reporting requirements for quality assurance activities including weekly quality assurance review reports, periodic quality assurance and quality control audits, and other report and data submissions.

4.1.4 Construction Quality Assurance Plan (CQAP)

The RE oversaw the preparation of this Construction Quality Assurance Plan (CQAP) that describes the quality control components employed so that the proposed remedy accomplishes the remedial goals and RAOs and is completed in accordance with the design specifications. The contractor and construction manager will have the primary responsibility to provide construction quality. A list of personnel involved in implementation of the CQAP and procedures that will be carried out by the remedial team are identified in Section 4.2.1.

The RE will directly supervise field personnel that will be on-site during the remedial action to monitor particulates and organic vapor in accordance with the CAMP. Daily reports will be submitted to NYSDEC and NYSDOH and will include reporting of any CAMP results that exceed the specified action levels.

The RE will directly supervise field personnel that will meet with the Construction Superintendent on a daily basis to discuss the plans for that day and schedule upcoming activities. The field personnel will document remedial activities in daily reports. This document will be forwarded to the Field Team Leader, Project Manager, and NYSDEC on a daily basis and to the RE on a weekly basis.

The RE will directly supervise field personnel that will screen the excavation with a PID and Jerome J505 mercury vapor analyzer (or equivalent) during intrusive activities. All readings will be noted in the record. Readings that exceed the CAMP action levels will be reported to NYSDEC and NYSDOH in the daily reports. The field personnel will collect the excavation documentation samples in accordance with this RAWP.

A photo log will be kept to document construction activities by still photos. The photo log may also be used to record activities recorded in the daily report.

The project field book will be used to document all sampling activities and how they correspond to the RAWP. Observations and field and laboratory tests will be recorded in the project field book or on separate logs. Recorded field observations may take the form of notes, charts, sketches or photographs.

The Field Team Leader will maintain the current field book and original field paperwork during the performance of work. The Project Manager will maintain the field paperwork after completion and will maintain submittal document files.

4.1.5 Soil/Fill Management Plan (SFMP)

The RE prepared an SFMP that includes detailed plans for managing soil/fill that is disturbed at the site, including excavation, handling, storage, transport and disposal. It also includes controls that will be applied to these efforts to facilitate effective, nuisance-free performance in compliance with applicable federal, state and local laws and regulations (see Section 5.4).

4.1.6 Erosion and Sediment Control Plan

The erosion and sediment controls will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control. Erosion and sediment controls that will be implemented are briefly described in Section 5.4.9 (Stormwater Pollution Prevention) and will be further detailed in the Soil Sediment and Erosion Plan provided in Appendix F. A Stormwater Pollution Prevention Plan (SWPPP) is not necessary because there is not a water body adjacent to the site and the storm drains adjacent to the site flow to a combined sewer and not to the river. Stormwater discharge, as required, will be to a combined sewer in accordance with the New York City SPDES General Permit for Stormwater Discharges from Construction Activities. Best Management Practices (BMP) for soil erosion will be selected and implemented, as needed, to minimize erosion and sedimentation off-site.

4.1.7 Community Air Monitoring Plan (CAMP)

A CAMP has been prepared by the RE and is included as section 5.4.10 below and part of the CHASP in Appendix D.

4.1.8 Contractors Site Operations Plan (SOP)

The RE will review plans and submittals for this remedial project (including those listed above as well as contractor and sub-contractor document submittals) and document their compliance with this RAWP. The RE is responsible for documenting that contractor and subcontractor document submittals are in compliance with this RAWP. Remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and before the start of work.

4.1.9 Citizen Participation Plan

A certification of mailing will be sent by the Volunteer to the NYSDEC project manager following the distribution of Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed, (2) the date they were mailed; (3) a copy of the Fact Sheet, (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all of the applicable project documents.

No changes will be made to the approved Fact Sheets authorized for release by NYSDEC without written consent from NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The approved Citizen Participation Plan for this project is included as Appendix G.

A project specific website contain project documents can be found at https://250bcp.com/. Document repositories were established at the following locations and contain project documents and can also be accessed using the following link: https://gisservices.dec.ny.gov/gis/dil/

New York Public Library – Chatham Square Branch
33 E Broadway
New York, NY 10002
Phone: (212) 964-6598

Manhattan Community Board No. 1
Tammy Meltzer, Chairperson
1 Centre Street, Room 2202
New York, NY 10007
Phone: (212) 669-7070

4.2 General Remedial Construction Information

4.2.1 Project Organization

This section presents the anticipated project organization and associated roles, including key personnel, descriptions of duties and lines of authority in the management of the RAWP. Information regarding the organization/personnel and their associated responsibilities is provided below.

Remediation Engineer (RE):	Jason J. Hayes, P.E.
Project Leader/Program Manager :	Mimi S. Raygorodetsky
Quality Assurance Officer	Michael D. Burke, PG, CHMM
Project Manager:	Paul McMahon, P.E.
Langan Health & Safety Officer:	Tony Moffa, CHMM, CSP
Site Safety Coordinator:	William Bohrer, PG
Field Team Leader:	Joseph Yanowitz

Project personnel resumes are provided in Appendix H.

4.2.2 Remedial Engineer

The RE for this project will be Jason J. Hayes, P.E. The RE is a registered Professional Engineer licensed by the State of New York who will have primary direct responsibility for implementation of the remedial program. The RE will certify in the FER that the remedial activities were observed by personnel under his supervision and that the remediation requirements set forth in the RAWP and any other relevant provisions of ECL 27-1419 were achieved in full conformance with that plan. Other RE certification requirements are listed later in this RAWP.

The RE will direct field personnel to document the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, dewatering, air monitoring, emergency spill response services, import of backfill material, and management of waste transport and disposal. The RE will be responsible for appropriate communication with the NYSDEC and NYSDOH.

The RE will review pre-remedial plans submitted by contractors for compliance with this RAWP and will certify compliance in the FER.

In the FER, the RE will provide the certifications listed in Section 8.1.

4.2.3 Project/Remediation Schedule

The anticipated project/remediation construction schedule is provided in Appendix I. Proposed changes, delays or deviations will be promptly communicated to the NYSDEC.

4.2.4 Work Hours

The hours of operation for remedial construction will either conform to the requirements of the New York City Department of Buildings (NYCDOB) construction code or to a site-specific variance issued by the NYCDOB. The NYSDEC will be notified by the Volunteer of any variances issued by the NYCDOB. The NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.5 Site Security

The site perimeter will be secured with gated, signed, plywood fencing with points of entry in accordance with the NYCDOB and New York City Department of Transportation (NYCDOT) permits and requirements. The purpose of the fencing is to limit site access to authorized personnel, protect pedestrians from site activities, and maintain site security.

Once remedial excavating begins, the site entrance will be manned during working hours. The project will be guarded in accordance with the NYCDOB codes and requirements.

4.2.6 Traffic Control

Site traffic will be controlled through designated points of access along Pearl Street. Access points will be continuously monitored and if necessary, a flagging system will be used to protect workers, pedestrians, and authorized guests. Traffic will also adhere to applicable local, state, and federal laws. Proposed inbound and outbound truck routes to the site are discussed in Section 5.4.

4.2.7 Contingency Plans

Contingency plans, as described below, were developed to effectively deal with unexpected discoveries of additional contaminated media or unexpected USTs.

4.2.7.1 Discovery of Additional Contaminated Soil

During remediation and construction activities, the soil will be continuously monitored by the RE's field representatives using a PID and Jerome J505 mercury vapor analyzer (or equivalent) as well as visual and olfactory field screening techniques to identify soil that may not be suitable for the selected disposal facility(ies). This historic fill and soil will be segregated and sampled for lab analysis in accordance with disposal facility requirements. If the proposed facility is not permitted to receive the suspect historic fill and soil, the material will be disposed of off-site at a permitted facility able to receive the material based on the characterization data. Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to the NYSDEC Project Manager. These findings will be detailed in daily reports and subsequent monthly BCP progress reports.

4.2.7.2 Discovery of USTs

Previously unidentified USTs may be discovered during site-wide excavation. Unexpected USTs encountered during remedial and/or construction activities will be decommissioned in accordance with 6 NYCRR Parts 612.2 and 613.9 and NYSDEC DER-10 Section 5.5. After the tank, its contents, and associated piping are removed, post-excavation soil samples will be collected per the requirements of NYSDEC DER-10. If encountered, petroleum-impacted soils will be excavated, stockpiled separately, and disposed of off-site at a permitted disposal facility in accordance with applicable regulations. UST closure documentation, including contractor

affidavits, waste manifests, and tank disposal receipts, will be included as appendices to the FER. USTs will be registered with the NYSDEC Petroleum Bulk Storage unit, as necessary.

If USTs are encountered during invasive site work, the findings will be promptly communicated by phone to the NYSDEC's Project Manager and detailed in daily reports and subsequent monthly BCP progress reports.

4.2.8 Worker Training and Monitoring

Worker training and monitoring will be conducted in accordance with the CHASP (Appendix D).

4.2.9 Agency Approvals

Permits or government approvals required for remedial construction will be obtained prior to the start of remediation and included in the FER. The planned end use as mixed use commercial and residential building conforms to current zoning for the property. The proposed development will require the approval of the New York City Landmarks & Preservation Commission (NYCLPC); however the NYCLPC approval does not impact the remedy.

4.2.10 Pre-Construction Meeting with the NYSDEC

Prior to the start of remedial construction, a meeting will be conducted with the RE, Volunteer, Construction Manager, remediation contractor and the NYSDEC to discuss project roles, responsibilities, and expectations associated with this RAWP.

4.2.11 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in the CHASP (Appendix D). That document will define the specific project contacts for use by the NYSDEC and NYSDOH in the case of a day or night emergency.

4.2.12 Remedial Action Costs

The estimated engineer and contractor cost of the preferred Track 2 remedy is about $11.7 million. An itemized and detailed summary of estimated costs for remedial activity is provided as Table 4. This estimate will be revised based on actual costs and submitted as an appendix to the FER.

4.3 Site Preparation

The RE will work with the Volunteer and its contractors so that any site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this RAWP.

4.3.1 Mobilization

Before commencing site remediation, the remediation contractor will mobilize to the site and prepare for remedial activities. Mobilization and site preparation activities may include the following:

- Identifying the location of all aboveground and underground utilities (e.g., power, gas, water, sewer, telephone), equipment, and structures (as necessary to implement the remediation);
- Mobilizing necessary remediation personnel, equipment, and materials to the site;
- Constructing one or more stabilized construction entrances consisting of virgin crushed stone or RCA at or near the site exit, which takes into consideration the site setting and site perimeter;
- Constructing a decontamination pad for trucks, equipment, and personnel that come into contact with impacted materials during remedial activities;
- Installing erosion and sedimentation control measures, as necessary; and
- Installing temporary fencing or other temporary barriers to limit unauthorized access to areas where remediation activities will be conducted.

4.3.2 Monitoring Well Decommissioning

Existing groundwater monitoring wells will be properly decommissioned in accordance with NYSDEC CP-43, when no longer required. The only exception to this is if the full length of the well is to be excavated during remediation. Well decommissioning will be performed by an experienced driller and logged by Langan field personnel. Decommissioning documentation will be provided in the FER.

4.3.3 Stabilized Construction Entrance(s)

Stabilized entrance areas will be constructed to prevent cleaned/washed trucks from being re-contaminated by site soil before exiting. The areas will be covered with virgin crushed stone or RCA and graded so that runoff water will be directed onto the site. The contractor will protect and maintain the existing sidewalks and roadway at site entrance points.

4.3.4 Utility Marker and Easements Layout

The Volunteer and its contractors are solely responsible for the identification of utilities that might be affected by work under this RAWP; the implementation of required, appropriate or necessary health and safety measures during performance of work under this RAWP; and the safe execution of invasive and other work performed under this RAWP. The Volunteer and its contractors must obtain local, state or federal permits and/or approvals that may be required to

perform work under this RAWP. Approval of this RAWP by the NYSDEC does not constitute satisfaction of these requirements.

The presence of utilities and easements on the site will be investigated by the Volunteer and its contractors. No impediments to the planned work under this RAWP are expected by known utilities or easements on the site.

4.3.5 Sheeting and Shoring

Appropriate management of structural stability of on-site and off-site structures during on-site activities, including excavation, is the responsibility of the Volunteer and its contractors. The Volunteer and its contractors must obtain local, state or federal permits and/or approvals that may be required to perform this work. The Volunteer and its contractors are solely responsible for the implementation of required, appropriate, or necessary health and safety measures during performance of work under the approved RAWP.

4.3.6 Equipment and Material Staging

The contractor will notify the RE and the Volunteer in writing with receipt confirmed, of pending site work mobilization at least 30 calendar days in advance. During mobilization, construction equipment will be delivered to the site, temporary facilities constructed, and temporary utilities installed. The contractor will place and maintain temporary toilet facilities within the work areas for usage by all site personnel. The contractor will provide drinking water for all site personnel.

4.3.7 Truck and Equipment Wash/Cleaning Area

The contractor will construct wash/cleaning pads within the site boundary at each site entrance/exit planned for construction vehicle usage. The location of wash/cleaning pads may change periodically to accommodate the Contractor's sequencing of work. Where required, the pads will be constructed by the contractor so wastewater stays on-site. If the pads cannot be constructed onsite, then they will be constructed to collect wastewater for off-site disposal or treatment and discharge, if generated during wash/cleaning activities. The design will consider adequate space to wash/cleaning equipment and vehicles, and sloping and liners to facilitate the proper handling of wastewater. If collected, wastewater shall be either discharged in accordance with the Contractor's New York City Department of Environmental Protection (NYCDEP) permit or tested and transported to an off-site disposal facility that is permitted to accept this waste, in accordance with applicable local, state and federal regulations. The contractor will maintain the pad(s) throughout the duration of site work. Prior to demobilization, the contractor will deconstruct the pads and dispose of materials as required.

If the contractor uses high pressure washing methods, the contractor shall provide splash protection around the vehicle cleaning/washing station to prevent splatter and mist migrating off-

site during the vehicle cleaning process. Splash protection shall be temporary and stable and capable of being dismantled in the event of high winds.

4.3.8 Site Fencing

The site perimeter will be secured with gated, signed, plywood fencing. The purpose of the fencing is to limit site access to authorized personnel, protect pedestrians from site activities and maintain site security.

4.3.9 Demobilization

The contractor will be responsible for demobilizing all labor, equipment and materials not designated for off-site disposal. The RE will be required to document that the remediation contractor has decontaminated all equipment and materials before removal from the site. The RE will document performance by the contractor of any follow-up coordination and maintenance for the following activities: removal of sediment and erosion control measures and disposal of materials in accordance with acceptable rules and regulations; removal of residual contaminated material or wastes; equipment decontamination; and general refuse disposal.

4.4 Reporting

Daily and monthly reports and an FER will be required to document the remedial action. The RE responsible for certifying the FER will be an individual licensed to practice engineering in the State of New York; Jason Hayes, P.E., of Langan, will have this responsibility. Should Mr. Hayes become unable to fulfill this responsibility, another suitably qualified New York State professional engineer will take his place. All daily and monthly reports will be included in the FER. In addition to the periodic reports and the FER, copies of all relevant contractor documents will be submitted to the NYSDEC.

4.4.1 Daily Reports

Daily reports will be submitted to the NYSDEC and NYSDOH Project Managers by the end of the following day, or at a frequency acceptable to them, and will include:

- An update of progress made during the reporting day, including a photographic log;
- Locations of work and quantities of material imported and historic fill/soil 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 any exceedances and actions taken to address the exceedances;
- An explanation of notable site conditions;

- A description of anticipated site activities; and
- The NYSDEC-assigned project number will appear on all reports.

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 RAWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RAWP will be addressed directly to NYSDEC Project Manager via personal communication.

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

4.4.2 Monthly Reports

Monthly reports will be submitted to the NYSDEC and NYSDOH Project Managers by the tenth of the following month of the reporting period and will include the following information, as well as the information required in the BCA:

- 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 historic fill/soil exported and material imported, etc.);
- Description of approved activity modifications, including changes to the scope of work and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and
- 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.

4.4.3 Other Reporting

Photographs will be taken of remedial activities and submitted to the NYSDEC in digital (JPEG) format. Photographs will illustrate the remedial program elements and will be of acceptable quality. Representative photographs of the site before any remedial actions and of each contaminant source area and site structures before, during and after remediation will be provided. Photographs will be submitted to NYSDEC in digital format (e.g. jpeg files). A photograph log keyed to photo file ID numbers will be prepared to provide explanation for all representative photos.

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

4.4.4 Complaint Management Plan

The management plan for documenting complaints is detailed below.

Item	Description
Approach	Complaints regarding remediation or construction activities/operations will be minimized and mitigation measures will be implemented to reduce the incidence of complaints.
Objective	To manage environmental complaints from the community regarding construction or remediation.
Implementation Strategy/Mitigation Measures	All complaints will be documented on a complaint register. The register will be maintained as an ongoing record. Each entry will include the following information: • Time, date and nature of complaint; • Type of communication (telephone, letter, personal, etc.); • Name, contact address and contact number; and • Response and investigation undertaken as a result of the complaint and action taken with the signature of the responsible person. Each complaint will be investigated as soon as practicable in relation to the requirements.
Monitoring	A representative from the Volunteer or the RE will follow up on the complaint within two weeks of receipt to ensure it has been resolved.
Reporting	Upon receipt, the NYSDEC will be notified. Complaints and resolutions will be documented in the daily reports.
Corrective Action	Should an incident or failure to comply occur in relation to the management of environmental complaints, one or more of the following corrective actions will be undertaken as appropriate: • Conduct additional training of staff to handle environmental complaints; • Investigate why the environmental complaint was not addressed within the specified time frame; and • Investigate the complaint and action follow-up according to the investigation results.

4.4.5 Deviations from the RAWP

Necessary deviations from the RAWP will be coordinated with the NYSDEC in advance. Notification will be provided to the NYSDEC by telephone/email for conditions requiring immediate action (e.g., conditions judged to be a danger to the surrounding community). Addendums to the RAWP will be prepared, as necessary and will include:

- Reasons for deviating from the approved RAWP;
- Approval process to be followed for changes/editions to the RAWP; and

- Effect of the deviations on the overall remedy.

5.0 REMEDIAL ACTION: SOIL/FILL REMOVAL FROM SITE

5.1 Soil Cleanup Objectives

A Track 2 remediation is proposed; therefore, the applicable site-specific SCOs are the NYSDEC RURR SCOs listed in 6 NYCRR Part 375-6.8(b).

Soil and historic fill management on- and off-site will be conducted in accordance with the SFMP described below (Section 5.4). UST closures will conform to the criteria defined in 6 NYCRR Part 613.9, NYSDEC CP-51, and other applicable NYSDEC UST closure requirements including DER-10 Chapter 5.5. Track 2 SCOs are shown in Table 1.

5.2 Remedial Performance Evaluation

5.2.1 Soil

Confirmation soil samples will be collected from the final bottom of excavation at a frequency of one per 900 square feet per NYSDEC DER-10 5.4(b)(5)(ii). Sidewall samples will not be collected from the excavation perimeter because support of excavation measures will preclude collection of sidewall samples. A reduced sample frequency, or utilizing RI grab samples results in place of new Track 2 endpoint samples, may be allowed with NYSDEC approval. The proposed confirmation sampling locations are presented on Figure 12.

Confirmation samples will be transported under standard chain-of-custody protocol to an NYSDOH ELAP-approved laboratory for 6 NYCRR Part 375 VOCs, SVOCs, pesticides/herbicides, PCBs, and metals analysis. Laboratory analyses will be conducted in accordance with EPA SW-846 methods and NYSDEC Analytical Services Protocol (ASP) Category B deliverable format. QA/QC procedures required by the NYSDEC ASP and SW-846 methods will be followed, including instrument calibration, standard compound spikes, surrogate compound spikes, and analysis of quality control samples. The laboratory will provide sample bottles, which are pre-cleaned and preserved. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP shall take precedence.

5.2.1.1 Mercury-Impacted Soil Hotspot

The mercury-impacted soil hotspot is located in the former location of the thermometer factory at 302 Pearl Street. The mercury-impacted soil hotspot is shown on Figure 8. It was delineated during the remedial investigation and will be further defined during the remedial design investigation/waste characterization. Mercury vapor monitoring will be conducted in accordance with the CAMP (see section 5.4.10 and the CHASP in Appendix E).

After removal of the mercury-impacted soil hotspot, perimeter mercury vapor monitoring may be discontinued or reduced with approval of DEC/DOH based on an evaluation of air monitoring

results during hotspot removal. Handheld mercury vapor monitoring will continue throughout the remainder of excavation.

5.2.2 Groundwater

Groundwater sampling will be performed after the petroleum source material is removed and dewatering is complete to assess the performance of the remedy and whether the groundwater source has been sufficiently remediated.

The influent groundwater of the dewatering system will be sampled, containerized, and transported under standard chain-of-custody protocol to an NYSDOH ELAP-approved laboratory for 6 NYCRR Part 375/TCL VOC and SVOC analysis. Laboratory analyses will be conducted in accordance with EPA SW-846 methods and NYSDEC ASP Category B deliverable format. QA/QC procedures required by the NYSDEC ASP and SW-846 methods will be followed, including instrument calibration, standard compound spikes, surrogate compound spikes, and analysis of quality control samples. The laboratory will provide sample bottles, which are pre-cleaned and preserved. Where there are differences in the SW-846 and NYSDEC ASP requirements, the NYSDEC ASP shall take precedence.

Laboratory Analysis and Reporting

A data usability summary report (DUSR) will be included in the FER and in post-remedial groundwater sampling reports. Quality control procedures for the sampling are included in the QAPP (Appendix E). Documentation sample results will be provided in NYSDEC electronic data deliverable (EDD) format for EQuIS™. Guidance on sampling frequency is presented in Section 5.4 of DER-10.

The FER will provide a tabular and map summary of all documentation sample results.

5.3 Estimated Soil/Fill Removal Quantities

The estimated quantity of soil/fill to be removed from the site for a Track 2 cleanup is about 21,700 cubic yards. Over-excavated areas will require backfill meeting the more stringent of the RURR or PGW SCOs or virgin stone. The remedial excavation extents are shown on Figure 8 and 10.

5.4 Soil/Fill Management Plan

This section presents the approach to management, disposal and reuse of soil and fill excavated from the site. This plan is based on the current knowledge of site conditions, and will be augmented with the additional data collected during remediation. Langan field personnel, under the direction of the RE or qualified environmental professional (QEP), will monitor and document the handling and transport of contaminated soil and historic fill removed from the site for disposal as a regulated solid waste. Field personnel, under the direction of the RE or QEP, will assist the

remedial contractor in identifying impacted soil and historic fill during excavation, determining soil and historic fill suitable for direct load-out versus temporary on-site stockpiling, selection of samples for waste characterization, and determining the proper off-site disposal facility for soil and historic fill. Separate stockpile areas will be constructed as needed to stage various excavated materials with the intent to more efficiently manage and characterize the soil and historic fill and to avoid comingling of impacted soil and historic fill with non-impacted soil.

5.4.1 Soil Screening Methods

Visual, olfactory and PID/Jerome soil screening and assessment will be performed by Langan field personnel under the direct supervision of the RE or QEP during excavations into known or potentially contaminated soil and historic fill. Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during any development phase, such as excavations for foundations and utility work before issuance of the Certificate or Completion.

Field screening for evidence of contamination will be performed by field personnel under the direct supervision of the RE or QEP. Resumes will be provided for personnel responsible for field screening (i.e., those representing the RE) of invasive work for known or unknown contaminant sources during remediation and any development work.

5.4.2 Stockpile Methods

Soil stockpile areas, if needed for the different types of soil and historic fill, will be constructed for staging of site soil, pending loading or waste characterization testing. Separate stockpile areas will be constructed to avoid comingling soil and historic fill of differing waste types. All stockpile areas will meet the following minimum requirements:

- The excavated soil and historic fill will be placed onto an impermeable surface or on minimum thickness of 8 mil low-permeability plastic sheeting or tarps of sufficient strength to prevent puncture during use; separate stockpiles will be created where soil and historic fill types are different (e.g., historic fill on areas where historic fill is present.). The use of multiple layers of thinner liners is permissible.
- Equipment and procedures will be used to place and remove the soil and historic fill so as to minimize the potential to jeopardize the integrity of the liner.
- Stockpiles will be covered at the designated times (see below) with minimum 8-mil plastic sheeting or tarps, which will be securely anchored to the ground. Stockpiles will be routinely inspected and broken sheeting covers will be promptly replaced.
- Stockpiles will be covered, upon reaching their capacity of approximately 1,000 cubic yards, until ready for loading.
- Active stockpiles (e.g. stockpiles that have not reached their capacity) will be covered at the end of each workday.

- Each stockpile area will be encircled with silt fences and hay bales, as needed, to contain and filter particulates from rainwater that has drained off the soils, and to mitigate the potential for surface water run-off off-site.
- Stockpiles will be inspected at a minimum once each day and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.
- Mercury and petroleum-impacted soil and historical fill stockpiles will be promptly removed from the site, and the vapor, dust, odor and nuisance controls discussed in section 5.4.12 will be implemented.

5.4.3 Soil/Fill Characterization, Excavation and Loading

Excavated soil and historic fill will be characterized for off-site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results and QA/QC data will be reported in the FER. All data available for soil or subsurface material to be disposed of at a given facility must be submitted to the disposal facility for review and approval before shipment and receipt.

The Volunteer and its contractors are solely responsible for safe execution of invasive work, the excavation support, structures that may be affected by excavations, and other work performed under this RAWP. Field personnel under the direct supervision of the RE or QEP will observe and document all invasive work and the excavation and loading of excavated soil and historic fill. Remediation areas will be excavated and post-excavation confirmation sampling completed before excavations related to site development can move forward in the remediated area of the site. Development-related grading cuts and fills will not be performed without NYSDEC approval of the RAWP, and the RE will provide that any site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this RAWP.

The RE's field personnel will be responsible for monitoring egress points for truck and equipment transport from the site and ensuring that the Contractor is notified of their obligation to immediately clean the sidewalks and streets of dirt and other materials derived from the site during site remediation. Non-compliance will be reported to the NYSDEC. Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site sediment tracking. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials. Loaded vehicles leaving the site will be appropriately lined, securely covered, manifested, and placarded in accordance with appropriate federal, state, and local requirements, and all other applicable transportation requirements. Trucks hauling historic fill will not be lined unless the material exhibits free liquids or is grossly impacted. On-site, mechanical processing of historic fill and contaminated soil is prohibited unless otherwise approved by the NYSDEC.

5.4.4 Soil/Fill Transport Off-Site

Transport of soil and historic fill will be performed by licensed haulers in accordance with appropriate local, state and federal regulations, including 6 NYCRR Part 364. Trucks entering or leaving the site will be securely covered with tight fitting covers. Haulers will be appropriately licensed and trucks properly placarded. Trucks will enter and exit the site using dedicated ingress/egress points. Trucks loaded with site soil and historic fill will exit the vicinity of the site using only approved truck routes. Trucks will be prohibited from stopping and idling unnecessarily in the neighborhood outside the site. To the extent possible, queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be minimized.

Proposed inbound and outbound truck routes to the site are shown on Figure 13. This is the most appropriate route and takes into account:

- Limiting transport through residential areas and past sensitive sites;
- Prohibiting off-site queuing of trucks entering the facility;
- Limiting total distance to major highways;
- Promoting safety in access to highways;
- Overall safety in transport; and
- Community input.

A truck wash/cleaning area will be operated on-site. The RE's field personnel will be responsible for documenting that outbound trucks are washed and cleaned at the truck wash before leaving the site until the remedial construction is complete. Locations where vehicles enter or exit the site will be inspected daily for evidence of off-site sediment tracking.

The RE's field personnel will be responsible for documenting that egress points for truck and equipment transport from the site are free of dirt and other subsurface materials derived from the site during remediation. Cleaning of the adjacent streets will be performed by the remediation contractor as needed to maintain a clean condition with respect to site-derived materials.

5.4.5 Soil/Fill Disposal Off-Site

Excavated soil/fill material and other solid wastes removed from the site will be handled, transported and disposed of in accordance with local, state (including 6 NYCRR Parts 360 and 361) and federal regulations. If disposal of fill material is proposed for unregulated disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC's Project Manager. Unregulated off-site management of materials from this site is prohibited without formal NYSDEC approval.

Excavated fill material must be disposed of at an in-state or out-of-state facility licensed to accept the material. Non-hazardous fill material can be sent to a construction and demolition debris handling and recovery facility only with written approval from the NYSDEC. Hazardous waste is prohibited from being sent to a construction and demolition debris handling and recovery facility (6 NYCRR Part 361-5). Hazardous wastes derived from the site will be managed, transported and disposed of in full compliance with applicable local, state and federal regulations.

The following documentation will be obtained and reported by the RE for each off-site disposal location used in this project to fully demonstrate and document that the disposal of soil and historic fill derived from the site conforms to applicable laws:

1) A letter from the RE or BCP Volunteer to the receiving facility describing the soil or historic fill to be disposed of and requesting formal written acceptance of the material. This letter will state that the soil or historic fill to be disposed of is contaminated material generated at an environmental remediation site in New York State. The letter will provide the project identity and the name and phone number of the RE. The letter will include, as an attachment, a summary of all chemical data for the soil or historic fill being transported (including site characterization data); and
2) A letter from each receiving facility stating it is in receipt of the correspondence (above) and is approved to accept the soil or historic fill. These documents will be included in the FER.

The FER will include an account of the destination of all soil and historic fill removed from the site during the remedy, including excavated soil, contaminated soil, historic fill, hazardous waste, and fluids. Documentation associated with disposal of soil and historic fill must also include records (i.e., manifests and scale tickets) and approvals for receipt of the material by the facilities. This information will also be presented in the FER.

5.4.6 Soil/Fill Reuse On-Site

Soil or historic fill excavated during the remedy is not anticipated to be reused on this site under the proposed remedy. If soil reuse is considered, it will be reused if the requirements in this section and 6 NYCRR Part 360 are met. Grossly contaminated soil or soil with petroleum staining or odor will not be reused on-site. Soil acceptable for reuse must be non-hazardous and meet the lower of the RURR SCOs and Protection of Groundwater SCOs, unless a determination for a remedial track other than Track 2 is pursued. The Protection of Groundwater SCOs apply only to compounds or analytes detected in groundwater at concentrations that exceeded the Ambient Water Quality SGVs for Class GA water.

Soil or historic fill removed during implementation of the remedy or removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. Soil and historic fill deemed unfit for reuse will be transported for off-site

disposal. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

5.4.7 Fluids Management

Remedial excavation will extend below the groundwater table and dewatering will be required to facilitate the remedial excavation. A temporary dewatering and treatment system will be designed by the Remediation Contractor's NYS-licensed Professional Engineer. Liquids to be removed from the site, including dewatering fluids, will be handled, transported, and disposed of in accordance with applicable local, state, and federal regulations. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP. For the remedy, dewatering is considered a remedial component inasmuch as it is necessary to facilitate excavation of contaminated material.

Dewatering fluids will not be recharged back to the land surface or subsurface. Dewatering fluids will be managed off-site. Discharge of water generated during remedial construction to surface waters (i.e., a local pond, stream, and/or river) is prohibited without a SPDES permit.

5.4.8 Backfill from Off-site Sources

Materials proposed for import will be approved by the RE and will be in compliance with provisions in this RAWP prior to receipt at the site. Imported soil for backfill must meet the requirements of 6 NYCRR Part 375-6.7(d) and NYSDEC DER-10 Section 5.4(e), Table 5.4(e)10, and Appendix 5. Material from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the site. Solid waste will not be imported to the site.

The FER will include the following certification by the RE: "I certify that all import of soil from off-site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the RAWP".

Backfill material will consist of clean fill (as described in the following paragraph) or other acceptable fill material such as virgin stone from a quarry or RCA. If RCA is imported to the site, it will be from a NYSDEC-registered facility in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. Import of RCA will require a site-specific Beneficial Use Determination (BUD) by NYSDEC. RCA imported from compliant facilities will not require chemical testing, unless required by the NYSDEC under the terms for operation of the facility. RCA imported to the site must be derived from recognizable and uncontaminated concrete. RCA is not acceptable for and will not be used as cover or drainage material. RCA or virgin stone must contain less than 10% by weight passing a No. 10 sieve to be excluded from NYSDEC DER-10 sampling requirements.

Imported soil (i.e., clean fill) will meet the lower of RURR and Protection of Groundwater SCOs. Non-compliant soil will not be imported to the site. Clean fill will be segregated at a source/facility that is free of environmental contaminants. Qualified environmental personnel will collect representative samples at a frequency consistent with NYSDEC CP-51. The samples will be analyzed for Part 375 VOCs (USEPA Method 8260), SVOCs (USEPA Method 8270), pesticides/PCBs (USEPA Method 8082/8081), metals (USEPA Method 6010), and per and polyfluoroalkyl substances (USEPA Method 537) by NYSDOH ELAP-certified laboratory. Upon meeting these criteria, the certified-clean fill be transported to the site and segregated from impacted material, as necessary, on plastic until the certified-clean fill is used as backfill.

Soil that meets 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives, will not be imported to the site without prior approval by NYSDEC. The contents of this RAWP and NYSDEC approval of this RAWP should not be construed as an approval for this purpose.

Facilities will be identified in the FER. A Professional Engineer (PE) or QEP will review the 6 NYCRR Part 360 registrations and permits for the facilities for the period of acquisition of RCA. Imported RCA, virgin gravel, or rock or stone from mines or quarries must have no more than 10% by weight passing through a No. 10 sieve and will not require additional testing unless required by NYSDEC under its terms for operation of the facility. Additional exemptions from testing requirements may be approved by NYSDEC Project Manager based on their review of requests by the PE/QEP.

Trucks entering the site with imported soil will be securely covered with tight fitting covers.

5.4.9 Typical Storm Water Pollution Prevention

Silt fencing or hay bales will be installed around the perimeter of the remedial construction area, as required. Barriers and hay bale checks will be installed and inspected once per week and after every storm event; necessary repairs shall be made immediately. Results of inspections will be recorded in a logbook maintained at the site and available for inspection by the NYSDEC. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fence damaged due to weathering. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

5.4.10 Extreme Storm Preparedness and Response Contingency Plan

In the event of emergency conditions caused by an extreme storm event, the remediation contractor will undertake the following steps for site preparedness prior to the event and in response after the event.

5.4.10.1 Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the property; loose materials will be secured to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and generators will be removed from excavated areas, trenches and depressions to high ground or removed from the property; an inventory of the property with photographs will be performed to establish conditions for the site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the property; storm water management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, hay bales; clean storm sewer filters and traps; and secure and protect pumps and hosing.

5.4.10.2 *Storm Response*

At the conclusion of an extreme storm event, as soon as it is safe to access the property, a complete inspection of the property will be performed. Potential hazards will be addressed immediately. Emergency and spill conditions will be reported to NYSDEC.

Public safety structures related to remediation, such as construction security fences, will be repaired promptly to eliminate potential public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will be collected and appropriately managed. Support of excavation structures will be inspected and fortified as required by DOB. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Storm water control systems and structures will be inspected and maintained as necessary.

5.4.11 Community Air Monitoring Plan

Community air monitoring will be conducted in compliance with the NYSDOH Generic CAMP outlined below and included in the CHASP (Appendix D). Continuous monitoring at the perimeter of the site will be performed during ground-intrusive activities such as investigation and excavation. The CAMP will include perimeter CAMP stations, one weather station, and one handheld mercury vapor analyzer. CAMP stations will monitor for VOCs with a PID, for mercury vapor with a Jerome® J405, and dust emissions with equipment using real-time monitoring capable of measuring PM-10 (e.g., DustTrak). The day-to-day location of CAMP stations will be fluid and dynamic based on wind direction and work zone location and will take into account the location of sensitive receptors and ground level air-intakes. The weather and perimeter air

monitoring stations will utilize a wireless telemetry system to monitor real-time wind direction, temperature, concentrations.

A portable PID will be used to monitor the work zone and for monitoring for VOCs during activities such as soil and groundwater sampling. A portable mercury vapor analyzer (Jerome® J505 or equivalent) will be used to capture instantaneous mercury vapor concentrations around the site and downwind from the work zone. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements. Particulate or dust will be monitored continuously with real-time field instrumentation that will meet, at a minimum, the performance standards from DER-10 Appendix 1B.

Remedial Design Investigation

The first task to be completed under the RAWP will be the RDI. The CAMP for the RDI will be conducted in accordance with the NYSDEC-approved May 2020 RIWP. A baseline community ambient air monitoring event may be conducted as part of the RDI.

Ground-intrusive Activities after RDI

After completion of the RDI and acceptance of the RDM by the NYSDEC, the mercury-impacted hotspot will be removed prior to the site-wide remedial excavation. Continuous monitoring at the perimeter of the site during ground intrusive activities. A total of six perimeter CAMP stations, one weather station, and one handheld mercury vapor analyzer will be used for community air monitoring during the hotspot removal. No changes to the CAMP will be implemented without approval from NYSDEC and NYSDOH.

CAMP Action Levels

For VOC monitoring, the following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 parts per million (ppm) above background for the 15-minute average at the site perimeter, work activities will be halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background at the site perimeter, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the site persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the work zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm above background for the 15-minute average.

- If the downwind total VOC level persist above 25 ppm at the perimeter of the site, activities will be shut down.

All 15-minute readings will be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

For dust monitoring with field instrumentation, the following actions will be taken based on instrumentation measurements:

- If the downwind particulate level is 100 µg/m³ greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work zone, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 µg/m³ above the background level and provided that no visible dust is migrating from the work zone.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m³ above the background level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

For mercury vapor monitoring with field instrumentation, the following actions will be taken based on instrumentation measurements:

- If the downwind mercury vapor level is greater than 1 µg/m³ above background for the 15-minute period, then work activities will be halted and monitoring continued. The source of the vapors will be identified, and corrective actions will be taken to abate emissions, and monitoring continued. Corrective actions will include covering any exposed stockpiles with polyethylene sheeting, and MERCON will be sprayed onto any exposed soil exhibiting elevated Jerome meter readings. If levels readily decrease (per instantaneous readings) below 1 µg/m³ above background, work activities will resume with continued monitoring.
- If mercury vapor levels within the work zone persist at levels in excess of 10 µg/m³ above background, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the mercury vapor level at the site perimeter, is below 1 µg/m³ above background for the 15-minute average.

5.4.12 Vapors, Odor, Dust and Nuisance Control Plan

Vapors, dust, odor and nuisance control will be accomplished by the contractor as described in this section. The FER will include the following certification by the RE: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the RAWP."

Mercury Vapor Control Plan

Specific mercury vapor control methods to be used on a routine basis will include application of MERCON, tarps/plastic sheeting over soil stockpiles, and tarps/plastic sheeting over hotspot excavation areas when excavation is not active. If mercury vapor action levels are exceeded, as defined in the CAMP, work will be halted and the source of mercury vapor will be identified and corrected. Work will not resume until the mercury vapor is abated. The NYSDEC and NYSDOH will be notified of all mercury vapor events. Implementation of mercury vapor monitoring, including the halt of work, will be the responsibility of the RE, who is responsible for certifying the FER. Application of mercury vapor controls is the responsibility of the contractor.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, procedures may include: (a) direct load-out of soils to trucks for off-site disposal, (b) limiting the area of open excavations; (c) shrouding open excavations with tarps and other covers; and (d) using MERCON to cover exposed soils.

Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include application of foam suppressants or tarps over any odorous or VOC source areas. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until nuisance odors are abated. The NYSDEC and NYSDOH will be notified of all odor events and of all other odor complaints about the project. Implementation of odor monitoring, including the halt of work, will be the responsibility of the RE, who is responsible for certifying the FER. Application of odor controls is the responsibility of the contractor.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, procedures may include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (a) direct load-out of soils to trucks for off-site disposal; (b) use of chemical odorants in spray or misting systems; and (c) use of staff to monitor odors in surrounding neighborhoods.

Dust Control Plan

Dust suppression plan that addresses dust management during ground-intrusive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated water distribution system, on-site water trucks, or an alternate source with suitable supply and pressure for use in dust control.
- Gravel will be used for on-site roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water spraying.

Other Nuisances

A plan for rodent control will be developed and utilized by the contractor before and during site clearing and grubbing, and during all remedial work.

A plan for noise control will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to the NYCDEP noise control standards.

6.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

Since residual contaminated soil and groundwater will exist beneath the site after the Track 2 remedy is complete, ICs are required to protect human health and the environment. These ICs are described hereafter. Long-term management of ICs and of residual contamination will be executed under a Site-Specific SMP that will be developed and included in the FER.

Achievement of a Track 2 cleanup is contingent upon achieving Track 2 SCOs before the Certificate of Completion. If these conditions are not met, the site will achieve a Track 4 Restricted-Residential Use remedy and the composite cover system will serve as long-term engineering control.

The FER will provide tables and figures documenting residual contamination at the site. This will include presentation of concentrations exceeding both UU and RURR cleanup standards.

7.0 INSTITUTIONAL CONTROLS

Following completion of the remedy, contamination above Track 2 SCOs may remain in place; therefore, ICs will be required as part of the remedial action. An SMP will be implemented to manage and monitor the ICs and define restricted uses of the site.

7.1 Environmental Easement

An environmental easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-site after the remedy is complete. A Track 2 cleanup requires that an environmental easement approved by the NYSDEC will be filed and recorded with the New York County Office before the Certificate of Completion can be issued by the NYSDEC. The environmental easement will be submitted as part of the FER.

The environmental easement renders the site a Controlled Property. The easement will list the ICs required under this remedy to prevent future exposure to residual contamination, including controlling disturbances of the subsurface soil and restricting the use of the site to restricted residential, commercial, and industrial uses only. ECs will not be required if the Track 2 is achieved. If a Track 2 remedy is not achieved, the site will achieve a Track 4 Restricted-Residential Use remedy with ECs. The ICs are generally subdivided between controls that support ECs and those that place general restrictions on site usage or other requirements. ICs in both of these groups are closely integrated with the SMP, which provides the methods and procedures to be followed to comply with this remedy.

The ICs that support ECs if a Track 4 remedy is achieved are:

- Compliance with the environmental easement by the grantor and the grantor's successors and adherence of all elements of the SMP is required;
- ECs must be operated and maintained as specified in the SMP;
- ECs on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner defined in the SMP; and
- ECs may not be discontinued without an amendment or extinguishment of the environmental easement.

Adherence to these ICs is mandated by the environmental easement and will be implemented under the SMP (discussed in the next section). The site restrictions that apply to the site are:

- Vegetable gardens and farming in residual site soil on the site are prohibited;
- Use of groundwater underlying the site is prohibited without treatment rendering it safe for intended purpose;

- All future activities on the site that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the SMP;
- The site may be used for restricted-residential, commercial, and industrial uses use only, provided the long-term ECs and ICs included in the SMP are employed; and
- The site may not be used for a higher level of use without an amendment or extinguishment of the environmental easement.

Grantor agrees to submit to the NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the site are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. This certification shall be submitted annually, or at a specified frequency allowed by the NYSDEC. The NYSDEC retains the right to access the site at any time in order to evaluate the continued maintenance of any and all controls.

7.2 Site Management Plan

A Track 2 cleanup requires an SMP. Site management is the last phase of remediation and begins with the approval of the FER and issuance of the Certificate of Completion for the remedy. The SMP is submitted as part of the FER, but will be written in a manner that allows its removal and use as a complete and independent document. Site management continues in perpetuity or until released in writing by the NYSDEC. The property owner is responsible for all site management responsibilities defined in the environmental easement and performance of the SMP. ECs will not be required if the Track 2 is achieved. If a Track 2 remedy is not achieved, the site will achieve a Track 4 Restricted-Residential Use remedy with ECs.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the site following completion of the remedy in accordance with the NYSDEC BCA. This includes: (1) development, implementation, and management of all ECs and ICs; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain any treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); (4) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of site information to the NYSDEC; and (5) defining criteria for termination of treatment system operation.

To address these needs, this SMP will include four plans: (1) an EC and IC Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems; and (4) a Site Management Reporting Plan for

submittal of data, information, recommendations, and certifications to NYSDEC. The SMP will be prepared in accordance with the requirements in NYSDEC DER-10 and the guidelines provided by the NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annual and will be due for submission to the NYSDEC by March 1 of the year following the reporting period.

No exclusions for handling of residual contaminated soils will be provided in the SMP. All handling of residual contaminated material will be subject to provisions contained in the SMP.

8.0 FINAL ENGINEERING REPORT

An FER, prepared in accordance with DER-10, will be submitted to the NYSDEC following implementation of the remedial action defined in this RAWP. The FER provides documentation that the remedial work required under this RAWP was completed and was performed in compliance with this plan. The FER will include the following documentation:

1. A written and photographic documentation (via daily field reports) of the completed remedy;
2. A description of any deviations from the RAWP;
3. An account of waste material exported from the site, including waste types and volumes, waste characterization documentation, facility-signed manifests and scale tickets, facility approvals and other waste disposal documentation;
4. An account of materials imported to the site;
5. A tabular summary of post-excavation documentation sampling results and other sampling and laboratory analysis completed as part of the remedial action;
6. As-built drawings for ECs; and
7. An itemized description of actual costs incurred during the remedy.

Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital form on electronic media (PDF).

8.1 Certification

The following certification will appear in front of the Executive Summary of the FER. The certification will be signed by the RE, Jason Hayes, who is a Professional Engineer registered in New York State. This certification will be appropriately signed and stamped. The certification will include the following statements:

I, _____, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the 250 Water Street Site.

I certify that the site description presented in this Final Engineering Report is identical to the site descriptions presented in the Brownfield Cleanup Agreement for the 250 Water Street site and related amendments.

I certify that the Remedial Action Work Plan dated [month day year] and Stipulations [if any] in a letter dated [month day year] and approved by the NYSDEC were implemented and that all requirements in those documents have been substantively complied with.

I certify that the remedial activities were observed by Langan personnel under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.

I certify that the export of contaminated soil, fill, water, or other material from the property was performed in accordance with the Remedial Action Work Plan, and were taken to facilities licensed to accept this material in full compliance with all federal, state, and local laws.

I certify that import of soils from off-site, including source approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.

I certify that ground-intrusive work during remediation and development-related construction was conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan.

I certify that community air monitoring conducted during remediation and development-related construction was conducted in compliance with the NYSDOH Generic CAMP and Remedial Action Work Plan.

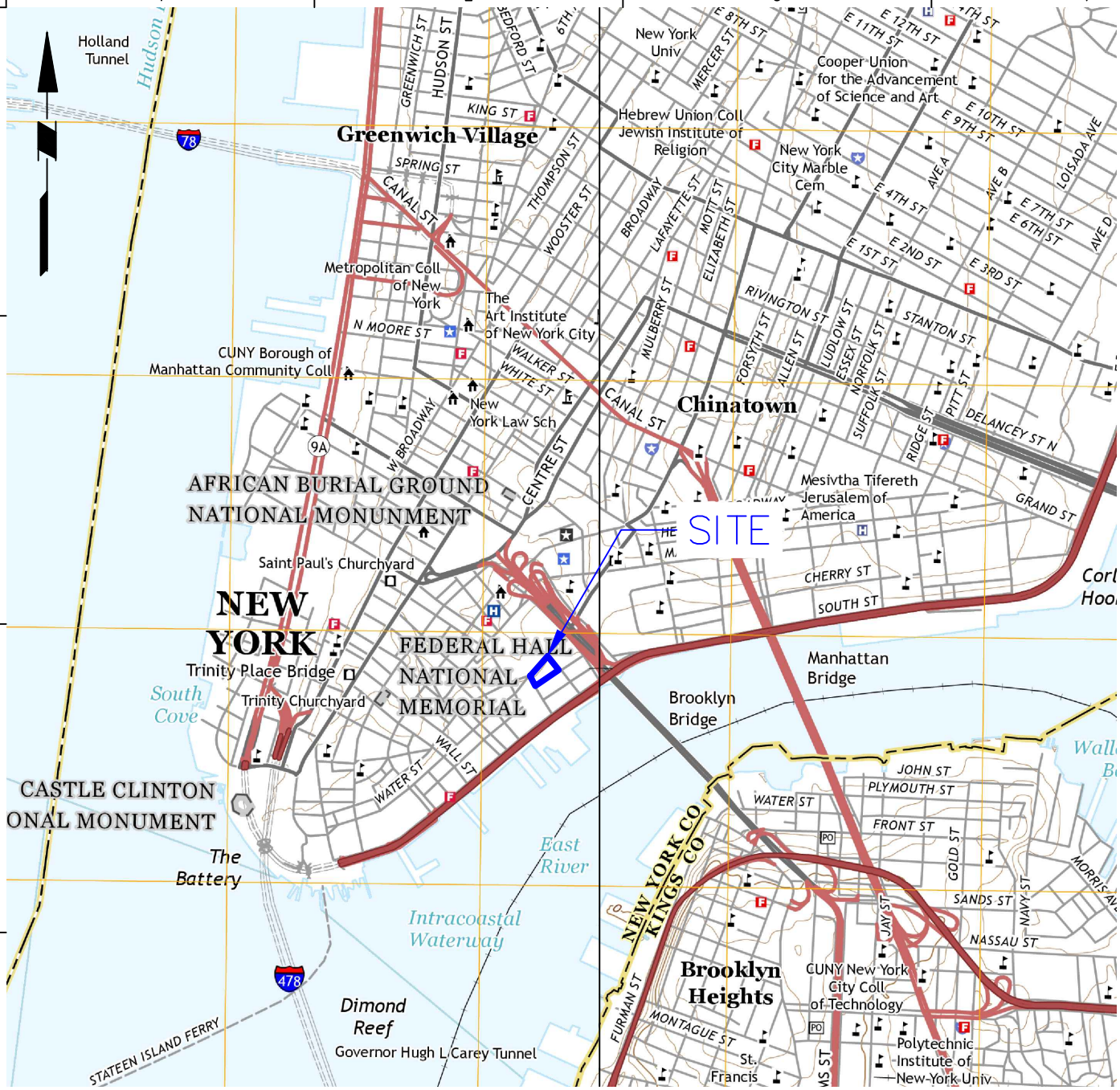
I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

9.0 SCHEDULE

Mobilization will commence before remedial activities at the site and is expected to take about two weeks. Once mobilization is complete, the remedial activities can begin, and are anticipated to take about 10 months. Within 60 days of completion of remedial activities at the site, an FER will be submitted to the NYSDEC as detailed in Section 8.0. A detailed project schedule is included in Appendix I.

The RDI will be completed followed by the submission of the RDM to the NYSDEC. After approval of the RDM, the first remedial task completed will be the removal of the mercury-impacted soil hotspot.

FIGURES



NOTES:

1. BASE MAP REFERENCE: USGS 7.5 MINUTE SERIES QUADRANGLE MAP OF JERSEY CITY, NJ, AND BROOKLYN, NY, DATED 2016

2000 0 1000 2000

SCALE IN FEET

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

LANGAN

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Project	Drawing Title	Project No.	Drawing No.
250 WATER STREET BLOCK No. 98, LOT No.1 NEW YORK NEW YORK	SITE LOCATION MAP	170381202 Date 12/23/2020 Drawn By JFY Checked By PM	1

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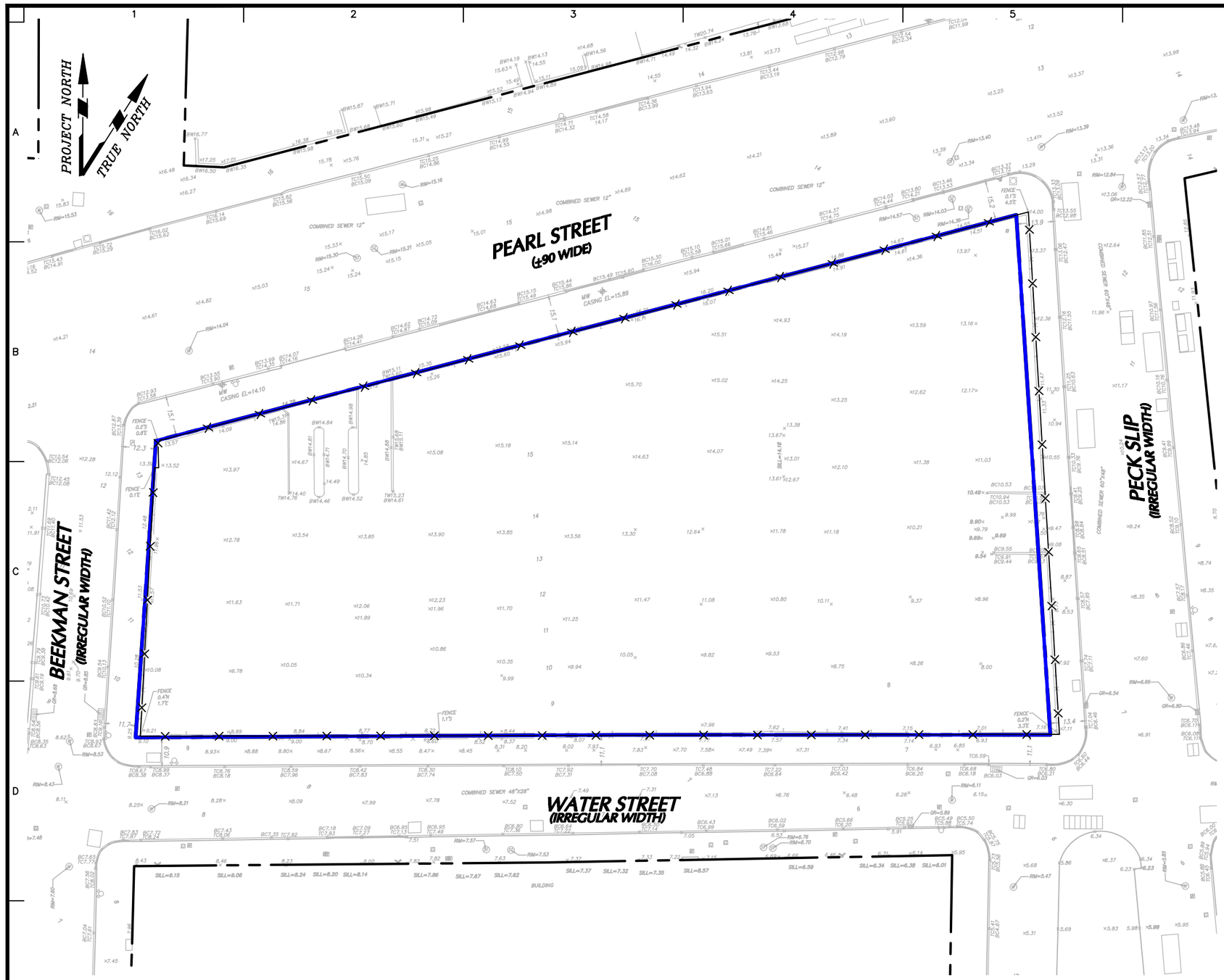
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 1 - Site Location Map.dwg Date: 2/5/2021 Time: 14:22 User: astappenbeck Style Table: Langan.stb Layout: ANSIA-BP



LEGEND

SITE BOUNDARY

APPROXIMATE LOCATION OF SITE FENCE

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	SITE PLAN
Project No.	170381202
Date	1/14/2021
Drawn By	JFY
Checked By	PM
Drawing No.	2

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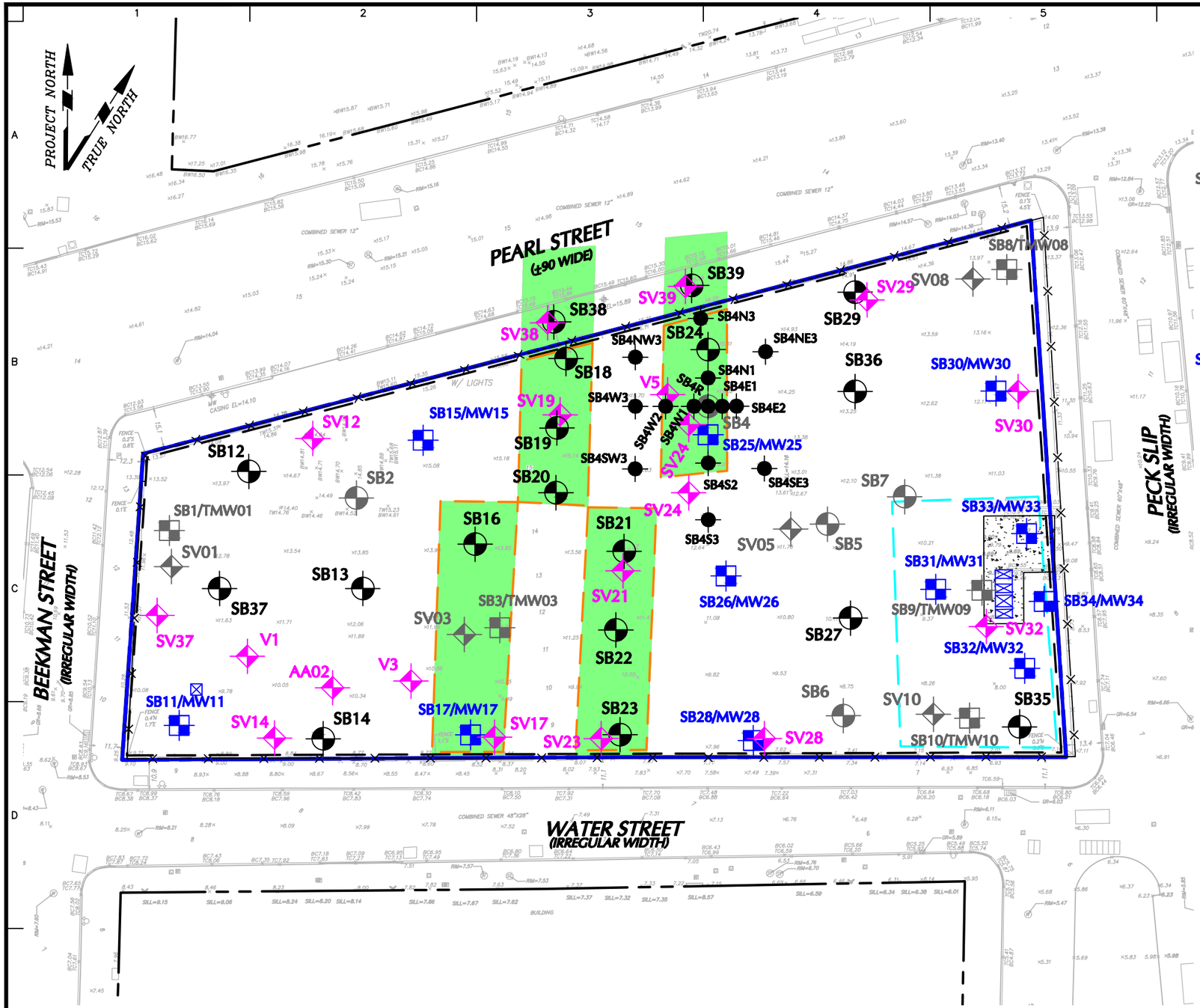
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 2 - Site Plan.dwg Date: 2/5/2021 Time: 14:23 User: astappenbeck Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

- SITE BOUNDARY (AOC 1)
- APPROXIMATE LOCATION OF SITE FENCE
- SB02 — PHASE II ESI SOIL BORING LOCATION
- SB01/TMW01 — PHASE II ESI SOIL BORING LOCATION WITH TEMPORARY MONITORING WELL
- SV01 — PHASE II ESI SOIL VAPOR LOCATION
- SB19 — SOIL BORING LOCATION
- SB4E1 — MERCURY DELINEATION SOIL BORING LOCATION
- SB11/MW11 — SOIL BORING AND MONITORING WELL LOCATION
- SV24 — SOIL VAPOR LOCATION
- APPROXIMATE UST LOCATION
- APPROXIMATE EXTENT OF HISTORICAL THERMOMETER FACTORY/WORKSHOPS

AOCS:

- AOC 1 - HISTORIC FILL MATERAL
- AOC 2 - PETROLEUM-LIKE IMPACTS AND OPEN SPILL (SPILL No. 1507371)
- AOC 3 - HISTORICAL THERMOMETER FACTORY/WORKSHOPS
- AOC 4 - HISTORICAL USE OF THE SITE AND SURROUNDING PROPERTIES

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. REMEDIAL INVESTIGATION AND PHASE II ESI BORING LOCATIONS WERE MEASURED OFF OF SURVEYED LOCATIONS USING A HANDHELD TAPE MEASURE AND ARE APPROXIMATE.
4. AOC = AREA OF CONCERN
5. UST = UNDERGROUND STORAGE TANK

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

40 0 10 25 40
SCALE IN FEET

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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	AREAS OF CONCERN AND SAMPLE LOCATION MAP
Project No.	170381202
Date	03/25/2021
Drawn By	JFY
Checked By	PM
Drawing No.	3

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Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\Sheet Files\Environmental\BCP RAWP\Figure 3 - AOC and BLP.dwg Date: 3/25/2021 Time: 08:20 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL

PROJECT NORTH
TRUE NORTH

Sample ID	SB19_0-2	SB19_6-8	SB19_18-20
Sample Date	7/29/2020	7/29/2020	7/29/2020
Sample Depth (feet bgs)	0-2	6-8	18-20
VOCs (mg/kg)			
Acetone	0.011 J	0.092	0.1
SVOCs (mg/kg)			
Benzo(a)anthracene	2.3 J	ND	ND
Benzo(a)pyrene	2.1 J	ND	ND
Benzo(b)fluoranthene	2.9 J	ND	ND
Benzo(k)fluoranthene	0.99 J	ND	ND
Chrysene	2.3 J	0.0938 J	ND
Dibenz(a,h)anthracene	0.39 J	ND	ND
Indeno(1,2,3-cd)pyrene	1.6 J	ND	ND
Pesticides (mg/kg)			
4,4'-DDD	0.0061 JP	ND	ND
4,4'-DDE	0.021 J	ND	ND
4,4'-DDT	0.013 JP	ND	ND
Dieldrin	0.0022 J	0.0056 J	0.0008 J
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	ND	ND	ND
Inorganics (mg/kg)			
Chromium, Hexavalent	ND	ND	ND
Copper	83	7.2	9.5
Lead	588 J	2.4	4
Mercury	4.1 J	0.12 J	0.047 J
Nickel	20	14	13
PFAS (ppb)			
Perfluorooctanesulfonic Acid	9.5 J	ND	ND
Perfluorooctanoic Acid	0.28 J	ND	ND

Sample ID	SB18_0-2	SB18_7-8	SB18_18-20
Sample Date	7/30/2020	7/30/2020	7/30/2020
Sample Depth (feet bgs)	0-2	7-8	18-20
VOCs (mg/kg)			
Acetone	0.015 J	0.14	0.051
SVOCs (mg/kg)	NE	ND	NE
Pesticides (mg/kg)	NE	ND	NE
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	NE
Inorganics (mg/kg)			
Total PCBs	0.15	ND	ND
Inorganics (mg/kg)			
Copper	150	9.8	7.3
Lead	780 J	2.2 J	2.6 J
Mercury	8.8	ND	ND
Nickel	38 J	16 J	16 J
Zinc	160 J	14	19 J
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.0951 JP	ND	ND
Perfluorooctanoic Acid	ND	ND	ND

Sample ID	SB33_0-2	SDDUP02_SB032020	SB38_6-8	SB38_22-24
Sample Date	8/3/2020	8/3/2020	8/3/2020	8/3/2020
Sample Depth (feet bgs)	0-2	0-2	6-8	22-24
VOCs (mg/kg)				
Acetone	NE	ND	NE	NE
SVOCs (mg/kg)	NE	ND	NE	NE
Pesticides (mg/kg)	NE	ND	NE	NE
Herbicides (mg/kg)	ND	ND	ND	ND
PCBs (mg/kg)	NE	ND	NE	NE
Inorganics (mg/kg)				
Total PCBs	0.19	0.3 J	49 J	2.7 J
Inorganics (mg/kg)				
Perfluorooctanesulfonic Acid	0.41 J	0.46 J	ND	ND

Sample ID	SB39_0-2	SB39_8-10	SB39_18-20
Sample Date	8/3/2020	8/3/2020	8/3/2020
Sample Depth (feet bgs)	0-2	8-10	18-20
VOCs (mg/kg)			
Acetone	0.082 J	0.076 J	0.029 J
SVOCs (mg/kg)			
Benzo(a)anthracene	0.82 J	5.7 J	0.0089 J
Benzo(a)pyrene	0.87 J	4.5 J	0.0056 J
Benzo(b)fluoranthene	0.83 J	7.7 J	0.0077 J
Benzo(k)fluoranthene	0.33 J	1.9 J	0.0047 J
Chrysene	0.82 J	5.5 J	0.0084 J
Dibenz(a,h)anthracene	0.2 J	1.1 J	ND
Indeno(1,2,3-cd)pyrene	0.47 J	2.4 J	ND
Pesticides (mg/kg)	NE	NE	NE
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	NE
Inorganics (mg/kg)			
Chromium, Hexavalent	ND	ND	ND
Copper	82 J	50 J	11 J
Lead	130 J	290 J	3.1 J
Mercury	0.3	42	ND
Nickel	19	49	38
Zinc	220 J	160 J	19 J
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.91 J	0.53 J	ND
Perfluorooctanoic Acid	0.24 J	ND	ND

Sample ID	SB25_0-2	SB25_6-8	SB25_28-30
Sample Date	7/28/2020	7/28/2020	7/28/2020
Sample Depth (feet bgs)	0-2	6-8	28-30
VOCs (mg/kg)			
Acetone	0.12	0.023 J	0.022
SVOCs (mg/kg)	NE	ND	NE
Pesticides (mg/kg)			
4,4'-DDD	0.025 JP	ND	ND
4,4'-DDE	ND	ND	ND
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	NE
Inorganics (mg/kg)			
Lead	88	4.3	2.4
Mercury	0.3	1.6	ND
Nickel	33	18	24
PFAS (ppb)			
Perfluorooctanesulfonic Acid	1.2 J	ND	ND
Perfluorooctanoic Acid	0.51 J	0.88	ND

Sample ID	SB36_0-2	SB36_2-4	SB36_16-18	SB36_22-24
Sample Date	8/24/2020	8/17/2020	8/24/2020	8/24/2020
Sample Depth (feet bgs)	0-2	2-4	16-18	22-24
VOCs (mg/kg)				
1,2,4-Trimethylbenzene	0.0965	9.4	0.94 J	ND
Acetone	0.085 J	ND	ND	0.037 J
Benzene	0.0027 J	0.062 J	0.058 J	ND
Ethylbenzene	0.009 J	2.0	0.06 J	ND
Toluene	0.0028 J	2.9 J	0.062 J	0.0008 J
Total Xylenes	0.0002 J	15	0.18 J	ND
SVOCs (mg/kg)				
Benzo(a)anthracene	3.2 J	0.65 J	0.027 J	ND
Benzo(a)pyrene	2.9 J	0.55 J	0.023 J	ND
Benzo(b)fluoranthene	3.4 J	0.61 J	0.026 J	ND
Benzo(k)fluoranthene	1.1 J	0.3 J	ND	ND
Chrysene	3.1 J	0.59 J	0.027 J	ND
Dibenz(a,h)anthracene	0.57 J	0.1 J	ND	ND
Indeno(1,2,3-cd)pyrene	1.9 J	0.36 J	0.015 J	ND
Naphthalene	0.37 J	1.5 J	ND	ND
Pesticides (mg/kg)				
4,4'-DDD	ND	0.33 J	ND	ND
4,4'-DDT	3.6	19	49 J	38
Aldrin	ND	0.24 J	ND	ND
Alpha BHC (Alpha Hexachlorocyclohexane)	ND	0.23 J	ND	ND
Alpha Chlordane	0.045	0.97 J	ND	ND
Dieldrin	0.14	0.27 J	0.14 J	ND
Heptachlor	0.1 J	0.18 J	0.005 J	ND
Herbicides (mg/kg)	ND	ND	ND	ND
PCBs (mg/kg)				
Total PCBs	2 J	48	ND	ND
Inorganics (mg/kg)				
Barium	610 J	700	93 J	37
Cadmium	3.4 J	7.2	0.76 J	ND
Chromium, Trivalent	54 J	100	7.2 J	3 J
Copper	140 J	290	8.5 J	6
Lead	880 J	830	6.6 J	2.7 J
Mercury	0.57	1.4	ND	ND
Nickel	24 J	74	15 J	24 J
Zinc	450 J	1,900	16 J	170 J
PFAS (ppb)				
4-ethyl perfluorooctane sulfonamidoacetic Acid	ND	4.9	ND	ND
N-methyl perfluorooctane sulfonamidoacetic Acid	ND	1 J	ND	ND
Perfluorodecanesulfonic Acid	ND	0.3 J	ND	ND
Perfluorohexanesulfonic Acid	ND	0.83	ND	ND
Perfluorohexanoic Acid	ND	0.28 J	ND	ND
Perfluorononanoic Acid	ND	0.38 J	ND	ND
Perfluorooctanesulfonic Acid	ND	0.92 J	ND	ND
Perfluorooctanoic Acid	ND	0.92 J	ND	ND

Sample ID	SB40_0-2	SB40_8-10	SB40_14-16
Sample Date	8/19/2020	8/19/2020	8/19/2020
Sample Depth (feet bgs)	0-2	8-10	14-16
VOCs (mg/kg)			
Acetone	0.079 J	0.18 J	0.15 J
SVOCs (mg/kg)	NE	NE	NE
Pesticides (mg/kg)	NE	ND	NE
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	NE
Inorganics (mg/kg)			
Copper	19	860	11
Lead	120	1,100 B	3.7
Mercury	1.2	2.3	ND
Silver	1.1	2.1	ND
Zinc	180	910	50 J
PFAS (ppb)			
Perfluorooctanoic Acid	0.68	1.4	ND

Sample ID	SB41_0-2	SB41_8-10	SB41_18-20
Sample Date	8/19/2020	8/19/2020	8/19/2020
Sample Depth (feet bgs)	0-2	8-10	18-20
VOCs (mg/kg)			
Acetone	0.11 J	0.042 J	0.1 J
SVOCs (mg/kg)			
Benzo(a)anthracene	2.3 J	ND	ND
Benzo(a)pyrene	2.1 J	ND	ND
Benzo(b)fluoranthene	2.9 J	ND	ND
Benzo(k)fluoranthene	0.99 J	ND	ND
Chrysene	2.3 J	0.0938 J	ND
Dibenz(a,h)anthracene	0.39 J	ND	ND
Indeno(1,2,3-cd)pyrene	1.6 J	ND	ND
Pesticides (mg/kg)			
4,4'-DDD	0.0061 JP	ND	ND
4,4'-DDE	0.021 J	ND	ND
4,4'-DDT	0.013 JP	ND	ND
Dieldrin	0.0022 J	0.0056 J	0.0008 J
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	NE
Inorganics (mg/kg)			
Chromium, Hexavalent	1.5	ND	ND
Copper	59	79	11
Lead	588 J	2.4	4
Mercury	4.1 J	0.12 J	0.047 J
Nickel	20	14	13
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.61 J	ND	ND
Perfluorooctanoic Acid	0.23 J	ND	ND

Sample ID	SB42_0-2	SB42_4-6	SB42_8-10
Sample Date	8/18/2020	8/18/2020	8/18/2020
Sample Depth (feet bgs)	0-2	4-6	8-10
VOCs (mg/kg)	0.033 J	0.53 J	0.071 J
SVOCs (mg/kg)			
Benzo(a)anthracene	8.8 J	11 J	3.5 J
Benzo(a)pyrene	8.2 J	8.3 J	3.1 J
Benzo(b)fluoranthene	8.2 J	9.8 J	3 J
Benzo(k)fluoranthene	4 J	4.2 J	1.2 J
Chrysene	9 J	11 J	3.5 J
Dibenz(a,h)anthracene	1.4 J	1.4 J	0.5 J
Indeno(1,2,3-cd)pyrene	5 J	5.1 J	1.8 J
Pesticides (mg/kg)	NE	NE	NE
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	NE
Inorganics (mg/kg)			
Barium	110	380 J	370 J
Copper	80 J	250 J	130 J
Lead	300 J	790 J	1,300 J
Mercury	0.3	1.2	0.94
Zinc	230	490	330
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.65 J	0.36 J	0.54 J
Perfluorooctanoic Acid	ND	ND	0.71
Perfluoropentanoic Acid	ND	ND	0.22 J

Sample ID	SB43_0-2	SB43_4-6	SB43_8-10	SB43_12-14
Sample Date	8/18/2020	8/18/2020	8/18/2020	8/18/2020
Sample Depth (feet bgs)	0-2	4-6	8-10	12-14
VOCs (mg/kg)				
Acetone	0.056 J	ND	ND	0.08 J
SVOCs (mg/kg)				
Benzo(a)anthracene	8.3 J	2.1 J	ND	ND
Benzo(a)pyrene	6.9 J	2.6 J	ND	ND
Benzo(b)fluoranthene	9.2 J	3.1 J	ND	ND
Benzo(k)fluoranthene	3.2 J	1.1 J	ND	ND
Chrysene	9.3 J	2.9 J	ND	ND
Dibenz(a,h)anthracene	0.73 J	0.48 J	ND	ND
Indeno(1,2,3-cd)pyrene	2.7 J	1.8 J	ND	ND
Pesticides (mg/kg)				
4,4'-DDD	0.04 J	0.0063 J	ND	ND
4,4'-DDE	0.021 J	0.0035 J	ND	ND
4,4'-DDT	0.011 JN	0.0077 JN	ND	ND
Dieldrin	0.0022 J	0.0056 J	0.0008 J	ND
Herbicides (mg/kg)	ND	ND	ND	ND
PCBs (mg/kg)	ND	ND	ND	ND
Inorganics (mg/kg)				
Barium	500	220	39	34
Lead	810 J	2,200 J	2.2 J	2.1 J
Mercury	0.6	0.27	ND	ND
Nickel	180 J	77 J	16 J	15 J
Zinc	270 J	850 J	17 J	15 J
PFAS (ppb)				
Perfluorooctanesulfonic Acid	0.97	ND	ND	NA

Sample ID	SB44_3-4	SB44_13-14
Sample Date	10/3/2019	10/3/2019
Sample Depth (feet bgs)	3-4	13-14
VOCs (mg/kg)	NE	ND
SVOCs (mg/kg)	NE	ND
PCBs (mg/kg)	NE	ND
Inorganics (mg/kg)		
Copper	83	20
Lead	588	4.2
Mercury	4.1	109
Zinc	4.2	0.82 J

Sample ID	SB45_0-2	SB45_6-8	SB45_18-20
Sample Date	8/17/2020	8/17/2020	8/17/2020
Sample Depth (feet bgs)	0-2	6-8	18-20
VOCs (mg/kg)			
Acetone	0.029 J	ND	ND
SVOCs (mg/kg)			
Benzo(a)anthracene	0.38 J	0.2 J	1.3 J
Benzo(a)pyrene	0.41 J	2.1 J	1.3 J
Benzo(b)fluoranthene	0.47 J	0.5 J	1.5 J
Benzo(k)fluoranthene	0.19 J	2.9 J	0.69 J
Chrysene	0.35 J	7.5 J	1.1 J
Dibenz(a,h)anthracene	ND	1 J	0.29 J
Indeno(1,2,3-cd)pyrene	0.2 J	0.8 J	0.77 J
Pesticides (mg/kg)			
4,4'-DDD	0.018 J+	ND	NA
4,4'-DDE	0.013 J+	ND	NA
4,4'-DDT	0.017 J+	0.58	NA
Alpha Chlordane	0.04 J+	0.14 J	NA
Dieldrin	0.027 J+	0.1 J	NA
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)			
Total PCBs	0.22 J	7.9	NA
Inorganics (mg/kg)			
Arsenic	4.6	22	7
Barium	92	440	230
Cadmium	0.5	2.6	0.99
Chromium, Trivalent	20	45	23
Copper	91	500	190
Lead	81	1000	390
Mercury	0.059 J	0.73	0.37
Nickel	22	44	26
Zinc	100 J	1,100	2,600 J
PFAS (ppb)			
4-ethyl perfluorooctane sulfonamidoacetic Acid	ND	NA	NA
Perfluorohexanoic Acid	ND	0.31 J	NA
Perfluorooctanesulfonic Acid	0.59	0.7	NA
Perfluorooctanoic Acid	ND	ND	NA

Sample ID	SB46_0-2	SB46_4-6	SB46_12-14
Sample Date	8/18/2020	8/18/2020	8/18/2020
Sample Depth (feet bgs)	0-2	4-6	12-14
VOCs (mg/kg)	NE	NE	NE
SVOCs (mg/kg)			
Benzo(a)anthracene	5.8 J	0.13 J	ND
Benzo(a)pyrene	4.5 J	0.099 J	ND
Benzo(b)fluoranthene	5.4 J	0.11 J	ND
Benzo(k)fluoranthene	2.3 J	0.065 J	ND
Chrysene	5.3 J	0.13 J	ND
Dibenz(a,h)anthracene	0.73 J	0.019 J	ND
Indeno(1,2,3-cd)pyrene	2.5 J	0.03 J	ND
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	NE
Inorganics (mg/kg)			
Arsenic	8.3 J	41 J	2 J
Barium	150 J	380 J	25 J
Cadmium	1.1 J	3.6 J	ND
Chromium, Hexavalent	ND	1.5	ND
Chromium, Trivalent	15 J+	350 J+	12 J+
Copper	90 J	280 J	11 J
Lead	390 J	20,000 J	3.6 J
Mercury	1.6 J	2.6 J	ND
Nickel	24 J	98 J	32 J
Silver	0.5 J	1.2 J	ND
Zinc	250 J	1,400 J	72 J
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.39 J	0.76 J	ND

Sample ID	SB47_0-2	SB47_10-12	SB47_20-22
Sample Date	8/20/2020	8/20/2020	8/20/2020
Sample Depth (feet bgs)	0-2	10-12	20-22
VOCs (mg/kg)			
Acetone	0.032	0.082 J	0.031 J	0.039 J
SVOCs (mg/kg)				
Benzo(a)anthracene	2.9 J	ND	ND	ND
Benzo(a)pyrene	2.8 J	ND	ND	ND
Benzo(b)fluoranthene	3.8 J	0.0039 J	0.0051 J	ND
Benzo(k)fluoranthene	1.1 J	ND	ND	ND
Chrysene	2.3 J	ND	ND	0.0047 J
Dibenz(a,h)anthracene	0.51 J	ND	ND	ND
Indeno(1,2,3-cd)pyrene	2.5 J	ND	ND	ND
Pesticides (mg/kg)	NE	ND	NE	NA
Herbicides (mg/kg)	ND	ND	ND	NA
PCBs (mg/kg)	NE	ND	NE	NA
Inorganics (mg/kg)				
Copper	53 J	7.5 J	8.4 J	NA
Lead	270 J	4.4 J	ND J	NA
Mercury	0.47 J	0.04 J	0.03 J	NA
Zinc	340 J	14 J	12 J	NA

Sample ID	SB48_0-2	SB48_2-4	SB48_18-20
Sample Date	8/17/2020	8/17/2020	8/17/2020
Sample Depth (feet bgs)	0-2	2-4	18-20
VOCs (mg/kg)			
Acetone	0.052 J	0.076 J	0.029 J
SVOCs (mg/kg)			
Benzo(a)anthracene	0.82 J	5.7 J	0.0089 J
Benzo(a)pyrene	0.87 J	4.5 J	0.0056 J
Benzo(b)fluoranthene	0.83 J	7.7 J	0.0077 J
Benzo(k)fluoranthene	0.33 J	1.9 J	0.0047 J
Chrysene	0.82 J	5.5 J	0.0084 J
Dibenz(a,h)anthracene	0.2 J	1.1 J	ND
Indeno(1,2,3-cd)pyrene	0.47 J	2.4 J	ND
Pesticides (mg/kg)	NE	NE	NE
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	NE
Inorganics (mg/kg)			
Chromium, Hexavalent	ND	ND	ND
Copper	82 J	50 J	11 J
Lead	130 J	290 J	3.1 J
Mercury	0.3	42	ND
Nickel	19	49	38
Zinc	220 J	160 J	19 J
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.91 J	0.53 J	ND
Perfluorooctanoic Acid	0.24 J	ND	ND

Sample ID	SB49_0-2	SB49_4-6	SB49_12-14
Sample Date	8/18/2020	8/18/2020	8/18/2020
Sample Depth (feet bgs)	0-2	4-6	12-14
VOCs (mg/kg)	NE	NE	NE
SVOCs (mg/kg)			
Benzo(a)anthracene	5.8 J	0.13 J	ND
Benzo(a)pyrene	4.5 J	0.099 J	ND
Benzo(b)fluoranthene	5.4 J	0.11 J	ND
Benzo(k)fluoranthene	2.3 J	0.065 J	ND
Chrysene	5.3 J	0.13 J	ND
Dibenz(a,h)anthracene	0.73 J	0.019 J	ND
Indeno(1,2,3-cd)pyrene	2.5 J	0.03 J	ND
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	NE
Inorganics (mg/kg)			
Arsenic	8.3 J	41 J	2 J
Barium	150 J	380 J	25 J
Cadmium	1.1 J	3.6 J	ND
Chromium, Hexavalent	ND	1.5	ND
Chromium, Trivalent	15 J+	350 J+	12 J+
Copper	90 J	280 J	11 J
Lead	390 J	20,000 J	3.6 J
Mercury	1.6 J	2.6 J	ND
Nickel	24 J	98 J	32 J
Silver	0.5 J	1.2 J	ND
Zinc	250 J	1,400 J	72 J
PFAS (ppb)			
Perfluorooctanesulfonic Acid	0.39 J	0.76 J	ND

Sample ID	SB50_0-2	SB50_4-6	SB50_13-15	SDDUP05_08242020
Sample Date	8/24/2020	8/24/2020	8/24/2020	8/24/2020
Sample Depth (feet bgs)	0-2	4-6	13-15	13-15
VOCs (mg/kg)	NE	NE	NE	NE
SVOCs (mg/kg)				
Benzo(a)anthracene	1.5 J	NA	1.9 J	ND
Benzo(a)pyrene	1.3 J	NA	1.8 J	ND
Benzo(b)fluoranthene	1.3 J	NA	1.8 J	ND
Chrysene	1.3 J	NA	2 J	0.004 J
Dibenz(a,h)anthracene	0.35 J	NA	0.33	ND
Indeno(1,2,3-cd)pyrene	1 J	NA	1.2 J	ND
Pesticides (mg/kg)				
4,4'-DDD	0.0065 J+	NA	0.0063 J	ND
4,4'-DDE	ND	NA	ND	ND
4,4'-DDT	0.0095 J+	NA	0.0083 J	ND
Herbicides (mg/kg)	NE	NA	NE	NE
PCBs (mg/kg)	NE	NA	NE	NE
Inorganics (mg/kg)				
Cadmium	0.84	NA	4.1	ND
Chromium, Trivalent	32	NA	29 J	9.1 J
Copper	120	NA	320 J	13 J
Lead	440	NA	1,100 J	4.1 J
Mercury	0.2	NA	1.1 J	0.1 J
Nickel	27	NA	27	11 J
Silver	0.9	NA	34	ND
Zinc	330 J	NA	710 J	20 J
PFAS (ppb)				
Perfluorooctanesulfonic Acid	0.99	NA	ND	ND
Perfluorooctanoic Acid	ND	NA	ND	ND

Sample ID	SB51_0-2	SB51_4-6	SB51_9-11	SDDUP03_081920
Sample Date	8/19/2020	8/19/2020	8/19/2020	8/19/2020
Sample Depth (feet bgs)	0-2	4-6	9-11	9-11
VOCs (mg/kg)	NE	ND	ND	NE
SVOCs (mg/kg)				
Benzo(a)anthracene	5.1 J	0.19 J	3.8 J	13 J
Benzo(a)pyrene	5.1 J	0.18 J	4 J	12 J
Benzo(b)fluoranthene	4.6 J	0.24 J	4.1 J	12 J
Benzo(k)fluoranthene	2.2 J	0.071 J	1.5 J	4.3 J
Chrysene	4.7 J	0.271 J	3.9 J	12 J
Dibenz(a,h)anthracene	0.7 J	0.038 J	0.88 J	1.8 J
Indeno(1,2,3-cd)pyrene	2.7 J	0.14 J	2.7 J	6.3 J
Pesticides (mg/kg)				
4,4'-DDE	ND	ND	0.0038 J	0.0032 J
4,4'-DDT	0.0078 J	ND	ND	0.008 J
Herbicides (mg/kg)	NE	NE	NE	NE
PCBs (mg/kg)	NE	NE	NE	NE
Inorganics (mg/kg)				
Barium	310 J	110 J	640 J	410 J
Copper	110 J	260 J	88 J	92 J
Lead	75 J	230 J	550 J	300 J
Mercury	3.2	0.84	3.7	3.1
Nickel	22 J	9.8 J	17 J	17 J
Zinc	260 J	160 J	410 J	370 J
PFAS (ppb)				
Perfluorooctanesulfonic Acid	0.69 J	ND	ND	1.2 J
Perfluoropentanoic Acid	0.32 J	0.29 J	ND	ND

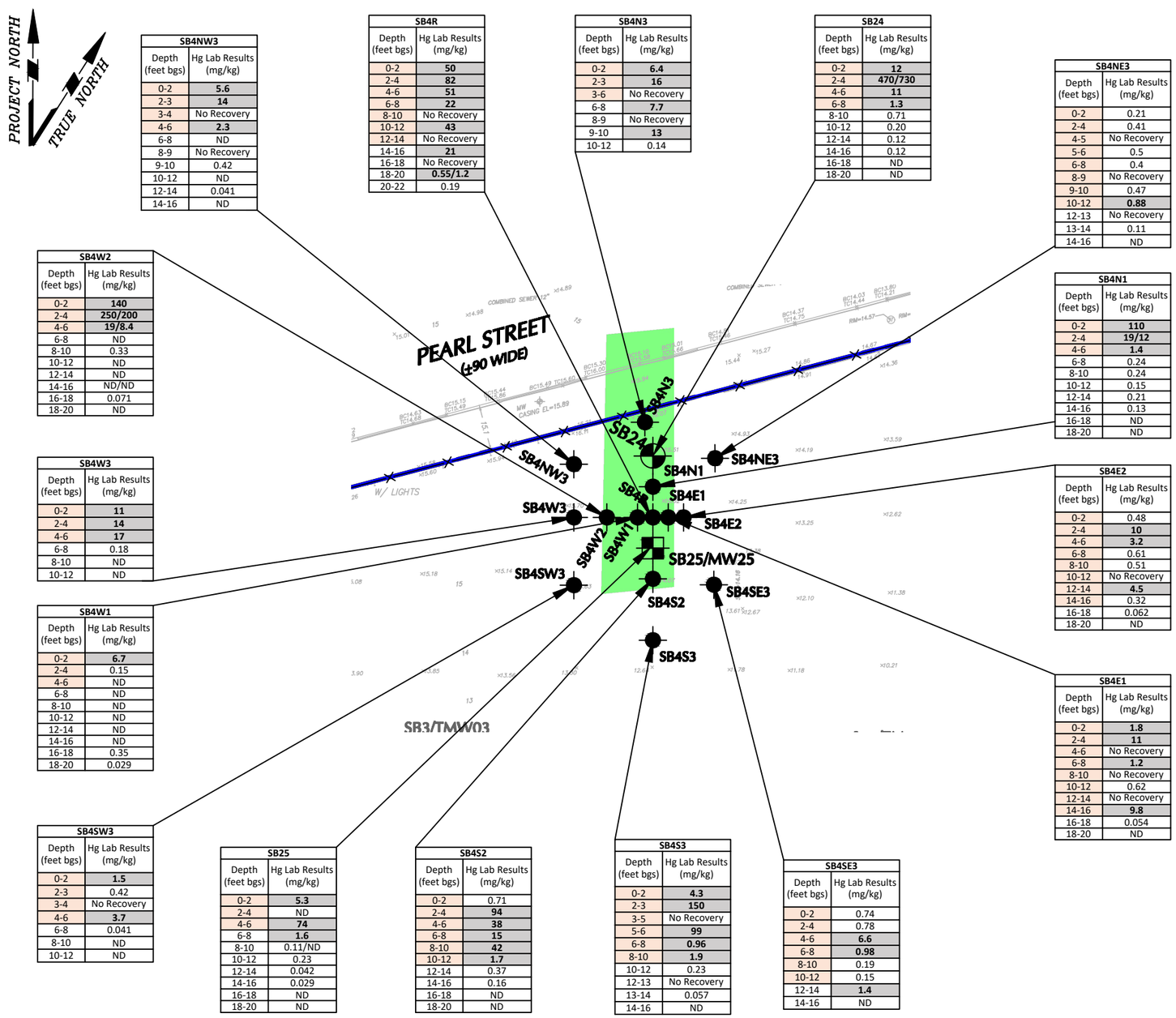
Sample ID	SB52_0-2	SB52_4-6	SB52_9-11	SB52_20-22
Sample Date	7/31/2020	7/31/2020	7/31/2020	7/31/2020
Sample Depth (feet bgs)	0-2	4-6	9-11	20-22
VOCs (mg/kg)	0.19 J	ND	0.035 J	ND
SVOCs (mg/kg)				
Benzo(a)anthracene	2.3	0.046 J	ND	ND
Benzo(a)pyrene	2	0.047 J	ND	ND
Benzo(b)fluoranthene	2.3	0.044 J	ND	ND
Chrysene	2.1	0.044 J	0.0051 J	ND
Dibenz(a,h)anthracene	0.36	ND	ND	ND
Indeno(1,2,3-cd)pyrene	1.3	0.059 J	ND	ND
Pesticides (mg/kg)				
4,4'-DDT	ND	ND	ND	0.038 B
Gamma BHC (Lindane)	0.11	ND	ND	ND
Heptachlor Epoxide	0.11	ND	ND	ND
PCBs (mg/kg)	ND	ND	ND	ND
Inorganics (mg/kg)				
Copper	150	7.5	8.8	7.3
Lead	420 J+	20 J+	9 J+	2.7 J+
Mercury	0.7	0.1	0.07	ND
Zinc	250 J	18 J	17 J	16 J
PFAS (ppb)				
Perfluoroheptanoic Acid	0.63 J	ND	ND	ND
Perfluorohexanoic Acid	0.79	ND	ND	ND
Perfluorooctanesulfonic Acid	1.7	ND	ND	ND
Perfluorooctanoic Acid	2.8	ND	ND	ND
Perfluoropentanoic Acid	0.48 J	ND	ND	ND

Sample ID	SB53_0-2	SB53_11-13	SB53_19-20
Sample Date	8/21/2020	8/21/2020	8/21/2020
Sample Depth (feet bgs)	0-2	11-13	19-20
VOCs (mg/kg)			
1,2,4-Trimethylbenzene	NO	6.7	NO
Acetone	0.029 J+	ND	0.068
n-Propylbenzene	NO	4	0.0005 J
Toluene	NO	1.1	ND
SVOCs (mg/kg)			
Benzo(a)anthracene	1.5 J	0.15 J	0.25 J
Benzo(a)pyrene	1.5 J	0.14 J	0.23 J
Benzo(b)fluoranthene	1.9 J	0.21 J	0.29 J
Benzo(k)fluoranthene	0.94 J	0.072 J	0.11 J
Chrysene	1.6 J	0.15 J	0.25 J
Indeno(1,2,3-cd)pyrene	1 J	0.11 J	0.15 J
Pesticides (mg/kg)			
4,4'-DDT	0.0045 J	ND	ND
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	ND
Inorganics (mg/kg)			
Copper	120	17	13
Lead	180	3.1	2.2
Mercury	1.1	0.13	ND
Zinc	370 J	43 J	46 J
PFAS (ppb)			
Perfluorohexanesulfonic Acid	ND	0.3 J	ND
Perfluorooctanoic Acid	ND	0.69	ND
Perfluorononanoic Acid	ND	0.1 J	ND
Perfluorooctanesulfonic Acid	0.44 J	ND	ND
Perfluoroundecanoic Acid	ND	ND	0.66

Sample ID	SB54_4-6	SB54_10-12	SB54_12-14	SB54_16-20
Sample Date	8/25/2020	8/25/2020	8/25/2020	8/25/2020
Sample Depth (feet bgs)	4-6	10-12	12-14	16-20
VOCs (mg/kg)				
Acetone	0.094	0.052 J+	0.35 J+	0.055 J+
SVOCs (mg/kg)				
Dibenz(a,h)anthracene	0.54	0.012 J	ND	ND
Pesticides (mg/kg)	NE	ND	ND	NA
Herbicides (mg/kg)	NE	ND	ND	NA
PCBs (mg/kg)	NE	ND	ND	NA
Inorganics (mg/kg)				
Barium	14	11 J	9.6 J	7 J
Chromium, Hexavalent	16	0.83	ND	ND
Chromium, Trivalent	59	29 J	7.2 J	30 J
Mercury	2.5 J	0.1 J	ND	ND
Nickel	42	21 J	16 J	77 J
Zinc	110 J	50 J	13 J	68 J
PFAS (ppb)				
Perfluorooctanesulfonic Acid	0.73	ND	ND	NA

Sample ID	SB55_0-2	SB55_8-10	SB55_28-28
Sample Date	8/25/2020	8/25/2020	8/25/2020
Sample Depth (feet bgs)	0-2	8-10	28-28
VOCs (mg/kg)	NO	0.017 J	NO
SVOCs (mg/kg)	NO	0.0046 J+	ND
PCBs (mg/kg)	NE	ND	NE
Inorganics (mg/kg)			
Arsenic	7.4	5.9	59
Barium	300	390	640
Chromium, Trivalent	19	40	550
Copper	58	180	190
Lead	440	640	1,100 J
Mercury	0.78	0.47 J	ND
Nickel	24	37	36
Silver	2.2	2.4	1.1
Zinc	529 J	430 J	11 J
PFAS (ppb)			
Perfluorooctanesulfonic Acid	1.9	0.2 J	ND

Sample ID	SB56_0-2	SB56_8-10	SB56_18-18
Sample Date	8/24/2020	8/24/2020	8/24/2020
Sample Depth (feet bgs)	0-2	8-10	18-18
VOCs (mg/kg)			
Acetone	0.11 J	0.1 J	0.1 J
SVOCs (mg/kg)			
Benzo(a)anthracene	1.7 J	0.12	ND
Benzo(a)pyrene	1.9 J	0.1	ND
Benzo(b)fluoranthene	2.1 J	0.12	ND
Benzo(k)fluoranthene	0.94



SB4NW3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**5.6**
2-3	**14**
3-4	No Recovery
4-6	**2.3**
6-8	ND
8-9	No Recovery
9-10	0.42
10-12	ND
12-14	0.041
14-16	ND

SB4R	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**50**
2-4	**82**
4-6	**51**
6-8	**22**
8-10	No Recovery
10-12	**43**
12-14	No Recovery
14-16	**21**
16-18	No Recovery
18-20	**0.55/1.2**
20-22	0.19

SB4N3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**6.4**
2-3	**16**
3-6	No Recovery
6-8	**7.7**
8-9	No Recovery
9-10	**13**
10-12	0.14

SB24	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**12**
2-4	**470/730**
4-6	**11**
6-8	**1.3**
8-10	0.71
10-12	0.20
12-14	0.12
14-16	0.12
16-18	ND
18-20	ND

SB4NE3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	0.21
2-4	0.41
4-5	No Recovery
5-6	0.5
6-8	0.4
8-9	No Recovery
9-10	0.47
10-12	**0.88**
12-13	No Recovery
13-14	0.11
14-16	ND

SB4W2	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**140**
2-4	**250/200**
4-6	**19/8.4**
6-8	ND
8-10	0.33
10-12	ND
12-14	ND
14-16	ND/ND
16-18	0.071
18-20	ND

SB4N1	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**110**
2-4	**19/12**
4-6	**1.4**
6-8	0.24
8-10	0.24
10-12	0.15
12-14	0.21
14-16	0.13
16-18	ND
18-20	ND

SB4W3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**11**
2-4	**14**
4-6	**17**
6-8	0.18
8-10	ND
10-12	ND

SB4E2	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	0.48
2-4	**10**
4-6	**3.2**
6-8	0.61
8-10	0.51
10-12	No Recovery
12-14	**4.5**
14-16	0.32
16-18	0.062
18-20	ND

SB4W1	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**6.7**
2-4	0.15
4-6	ND
6-8	ND
8-10	ND
10-12	ND
12-14	ND
14-16	ND
16-18	0.35
18-20	0.029

SB4E1	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**1.8**
2-4	**11**
4-6	No Recovery
6-8	**1.2**
8-10	No Recovery
10-12	0.62
12-14	No Recovery
14-16	**9.8**
16-18	0.054
18-20	ND

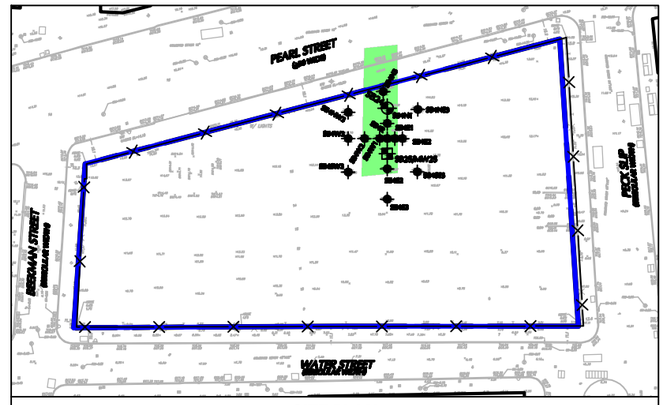
SB4SW3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**1.5**
2-3	0.42
3-4	No Recovery
4-6	**3.7**
6-8	0.041
8-10	ND
10-12	ND

SB25	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**5.3**
2-4	ND
4-6	**74**
6-8	**1.6**
8-10	0.11/ND
10-12	0.23
12-14	0.042
14-16	0.029
16-18	ND
18-20	ND

SB4S2	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	0.71
2-4	**94**
4-6	**38**
6-8	**15**
8-10	**42**
10-12	**1.7**
12-14	0.37
14-16	0.16
16-18	ND
18-20	ND

SB4S3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	**4.3**
2-3	**150**
3-5	No Recovery
5-6	**99**
6-8	**0.96**
8-10	**1.9**
10-12	0.23
12-13	No Recovery
13-14	0.057
14-16	ND

SB4SE3	
Depth (feet bgs)	Hg Lab Results (mg/kg)
0-2	0.74
2-4	0.78
4-6	**6.6**
6-8	**0.98**
8-10	0.19
10-12	0.15
12-14	**1.4**
14-16	ND



SITE PLAN
(1"=100')

LEGEND

- SITE BOUNDARY (AOC 1)
- APPROXIMATE LOCATION OF SITE FENCE
- SB19 — SOIL BORING LOCATION
- SB4E1 — MERCURY DELINEATION SOIL BORING LOCATION
- SB25/MW25 — SOIL BORING AND MONITORING WELL LOCATION
- APPROXIMATE EXTENT OF HISTORICAL THERMOMETER FACTORY

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. SOIL SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TITLE 6 OF THE OFFICIAL COMPILATION OF NEW YORK CODES, RULES, AND REGULATIONS (NYCRR) PART 375 RESTRICTED USE RESTRICTED-RESIDENTIAL (RURR) SOIL CLEANUP OBJECTIVES (SCOs).
3. CONCENTRATIONS ABOVE RURR SCOs ARE BOLD AND SHADED.
4. Hg = MERCURY
5. bgs = BELOW GRADE SURFACE
6. mg/kg = MILLIGRAM PER KILOGRAM
7. ND = NOT DETECTED
8. TAN SHADED DEPTH INTERVALS WERE IDENTIFIED AS HISTORIC FILL

WARNING: IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

40 0 10 25 40
SCALE IN FEET

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Project
250 WATER STREET
BLOCK No. 98, LOT No. 1
CITY
NEW YORK NEW YORK

Drawing Title
MERCURY DELINEATION SOIL SAMPLE ANALYTICAL RESULTS MAP

Project No. 170381202
Date 1/14/2021
Drawn By JFY
Checked By PM

Drawing No. **4B**

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Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 4B - Mercury Delineation.dwg Date: 2/5/2021 Time: 15:25 User: astappenbeck Style Table: Langan.stb Layout: ANSIB-BL

Sample ID	MW15_090120
Sample Date	9/1/2020
VOCs (µg/L)	NE
SVOCs (µg/L)	NE
Pesticides (µg/L)	NE
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Antimony	5.79 J
Antimony (Dissolved)	7.03 J
Magnesium	84,600
Magnesium (Dissolved)	86,700
Sodium	212,000
Sodium (Dissolved)	213,000
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	55.7
Perfluorobutanoic acid	12.5
Perfluorodecanoic Acid	1.91
Perfluoroheptanoic acid	18.4
Perfluorohexanesulfonic Acid	3.15
Perfluorohexanoic Acid	17.4
Perfluorononanoic Acid	2.28
Perfluorooctanesulfonic Acid	24.3
Perfluorooctanoic Acid	45.8
Perfluoropentanoic Acid	21.9
Total PFOA and PFOS	70.1

Sample ID	MW25_090120
Sample Date	9/1/2020
VOCs (µg/L)	NE
SVOCs (µg/L)	NE
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Antimony (Dissolved)	3.48 J
Sodium	96,900
Sodium (Dissolved)	97,500
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	5.67
Perfluorobutanoic acid	8.27
Perfluorodecanoic Acid	4.49
Perfluoroheptanesulfonic Acid	1.3 J
Perfluoroheptanoic acid	17.1
Perfluorohexanesulfonic Acid	11.7
Perfluorohexanoic Acid	14.4
Perfluorononanoic Acid	4.96
Perfluorooctanesulfonic Acid	52.8
Perfluorooctanoic Acid	103
Perfluoropentanoic Acid	14.3
Total PFOA and PFOS	156

Sample ID	MW30_090220	GWDUP01_090220
Sample Date	9/2/2020	9/2/2020
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	17	18
Benzene	10	9.4
Ethylbenzene	7.3	7.9
Isopropylbenzene (Cumene)	63	68
M,P-Xylene	16	17
n-Butylbenzene	6.4	7.2
n-Propylbenzene	65	72
Sec-Butylbenzene	10	11
Toluene	5.5	5.4
Total Xylenes	20	21
SVOCs (µg/L)		
Benzo(a)anthracene	0.16 JN	ND
Benzo(a)pyrene	0.17 J+	0.07 J
Benzo(b)fluoranthene	0.19 JN	0.09 J
Benzo(k)fluoranthene	0.08 J+	ND
Chrysene	0.14 J+	ND
Indeno(1,2,3-cd)pyrene	0.15 JN	0.06 JN
Pesticides (µg/L)	ND	ND
Herbicides (µg/L)	ND	ND
PCBs (µg/L)		
Total PCBs	0.977 J-	0.082 J-
Inorganics (µg/L)		
Iron	1,310 J	878 J
Sodium	144,000 J	144,000 J
Sodium (Dissolved)	146,000 J	139,000 J
PFAS (ng/L)		
N-ethyl perfluorooctane- sulfonamidoacetic Acid	5.4	5.43
N-methyl perfluorooctane- sulfonamidoacetic Acid	1.59 J	1.23 J
Perfluorobutanesulfonic Acid	7.98 J	8.9 J
Perfluorobutanoic acid	17.7 J	20.3 J
Perfluorodecanoic Acid	3.75	3.88
Perfluoroheptanesulfonic Acid	1.41 J	1.33 J
Perfluoroheptanoic acid	24.4	25.2
Perfluorohexanesulfonic Acid	24	25.3
Perfluorohexanoic Acid	24.5	26
Perfluorononanoic Acid	4.7 J+	5.08 J+
Perfluorooctanesulfonamide	45.2 J-	60.2 J-
Perfluorooctanesulfonic Acid	121	126
Perfluorooctanoic Acid	94.5 J	93.6 J
Perfluoropentanoic Acid	21.2	21.3
Sodium 1H,1H,2H,2H-Perfluorodecane Sulfonate (8:2)	ND	1.2 J+
Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	ND	2.6 J+
Total PFOA and PFOS	216	220

Sample ID	TMW08_100315
Sample Date	10/3/2015
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	6.8
n-Butylbenzene	11
sec-Butylbenzene	13
SVOCs (µg/L)	
Total SVOCs	NE
PCBs, Total	ND
Dissolved Metals (µg/L)	
Sodium, Dissolved	87,800
Total Metals (µg/L)	
Iron, Total	815
Sodium, Total	83,600

Sample ID	MW33_090220
Sample Date	9/2/2020
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	39
Benzene	1.4
Isopropylbenzene (Cumene)	45
n-Butylbenzene	6.7
n-Propylbenzene	92
Sec-Butylbenzene	6.9
SVOCs (µg/L)	
Benzo(a)anthracene	0.04 JN
Benzo(b)fluoranthene	0.02 JN
Chrysene	0.04 J
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	NE
Inorganics (µg/L)	
Antimony (Dissolved)	3.01 J
Iron	1,320 J
Iron (Dissolved)	1,270 J
Sodium	411,000 J
Sodium (Dissolved)	393,000 J
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	9.96
Perfluorobutanoic acid	16.9
Perfluorodecanoic Acid	0.944 J
Perfluoroheptanesulfonic Acid	0.763 J
Perfluoroheptanoic acid	5.92
Perfluorohexanesulfonic Acid	3.71
Perfluorohexanoic Acid	9.16
Perfluorononanoic Acid	10.3 J+
Perfluorooctanesulfonic Acid	36.9
Perfluorooctanoic Acid	61.6
Perfluoropentanoic Acid	10.7
Perfluoroundecanoic Acid	4.92 J+
Total PFOA and PFOS	98.5

Sample ID	MW31_090220
Sample Date	9/2/2020
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	35
1,2,4-Trimethylbenzene	550
1,3,5-Trimethylbenzene (Mesitylene)	140
Benzene	53
Ethylbenzene	390
Isopropylbenzene (Cumene)	34
M,P-Xylene	1,300
n-Butylbenzene	6.6 J
n-Propylbenzene	74
o-Xylene (1,2-Dimethylbenzene)	390
Sec-Butylbenzene	5.8 J
Toluene	290
Total Xylenes	1,700
SVOCs (µg/L)	
2,4-Dimethylphenol	4.9 J-
Biphenyl (Diphenyl)	7.9
Naphthalene	210
Phenol	2.5 J-
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	308 J
Magnesium	52,800 J
Magnesium (Dissolved)	52,100 J
Manganese	539.5
Manganese (Dissolved)	542.3
Sodium	336,000 J
Sodium (Dissolved)	331,000 J
PFAS (ng/L)	
N-ethyl perfluorooctane- sulfonamidoacetic Acid	2.08
N-methyl perfluorooctane- sulfonamidoacetic Acid	1.22 J
Perfluorobutanesulfonic Acid	12.3 J
Perfluorobutanoic acid	24 J
Perfluorodecanoic Acid	1.44 J
Perfluoroheptanesulfonic Acid	0.787 J
Perfluoroheptanoic acid	18.3
Perfluorohexanesulfonic Acid	25.9
Perfluorohexanoic Acid	19.5
Perfluorononanoic Acid	5.2 J+
Perfluorooctanesulfonamide	1.46 J
Perfluorooctanesulfonic Acid	37.4 J
Perfluorooctanoic Acid	78.4 J
Perfluoropentanoic Acid	20.4
Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	2.09 J+
Total PFOA and PFOS	116

Sample ID	TMW01_100315
Sample Date	10/3/2015
VOCs (µg/L)	
Total VOCs	ND
SVOCs (µg/L)	
Total SVOCs	NE
PCBs (µg/L)	
PCBs, Total	ND
Dissolved Metals (µg/L)	
Magnesium, Dissolved	103,000
Sodium, Dissolved	881,000
Total Metals (µg/L)	
Iron, Total	359
Magnesium, Total	101,000
Sodium, Total	882,000

Sample ID	TMW03_100315
Sample Date	10/3/2015
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	10
SVOCs (µg/L)	
Total SVOCs	NE
PCBs (µg/L)	
PCBs, Total	ND
Dissolved Metals (µg/L)	
Barium, Dissolved	1,014
Iron, Dissolved	1,080
Magnesium, Dissolved	128,000
Manganese, Dissolved	2,762
Sodium, Dissolved	930,000
Total Metals (µg/L)	
Iron, Total	2,500
Lead, Total	25.8
Magnesium, Total	128,000
Manganese, Total	2,850
Sodium, Total	966,000

Sample ID	MW11_090120
Sample Date	9/1/2020
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(b)fluoranthene	0.01 JN
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	452
Manganese	306.7
Manganese (Dissolved)	307.9
Sodium	35,900
Sodium (Dissolved)	35,200
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	10.7
Perfluorobutanoic acid	6.2
Perfluorodecanoic Acid	2.51
Perfluoroheptanoic acid	3.15
Perfluorohexanesulfonic Acid	1.1 J
Perfluorohexanoic Acid	4.35
Perfluorononanoic Acid	2.14
Perfluorooctanesulfonic Acid	23.1
Perfluoropentanoic Acid	7
Total PFOA and PFOS	29.3

Sample ID	MW17_090120
Sample Date	9/1/2020
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)anthracene	0.03 JN
Chrysene	0.02 JN
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	1,340
Iron (Dissolved)	1,240
Manganese	629.6
Manganese (Dissolved)	645.3
Sodium	150,000
Sodium (Dissolved)	145,000
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	10.1
Perfluorobutanoic acid	9.93
Perfluorodecanoic Acid	2.47
Perfluoroheptanoic acid	5.46
Perfluorohexanesulfonic Acid	0.954 J
Perfluorohexanoic Acid	13.5
Perfluorononanoic Acid	2.65
Perfluorooctanesulfonic Acid	22.8
Perfluoropentanoic Acid	27.2
Total PFOA and PFOS	32.1

Sample ID	MW26_090220
Sample Date	9/2/2020
VOCs (µg/L)	NE
SVOCs (µg/L)	NE
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	
Total PCBs	0.139 J-
Inorganics (µg/L)	
Antimony	4.09 J
Antimony (Dissolved)	3.62 J
Iron	1,470 J
Iron (Dissolved)	1,340 J
Magnesium	37,300 J
Magnesium (Dissolved)	35,700 J
Sodium	211,000 J
Sodium (Dissolved)	201,000 J
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	9.23 J
Perfluorobutanoic acid	10.8 J
Perfluorodecanoic Acid	2.02
Perfluoroheptanoic acid	6.83 J
Perfluorohexanesulfonic Acid	10.6
Perfluorohexanoic Acid	5.49
Perfluorononanoic Acid	1.96 J+
Perfluorooctanesulfonic Acid	27.7
Perfluorooctanoic Acid	46
Perfluoropentanoic Acid	7.21
Total PFOA and PFOS	73.7

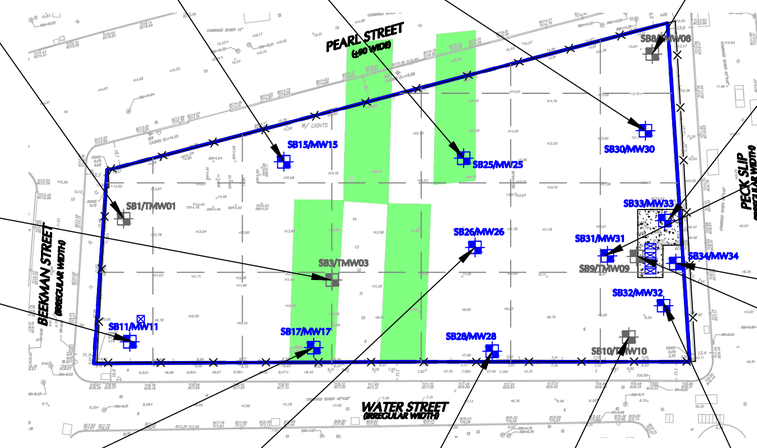
Sample ID	MW28_090120
Sample Date	9/1/2020
VOCs (µg/L)	NE
SVOCs (µg/L)	
Benzo(a)anthracene	0.04 J
Benzo(a)pyrene	0.03 J
Benzo(b)fluoranthene	0.04 J
Benzo(k)fluoranthene	0.02 J
Chrysene	0.03 J
Indeno(1,2,3-cd)pyrene	0.03 JN
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Antimony	40.08
Antimony (Dissolved)	28.62
Arsenic	116
Arsenic (Dissolved)	118.4
Iron	8,100
Iron (Dissolved)	8,010
Lead	66.74
Manganese	861.6
Manganese (Dissolved)	851
Sodium	301,000
Sodium (Dissolved)	299,000
PFAS (ng/L)	
Perfluorobutanesulfonic Acid	8.29
Perfluorobutanoic acid	11.3
Perfluoroheptanoic acid	13.4
Perfluorohexanesulfonic Acid	1.19 J
Perfluorohexanoic Acid	32.2
Perfluorononanoic Acid	3.71
Perfluorooctanesulfonic Acid	17.5
Perfluorooctanoic Acid	18
Perfluoropentanoic Acid	38.1
Total PFOA and PFOS	35.5

Sample ID	TMW10_100315	DUP02_100315
Sample Date	10/3/2015	10/3/2015
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	10	10
n-Propylbenzene	7.8	7.9
SVOCs (µg/L)		
Total SVOCs	NE	NE
PCBs (µg/L)		
PCBs, Total	ND	ND
Dissolved Metals (µg/L)		
Iron, Dissolved	349	336
Magnesium, Dissolved	50,700	54,800
Manganese, Dissolved	292.4	315.8
Sodium, Dissolved	494,000	536,000
Total Metals (µg/L)		
Iron, Total	668	906
Magnesium, Total	40,700	44,000
Sodium, Total	460,000	460,000

Sample ID	MW32_090220
Sample Date	9/2/2020
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	18
1,2,4-Trimethylbenzene	22
Benzene	8.6
Ethylbenzene	5.7
Isopropylbenzene (Cumene)	28
n-Propylbenzene	23
SVOCs (µg/L)	NE
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	NE
Inorganics (µg/L)	
Iron	2,100 J
Iron (Dissolved)	1,810 J
Magnesium	42,000 J
Magnesium (Dissolved)	39,600 J
Manganese	654.6
Manganese (Dissolved)	644
Sodium	511,000 J
Sodium (Dissolved)	505,000 J
PFAS (ng/L)	
N-ethyl perfluorooctane- sulfonamidoacetic Acid	1.52 J
Perfluorobutanesulfonic Acid	7.53
Perfluorobutanoic acid	16
Perfluorodecanoic Acid	1.66 J
Perfluorododecanoic Acid	0.452 J
Perfluoroheptanoic acid	8.57
Perfluorohexanesulfonic Acid	6.5
Perfluorohexanoic Acid	11.3
Perfluorononanoic Acid	68.4 J+
Perfluorooctanesulfonamide	5.66 J-
Perfluorooctanesulfonic Acid	33.3
Perfluorooctanoic Acid	46.3
Perfluoropentanoic Acid	14.4
Perfluoroundecanoic Acid	5.34 J+
Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	1.69 J+
Total PFOA and PFOS	79.6

Sample ID	MW34_090220
Sample Date	9/2/2020
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	11
Isopropylbenzene (Cumene)	53
n-Propylbenzene	53
Sec-Butylbenzene	9.9
SVOCs (µg/L)	NE
Pesticides (µg/L)	ND
Herbicides (µg/L)	ND
PCBs (µg/L)	
Total PCBs	0.098 J-
Inorganics (µg/L)	
Iron	1,490 J
Iron (Dissolved)	1,020
Sodium	235,000 J
Sodium (Dissolved)	232,000
PFAS (ng/L)	
N-ethyl perfluorooctane- sulfonamidoacetic Acid	3.62
Perfluorobutanesulfonic Acid	4.97
Perfluorobutanoic acid	9.76
Perfluorodecanoic Acid	1.67 J
Perfluoroheptanoic acid	4.48
Perfluorohexanesulfonic Acid	2.69
Perfluorohexanoic Acid	8.04
Perfluorononanoic Acid	2.01 J+
Perfluorooctanesulfonamide	1.25 J-
Perfluorooctanesulfonic Acid	23.4
Perfluorooctanoic Acid	21.5
Perfluoropentanoic Acid	10.3
Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	8.74 J+
Total PFOA and PFOS	44.9

Sample ID	TMW09_100315
Sample Date	10/3/2015
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	550
1,2,4-Trimethylbenzene	6,100
1,3,5-Trimethylbenzene	1,800
Benzene	330
Ethylbenzene	1,800
Isopropylbenzene	240 J
n-Butylbenzene	240 J
n-Propylbenzene	760
o-Xylene	3,400
p-Isopropyltoluene	83 J
p/m-Xylene	8,400
sec-Butylbenzene	86 J
Toluene	2,700
SVOCs (µg/L)	
Biphenyl	28
Phenol	44
Acenaphthene	53
Benzo(a)anthracene	4.6 J
Benzo(a)pyrene	2.2 J
Benzo(b)fluoranthene	2.8 J
Chrysene	3.7 J
Naphthalene	540
Phenanthrene	77
PCBs (µg/L)	
PCBs, Total	ND
Dissolved Metals (µg/L)	
Antimony, Dissolved	6.1
Iron, Dissolved	697
Magnesium, Dissolved	90,800
Manganese, Dissolved	478.7
Sodium, Dissolved	1,660,000
Total Metals (µg/L)	
Antimony, Total	5.1
Barium, Total	1,136
Chromium, Total	98.1
Copper, Total	227
Iron, Total	41,500
Lead, Total	725.5
Magnesium, Total	111,000
Manganese, Total	1,820
Nickel, Total	112.2
Sodium, Total	1,480,000



LEGEND

- SITE BOUNDARY
- APPROXIMATE LOCATION OF SITE FENCE
- 50-FOOT BY 50-FOOT GRID LINES
- SB01/TMW01 — PHASE II ESI SOIL BORING LOCATION WITH TEMPORARY MONITORING WELL
- SB11/MW11 — SOIL BORING AND MONITORING WELL LOCATION
- APPROXIMATE UST LOCATION
- APPROXIMATE EXTENT OF HISTORICAL THERMOMETER FACTORY/WORKSHOPS

Analyte	NYSDEC SGVs	NYSDEC January 2020 Guidance Values
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	5	~
1,2,4-Trimethylbenzene	5	~
1,3,5-Trimethylbenzene (Mesitylene)	5	~
Benzene	1	~
Ethylbenzene	5	~
Isopropylbenzene (Cumene)	5	~
M,P-Xylene	5	~
n-Butylbenzene	5	~
n-Propylbenzene	5	~
o-Xylene (1,2-Dimethylbenzene)	5	~
Sec-Butylbenzene	5	~
Toluene	5	~
Total Xylenes	5	~
SVOCs (µg/L)		
2,4-Dimethylphenol	1	~
Benzo(a)anthracene	0.002	~
Benzo(a)pyrene	0	~
Benzo(b)fluoranthene	0.002	~
Benzo(k)fluoranthene	0.002	~
Biphenyl (Diphenyl)	5	~
Chrysene	0.002	~
Indeno(1,2,3-cd)pyrene	0.002	~
Naphthalene	10	~
Phenol	1	~
PCBs (µg/L)		
Total PCBs	0.09	~
Inorganics (µg/L)		
Antimony	3	~
Arsenic	25	~
Iron	300	~
Lead	25	~
Magnesium	35,000	~
Manganese	300	~
Sodium	20,000	~
PFAS (ng/L)		
Perfluorooctanesulfonic Acid	~	10
Perfluorooctanoic Acid	~	10

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. GROUNDWATER SAMPLE ANALYTICAL RESULTS ARE COMPARED TO THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES (SGVs) FOR DRINKING WATER (CLASS GA) AND TO THE NYSDEC PER- AND POLYFLUOROALKYL SUBSTANCE (PFAS) SCREENING LEVELS , JANUARY 2021.
4. ONLY DETECTED COMPOUNDS ARE SHOWN.
5. SGV EXCEEDANCES ARE HIGHLIGHTED AND IN BOLD.
6. PFAS SCREENING LEVELS EXCEEDANCES ARE IN RED
7. TOTAL AND DISSOLVED MERCURY WAS NOT DETECTED IN THE SEPTEMBER 2020 GROUNDWATER SAMPLES.
8. µg/L = MICROGRAM PER LITER
9. ng/L = NANOGRAM PER LITER
10. VOC = VOLATILE ORGANIC COMPOUND
11. SVOC = SEMIVOLATILE ORGANIC COMPOUND
12. PCB = POLYCHLORINATED BIPHENYL
13. ND = NOT DETECTED
14. NE = NO EXCEEDANCE
15. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT BUT BELOW THE REPORTING LIMIT; THEREFORE, THE RESULT IS AN ESTIMATE
16. J+ = THE REPORTED VALUE MAY BE BIASED HIGH. THE ACTUAL VALUE IS EXPECTED TO BE LESS THAN THE REPORTED VALUE
17. J- = THE REPORTED VALUE MAY BE BIASED LOW. THE ACTUAL VALUE IS EXPECTED TO BE GREATER THAN THE REPORTED VALUE
18. JN = THE ANALYSIS INDICATES THE PRESENCE OF AN ANALYTE THAT HAS BEEN "TENTATIVELY IDENTIFIED" AND THE ASSOCIATED NUMERICAL VALUES REPRESENTS ITS APPROXIMATE CONCENTRATION
19. UST = UNDERGROUND STORAGE TANK

WARNING:
IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

60 0 20 40 60
SCALE: 1 INCH = 60 FEET

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Project
250 WATER STREET
BLOCK No. 98, LOT No. 1
NEW YORK NEW YORK

Drawing Title
GROUNDWATER SAMPLE ANALYTICAL RESULTS MAP

Project No. 170381202
Date 1/14/2021
Drawn By JFY
Checked By PM

Drawing No. 5

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Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 5 - Groundwater Analytical Results Map.dwg Date: 3/5/2021 Time: 08:27 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL (2)

PROJECT NORTH
TRUE NORTH

Sample ID	SV12_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,1,1-Trichloroethane	1.51
1,2,4-Trimethylbenzene	14.8
1,3,5-Trimethylbenzene (Mesitylene)	4.62
1,3-Butadiene	1.16
2-Hexanone	68.4 J
4-Ethyltoluene	1.79
Acetone	234
Benzene	9.78
Carbon Disulfide	21.1
Chloroform	4.45 J
Cyclohexane	41.3
Dichlorodifluoromethane	56.9
Ethanol	61.8
Ethylbenzene	4
Isopropanol	2.21
M,P-Xylene	12.9
Methyl Ethyl Ketone (2-Butanone)	187
Methyl Isobutyl Ketone	6.56
n-Heptane	74.6
n-Hexane	21.1
o-Xylene (1,2-Dimethylbenzene)	7.17
Styrene	0.949
Tert-Butyl Alcohol	14.6
Tetrachloroethene (PCE)	42.6 J
Toluene	26.5
Total Xylenes	20.1
Trichlorofluoromethane	7.02 J
Total BTEX	60.4
Total VOCs	929
Other (µg/m³)	ND
Mercury	0.00073 U

Sample ID	SV01_100315
Sample Date	10/3/2015
Sample Type	SV
1,2,4-Trimethylbenzene	10.7
1,3,5-Trimethylbenzene	3.22
2,2,4-Trimethylpentane	2.38
2-Butanone	6.05
4-Ethyltoluene	4.57
Acetone	22.3
Benzene	1.42
Carbon disulfide	1.77
Chloroform	2.47
Cyclohexane	0.709
Ethylbenzene	38.4
Heptane	34.7
n-Hexane	92
o-Xylene	11.2
p/m-Xylene	28.7
Styrene	16
tert-Butyl Alcohol	10.6
Tetrachloroethene	3.36
Tetrahydrofuran	1.57
Toluene	16.6
Total BTEX	96.32
Total VOCs	318.58

Sample ID	SV19_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	4.71
1,3,5-Trimethylbenzene (Mesitylene)	1.17
2-Hexanone	45.5 J
Acetone	65.6
Benzene	1.48
Carbon Disulfide	2.34
Chloroform	1.13 J
Dichlorodifluoromethane	7.37
Ethanol	14.9
Ethylbenzene	1.78
M,P-Xylene	9.08
Methyl Ethyl Ketone (2-Butanone)	125
n-Heptane	1.64
n-Hexane	1.26
o-Xylene (1,2-Dimethylbenzene)	5.21
Tert-Butyl Alcohol	7.34
Tetrachloroethene (PCE)	57.6 J
Toluene	6.41
Total Xylenes	14.3
Trichloroethene (TCE)	1.27
Trichlorofluoromethane	24.8 J
Total BTEX	24
Total VOCs	386
General Chemistry (µg/m³)	
Mercury	0.00086 U

Sample ID	SV38_080320
Sample Date	8/3/2020
Sample Type	SV
VOCs (µg/m³)	
Ethanol	171
Acetone	245
Trichlorofluoromethane	17.3
2-Butanone	3420
n-Hexane	104
Benzene	20.7
Cyclohexane	17
Xylenes, Total	277
2,2,4-Trimethylpentane	110
Heptane	48.4
Toluene	274
2-Hexanone	400
Tetrachloroethene	283
Ethylbenzene	62.1
p/m-Xylene	199
o-Xylene	78.2
1,3,5-Trimethylbenzene	19.2
1,2,4-Trimethylbenzene	66.9
General Chemistry (µg/m³)	
Mercury	0.271 J+

Sample ID	SV39_080320
Sample Date	8/3/2020
Sample Type	SV
VOCs (µg/m³)	
Chloromethane	8.49
Acetone	333
Trichlorofluoromethane	86.5
Carbon disulfide	60.1
2-Butanone	3750
n-Hexane	92.7
Benzene	20.3
Cyclohexane	17
Xylenes, Total	277
2,2,4-Trimethylpentane	84.1
Heptane	53.3
Toluene	221
2-Hexanone	590
Tetrachloroethene	300
Ethylbenzene	60.8
p/m-Xylene	197
o-Xylene	79.5
1,3,5-Trimethylbenzene	20.5
1,2,4-Trimethylbenzene	32.9
General Chemistry (µg/m³)	
Mercury	0.222 J+

Sample ID	SV24_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	4.15
1,3,5-Trimethylbenzene (Mesitylene)	1.19
2-Hexanone	12.3 J
Acetone	197
Benzene	1.77
Carbon Disulfide	3.27
Chloroform	7.42 J
Dichlorodifluoromethane	5.79
Ethanol	19.2
Ethylbenzene	50
Isopropanol	1.3
M,P-Xylene	245
Methyl Ethyl Ketone (2-Butanone)	39.5
n-Heptane	2.53
n-Hexane	1.35
o-Xylene (1,2-Dimethylbenzene)	66.9
Tert-Butyl Alcohol	8.09
Tetrachloroethene (PCE)	**437 J**
Toluene	8.89
Total Xylenes	312
Trichloroethene (TCE)	5.43
Trichlorofluoromethane	25.2 J
Total BTEX	373
Total VOCs	1,140
General Chemistry (µg/m³)	
Mercury	0.00084 U

Sample ID	SV08_100315
Sample Date	10/3/2015
Sample Type	SV
1,1,1-Trichloroethane	1.49
1,1,2-Trichloro-1,2,2-Trifluoroethane	1.66
1,2,4-Trimethylbenzene	11.4
1,3,5-Trimethylbenzene	3.81
1,3-Butadiene	1.99
2-Butanone	32.4
4-Ethyltoluene	5.26
Acetone	98.6
Benzene	11.4
Carbon disulfide	77.2
Chloroform	19.2
Cyclohexane	11.4
Dichlorodifluoromethane	5.44
Ethyl Alcohol	9.72
Ethylbenzene	63.9
Heptane	147
Iso-Propyl Alcohol	5.83
n-Hexane	327
o-Xylene	18
p/m-Xylene	45.2
Styrene	24.6
tert-Butyl Alcohol	19.9
Tetrachloroethene	30
Tetrahydrofuran	3.8
Toluene	36.3
Trichloroethene	2.1
Trichlorofluoromethane	179
Total BTEX	174.8
Total VOCs	1193.6

Sample ID	SV29_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	27.9
1,3,5-Trimethylbenzene (Mesitylene)	11.2
1,3-Butadiene	4.54
2,2,4-Trimethylpentane	96.2 J
2-Hexanone	126 J
4-Ethyltoluene	7.47
Acetone	570
Benzene	125
Carbon Disulfide	214
Chloroethane	1.72
Chloroform	3.37 J
Chloromethane	1.64
Cyclohexane	89.5
Dichlorodifluoromethane	8.9
Ethanol	97.6
Ethylbenzene	28.6
Isopropanol	11.7
M,P-Xylene	80.4
Methyl Ethyl Ketone (2-Butanone)	507
Methyl Isobutyl Ketone	9.47
n-Heptane	179
n-Hexane	211
o-Xylene (1,2-Dimethylbenzene)	25.6
Tert-Butyl Alcohol	36.7
Tetrachloroethene (PCE)	**110 J**
Tetrahydrofuran	30.4
Toluene	129
Total Xylenes	106
Trichloroethene (TCE)	**13.2**
Trichlorofluoromethane	151 J
Total BTEX	389
Total VOCs	2,910
General Chemistry (µg/m³)	
Mercury	0.00079 U

Sample ID	SV30_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	7.13
1,3-Butadiene	1.7
Acetone	333
Benzene	54.9
Carbon Disulfide	26.4
Chloroform	4.17 J
Cyclohexane	816
Dichlorodifluoromethane	8.7
Ethanol	78.2
Ethylbenzene	7.51
Isopropanol	7.18
M,P-Xylene	19
Methyl Ethyl Ketone (2-Butanone)	204
n-Heptane	520
n-Hexane	571
o-Xylene (1,2-Dimethylbenzene)	7.91
Tert-Butyl Alcohol	13.4
Tetrachloroethene (PCE)	10 J
Toluene	36.6
Total Xylenes	26.9
Trichlorofluoromethane	214 J
Total BTEX	126
Total VOCs	2,940
General Chemistry (µg/m³)	
Mercury	0.00096 U

Sample ID	V5_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	NA
General Chemistry (µg/m³)	
Mercury	0.00065 U

Sample ID	V3_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	NA
General Chemistry (µg/m³)	
Mercury	0.00094 U

Sample ID	V1_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	NA
General Chemistry (µg/m³)	
Mercury	0.00082 U

Sample ID	SV05_100315
Sample Date	10/3/2015
Sample Type	SV
1,2,4-Trimethylbenzene	13.4
1,3-Butadiene	20.5
2,2,4-Trimethylpentane	111
2-Butanone	25.1
Cyclohexane	23
Dichlorodifluoromethane	40.4
Ethyl Alcohol	53.3
Ethylbenzene	49.5
Heptane	114
n-Hexane	217
o-Xylene	26.1
p/m-Xylene	67.3
Styrene	16
tert-Butyl Alcohol	17.8
Tetrachloroethene	82.7
Toluene	46.4
Trichlorofluoromethane	4180
Total BTEX	189.3
Total VOCs	5352.8

Sample ID	AA02_070920
Sample Date	7/9/2020
Sample Type	AA
VOCs (µg/m³)	
2,2,4-Trimethylpentane	2.43 J
Acetone	8.12
Benzene	1.32
Chloromethane	1.1
Dichlorodifluoromethane	2.26
Ethanol	13.9
Isopropanol	1.24
M,P-Xylene	2.24
n-Hexane	1.06
o-Xylene (1,2-Dimethylbenzene)	0.886
Toluene	2.39
Total Xylenes	3.13
Trichlorofluoromethane	1.45 J
Total BTEX	6.84
Total VOCs	38.4
General Chemistry (µg/m³)	
Mercury	0.00082 U

Sample ID	SV32_070920
Sample Date	7/9/2020
Sample Type	SV
2,2,4-Trimethylpentane	4,100 J
Benzene	649
Carbon Disulfide	114
Cyclohexane	3,070
Ethylbenzene	414
M,P-Xylene	1,790
n-Heptane	12,100
n-Hexane	13,900
o-Xylene (1,2-Dimethylbenzene)	656
Toluene	2,520
Total Xylenes	2,450
Total BTEX	6,030
Total VOCs	39,300
General Chemistry (µg/m³)	
Mercury	0.00096 U

Sample ID	SV28_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	5.11
1,3,5-Trimethylbenzene (Mesitylene)	1.88
2-Hexanone	26.6 J
Acetone	340
Benzene	2.57
Carbon Disulfide	2.91
Chloroform	10.4 J
Cis-1,2-Dichloroethene	3.14
Cyclohexane	1.37
Dichlorodifluoromethane	3.44
Ethanol	33.4
Ethylbenzene	1.96
Isopropanol	2.93
M,P-Xylene	8.99
Methyl Ethyl Ketone (2-Butanone)	97.6
n-Heptane	6.23
n-Hexane	8.32
o-Xylene (1,2-Dimethylbenzene)	4.95
Tert-Butyl Alcohol	13.3
Tetrachloroethene (PCE)	**827 J**
Toluene	6.1
Total Xylenes	13.9
Trichloroethene (TCE)	**27.3**
Trichlorofluoromethane	4.1 J
Total BTEX	24.5
Total VOCs	1,440
General Chemistry (µg/m³)	
Mercury	0.00089 U

Sample ID	SV10_100315
Sample Date	10/3/2015
Sample Type	SV
1,2,4-Trimethylbenzene	11.1
1,3,5-Trimethylbenzene	4.37
1,3-Butadiene	0.788
2,2,4-Trimethylpentane	257
2-Butanone	6.02
4-Ethyltoluene	4.54
Benzene	26.1
Carbon disulfide	15.5
Chloroform	4.22
Cyclohexane	158
Ethyl Alcohol	20.2
Ethylbenzene	40.9
Heptane	71.3
n-Hexane	244
o-Xylene	16.7
p/m-Xylene	37
Styrene	13.8
Tetrachloroethene	7.12
Toluene	36.5
Trichloroethene	1.09
Trichlorofluoromethane	224
Total BTEX	157.2
Total VOCs	979.51

Sample ID	SV37_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	4.12
1,3,5-Trimethylbenzene (Mesitylene)	1.14
2-Hexanone	34.5 J
Acetone	442
Benzene	1.88
Carbon Disulfide	7.22
Chloroform	6.45 J
Cyclohexane	1.77
Dichlorodifluoromethane	271
Ethanol	45.6
Ethylbenzene	2.26
Isopropanol	3.61
M,P-Xylene	9.64
Methyl Ethyl Ketone (2-Butanone)	117
n-Heptane	35.7
n-Hexane	200
o-Xylene (1,2-Dimethylbenzene)	4.25
Tetrachloroethene (PCE)	6.39 J
Tetrahydrofuran	1.52
Toluene	6.44
Total Xylenes	13.9
Trichloroethene (TCE)	1.1
Trichlorofluoromethane	1.42 J
Total BTEX	24.5
Total VOCs	1,210
General Chemistry (µg/m³)	
Mercury	0.00075 U

Sample ID	SV14_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	3.76
1,3,5-Trimethylbenzene (Mesitylene)	1.04
1,3-Butadiene	0.542
2-Hexanone	12 J
Acetone	283
Benzene	1.08
Carbon Disulfide	2.75
Chloroform	7.62 J
Dichlorodifluoromethane	19.1
Ethanol	27.1
Ethylbenzene	1.39
Isopropanol	1.89
M,P-Xylene	6.08
Methyl Ethyl Ketone (2-Butanone)	42.5
Methyl Isobutyl Ketone	2.28
n-Heptane	5.45
n-Hexane	10.1
o-Xylene (1,2-Dimethylbenzene)	2.92
Tert-Butyl Alcohol	9.4
Tetrachloroethene (PCE)	7.73 J
Tetrahydrofuran	2.51
Toluene	4.64
Total Xylenes	8.99
Trichlorofluoromethane	4.66 J
Total BTEX	16.1
Total VOCs	460
General Chemistry (µg/m³)	
Mercury	0.00096 U

Sample ID	SV03_100315
Sample Date	10/3/2015
Sample Type	SV
1,2,4-Trimethylbenzene	10
1,3,5-Trimethylbenzene	3.19
1,3-Butadiene	2.81
2,2,4-Trimethylpentane	3.13
2-Butanone	7.08
4-Ethyltoluene	3.89
Acetone	39.2
Benzene	3.61
Carbon disulfide	4.33
Chloroform	7.76
Cyclohexane	1.89
Ethylbenzene	34.8
Heptane	27.8
n-Hexane	47.2
o-Xylene	11.6
p/m-Xylene	28.9
Styrene	14.6
tert-Butyl Alcohol	8.73
Tetrachloroethene	60.2
Tetrahydrofuran	1.73
Toluene	18.7
Trichloroethene	**7.47**
Trichlorofluoromethane	2.05
Total BTEX	97.61
Total VOCs	360.82

Sample ID	SV17_070920	DUP01_070920
Sample Date	7/9/2020	7/9/2020
Sample Type	SV	SV
VOCs (µg/m³)		
1,2,4-Trimethylbenzene	4.01	2.73
1,3,5-Trimethylbenzene (Mesitylene)	1.23 J	ND
2,2,4-Trimethylpentane	194 J	124 J
2-Hexanone	17 J	23.2 J
Acetone	184	215
Benzene	1.35	1.39
Carbon Disulfide	1.68	1.64
Chloroform	28.9 J	18.4 J
Chloromethane	ND	0.454
Cyclohexane	1.92	1.34
Dichlorodifluoromethane	13.2	10.6
Ethanol	20.3	31.1
Ethylbenzene	1.55	1.26
Isopropanol	1.61	3.42
M,P-Xylene	8.04	5.95
Methyl Ethyl Ketone (2-Butanone)	50.7	58.1
Methyl Isobutyl Ketone	ND	2.75
Methylene Chloride	3.34	3.05
n-Heptane	18.2	16.6
n-Hexane	54.3	45.5
o-Xylene (1,2-Dimethylbenzene)	3.94	2.76
Tert-Butyl Alcohol	8.43	9.82
Tetrachloroethene (PCE)	60.1 J	38 J
Toluene	5.05	4.48
Total Xylenes	12	8.69
Trichlorofluoromethane	8.77 J	6.69 J
Total BTEX	20	15.8
Total VOCs	692	628
General Chemistry		
Mercury (µg/m³)	0.00085 U	0.871 U

Sample ID	SV23_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	4.12
2-Hexanone	20.4 J
Acetone	245
Benzene	1.18
Carbon Disulfide	2.39
Chloroform	4.24 J
Dichlorodifluoromethane	8.8
Ethanol	27.5
Ethylbenzene	1.55
Isopropanol	2.95
M,P-Xylene	7.38
Methyl Ethyl Ketone (2-Butanone)	64.3
n-Heptane	6.8
n-Hexane	14.4
o-Xylene (1,2-Dimethylbenzene)	3.71
Tert-Butyl Alcohol	9.22
Tetrachloroethene (PCE)	**333 J**
Toluene	5.46
Total Xylenes	11.1
Trichloroethene (TCE)	2.95
Trichlorofluoromethane	8.15 J
Total BTEX	19.3
Total VOCs	774
General Chemistry (µg/m³)	
Mercury	0.00078 U

Sample ID	SV21_070920
Sample Date	7/9/2020
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	5.85
1,3,5-Trimethylbenzene (Mesitylene)	2.24
2,2,4-Trimethylpentane	2.5 J
2-Hexanone	25.9 J
Acetone	242
Benzene	3.11
Carbon Disulfide	15.5
Chloroform	7.08 J
Chloromethane	0.446
Cyclohexane	1.73
Dichlorodifluoromethane	16.6
Ethanol	16.6
Ethylbenzene	2.87
Isopropanol	2.44
M,P-Xylene	11.9
Methyl Ethyl Ketone (2-Butanone)	82
Methyl Isobutyl Ketone	2.79
n-Heptane	11.5
n-Hexane	15.8
o-Xylene (1,2-Dimethylbenzene)	6.91
Styrene	1.19
Tert-Butyl Alcohol	11.8
Tetrachloroethene (PCE)	**263 J**
Toluene	10.3
Total Xylenes	18.8
Trichloroethene (TCE)	**12.3**
Trichlorofluoromethane	11.5 J
Total BTEX	35.1
Total VOCs	786
General Chemistry (µg/m³)	
Mercury	0.00102 U

LEGEND

- SITE BOUNDARY
- APPROXIMATE LOCATION OF SITE FENCE
- 50-FOOT BY 50-FOOT GRID LINES
- SV01 — PHASE II ESI SOIL VAPOR SAMPLE LOCATION
- SV24 — RI SOIL VAPOR/AMBIENT AIR SAMPLE LOCATION
- V1 — RI SOIL VAPOR SAMPLE LOCATION (VOID SPACE)
- APPROXIMATE UST LOCATION

Analyte	NYSDOH Decision Matrices Minimum Concentrations
VOCs (µg/m³)	
1,1,1-Trichloroethane	100
1,1,2-Trichloro-1,2,2-Trifluoroethane	~
1,2,4-Trimethylbenzene	~
1,3,5-Trimethylbenzene (Mesitylene)	~
1,3-Butadiene	~
2,2,4-Trimethylpentane	~
2-Hexanone	~
4-Ethyltoluene	~
Acetone	~
Benzene	~
Carbon Disulfide	~
Chloroethane	~
Chloroform	~
Chloromethane	~
Cis-1,2-Dichloroethene	6
Cyclohexane	~
Dichlorodifluoromethane	~
Ethanol	~
Ethylbenzene	~
Isopropanol	~
M,P-Xylene	~
Methyl Ethyl Ketone (2-Butanone)	~
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	~
Methylene Chloride	100
n-Heptane	~
n-Hexane	~
o-Xylene (1,2-Dimethylbenzene)	~
Styrene	~
Tert-Butyl Alcohol	~
Tetrachloroethene (PCE)	100
Tetrahydrofuran	~
Toluene	~
Total Xylenes	~
Trichloroethene (TCE)	6
Trichlorofluoromethane	~
General Chemistry (µg/m³)	
Mercury	~

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. PHASE II ENVIRONMENTAL SITE INVESTIGATION (ESI) AND REMEDIAL INVESTIGATION (RI) SAMPLING LOCATIONS WERE MEASURED OFF OF SURVEYED LOCATIONS USING A HANDHELD TAPE MEASURE AND ARE APPROXIMATE.
4. SOIL VAPOR ANALYTICAL RESULTS ARE COMPARED TO THE MINIMUM SOIL VAPOR CONCENTRATIONS AT WHICH MITIGATION IS RECOMMENDED AS SET FORTH IN THE NEW YORK STATE DEPARTMENT OF HEALTH (NYSDOH) OCTOBER 2006 GUIDANCE FOR EVALUATING SOIL VAPOR INTRUSION IN THE STATE OF NEW YORK DECISION MATRICES FOR SUB-SLAB VAPOR AND INDOOR AIR AND SUBSEQUENT UPDATES (2017).
5. AMBIENT AIR SAMPLE ANALYTICAL RESULTS ARE SHOWN FOR REFERENCE ONLY.
6. ONLY DETECTED COMPOUNDS, WITH THE EXCEPTION OF MERCURY, ARE SHOWN IN THE FIGURE.
7. DETECTED ANALYTICAL RESULTS ABOVE THE MINIMUM SOIL VAPOR CONCENTRATIONS RECOMMENDING MITIGATION ARE SHADED AND BOLDED.
8. SAMPLE DUP01_070920 IS A DUPLICATE OF PARENT SAMPLE SV17_070920.
9. ~ = REGULATORY LIMIT FOR THIS ANALYTE DOES NOT EXIST
10. µg/m³= MICROGRAMS PER CUBIC METER
11. J = THE ANALYTE WAS DETECTED ABOVE THE METHOD DETECTION LIMIT BUT BELOW THE REPORTING LIMIT; THEREFORE, THE RESULT IS AN ESTIMATE
12. J+ = THE REPORTED VALUE MAY BE BIASED HIGH. THE ACTUAL VALUE IS EXPECTED TO BE LESS THEN THE REPORTED VALUE
13. NA = NOT ANALYZED
14. UST = UNDERGROUND STORAGE TANK

60 0 20 40 60

SCALE: 1 INCH = 60 FEET

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Project: 250 WATER STREET
BLOCK No. 98, LOT No. 1
CITY NEW YORK NEW YORK

Drawing Title: SOIL VAPOR SAMPLE ANALYTICAL RESULTS MAP

Project No. 170381202
Date 1/14/2021
Drawn By JFY
Checked By PM
Drawing No. 6

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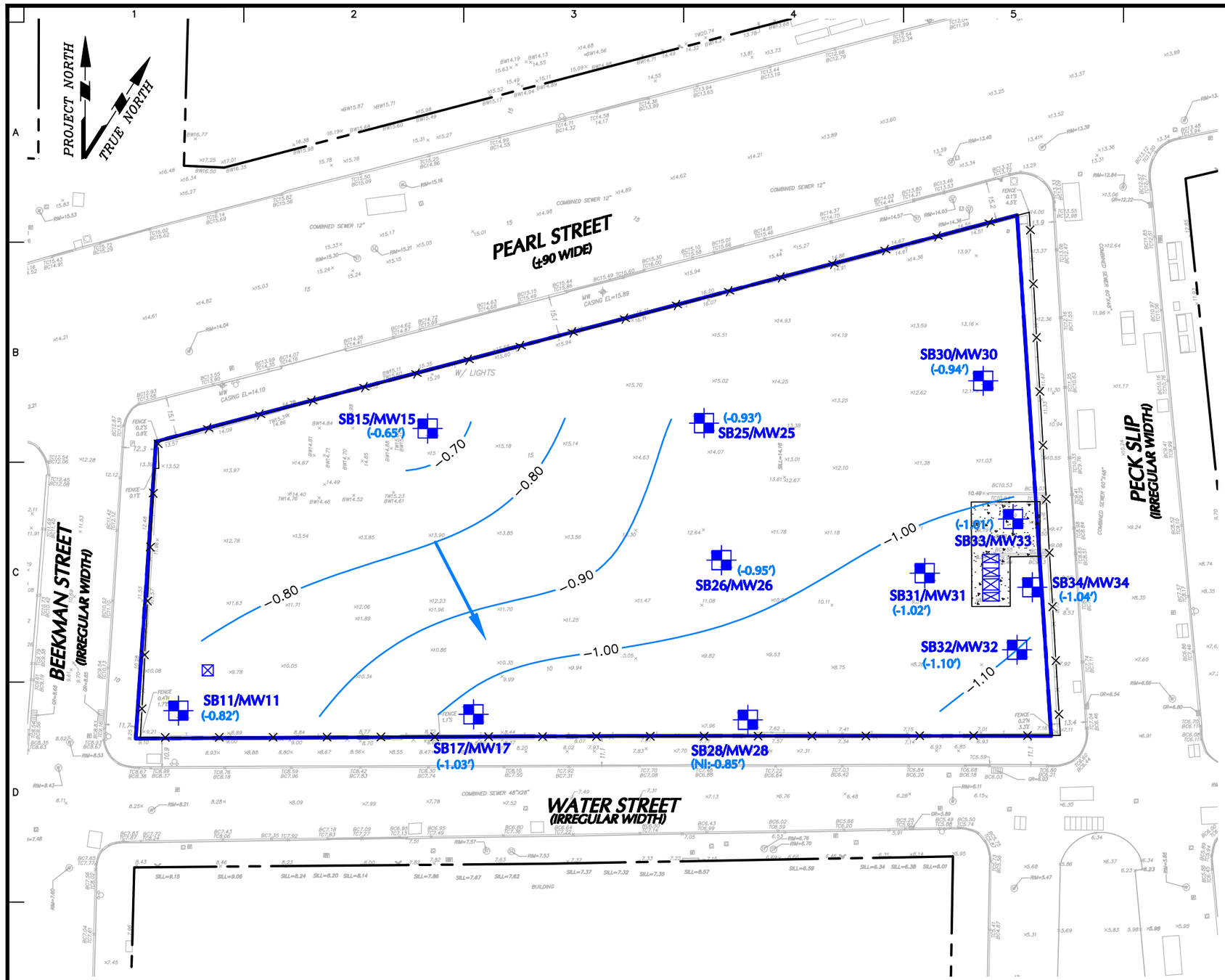
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 6 - Soil Vapor Analytical Results Map.dwg Date: 3/5/2021 Time: 08:29 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

- SITE BOUNDARY
- APPROXIMATE LOCATION OF SITE FENCE
- SB11/MW11 (-0.82') — SOIL BORING AND MONITORING WELL LOCATION (GROUNDWATER ELEVATION)
- —0.90— GROUNDWATER CONTOUR ELEVATION

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. MONITORING WELL TOP OF CASING ELEVATIONS WERE SURVEYED BY LANGAN ON SEPTEMBER 23, 2020.
4. GROUNDWATER ELEVATIONS ARE BASED ON A SYNOPTIC ROUND OF GROUNDWATER GAUGING ON OCTOBER 10, 2020.
5. GROUNDWATER CONTOURS INTERVAL IS 0.1 FOOT
6. THE GROUNDWATER ELEVATION AT MONITORING WELL MW28 WAS NOT INCLUDED BECAUSE OF GROUNDWATER MOUNDING CAUSED BY A SUBSURFACE UTILITY OR CONDITION .
7. NI = NOT INCLUDED

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40 0 10 25 40
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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	GROUNDWATER ELEVATION CONTOUR MAP
Project No.	170381202
Date	1/14/2021
Drawn By	JFY
Checked By	PM
Drawing No.	7A

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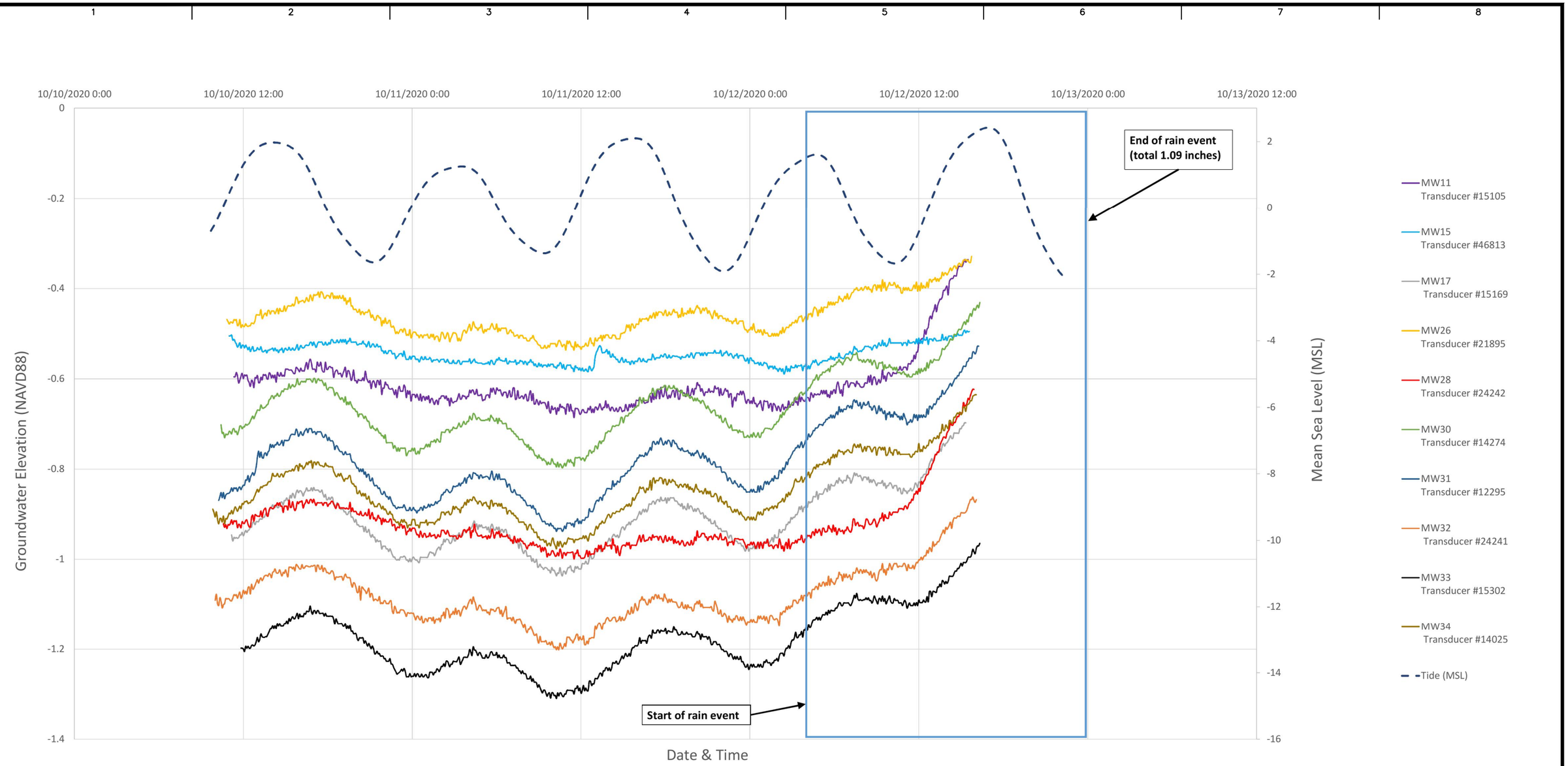
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 7 - Groundwater Elevation Contour Map.dwg Date: 2/5/2021 Time: 15:46 User: astappenbeck Style Table: Langan.stb Layout: ANSIB-BL



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Project
250 WATER STREET
BLOCK No. 98, LOT No. 1
CITY
NEW YORK NEW YORK

Drawing Title
GROUNDWATER ELEVATION OVER TIME

Project No.	170381202
Date	1/14/2021
Drawn By	JFY
Checked By	PM

Drawing No. **7B**

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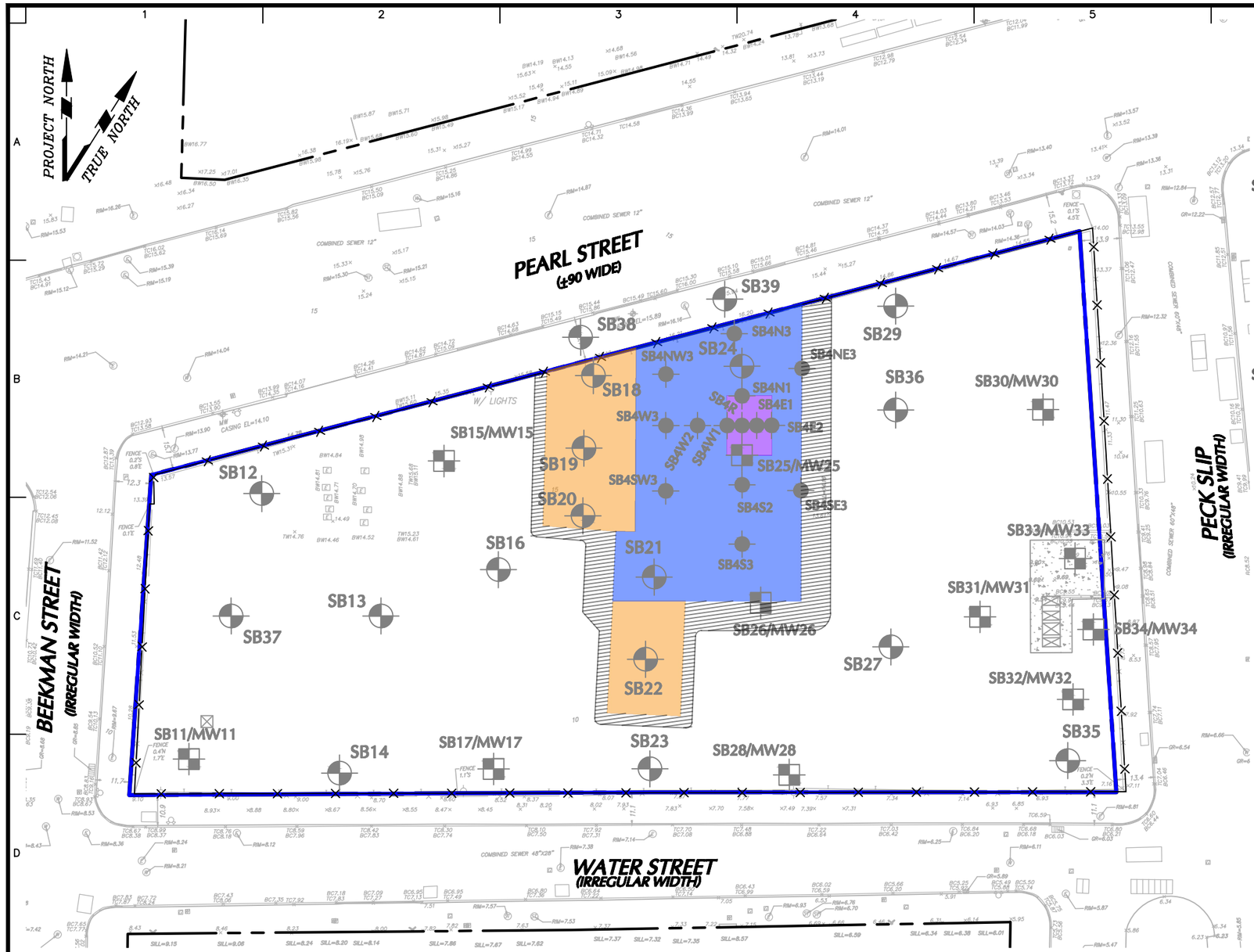
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 7 - Groundwater Elevation Contour Map.dwg Date: 2/5/2021 Time: 15:48 User: astappenbeck Style Table: Langan.stb Layout: ANSIB-BL (2)



LEGEND

- SITE BOUNDARY (AOC 1)
- APPROXIMATE LOCATION OF SITE FENCE
- SB02 — PHASE II ESI SOIL BORING LOCATION
- SB01/TMW01 — PHASE II ESI SOIL BORING LOCATION WITH TEMPORARY MONITORING WELL
- SV01 — PHASE II ESI SOIL VAPOR LOCATION
- SB19 — SOIL BORING LOCATION
- SB4E1 — MERCURY DELINEATION SOIL BORING LOCATION
- SB11/MW11 — SOIL BORING AND MONITORING WELL LOCATION
- APPROXIMATE UST LOCATION
- APPROXIMATE REMEDIAL EXCAVATION TO 4 FEET BGS
- APPROXIMATE REMEDIAL EXCAVATION FROM 8 TO 10 FEET BGS
- APPROXIMATE REMEDIAL EXCAVATION TO 16 FEET BGS
- APPROXIMATE EXTENT OF EXCAVATION FOR SUPPORT OF EXCAVATION (1:1 SLOPING)

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. REMEDIAL INVESTIGATION AND PHASE II ESI BORING LOCATIONS WERE MEASURED OFF OF SURVEYED LOCATIONS USING A HANDHELD TAPE MEASURE AND ARE APPROXIMATE.
4. BGS = BELOW GRADE SURFACE
5. REMEDIAL EXCAVATION EXTENTS ARE SUBJECT TO CHANGE BASED ON ENDPOINT SAMPLE RESULTS.

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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	MERCURY IMPACTED SOIL HOTSPOT REMOVL
Project No.	170381202
Date	3/5/2021
Drawn By	JFY
Checked By	PM
Drawing No.	8

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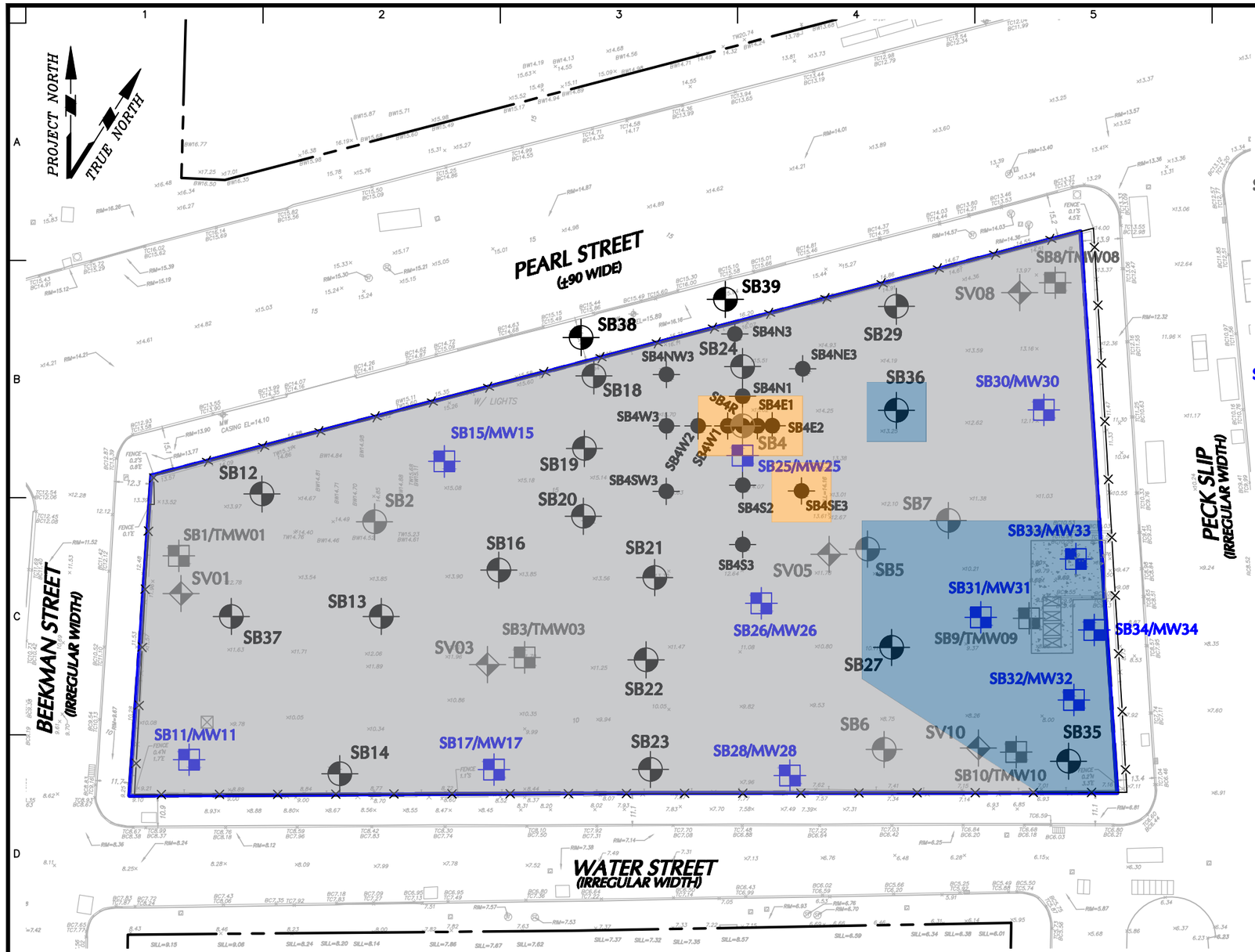
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 8 - Hg Hotspot.dwg Date: 5/4/2021 Time: 17:36 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

- SITE BOUNDARY (AOC 1)
- APPROXIMATE LOCATION OF SITE FENCE
- SB02 — PHASE II ESI SOIL BORING LOCATION
- SB01/TMW01 — PHASE II ESI SOIL BORING LOCATION WITH TEMPORARY MONITORING WELL
- SV01 — PHASE II ESI SOIL VAPOR LOCATION
- SB19 — SOIL BORING LOCATION
- SB4E1 — MERCURY DELINEATION SOIL BORING LOCATION
- SB11/MW11 — SOIL BORING AND MONITORING WELL LOCATION
- APPROXIMATE UST LOCATION
- APPROXIMATE REMEDIAL EXCAVATION FROM ABOUT 8 TO 16 FEET BGS
- APPROXIMATE REMEDIAL EXCAVATION FROM ABOUT 16 TO 22 FEET BGS
- APPROXIMATE REMEDIAL EXCAVATION FROM ABOUT 24 TO 34 FEET BGS

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	TRACK 1 CLEANUP PLAN
Project No.	170381202
Date	03/25/2021
Drawn By	JFY
Checked By	PM
Drawing No.	9

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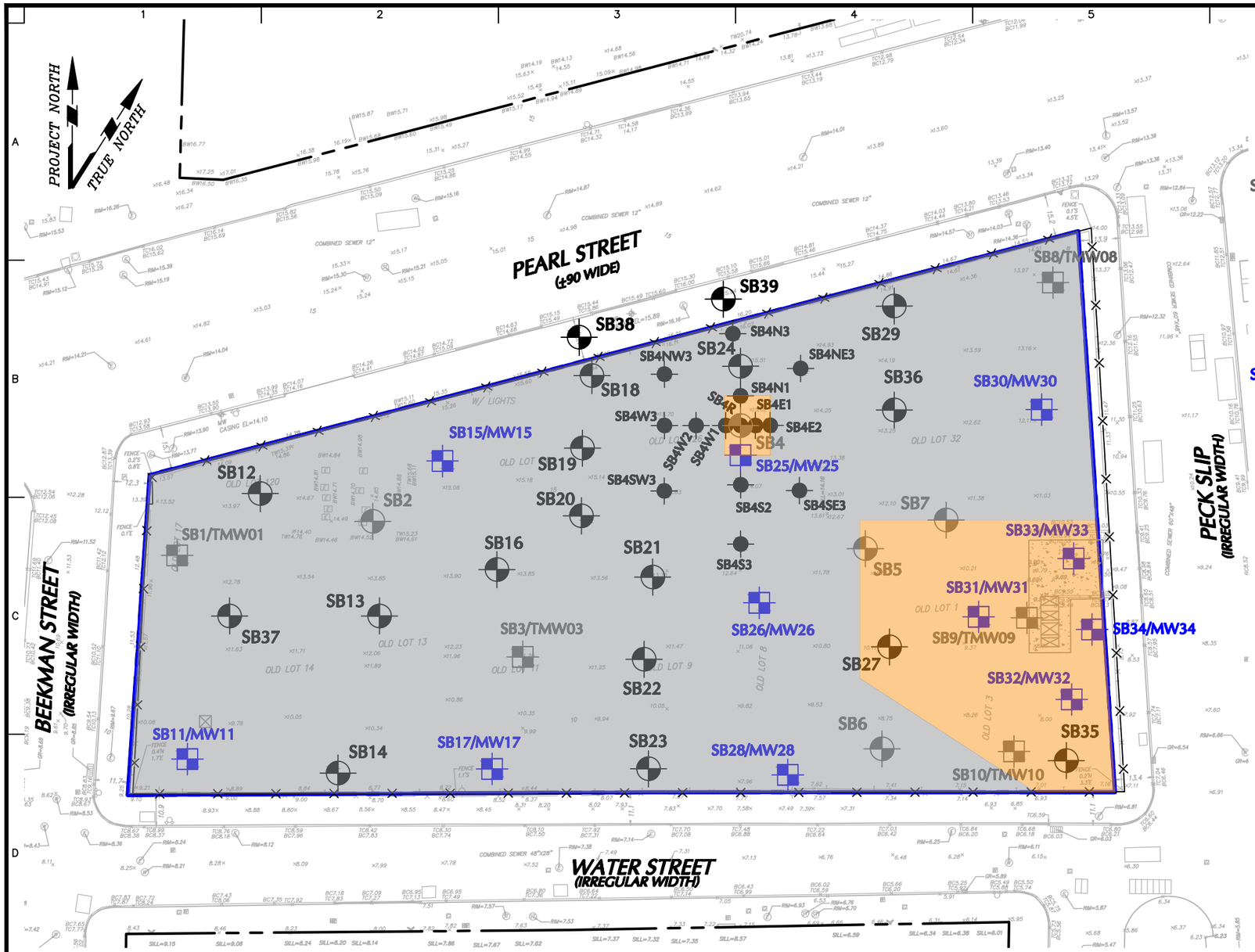
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 9 - Track 1 Excavation Depths.dwg Date: 3/25/2021 Time: 09:15 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

- SITE BOUNDARY (AOC 1)
- APPROXIMATE LOCATION OF SITE FENCE
- SB02 — PHASE II ESI SOIL BORING LOCATION
- SB01/TMW01 — PHASE II ESI SOIL BORING LOCATION WITH TEMPORARY MONITORING WELL
- SV01 — PHASE II ESI SOIL VAPOR LOCATION
- SB19 — SOIL BORING LOCATION
- SB4E1 — MERCURY DELINEATION SOIL BORING LOCATION
- SB11/MW11 — SOIL BORING AND MONITORING WELL LOCATION
- APPROXIMATE UST LOCATION
- APPROXIMATE REMEDIAL EXCAVATION TO ABOUT 15 FEET BGS
- APPROXIMATE REMEDIAL EXCAVATION FROM ABOUT 16 TO 18 FEET BGS

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. REMEDIAL INVESTIGATION AND PHASE II ESI BORING LOCATIONS WERE MEASURED OFF OF SURVEYED LOCATIONS USING A HANDHELD TAPE MEASURE AND ARE APPROXIMATE.
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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	TRACK 2 CLEANUP PLAN
Project No.	170381202
Date	12/23/2020
Drawn By	JFY
Checked By	PM
Drawing No.	10

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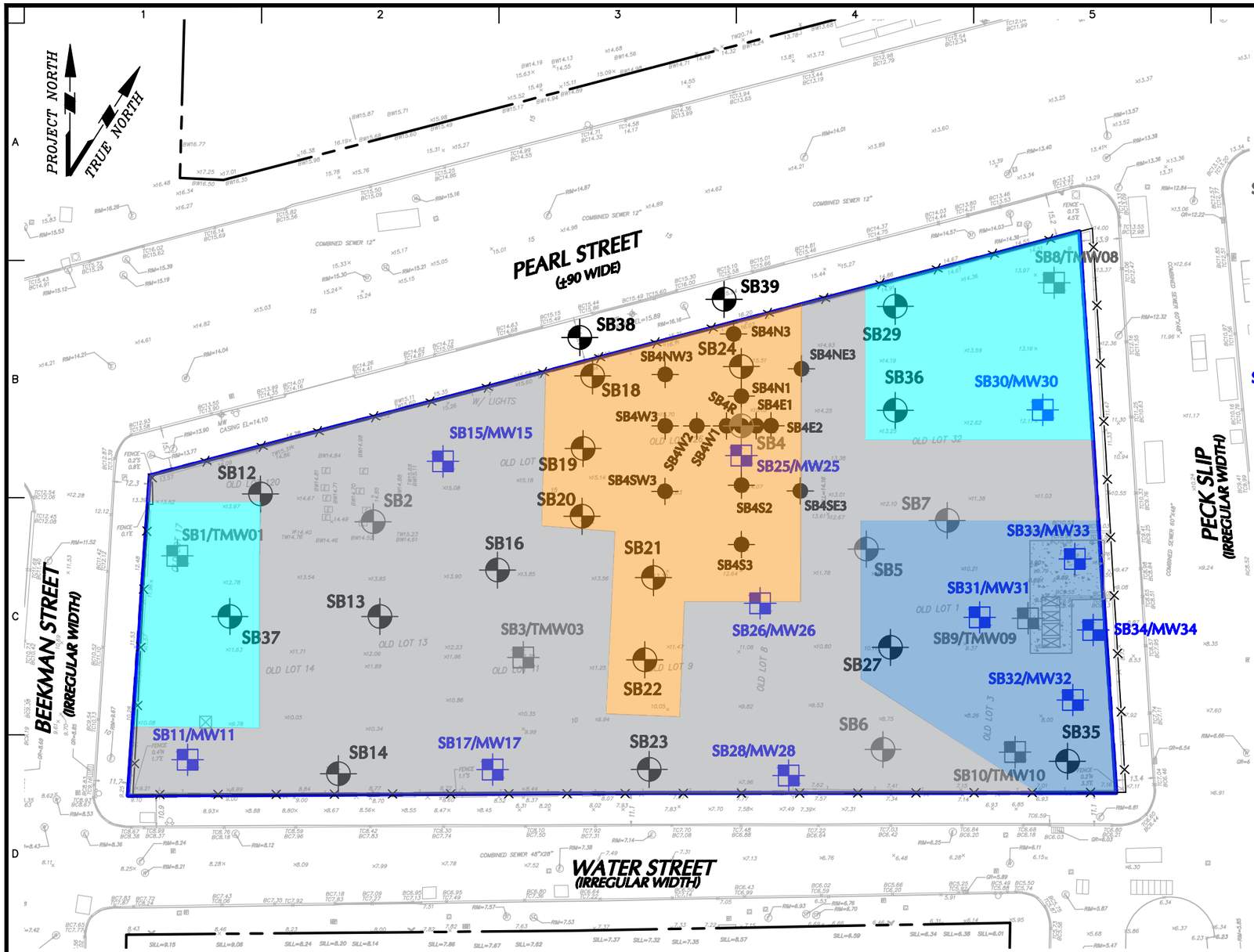
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 10 - Track 2 Excavation Depths.dwg Date: 3/25/2021 Time: 08:55 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

- SITE BOUNDARY (AOC 1)
- APPROXIMATE LOCATION OF SITE FENCE
- SB02 — PHASE II ESI SOIL BORING LOCATION
- SB01/TMW01 — PHASE II ESI SOIL BORING LOCATION WITH TEMPORARY MONITORING WELL
- SV01 — PHASE II ESI SOIL VAPOR LOCATION
- SB19 — SOIL BORING LOCATION
- SB4E1 — MERCURY DELINEATION SOIL BORING LOCATION
- SB11/MW11 — SOIL BORING AND MONITORING WELL LOCATION
- APPROXIMATE UST LOCATION
- APPROXIMATE EXTENT OF REMEDIAL EXCAVATION TO INSTALL COVER SYSTEM (ABOUT 2 FEET BGS)
- APPROXIMATE EXTENT OF REMEDIAL EXCAVATION TO REMOVE PETROLEUM IMPACTED MATERIAL (ABOUT 18 FEET BGS)
- APPROXIMATE EXTENT OF REMEDIAL EXCAVATION TO REMOVE PCB IMPACTED MATERIAL (ABOUT 10 FEET BGS)
- APPROXIMATE EXTENT OF REMEDIAL EXCAVATION TO REMOVE MERCURY IMPACTED MATERIAL (ABOUT 4 TO 16 FEET BGS)

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. REMEDIAL INVESTIGATION AND PHASE II ESI BORING LOCATIONS WERE MEASURED OFF OF SURVEYED LOCATIONS USING A HANDHELD TAPE MEASURE AND ARE APPROXIMATE.
4. BGS = BELOW GRADE SURFACE
5. REMEDIAL EXCAVATION AREA EXTENTS ARE SUBJECT TO CHANGE BASED ON ENDPOINT SAMPLE RESULTS.

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Project	Drawing Title	Project No.	Drawing No.
250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK	TRACK 4 CLEANUP PLAN	170381202 Date 12/23/2020 Drawn By JFY Checked By PM	11

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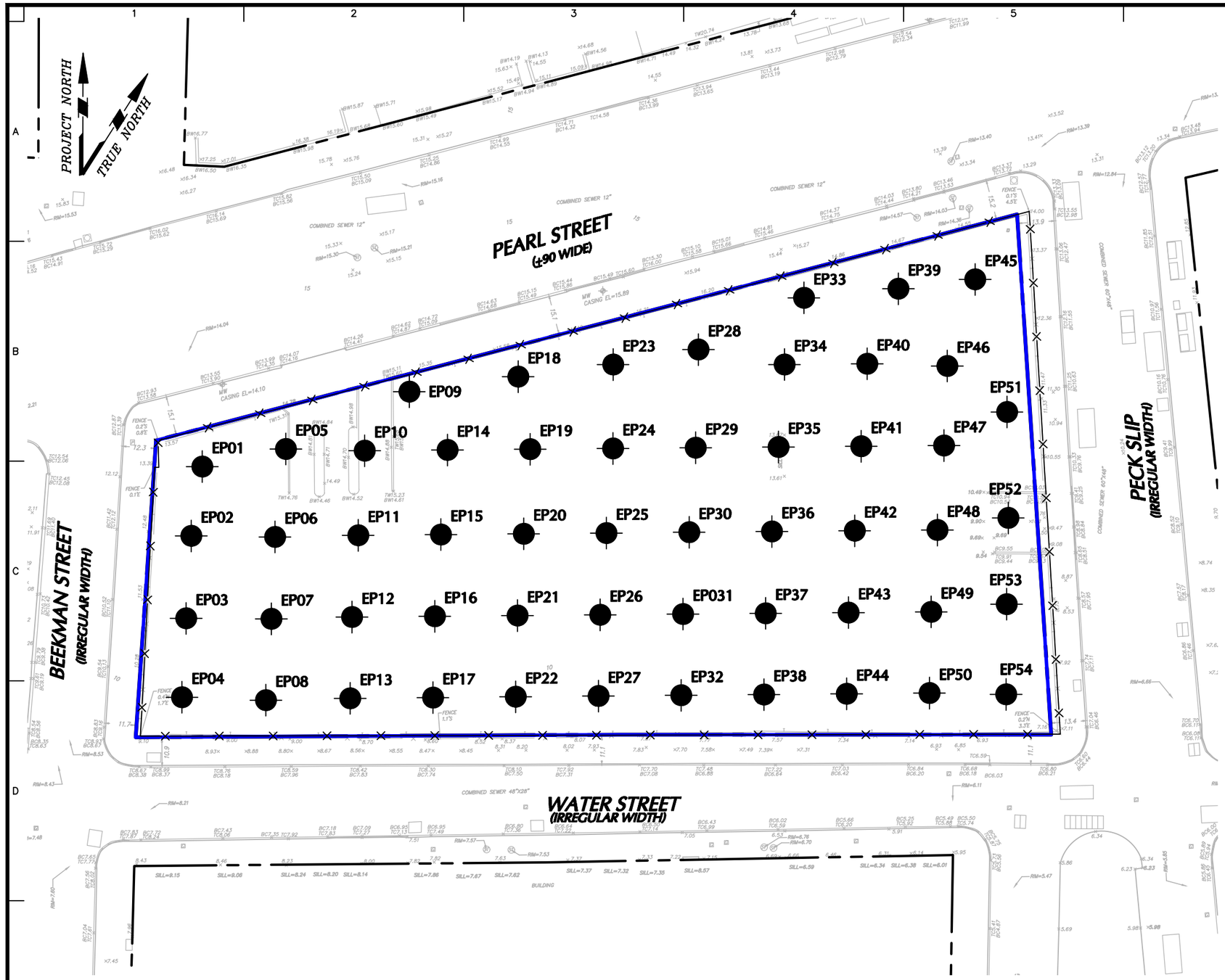
Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Figure 11 - Track 4 Excavation Depths.dwg Date: 3/25/2021 Time: 09:07 User: jyanowitz Style Table: Langan.stb Layout: ANSIB-BL



LEGEND

- SITE BOUNDARY
- APPROXIMATE LOCATION OF SITE FENCE
- EP01 PROPOSED CONFIRMATION SAMPLE LOCATION

NOTES:

1. BASE MAP IS FROM THE SURVEY DRAWING ALTA/NSPS LAND TITLE SURVEY, COMPLETED BY LANGAN, DATED JUNE 07, 2018.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

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Project	250 WATER STREET BLOCK No. 98, LOT No. 1 CITY NEW YORK NEW YORK
Drawing Title	PROPOSED CONFIRMATION SAMPLE LOCATION PLAN
Project No.	170381202
Date	1/14/2021
Drawn By	JFY
Checked By	PM
Drawing No.	12

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Holland Tunnel Restrictions

12'6" Height Limit

No tractor-trailers or trucks with four or more axles

Only two and three-axle single-unit trucks allowed.

LEGEND:

- APPROXIMATE SITE BOUNDARY
- TRUCK ROUTE
- LOCAL TRUCK ROUTE
- THROUGH TRUCK ROUTE
- THROUGH TRUCK ROUTE ON EXPRESSWAY
- THROUGH TRUCK ROUTE ON TUNNEL

NOTES:

1. BASEMAP IS REFERENCED FROM THE NEW YORK CITY DEPARTMENT OF TRANSPORTATION 2015 TRUCK ROUTE MAP, ACCESSED ON JANUARY 19, 2021.
2. LOCATION OF SITE ACCESS IS SUBJECT TO CHANGE, PENDING CONSTRUCTION LOGISTICS.
3. FIGURE IS NOT TO SCALE.

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Project	250 WATER STREET
	BLOCK No. 98, LOT No. 1
	CITY NEW YORK NEW YORK
Drawing Title	TRUCK ROUTE MAP
Project No.	170381202
Date	01/22/2021
Drawn By	AS
Checked By	PM
Drawing No.	13

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TABLES

Table 1
Track 2 Soil Cleanup Objectives
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

VOCs (mg/kg)	
1,1,1-Trichloroethane	100
1,1-Dichloroethane	26
1,1-Dichloroethene	100
1,2,4-Trimethylbenzene	52
1,2-Dichlorobenzene	100
1,2-Dichloroethane	3.1
1,3,5- Trimethylbenzene	52
1,3-Dichlorobenzene	49
1,4-Dichlorobenzene	13
1,4-Dioxane	13
Acetone	100
Benzene	4.8
Butylbenzene	100
Carbon tetrachloride	2.4
Chlorobenzene	100
Chloroform	49
cis-1,2-Dichloroethene	100
Ethylbenzene	41
Hexachlorobenzene	1.2
Methyl ethyl ketone	100
Methyl tert-butyl ether	100
Methylene chloride	100
n-Propylbenzene	100
sec-Butylbenzene	100
tert-Butylbenzene	100
Tetrachloroethene	19
Toluene	100
trans-1,2-Dichloroethene	100
Trichloroethene	21
Vinyl chloride	0.9
Xylene (mixed)	100
Metals (mg/kg)	
Arsenic	16
Barium	400
Beryllium	72
Cadmium	4.3
Chromium, hexavalent	110
Chromium, trivalent	180
Copper	270
Lead	400
Manganese	2000
Nickel	310
Selenium	180
Silver	180
Total Cyanide	27
Total Mercury	0.81
Zinc	10000

SVOCs (mg/kg)	
Acenaphthene	100
Acenapthylene	100
Anthracene	100
Benz(a)anthracene	1
Benzo(a)pyrene	1
Benzo(b)fluoranthene	1
Benzo(g,h,i)perylene	100
Benzo(k)fluoranthene	3.9
Chrysene	3.9
Dibenz(a,h)anthracene	0.33
Fluoranthene	100
Fluorene	100
Indeno(1,2,3-cd)pyrene	0.5
m-Cresol	100
Naphthalene	100
o-Cresol	100
p-Cresol	100
Pentachlorophenol	6.7
Phenanthrene	100
Phenol	100
Pyrene	100
PCBs/Pesticides (mg/kg)	
2,4,5-TP Acid (Silvex)	100
4,4'- DDD	13
4,4'-DDE	8.9
4,4'-DDT	7.9
Aldrin	0.097
alpha-BHC	0.48
beta-BHC	0.36
Chlordane (alpha)	4.2
delta-BHC	100
Dibenzofuran	59
Dieldrin	0.2
Endosulfan I	24
Endosulfan II	24
Endosulfan sulfate	24
Endrin	11
Heptachlor	2.1
Lindane	1.3
Polychlorinated biphenyls	1

Notes:

1. The above criteria are the Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 Restricted Use Restricted-Residential SCOs. (i.e., the Track 2 soil cleanup objectives)
2. SCO: Soil Cleanup Objective
3. SVOC: semivolatile organic compound
4. VOC: volatile organic compound
5. PCB: polychlorinated biphenyl
6. mg/kg: milligram per kilogram

Table 2
Track 1 Remedial Cost Estimate
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

Item No.	Item	Quantity	Unit	Unit Cost	Estimated Cost
CONTRACTOR FEES					
1	Remediation Facilities, Mobilization, Demobilization, and Site Maintenance - Remediation and decontamination facilities, site fencing, trailer, truck cleaning facilities, etc.		Lump Sum		$ 150,000.00
2	Management and Handling of Excavated Materials (Contaminated and Hazardous Materials)	28,300	Cubic Yard	$ 37.50	$ 1,061,250.00
3	Perimeter Support of Excavation (SOE) - Secant pile wall	19,000	Square Foot	$ 350.00	$ 6,650,000.00
4	Off-Site Transport and Disposal of Soil - Includes transport vehicles and disposal of material at a permitted facility to achieve a Track 1 cleanup.		Lump Sum		$ 4,700,000.00
5	Underground Storage Tank Removal - Registration, cleaning, removal and disposal of UST.	5	Each	$ 10,000.00	$ 50,000.00
6	Dewatering and Groundwater Treatment		Lump Sum		$ 2,400,000.00
7	Dust, Odor, and Vapor Control	14	Months	$ 10,000.00	$ 140,000.00
8	Backfill - Import and placement of clean fill. An additional 30% of material is included to account for compaction.	3,770	Cubic Yard	$ 55.00	$ 207,350.00
				Contractor Fee Subtotal	*$ 15,358,600.00*
				10% Contingency of Contractor Fee Subtotal	*$ 1,535,860.00*
ENGINEERING FEES					
9	BCP Consulting, Reporting, and Engineering Services		Lump Sum		$ 1,830,000.00
10	Confirmation Sampling - To confirm removal of material above Track 1 SCOs	57	Samples	$ 1,200.00	$ 68,400.00
				Engineering Fee Subtotal	*$ 1,898,400.00*
				10% Contingency of Engineering Fee Subtotal	*$ 189,840.00*
				Estimated Absolute Costs	**$ 19,000,000**

Table 2
Track 1 Remedial Cost Estimate
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

General Assumptions and Conditions:

- The density used for conversion from cubic yards (CY) to tons is 1.5 tons/CY.
- Costs provided are estimates.
- This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.
- Assumes duration of remediation oversight will be 16 months.

Contractor Cost Assumptions

1 Includes mobilization and demobilization of equipment and materials necessary to excavate, transport, and dispose of the targeted soil per the Remedial Action Work Plan. Also includes labor and any project-related permit or regulation fees.

2 Management and handling of contaminated and potentially hazardous material assumes 25 percent increase in labor costs for OSHA trained labor. Baseline labor fees assumes $30 per cubic yard. Soil handling includes excavation for off-site disposal.

3 Perimeter support assumes that secant pile walls will be necessary along the Site extents. Square footage based on depth of remedial cut. Remedial excavations along Site boundaries cannot be sloped and thus require excavation support.

4 The estimated volumes for the differing types of materials are based on the sampling results of the Phase II and Remedial Investigation completed by Langan.

5 We assume that up to five USTs will be decommissioned. The estimated number of USTs is based on the results of the geophysical survey performed as part of the remedial investigation.

6 This estimate assumes dewatering with pre-treatment will be necessary to achieve development depth. Pre-treatment can include the following: (1) settling tank for the removal of large solids and free product, (2) granular activated carbon (GAC) filters for removal of dissolved organic compounds, (3) oil-water separator tank if free product is encountered, (4) ion exchange chambers, and (5) flocculation tanks.

7 Dust, odor and vapor control will be required throughout the duration of soil excavation. This cost estimate includes incremental costs associated with equipment and material necessary to monitor and mitigate vapor/odor emission.

9 Estimate includes, but is not limited to, fees for the RI, Remedial Investigation Report (RIR), and preparation of a Remedial Action Work Plan (RAWP), Final Engineering Report (FER) and data validation; implementation of a CAMP as required by the NYSDEC; the presence of an on-site field personnel throughout remediation; remediation health and safety including purchase and maintenance of appropriate personal protective equipment (PPE); periodic office reporting to the regulatory agency and attendance of at least two site meetings per month. Remediation Engineer will field contractor questions related to remediation during the bidding process and support the current site owner, as necessary, during the bid leveling process. Includes submittal review, responses to Requests for Information (RFI), and coordination with development team and the architect.

10 Confirmation soil sample collection will be completed from the excavation base at a frequency of one sample per 900 square feet incuding QAQC.

Table 3
Track 2 Remedial Cost Estimate
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

Item No.	Item	Quantity	Unit	Unit Cost	Estimated Cost
CONTRACTOR FEES					
1	Remediation Facilities, Mobilization, Demobilization, and Site Maintenance - Remediation and decontamination facilities, site fencing, trailer, truck cleaning facilities, etc.		Lump Sum		$ 150,000.00
2	Management and Handling of Excavated Materials (Contaminated and Hazardous Materials)	21,700	Cubic Yard	$ 37.50	$ 813,750.00
3	Perimeter Support of Excavation (SOE) - Soldier Piles and Lagging	15,000	Square Foot	$ 200.00	$ 3,000,000.00
4	Off-Site Transport and Disposal of Soil - Includes transport vehicles and disposal of material at a permitted facility to achiev a Track 2 Cleanup.		Lump Sum		$ 2,200,000.00
5	Underground Storage Tank Removal - Registration, cleaning, removal and disposal of UST.	5	Each	$ 10,000.00	$ 50,000.00
6	Dewatering and Groundwater Treatment		Lump Sum		$ 1,500,000.00
7	Dust, Odor, and Vapor Control	10	Months	$ 10,000.00	$ 100,000.00
8	Backfill - Import and placement of clean fill. An additional 30% of material is included to account for compaction.	650	Cubic Yard	$ 55.00	$ 35,750.00
9	Vapor Barrier/Waterproofing Membrane - Materials and labor to install a vapor barrier/waterproofing membrane along the base and sidewalls of all development excavations.	80,000	Square Foot	$ 13.00	$ 1,040,000.00
				Contractor Fee Subtotal	*$ 8,889,500.00*
				10% Contingency of Contractor Fee Subtotal	*$ 888,950.00*
ENGINEERING FEES					
10	BCP Consulting, Reporting, and Engineering Services		Lump Sum		$ 1,650,000.00
11	Endpoint/Sidewall Sampling - To document residual site conditions following source material removal.	57	Samples	$ 1,200.00	$ 68,400.00
12	Institutional and Engineering Control Certification - Accounts for fees associated with annual on-site inspections and preparation and submission of annual Periodic Review Reports for five years.	5	Per Year	$ 5,000.00	$ 25,000.00
				Engineering Fee Subtotal	*$ 1,743,400.00*
				10% Contingency of Engineering Fee Subtotal	*$ 174,340.00*
				Estimated Absolute Costs	**$ 11,700,000**

Table 3
Track 2 Remedial Cost Estimate
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

General Assumptions and Conditions:

- The density used for conversion from cubic yards (CY) to tons is 1.5 tons/CY.
- Costs provided are estimates.
- This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.
- Assumes duration of remediation oversight will be 10 months.

Contractor Cost Assumptions

1 Includes mobilization and demobilization of equipment and materials necessary to excavate, transport, and dispose of the targeted soil per the Remedial Action Work Plan. Also includes labor and any project-related permit or regulation fees.

2 Management and handling of contaminated and potentially hazardous material assumes 25 percent increase in labor costs for OSHA trained labor. Baseline labor fees assumes $30 per cubic yard. Soil handling includes excavation for off-site disposal.

3 Perimeter support assumes that soldier pile and lagging will be necessary along the Site extents where applicable. Square footage based on depth of remedial cut. Remedial excavations along Site boundaries cannot be sloped and thus require excavation support.

4 The estimated volumes for the differing types of materials are based on the sampling results of the Phase II and remedial Investigation completed by Langan.

5 We assume that up to five USTs will be decommissioned. The estimated number of USTs is based on the results of the geophysical survey performed as part of the remedial investigation.

6 This estimate assumes dewatering with pre-treatment will be necessary to achieve development depth. Pre-treatment can include the following: (1) settling tank for the removal of large solids and free product, (2) granular activated carbon (GAC) filters for removal of dissolved organic compounds, (3) oil-water separator tank if free product is encountered, (4) ion exchange chambers, and (5) flocculation tanks.

7 Dust, odor and vapor control will be required throughout the duration of soil excavation. This cost estimate includes incremental costs associated with equipment and material necessary to monitor and mitigate vapor/odor emission.

9 Assumes a vapor barrier will be installed under the lowest level and along the foundation sidewalls and includes a 20% area addition for waste.

10 Estimate includes, but is not limited to, fees for the RI, Remedial Investigation Report (RIR), and preparation of a Remedial Action Work Plan (RAWP), Final Engineering Report (FER) and data validation; implementation of a CAMP as required by the NYSDEC; the presence of an on-site field personnel throughout remediation; remediation health and safety including purchase and maintenance of appropriate personal protective equipment (PPE); periodic office reporting to the regulatory agency and attendance of at least two site meetings per month. Remediation Engineer will field contractor questions related to remediation during the bidding process and support the current site owner, as necessary, during the bid leveling process. Includes submittal review, responses to Requests for Information (RFI), and coordination with development team and the architect.

11 Endpoint soil sample collection will be completed from the excavation base at a frequency of one sample per 900 square feet inlcuding QA/QC samples.

12 Costs are based on Langan's experience with regulatory programs and includes a Site Management Plan (SMP), and execution of and environmental easement.

Table 4
Track 4 Remedial Cost Estimate
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

Item No.	Item	Quantity	Unit	Unit Cost	Estimated Cost
CONTRACTOR FEES					
1	Remediation Facilities, Mobilization, Demobilization, and Site Maintenance - Remediation and decontamination facilities, site fencing, trailer, truck cleaning facilities, etc.		Lump Sum		$ 150,000.00
2	Management and Handling of Excavated Materials (Contaminated and Hazardous Materials)	11,000	Cubic Yard	$ 37.50	$ 412,500.00
3	Perimeter Support of Excavation (SOE) - Soldier Piles and Lagging	11,000	Square Foot	$ 200.00	$ 2,200,000.00
4	Off-Site Transport and Disposal of Soil - Includes transport vehicles and disposal of material at a permitted facility to achieve a Track 4 Cleanup.		Lump Sum		$ 2,000,000.00
5	Underground Storage Tank Removal - Registration, cleaning, removal and disposal of UST.	5	Each	$ 10,000.00	$ 50,000.00
6	Dewatering and Groundwater Treatment		Lump Sum		$ 900,000.00
7	Dust, Odor, and Vapor Control	8	Months	$ 10,000.00	$ 80,000.00
8	Backfill - Import and placement of clean fill. An additional 30% of material is included to account for compaction.	650	Cubic Yard	$ 55.00	$ 35,750.00
9	Vapor Barrier/Waterproofing Membrane - Materials and labor to install a vapor barrier/waterproofing membrane along the base and sidewalls of all development excavations.	80,000	Square Foot	$ 13.00	$ 1,040,000.00
				Contractor Fee Subtotal	*$ 6,868,250.00*
				10% Contingency of Contractor Fee Subtotal	*$ 686,825.00*
ENGINEERING FEES					
10	BCP Consulting, Reporting, and Engineering Services		Lump Sum		$ 1,410,000.00
11	Endpoint/Sidewall Sampling - To document residual site conditions following source material removal.	57	Samples	$ 1,200.00	$ 68,400.00
12	Post-Remediation Groundwater Monitoring - Installation of 2 groundwater monitoring wells and 8 quarterly groundwater monitoring events		Lump Sum		$ 90,000.00
13	Institutional and Engineering Control Certification - Accounts for fees associated with annual on-site inspections and preparation and submission of annual Periodic Review Reports for five years.	5	Per Year	$ 5,000.00	$ 25,000.00
				Engineering Fee Subtotal	*$ 1,593,400.00*
				10% Contingency of Engineering Fee Subtotal	*$ 159,340.00*
				Estimated Absolute Costs	**$ 9,400,000**

Table 4
Track 4 Remedial Cost Estimate
Remedial Action Work Plan

250 Water Street
New York, New York
BCP Site No.: C321127
Langan Project No.: 170381202

General Assumptions and Conditions:

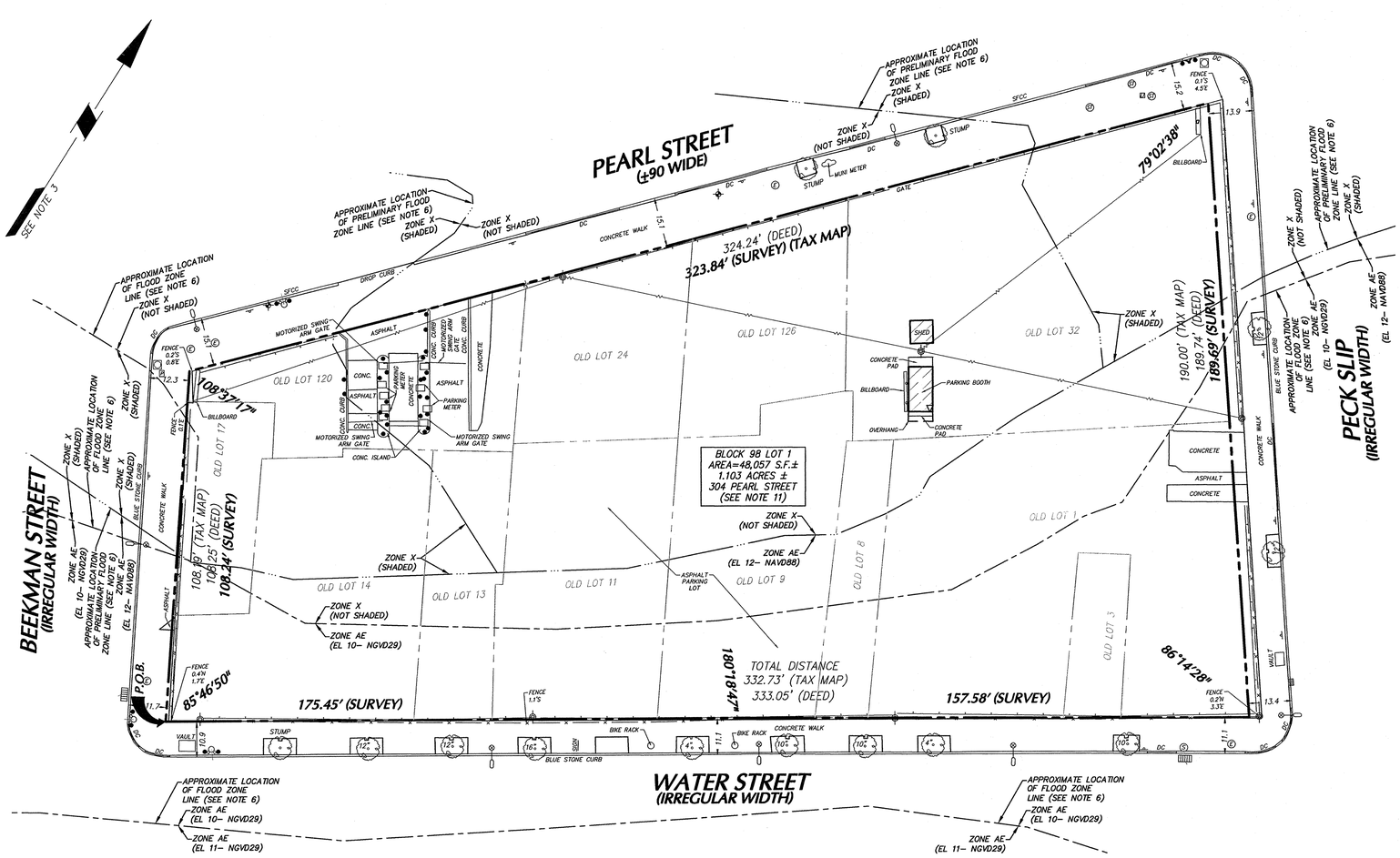
- The density used for conversion from cubic yards (CY) to tons is 1.5 tons/CY.
- Costs provided are estimates.
- This estimate has been prepared for the purposes of comparing potential remedial alternatives. The information in this cost estimate is based on the available information regarding the site investigation and the anticipated scope of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual cost. Utilization of this cost estimate information beyond the stated purpose is not recommended. Langan is not licensed to provide financial or legal consulting services; as such, this cost estimate information is not intended to be utilized for complying with financial reporting requirements associated with liability services.
- Assumes duration of remediation oversight will be 8 months.

Contractor Cost Assumptions

1 Includes mobilization and demobilization of equipment and materials necessary to excavate, transport, and dispose of the targeted soil per the Remedial Action Work Plan. Also includes labor and any project-related permit or regulation fees.
2 Management and handling of contaminated and potentially hazardous material assumes 25 percent increase in labor costs for OSHA trained labor. Baseline labor fees assumes $30 per cubic yard. Soil handling includes excavation for off-site disposal.
3 Perimeter support assumes that secant walls, soldier pile and lagging will be necessary along the Site extents where applicable. Square footage based on depth of remedial cut of 9 to 15 feet bgs. Remedial excavations along Site boundaries cannot be sloped and thus require excavation support.
4 The estimated volumes for the differing types of materials are based on the sampling results of the Phase II and remedial Investigation completed by Langan.
5 We assume that up to five USTs will be decommissioned. The estimated number of USTs is based on the results of the geophysical survey performed as part of the remedial investigation.
6 This estimate assumes dewatering with pre-treatment will be necessary to achieve development depth. Pre-treatment can include the following: (1) settling tank for the removal of large solids and free product, (2) granular activated carbon (GAC) filters for removal of dissolved organic compounds, (3) oil-water separator tank if free product is encountered, (4) ion exchange chambers, and (5) flocculation tanks.
7 Dust, odor and vapor control will be required throughout the duration of soil excavation. This cost estimate includes incremental costs associated with equipment and material necessary to monitor and mitigate vapor/odor emission.
9 Assumes a vapor barrier will be installed under the lowest level, foundation sidewalls, and includes a 20% area addition for waste.
10 Estimate includes, but is not limited to, fees for the RI, Remedial Investigation Report (RIR), and preparation of a Remedial Action Work Plan (RAWP), Final Engineering Report (FER) and data validation; implementation of a CAMP as required by the NYSDEC; the presence of an on-site field personnel throughout remediation; remediation health and safety including purchase and maintenance of appropriate personal protective equipment (PPE); periodic office reporting to the regulatory agency and attendance of at least two site meetings per month. Remediation Engineer will field contractor questions related to remediation during the bidding process and support the current site owner, as necessary, during the bid leveling process. Includes submittal review, responses to Requests for Information (RFI), and coordination with development team and the architect.
11 Endpoint soil sample collection will be completed from the excavation base at a frequency of one sample per 900 square feet including QA/QA samples.
12 To evaluate the efficacy of the remedy, two monitoring wells would be installed downgradient of the petroleum-impacted area and post-remediation groundwater monitoring will be performed. Post-remediation groundwater samples will be analyzed for Part 375 and Target Compound List (TCL)-listed volatile organic compounds (VOCs) and SVOCs. Groundwater
13 Costs are based on Langan's experience with regulatory programs and includes a Site Management Plan (SMP), and execution of and environmental easement.

APPENDIX A

SITE SURVEY



LEGEND (NOT SHOWN TO SCALE)

HYDRANT		MAILBOX	
STAND PIPE	DC	DROP CURB	
ROOF DRAIN	O.L.	ON LINE	
FLAG POLE		OVERHEAD WIRE	
PEDESTAL LIGHT		GUIDE RAIL WOOD	
STREET LIGHT		GUIDE RAIL METAL	
AREA LIGHT		TREE LINE	
SIGNAL POLE		CHAINLINK FENCE	
POWER POLE		STOCKADE FENCE	
GUY WIRE		IRON FENCE	
ANCHOR POLE		EASEMENT LINE	
MANHOLE (TYPE AS LABELED)		PROPERTY LINE	
WATER VALVE		RIGHT-OF-WAY LINE	
GAS VALVE	322	CONTOUR LINE	
UNKNOWN VALVE	G	GAS MARK OUT LINE	
CATCH BASIN	W	WATER MARK OUT LINE	
CLEAN OUT	E	ELECTRIC MARK OUT LINE	
TREE	T	COMMUNICATION MARK OUT LINE	
SIGN	S	SANITARY MARK OUT LINE	
BOLLARD	D	DRAINAGE MARK OUT LINE	
ELECTRIC BOX	UNK	UNKNOWN UTILITY MARK OUT LINE	
ELECTRIC METER	*R	REFERENCE UTILITY LINE (TYPE AS NOTED) – PLOTTED FROM EXISTING MAPPING	
GAS METER		CURRENT FLOOD ZONE LINE (SEE NOTE 6)	
WATER METER		PRELIMINARY FLOOD ZONE LINE (SEE NOTE 6)	
TELEPHONE BOX			
TRAFFIC SIGNAL POLE			
MONITOR WELL			
BENCH			
DOOR			
DOUBLE DOOR			
ROLL UP DOOR			
YARD DRAIN			

THE FOLLOWING REQUESTS FOR UTILITY INFORMATION HAVE BEEN MADE	
UTILITY	RECEIVED
WATER	DEP 05/15/2018
SEWER	DEP 05/15/2018
ECS/VERIZON	05/16/2018
MCI NETWORK	05/15/2018
CABLEVISION OF NYC	06/04/2018
AT&T LNS	05/18/2018
LEVEL 3	05/16/2018

SURVEY DESCRIPTION
BLOCK 98
TAX LOT 1
IN THE BOROUGH OF MANHATTAN, CITY OF NEW YORK
NEW YORK COUNTY, NEW YORK

ALL THAT CERTAIN PLOT, PIECE, OR PARCEL OF LAND, SITUATE, LYING, AND BEING IN THE BOROUGH OF MANHATTAN, NEW YORK COUNTY, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE NORTHERLY SIDE OF BEEKMAN STREET (IRREGULAR WIDTH) WITH THE WESTERLY SIDE OF WATER STREET (IRREGULAR WIDTH), SAID POINT BEING THE POINT OR PLACE OF BEGINNING AND RUNNING THENCE;

1. WESTERLY, ALONG SAID NORTHERLY SIDE OF BEEKMAN STREET, A DISTANCE OF 108.24 FEET (SURVEY) TO THE POINT FORMED BY THE INTERSECTION OF SAID NORTHERLY SIDE OF BEEKMAN STREET WITH THE EASTERLY SIDE OF PEARL STREET (±90 FEET WIDE); THENCE
2. NORTHERLY, ALONG SAID EASTERLY SIDE OF PEARL STREET, FORMING AN INTERIOR ANGLE OF 108°37'17" WITH THE PREVIOUS COURSE, A DISTANCE OF 323.84 FEET (SURVEY) TO THE POINT FORMED BY THE INTERSECTION OF SAID EASTERLY SIDE OF PEARL STREET WITH THE SOUTHERLY SIDE OF PECK SLIP (IRREGULAR WIDTH); THENCE
3. EASTERLY, ALONG SAID SOUTHERLY SIDE OF PECK SLIP, FORMING AN INTERIOR ANGLE OF 79°02'38" WITH THE PREVIOUS COURSE, A DISTANCE OF 189.69 FEET (SURVEY) TO THE POINT FORMED BY THE INTERSECTION OF SAID SOUTHERLY SIDE OF PECK SLIP WITH SAID WESTERLY SIDE OF WATER STREET; THENCE
4. SOUTHERLY, ALONG SAID WESTERLY SIDE OF WATER STREET, FORMING AN INTERIOR ANGLE OF 86°14'28" WITH THE PREVIOUS COURSE, A DISTANCE OF 157.58 FEET (SURVEY) TO A POINT THEREIN; THENCE
5. SOUTHERLY, CONTINUING ALONG SAID WESTERLY SIDE OF WATER STREET, FORMING AN INTERIOR ANGLE OF 180°18'47" WITH THE PREVIOUS COURSE, A DISTANCE OF 175.45 FEET (SURVEY) TO THE POINT OR PLACE OF BEGINNING.

ENCOMPASSING AN AREA OF 48,057 SQUARE FEET OR 1.103 ACRES, MORE OR LESS.

DEED DESCRIPTION
BLOCK 98
LOT 1
(SEE NOTE 10)

ALL THAT CERTAIN PLOT PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF MANHATTAN, CITY, COUNTY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE CORNER FORMED BY THE INTERSECTION OF THE NORTHERLY SIDE OF BEEKMAN STREET WITH THE WESTERLY SIDE OF WATER STREET;

RUNNING THENCE NORTHERLY ALONG THE WESTERLY SIDE OF WATER STREET 333 FEET 5/8 OF AN INCH TO THE CORNER FORMED BY THE INTERSECTION OF THE WESTERLY SIDE OF WATER STREET AND THE SOUTHERLY SIDE OF PECK SLIP;

THENCE WESTERLY ALONG THE SOUTHERLY SIDE OF PECK SLIP, 189 FEET 8–7/8 INCHES TO THE CORNER FORMED BY THE INTERSECTION OF THE SOUTHERLY SIDE OF PECK SLIP AND THE EASTERLY SIDE OF PEARL STREET AS WIDENED AND AS SHOWN ON MAP PREPARED BY THE BOROUGH PRESIDENT'S OFFICE, DATED MARCH 21, 1957 AND ADOPTED BY THE BOARD OF ESTIMATE ON JUNE 13, 1957;

THENCE SOUTHERLY ALONG THE EASTERLY SIDE OF PEARL STREET AS WIDENED AS AFORESAID 324 FEET 2–7/8 INCHES TO THE CORNER FORMED BY THE INTERSECTION OF THE EASTERLY SIDE OF PEARL STREET AND THE NORTHERLY SIDE OF BEEKMAN STREET; AND

THENCE EASTERLY ALONG THE NORTHERLY SIDE OF BEEKMAN STREET 108 FEET 3 INCHES TO THE CORNER FORMED BY THE INTERSECTION OF THE NORTHERLY SIDE OF BEEKMAN STREET AND THE WESTERLY SIDE OF WATER STREET, THE POINT OR PLACE OF BEGINNING.

NOTES

1. THIS SURVEY IS BASED UPON EXISTING PHYSICAL CONDITIONS FOUND AT THE SUBJECT SITE, AND THE FOLLOWING REFERENCES:
   A. BOROUGH OF MANHATTAN, BOROUGH SURVEY SHEET NO. 3.
   B. BOROUGH OF MANHATTAN, SECTIONAL MAP NO. 4.
   C. BOROUGH OF MANHATTAN, ALTERATION MAP, ACC. NO. 29485.
   D. CURRENT TAX MAP.
   E. OLD TAX MAP, EFFECTIVE DATE 01/01/1968, END DATE 12/09/2008.
   F. "ALTA/NSPS LAND TITLE SURVEY, 250 WATER STREET", BY LANGAN, PROJECT NO. 170381202, DRAWING NO. VL–101, DATED 06/07/18, LAST REVISED 05/28/19.
   G. CRFN 2018000085721, RECORDED/FILED: 05–22–2018 16:53 (DEED).
   H. TITLE REPORT BY AMTRUST TITLE INSURANCE COMPANY, TITLE NUMBER FN–15093–NY, EFFECTIVE DATE 08/19/2019.
   I. "ZONING AND SITE REQUIREMENTS SUMMARY, PZR REPORT FOR: 250 WATER STREET– EXISTING, 250 WATER STREET, BOROUGH OF MANHATTAN, NEW YORK CITY, NEW YORK" BY THE PLANNING AND ZONING RESOURCE COMPANY, PZR SITE NUMBER 133233–I, DATED FINAL 10/03/19.
2. THE SURVEYED PROPERTY IS SUBJECT BUT NOT LIMITED TO THE FOLLOWING FACTS AS REVEALED BY THE HEREON REFERENCED INFORMATION. THE INFORMATION SHOWN HEREON DOES NOT CONSTITUTE A TITLE SEARCH BY THE SURVEYOR. ALL INFORMATION THAT MAY AFFECT THE QUALITY OF TITLE TO BOTH THE SUBJECT AND ADJOINING PARCELS SHOULD BE VERIFIED BY AN ACCURATE AND CURRENT TITLE REPORT.

   SCHEDULE B–II (EXCEPTIONS) IN TITLE NO. FN–15093–NY, BY AMTRUST TITLE INSURANCE COMPANY (SEE NOTE 1H):

   (2.) THE PREMISES IS LOCATED IN AN AREA DESIGNATED AS A LANDMARK HISTORIC DISTRICT BY A NOTICE RECORDED IN THE CITY REGISTER/COUNTY CLERK'S OFFICE ON 1/30/1978 IN REEL 427 PAGE 152 – [BLANKET].
3. THE MERIDIAN OF THIS SURVEY IS REFERENCED TO APPROXIMATE NORTH (SEE NOTE 1A).
4. STREET NAMES, R.O.W. WIDTHS, BLOCK, AND LOT NUMBERS AS PER MAPS REFERENCED IN 1A, 1B, 1C, AND 1D.
5. PLANIMETRIC INFORMATION SHOWN HEREON HAS BEEN OBTAINED FROM GROUND SURVEYS BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, LANDSCAPE ARCHITECTURE AND GEOLOGY, D.P.C. DURING MAY AND JUNE 2018, AND REVISED BY VISUAL INSPECTION DURING SEPTEMBER OF 2019.
6. FEMA INFORMATION:

   CURRENT:
   AS PER THE NATIONAL FLOOD INSURANCE PROGRAM FIRM MAP TITLED "CITY OF NEW YORK, NEW YORK, BRONX, RICHMOND, NEW YORK, QUEENS, AND KINGS COUNTIES", PANEL 184 OF 457, MAP NUMBER 3604970184E, REVISED SEPTEMBER 5, 2007, A PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONE X (NOT SHADED), AN AREA DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, A PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONE X (SHADED), AN AREA OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD, AND A PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONE AE (EL 10– NGVD29), AN AREA WHERE THE BASE FLOOD ELEVATION IS DETERMINED.

   PRELIMINARY:
   AS PER THE NATIONAL FLOOD INSURANCE PROGRAM FIRM MAP TITLED "CITY OF NEW YORK, NEW YORK, BRONX, RICHMOND, NEW YORK, QUEENS, AND KINGS COUNTIES", PANEL 184 OF 457, MAP NUMBER 36049701840, REVISED DECEMBER 5, 2013, A PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONE X (NOT SHADED), AN AREA DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, A PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONE X (SHADED), AN AREA OF 0.2% ANNUAL CHANCE FLOOD; AREAS OF 1% ANNUAL CHANCE FLOOD WITH AVERAGE DEPTHS OF LESS THAN 1 FOOT OR WITH DRAINAGE AREAS LESS THAN 1 SQUARE MILE; AND AREAS PROTECTED BY LEVEES FROM 1% ANNUAL CHANCE FLOOD, AND A PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONE AE (EL 12– NAVD88), AN AREA WHERE THE BASE FLOOD ELEVATION IS DETERMINED.
7. OFFSETS (IF SHOWN) ARE FOR SURVEY REFERENCES ONLY AND ARE NOT TO BE USED IN CONSTRUCTION OF ANY TYPE.
8. WETLANDS, ENVIRONMENTAL AND/OR HAZARDOUS MATERIALS LOCATION, IF ANY, NOT COVERED UNDER THIS CONTRACT.
9. UNLESS SPECIFICALLY NOTED HEREON, STORM AND SANITARY SEWER INFORMATION (INCLUDING PIPE INVERT, PIPE MATERIAL, AND PIPE SIZE) WAS OBSERVED AND MEASURED AT FIELD LOCATED STRUCTURES (MANHOLES/CATCH BASINS, ETC.). CONDITIONS CAN VARY FROM THOSE ENCOUNTERED AT THE TIMES WHEN AND THE LOCATIONS WHERE DATA WAS OBTAINED. DESPITE MEETING THE REQUIRED STANDARD OF CARE THE SURVEYOR CANNOT AND DOES NOT WARRANT THAT PIPE MATERIAL AND/OR PIPE SIZE THROUGHOUT THE PIPE RUN ARE THE SAME AS THOSE OBSERVED AT EACH STRUCTURE, OR THAT THE PIPE RUN IS STRAIGHT BETWEEN THE LOCATED STRUCTURES.

   ADDITIONAL UTILITY (WATER, GAS, ELECTRIC ETC...) DATA MAY BE SHOWN FROM FIELD LOCATED SURFACE MARKINGS (BY OTHERS), EXISTING STRUCTURES, AND/OR FROM EXISTING DRAWINGS.

   UNLESS SPECIFICALLY NOTED HEREON THE SURVEYOR HAS NOT EXCAVATED TO PHYSICALLY LOCATE THE UNDERGROUND UTILITIES. THE SURVEYOR MAKES NO GUARANTEES THAT THE SHOWN UNDERGROUND UTILITIES ARE EITHER IN SERVICE, ABANDONED OR SUITABLE FOR USE, NOR ARE IN THE EXACT LOCATION OR CONFIGURATION INDICATED HEREON.

   PRIOR TO ANY DESIGN OR CONSTRUCTION THE PROPER UTILITY AGENCIES MUST BE CONTACTED FOR VERIFICATION OF UTILITY TYPE AND FOR FIELD LOCATIONS.

   UNLESS NOTED BELOW SUPPLEMENTAL DOCUMENTS WERE NOT USED TO COMPILE THE SUBSURFACE UTILITY INFORMATION SHOWN HEREON.

   SEWER AND WATER UTILITY MAPPING PROVIDED BY NYC DEP.

   CHARTER, ECS/VERIZON, LEVEL 3, CABLEVISION, AND AT&T UTILITY MAPS ARE NOT PLOTTED DUE TO UNKNOWN SCALE AND/OR SCHEMATIC MAPS BEING PROVIDED.
10. THIS IS TO CERTIFY THAT THERE ARE NO STREAMS NOR NATURAL WATERCOURSES ON THE PROPERTY AS SHOWN ON THIS SURVEY.
11. IN REFERENCE TO ALTA/NSPS ITEM NUMBER 2 OF THE TABLE "A" OPTIONAL REQUIREMENTS: ADDRESS INFORMATION IS BASED ON THE "NYC DEPARTMENT OF FINANCE'S PROPERTY TAX PUBLIC ACCESS" WEB PORTAL. (https://a836–pts–access.nyc.gov/care/forms/htmlframe.aspx?mode=content/home.htm)
12. IN REFERENCE TO ALTA/NSPS ITEM NUMBERS 7(a), 7(b–1), AND 7(c) OF THE TABLE "A" OPTIONAL REQUIREMENTS: THERE ARE NO PERMANENT BUILDINGS ON THE SUBJECT PROPERTY.
13. IN REFERENCE TO ALTA/NSPS ITEM NUMBER 9 OF THE TABLE "A" OPTIONAL REQUIREMENTS: THERE ARE NO DEFINED PARKING SPACES ON SITE, ONLY THE IRREGULAR REMAINS OF LANE STRIPING IN SOME AREAS (NOT SHOWN).
14. IN REFERENCE TO ALTA/NSPS ITEM NUMBERS 10(a) AND 10(b) OF THE TABLE "A" OPTIONAL REQUIREMENTS: THERE ARE NO PERMANENT BUILDINGS ON THE SUBJECT PROPERTY.
15. IN REFERENCE TO ALTA/NSPS ITEM NUMBER 13 OF THE TABLE "A" OPTIONAL REQUIREMENTS: THERE ARE NO ADJOINING LOTS.
16. IN REFERENCE TO ALTA/NSPS ITEM NUMBERS 17 OF THE TABLE "A" OPTIONAL REQUIREMENTS: NO INFORMATION WAS MADE AVAILABLE OF PROPOSED CHANGES IN STREET RIGHT OF WAY LINES BY THE CONTROLLING JURISDICTION. EVIDENCE OF RECENT STREET OR SIDEWALK CONSTRUCTION OR REPAIRS WAS NOT OBSERVED IN THE PROCESS OF CONDUCTING FIELD WORK.
17. IN REFERENCE TO ALTA/NSPS ITEM NUMBER 18 OF THE TABLE "A" OPTIONAL REQUIREMENTS: NO RECORD EVIDENCE OF WETLANDS WAS UNCOVERED IN THE RESEARCH CONDUCTED FOR THIS SURVEY. THE SURVEYOR HAS NOT CONDUCTED A WETLANDS INVESTIGATION AND DOES NOT CERTIFY TO THE PRESENCE OF WETLANDS ON THIS SITE.
18. IN REFERENCE TO ALTA/NSPS ITEM NUMBES 6(a) AND 6(b) OF THE TABLE "A" OPTIONAL REQUIREMENTS: AS SET FORTH IN THE LETTER REFERENCED IN NOTE 1I:

    EXISTING ZONING DESIGNATION:
    "C6–2A" (RESTRICTED CENTRAL COMMERCIAL) WITHIN THE SOUTH STREET SEAPORT SUBDISTRICT OF THE "LM". (SPECIAL LOWER MANHATTAN DISTRICT) AND WITHIN THE MANHATTAN CORE (MANHATTAN COMMUNITY DISTRICT 1)

    BUILDING YARD LINES:
    BUILDING YARDS:
    A. FRONT– NOT APPLICABLE; NONE REQUIRED
    B. SIDES– NOT APPLICABLE; NONE REQUIRED AS PROPERTY HAS ALL FRONT YARDS
    C. REAR– NOT APPLICABLE; NONE REQUIRED AS PROPERTY HAS ALL FRONT YARDS

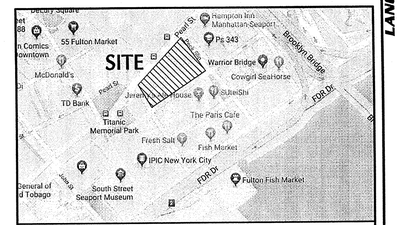
    STREET WALL:
    E. LOCATION, ALONG A WIDE STREET AND ALONG A NARROW STREET WITHIN 50 FEET OF A WIDE STREET– NOT APPLICABLE; THERE ARE NO EXISTING PERMANENT STRUCTURES THAT REQUIRE A STREET WALL

    BUILDING SIZE:
    A. MAXIMUM BASE HEIGHT OR STORIES– PER SECTION 91–661, 35–652(a), 23–662(a) & 23–662(c), "LM":
       MAXIMUM BUILDING HEIGHT: 120 FEET
       NO MINIMUM BASE HEIGHT SHALL APPLY
       MAXIMUM BASE HEIGHT: 85 FEET
       A 10 FEET SETBACK IS REQUIRED ALONG BOTH A NARROW STREET AND A WIDE STREET ABOVE THE MAXIMUM BASE HEIGHT
    B. EXISTING BUILDING HEIGHT OR STORIES– 1 STORY, ESTIMATED 10 FEET AT MAXIMUM FOR THE NON–PERMANENT TOLL BOOTH AND SHED STRUCTURES (PER REVIEW OF AERIAL IMAGERY)
    C. BUILDING SITE AREA REQUIREMENTS– PER SECTION 33–00 & 91–00 NONE SPECIFIED FOR COMMERCIAL USE

    DENSITY:
    A. BUILDING DENSITY FORMULA– PER SECTION 91–22 & 91–23, "LM":
       MAXIMUM BASIC FLOOR AREA RATIO: 6.00
       EXISTING: (175 / 48,100) = 0.004 (PER APPROXIMATE SCALE OF AERIAL IMAGERY)
    B. EXISTING ZONING FLOOR AREA– 175 SQUARE FEET WITHIN THE TOLL BOOTH AND SHED STRUCTURES (PER APPROXIMATE SCALE OF AERIAL IMAGERY)

    PARKING:
    A. PARKING SPACE FORMULA– PER SECTION 13–10 NONE REQUIRED WITHIN MANHATTAN CORE
    B. PARKING SPACES REQUIRED– NONE REQUIRED WITHIN MANHATTAN CORE
    C. PROPOSED PARKING SPACES– 105 TOTAL PARKING SPACES (PER CERTIFICATE OF OCCUPANCY)
19. UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209, SUB–DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.
20. THIS PLAN NOT VALID UNLESS EMBOSSED OR BLUE INK STAMPED WITH THE SEAL OF THE PROFESSIONAL.

20 0 5 10 20
SCALE IN FEET



PROJECT LOCATION MAP
SCALE: NOT TO SCALE

SOURCE: GOOGLE MAPS

ALTA CERTIFICATION

TO:

1. FIRST NATIONWIDE TITLE AGENCY LLC
2. AMTRUST TITLE INSURANCE COMPANY
3. LANDESBANK HESSEN–THÜRINGEN GIROZENTRALE, INDIVIDUALLY AND AS AGENT FOR THE OTHER BANKS, AND THEIR RESPECTIVE SUCCESSORS, NOMINEES AND ASSIGNS
4. 250 SEAPORT DISTRICT, LLC, A DELAWARE LIMITED LIABILITY COMPANY
5. CHICAGO TITLE INSURANCE COMPANY

"I HEREBY STATE THAT THIS PLAN IS BASED ON A FIELD SURVEY MADE BY ME OR UNDER MY IMMEDIATE SUPERVISION IN ACCORDANCE WITH NYSPLS CODE OF PRACTICE FOR LAND SURVEYS, AND TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION AND BELIEF, AND IN MY PROFESSIONAL OPINION, CORRECTLY REPRESENTS THE CONDITIONS FOUND ON THE DATE OF THE FIELD SURVEY AT THE SUBJECT PROPERTY" AND

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, AND INCLUDES ITEMS 2, 3, 4, 6(a), 6(b), 7(a), 7(b–1), 7(c), 8, 9, 10(a), 10(b), 11, 13, 14, 16, 17, 18, AND 19 OF TABLE A THEREOF.

THE FIELD WORK WAS COMPLETED ON SEPTEMBER 17, 2019.

Date: 10/17/2019

Signature: PAUL D. FISHER, PROFESSIONAL LAND SURVEYOR, NYS LIC. NO. 050784–1

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
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T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
250 WATER STREET
BLOCK No. 98, LOT No. 1
BOROUGH OF MANHATTAN
CITY OF NEW YORK
NEW YORK COUNTY NEW YORK

Drawing Title
ALTA/NSPS LAND TITLE SURVEY

Project No.	Drawing No.
170381203	VL101
Date: 09/25/19	
Drawn By: LB	
Checked By: PDF	Sheet 001 of 001

PROJECT NO. 170381203

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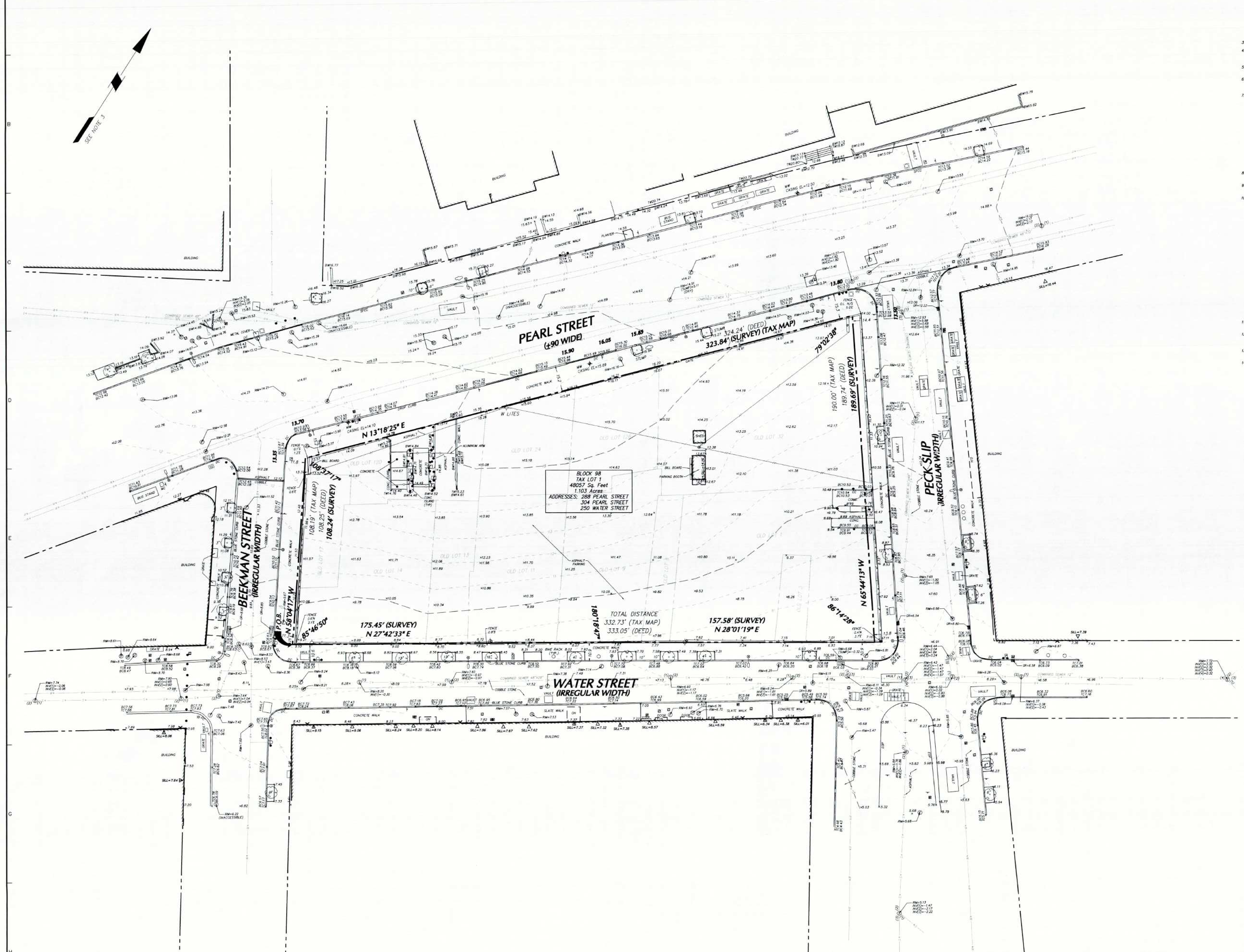
APPENDIX B

PROPOSED DEVELOPMENT PLANS



THE FOLLOWING REQUESTS FOR UTILITY INFORMATION HAVE BEEN MADE

UTILITY	RECEIVED
WATER	DEP 05/15/2018
SEWER	DEP 05/15/2018
ECS/VERIZON	05/16/2018
MCI NETWORK	05/15/2018
CABLEVISION OF NYC	06/04/2018
AT&T LNS	05/18/2018
LEVEL 3	05/16/2018

M.B.D.

DATUM CONVERSION CHART

0.00' MANHATTAN BOROUGH DATUM	1.650
0.00' NAVD 88	2.752'
0.00' NGVD 29	1.102

NOTES

1. THIS SURVEY IS BASED UPON EXISTING PHYSICAL CONDITIONS FOUND AT THE SUBJECT SITE, AND THE FOLLOWING REFERENCES:
   A. BOROUGH OF MANHATTAN, BOROUGH SURVEY SHEET NO. 3.
   B. BOROUGH OF MANHATTAN, SECTIONAL MAP NO. 4.
   C. BOROUGH OF MANHATTAN, ALTERATION MAP, ACC. NO. 29485.
   D. CURRENT TAX MAP.
   E. OLD TAX MAP, EFFECTIVE DATE 01/01/1968, END DATE 12/09/2008.
   F. DEED MADE BY AMPAL PROPERTIES CORP. DATED 8/22/1979 AND RECORDED ON 9/6/1979 IN REEL 494 PAGE 256.
   G. DEED MADE BY SELNO CORP. TO AMPAL PROPERTIES CORP. DATED 6/7/1973 AND RECORDED ON 6/13/1973 IN REEL 281 PAGE 1134.
   H. TITLE REPORT BY AMTRUST TITLE INSURANCE COMPANY, TITLE NUMBER FN-14094-NY, EFFECTIVE DATE 04/23/2018.
2. THE SURVEYED PROPERTY IS SUBJECT BUT NOT LIMITED TO THE FOLLOWING FACTS AS REVEALED BY THE HEREON REFERENCED INFORMATION. THE INFORMATION SHOWN HEREON DOES NOT CONSTITUTE A TITLE SEARCH BY THE SURVEYOR. ALL INFORMATION THAT MAY AFFECT THE QUALITY OF TITLE TO BOTH THE SUBJECT AND ADJOINING PARCELS SHOULD BE VERIFIED BY AN ACCURATE AND CURRENT TITLE REPORT.

   SCHEDULE B-II (EXCEPTIONS) IN TITLE NO. FN-14094-NY, BY AMTRUST TITLE INSURANCE COMPANY (SEE NOTE 1H):

   (7) THE PREMISES IS LOCATED IN AN AREA DESIGNATED AS A LANDMARK HISTORIC DISTRICT BY A NOTICE RECORDED IN THE CITY REGISTER/COUNTY CLERK'S OFFICE ON 1/30/1978 IN REEL 427 PAGE 152 - [BLANKET].
3. THE MERIDIAN OF THIS SURVEY IS REFERENCED TO APPROXIMATE NORTH (SEE NOTE 1A).
4. ELEVATIONS SHOWN ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED UPON BENCHMARKS 851 8750 TIDAL 3 & S 340 RESET, AS PUBLISHED BY THE NATIONAL GEODETIC SURVEY.
5. STREET NAMES AND R.O.W. WIDTHS, BLOCK AND LOT NUMBERS AS PER MAPS REFERENCED IN 1A, 1B & 1D.
6. PLANIMETRIC INFORMATION SHOWN HEREON HAS BEEN OBTAINED FROM GROUND SURVEYS BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, LANDSCAPE ARCHITECTURE AND GEOLOGY, D.P.C. DURING MAY AND JUNE 2018.
7. FEMA INFORMATION:

   CURRENT:
   AS PER THE "NATIONAL FLOOD INSURANCE PROGRAM FIRM MAP TITLED CITY OF NEW YORK, NEW YORK, BRONX, RICHMOND, NEW YORK, QUEENS, AND KINGS COUNTIES, PANEL 184 OF 457, MAP NUMBER 3604970184F, REVISED SEPTEMBER 5, 2007", THE ENTIRE OR PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONES: ZONE X (NOT SHADED)-AREA OF MINIMAL FLOOD HAZARD, ZONE X (SHADED)-AREA OF 0.2% ANNUAL CHANCE FLOOD HAZARD AND ZONE AE (EL 10 FEET)-AREA OF 1% ANNUAL CHANCE FLOOD.

   PRELIMINARY:
   AS PER THE "NATIONAL FLOOD INSURANCE PROGRAM FIRM MAP TITLED CITY OF NEW YORK, NEW YORK, BRONX, RICHMOND, NEW YORK, QUEENS, AND KINGS COUNTIES, PANEL 184 OF 457, MAP NUMBER 3604970184G, REVISED DECEMBER 5, 2013", THE ENTIRE OR PORTION OF THE SUBJECT PROPERTY LIES WITHIN ZONES: ZONE X (NOT SHADED)-AREA OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN, ZONE X (SHADED)-AREA OF 0.2% ANNUAL CHANCE FLOOD HAZARD AND ZONE AE (EL 12 FEET)-AREA OF 1% ANNUAL CHANCE FLOOD.
8. OFFSETS (IF SHOWN) ARE FOR SURVEY REFERENCES ONLY AND ARE NOT TO BE USED IN CONSTRUCTION OF ANY TYPE.
9. WETLANDS, ENVIRONMENTAL AND/OR HAZARDOUS MATERIALS LOCATION, IF ANY, NOT COVERED UNDER THIS CONTRACT.
10. UNLESS SPECIFICALLY NOTED HEREON, STORM AND SANITARY SEWER INFORMATION (INCLUDING PIPE INVERT, PIPE MATERIAL, AND PIPE SIZE) WAS OBSERVED AND MEASURED AT FIELD LOCATED STRUCTURES (MANHOLES/CATCH BASINS, ETC.). CONDITIONS CAN VARY FROM THOSE ENCOUNTERED AT THE TIMES WHEN AND THE LOCATIONS WHERE DATA WAS OBTAINED. DESPITE MEETING THE REQUIRED STANDARD OF CARE THE SURVEYOR CANNOT AND DOES NOT WARRANT THAT PIPE MATERIAL AND/OR PIPE SIZE THROUGHOUT THE PIPE RUN ARE THE SAME AS THOSE OBSERVED AT EACH STRUCTURE, OR THAT THE PIPE RUN IS STRAIGHT BETWEEN THE LOCATED STRUCTURES.

    ADDITIONAL UTILITY (WATER, GAS, ELECTRIC ETC..) DATA MAY BE SHOWN FROM FIELD LOCATED SURFACE MARKINGS (BY OTHERS), EXISTING STRUCTURES, AND/OR FROM EXISTING DRAWINGS.

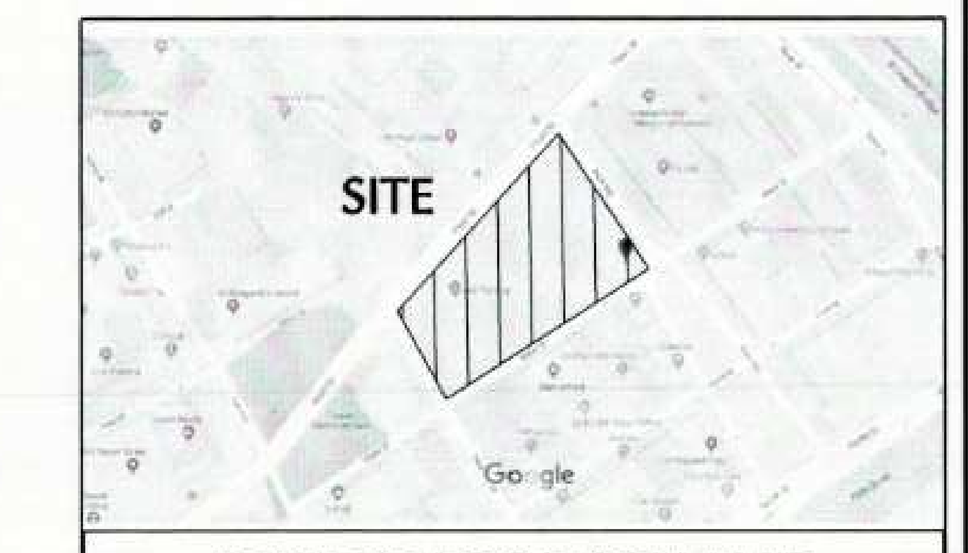
    UNLESS SPECIFICALLY NOTED HEREON THE SURVEYOR HAS NOT EXCAVATED TO PHYSICALLY LOCATE THE UNDERGROUND UTILITIES. THE SURVEYOR MAKES NO GUARANTEES THAT THE SHOWN UNDERGROUND UTILITIES ARE EITHER IN SERVICE, ABANDONED OR SUITABLE FOR USE, NOR ARE IN THE EXACT LOCATION OR CONFIGURATION INDICATED HEREON.

    PRIOR TO ANY DESIGN OR CONSTRUCTION THE PROPER UTILITY AGENCIES MUST BE CONTACTED FOR VERIFICATION OF UTILITY TYPE AND FOR FIELD LOCATIONS.

    UNLESS NOTED BELOW SUPPLEMENTAL DOCUMENTS WERE NOT USED TO COMPILE THE SUBSURFACE UTILITY INFORMATION SHOWN HEREON.

    SEWER AND WATER UTILITY MAPPING PROVIDED BY NYC DEP.

    CHARTER, ECS/VERIZON, (LEVEL 3), CABLEVISION AND AT&T UTILITY MAPS ARE NOT PLOTTED DUE TO UNKNOWN SCALE AND/OR SCHEMATIC MAPS BEING PROVIDED.
11. THIS IS TO CERTIFY THAT THERE ARE NO STREAMS NOR NATURAL WATERCOURSES ON THE PROPERTY AS SHOWN ON THIS SURVEY.
12. UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7209, SUB-DIVISION 2, OF THE NEW YORK STATE EDUCATION LAW.
13. THIS PLAN NOT VALID UNLESS EMBOSSED OR BLUE INK STAMPED WITH THE SEAL OF THE PROFESSIONAL.
14. THE SURVEYED PARCEL AS SHOWN HEREON IS THE SAME AS DESCRIBED IN THE TITLE COMMITMENT REFERENCED IN NOTE 1H.



PROJECT LOCATION MAP
SCALE: N.T.S.
SOURCE: GOOGLE MAPS

LEGEND (NOT SHOWN TO SCALE)

SYMBOL	DESCRIPTION
	HYDRANT
	STAND PIPE
	ROOF DRAIN
	FLAG POLE
	PEDESTAL LIGHT
	STREET LIGHT
	AREA LIGHT
	SIGNAL POLE
	POWER POLE
	GUY WIRE
	ANCHOR POLE
	MANHOLE (TYPE AS LABELED)
	WATER VALVE
	GAS VALVE
	UNKNOWN VALVE
	CATCH BASIN
x322.35	SPOT ELEVATION
	CLEAN OUT
	TREE
	SIGN
	BOLLARD
	ELECTRIC BOX
	ELECTRIC METER
	GAS METER
	WATER METER
	TELEPHONE BOX
	TRAFFIC SIGNAL POLE
	MONITOR WELL
	BENCH
	DOOR
	DOUBLE DOOR
	ROLL UP DOOR
	YARD DRAIN
	MAILBOX
BW	BOTTOM OF WALL
TW	TOP OF WALL
BC	BOTTOM OF CURB
TC	TOP OF CURB
DC	DROP CURB
FF=322.35	FINISHED FLOOR
61.7	LEGAL GRADE FROM SECTIONAL MAP (CONVERTED TO NAVD88 SEE NOTE 4)
(61.7)	EXISTING GRADE FROM SECTIONAL MAP (CONVERTED TO NAVD88 SEE NOTE 4)
O.L.	ON LINE
	OVERHEAD WIRE
	GUIDE RAIL WOOD
	GUIDE RAIL METAL
	TREE LINE
	CHAINLINK FENCE
	STOCKADE FENCE
	IRON FENCE
	EASEMENT LINE
	PROPERTY LINE
	RIGHT-OF-WAY LINE
322	CONTOUR LINE
G	GAS MARK OUT LINE
W	WATER MARK OUT LINE
E	ELECTRIC MARK OUT LINE
T	COMMUNICATION MARK OUT LINE
S	SANITARY MARK OUT LINE
D	DRAINAGE MARK OUT LINE
UNK	UNKNOWN UTILITY MARK OUT LINE
*R	REFERENCE UTILITY LINE (TYPE AS NOTED) - PLOTTED FROM EXISTING MAPPING

SURVEY DESCRIPTION
BLOCK 98
TAX LOT 1
IN THE BOROUGH OF MANHATTAN, CITY OF NEW YORK
NEW YORK COUNTY, NEW YORK

ALL that certain plot, piece, or parcel of land, situate, lying, and being in the Borough of Manhattan, New York County, City and State of New York, bounded and described as follows:

BEGINNING at the intersection of the northerly side of Beekman Street (irregular width) with the westerly side of Water Street (irregular width), said point being the Point or Place of Beginning and running thence;

1. Westerly, along said northerly side of Beekman Street, a distance of 108.24 feet (survey) to the point formed by the intersection of said northerly side of Beekman Street with the easterly side of Pearl Street (±90 feet wide); thence
2. Northerly, along said easterly side of Pearl Street, forming an interior angle of 108°37'17" with the previous course, a distance of 323.84 feet (survey) to the point formed by the intersection of said easterly side of Pearl Street with the southerly side of Peck Slip (irregular width); thence
3. Easterly, along said southerly side of Peck Slip, forming an interior angle of 79°02'38" with the previous course, a distance of 189.69 feet (survey) to the point formed by the intersection of said southerly side of Peck Slip with said westerly side of Water Street; thence
4. Southerly, along said westerly side of Water Street, forming an interior angle of 86°14'28" with the previous course, a distance of 157.58 feet (survey) to a point therein; thence
5. Southerly, continuing along said westerly side of Water Street, forming an interior angle of 180°18'47" with the previous course, a distance of 175.45 feet (survey) to the Point or Place of Beginning.

Encompassing an area of 48,057 square feet or 1.103 acres.

DEED DESCRIPTION
BLOCK 98
LOT 1

ALL THAT CERTAIN PLOT PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF MANHATTAN, CITY, COUNTY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE CORNER FORMED BY THE INTERSECTION OF THE NORTHERLY SIDE OF BEEKMAN STREET WITH THE WESTERLY SIDE OF WATER STREET;

RUNNING THENCE NORTHERLY ALONG THE WESTERLY SIDE OF WATER STREET 333 FEET 5/8 OF AN INCH TO THE CORNER FORMED BY THE INTERSECTION OF THE WESTERLY SIDE OF WATER STREET AND THE SOUTHERLY SIDE OF PECK SLIP;

THENCE WESTERLY ALONG THE SOUTHERLY SIDE OF PECK SLIP, 189 FEET 8-7/8 INCHES TO THE CORNER FORMED BY THE INTERSECTION OF THE SOUTHERLY SIDE OF PECK SLIP AND THE EASTERLY SIDE OF PEARL STREET AS WIDENED AND AS SHOWN ON MAP PREPARED BY THE BOROUGH PRESIDENT'S OFFICE, DATED MARCH 21, 1957 AND ADOPTED BY THE BOARD OF ESTIMATE ON JUNE 13, 1957;

THENCE SOUTHERLY ALONG THE EASTERLY SIDE OF PEARL STREET AS WIDENED AS AFORESAID 324 FEET 2-7/8 INCHES TO THE CORNER FORMED BY THE INTERSECTION OF THE EASTERLY SIDE OF PEARL STREET AND THE NORTHERLY SIDE OF BEEKMAN STREET;

THENCE EASTERLY ALONG THE NORTHERLY SIDE OF BEEKMAN STREET 108 FEET 3 INCHES TO THE CORNER FORMED BY THE INTERSECTION OF THE NORTHERLY SIDE OF BEEKMAN STREET AND THE WESTERLY SIDE OF WATER STREET, THE POINT OR PLACE OF BEGINNING.

ALTA CERTIFICATION

TO:

1. FIRST NATIONWIDE TITLE AGENCY LLC.
2. AMTRUST TITLE INSURANCE COMPANY.
3. PECK SLIP ASSOCIATES LLC, ITS SUCCESSORS AND/OR ASSIGNS.
4. 250 SEAPORT DISTRICT, LLC, ITS SUCCESSORS AND/OR ASSIGNS.

"I HEREBY STATE THAT THIS PLAN IS BASED ON A FIELD SURVEY MADE BY ME OR UNDER MY IMMEDIATE SUPERVISION IN ACCORDANCE WITH NYSPLS CODE OF PRACTICE FOR LAND SURVEYS, AND TO THE BEST OF MY PROFESSIONAL KNOWLEDGE, INFORMATION AND BELIEF, AND IN MY PROFESSIONAL OPINION, CORRECTLY REPRESENTS THE CONDITIONS FOUND ON THE DATE OF THE FIELD SURVEY AT THE SUBJECT PROPERTY" AND

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2016 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/NSPS LAND TITLE SURVEYS, AND INCLUDES ITEMS 2, 3, 4, 5, 8, 11 AND 14 OF TABLE A THEREOF.
THE FIELD WORK WAS COMPLETED ON JUNE 04, 2018.

Date:

Signature:

PAUL D. FISHER
PROFESSIONAL LAND SURVEYOR
NY LIC. No. 050784-1

SCALE IN FEET: 20 0 5 10 20

Date	Description	No.

REVISIONS

LANGAN
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21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project
250 WATER STREET
BLOCK No. 98, LOT No. 1
BOROUGH OF MANHATTAN
CITY OF NEW YORK
NEW YORK COUNTY NEW YORK

Drawing Title
ALTA / NSPS LAND TITLE SURVEY

Project No. 170381202
Date 06/07/2018
Drawn By TA, HBV
Checked By PDF
Drawing No. VL-101
Sheet 01 of 01

LANGAN
PROJECT NO. 170381202

Filename: \\langan.com\data\NYC\data2\170381202\Project Data_Discipline\Survey\CAD\Existing\170381202-ALTA.dwg Date: 6/8/2018 Time: 12:27 User: labdelsayed Style Table: Langan.stb Layout: ARCHE-SL

250 WATER STREET DEVELOPMENT

250 Water St, New York, NY 10038

OWNER
Howard Hughes
The Howard Hughes Corporation
199 Water Street, 28th Fl, New York, NY 10038

ARCHITECT
SOM
Skidmore, Owings & Merrill LLP
7 World Trade Center, New York, NY 10007

STRUCTURAL ENGINEER
DeSimone Consulting Engineers
140 Broadway, 25th Fl, New York, NY 10005

MEPF ENGINEER, AV, IT & SECURITY
Jaros Baum & Bolles (JB&B)
80 Pine Street, New York, NY 10005

CIVIL
Alee King Rosen & Fleming (AKRF)
440 Park Avenue S, 7th Fl, New York, NY 10016

GEOTECH
Langan
360 W. 31st Street, 8th Fl, New York, NY 10001

VERTICAL TRANSPORTATION
Van Deusen & Associates (VDA)
120 Eagle Rock Avenue, East Hanover, NJ 07936

RESIDENTIAL UNIT LAYOUT DESIGN ARCHITECT
Ismael Leyva Architects, P.C
48 W 37th Street, New York, NY 10018

ACOUSTICS
Longman Lindsey
200 W. 41st Street, Ste 1100, New York, NY 10036

CODE CONSULTING
Code Consultants, Inc. (CCI)
215 West 40th Street, 10th Fl, New York, NY 10018

WATERPROOFING / FACADE
AJ Lablle & Partners LLC (AJLP)
40 Worth Street, Suite 814, New York, NY 10013

FACADE MAINTENANCE
Entek Engineering, PLLC
166 Ames Street, Hackensack, NJ 07601

SUSTAINABILITY CONSULTANT
Vidaris, Inc.
360 Park Ave. South, 15th Fl, New York, NY 10010

LANDSCAPE CONSULTANT
Future Green Studio
18 Bay Street, Brooklyn, NY 11231

KEYPLAN

SEAL

NOT FOR CONSTRUCTION

NO.	DATE	DESCRIPTION
2	11/18/2020	FINAL SCHEMATIC DESIGN

DRAWING TITLE
SITE SURVEY

DRAWING NUMBER
G-004
B-SCAN - DRAWING NUMBER

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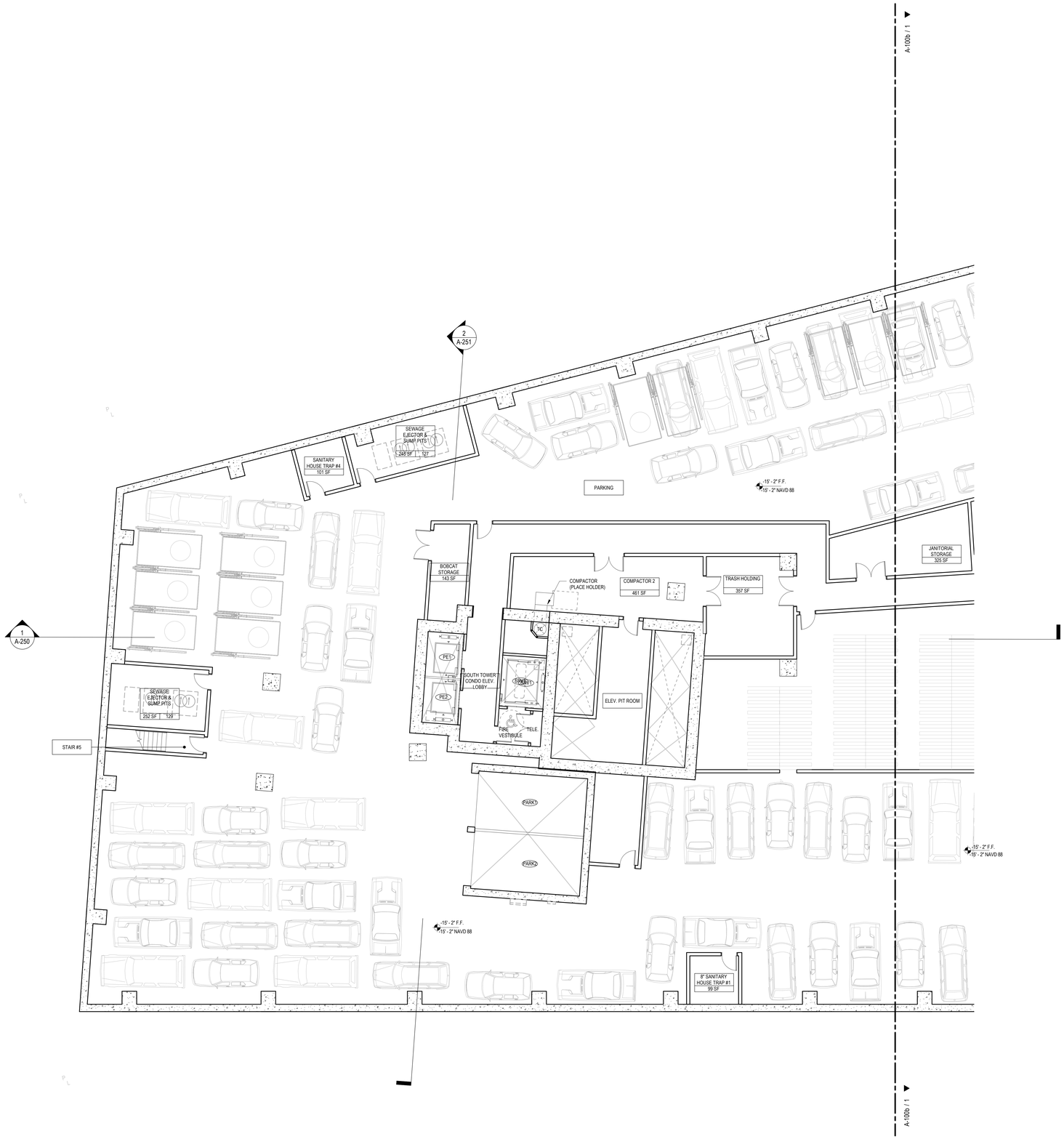
TOTAL PARKING COUNT : 105



1 FLOOR PLAN - CELLAR - PART A
SCALE: 1/8" = 1'-0"

250 WATER STREET DEVELOPMENT

250 Water St, New York, NY 10038

OWNER
The Howard Hughes Corporation
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DRAWING TITLE
FLOOR PLAN - CELLAR - PART A

DRAWING NUMBER
A-100a

B-SCAN - DRAWING NUMBER

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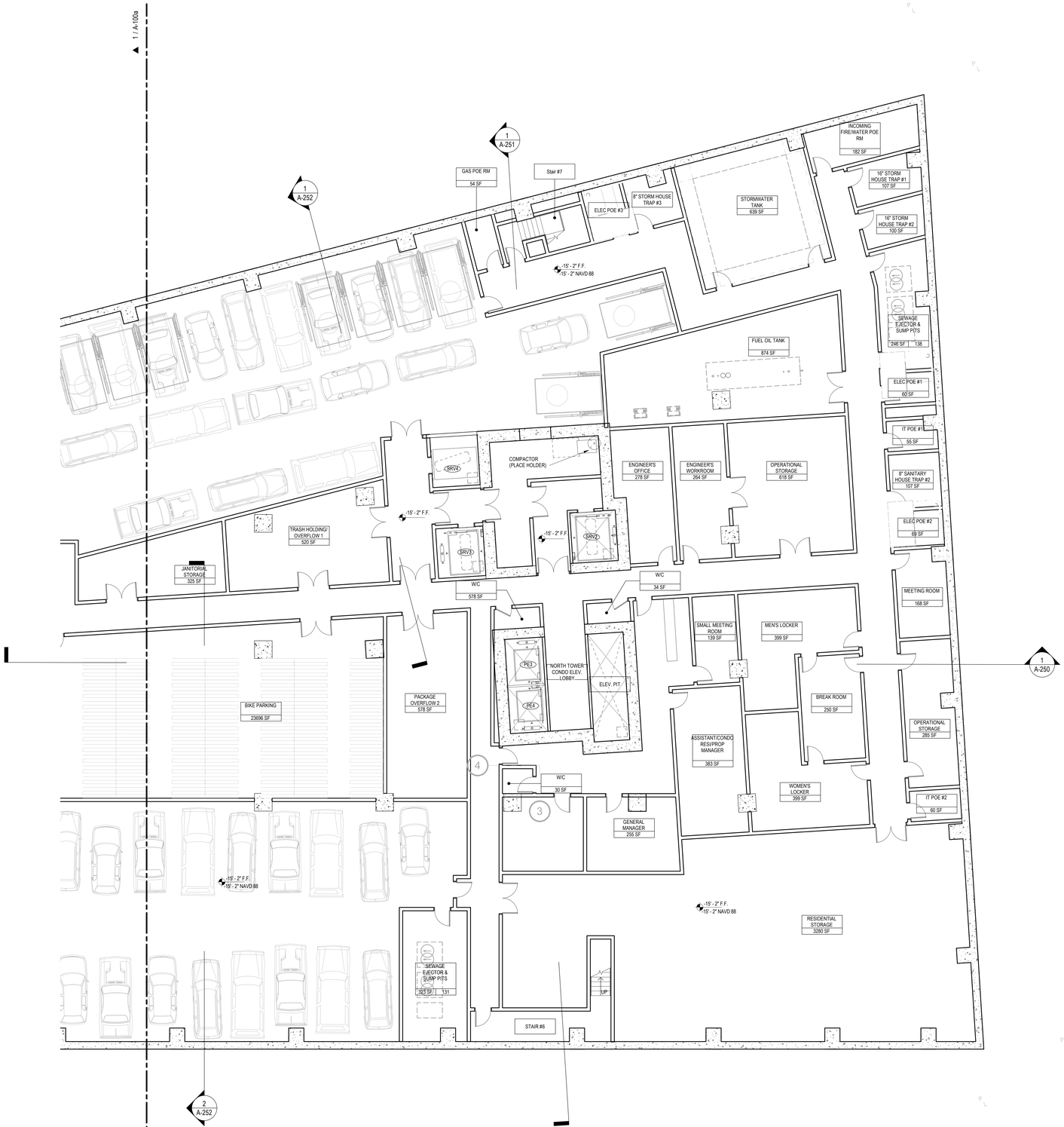

1 FLOOR PLAN - CELLAR - PART B
SCALE: 1/8" = 1'-0"

250 WATER STREET DEVELOPMENT

250 Water St, New York, NY 10038

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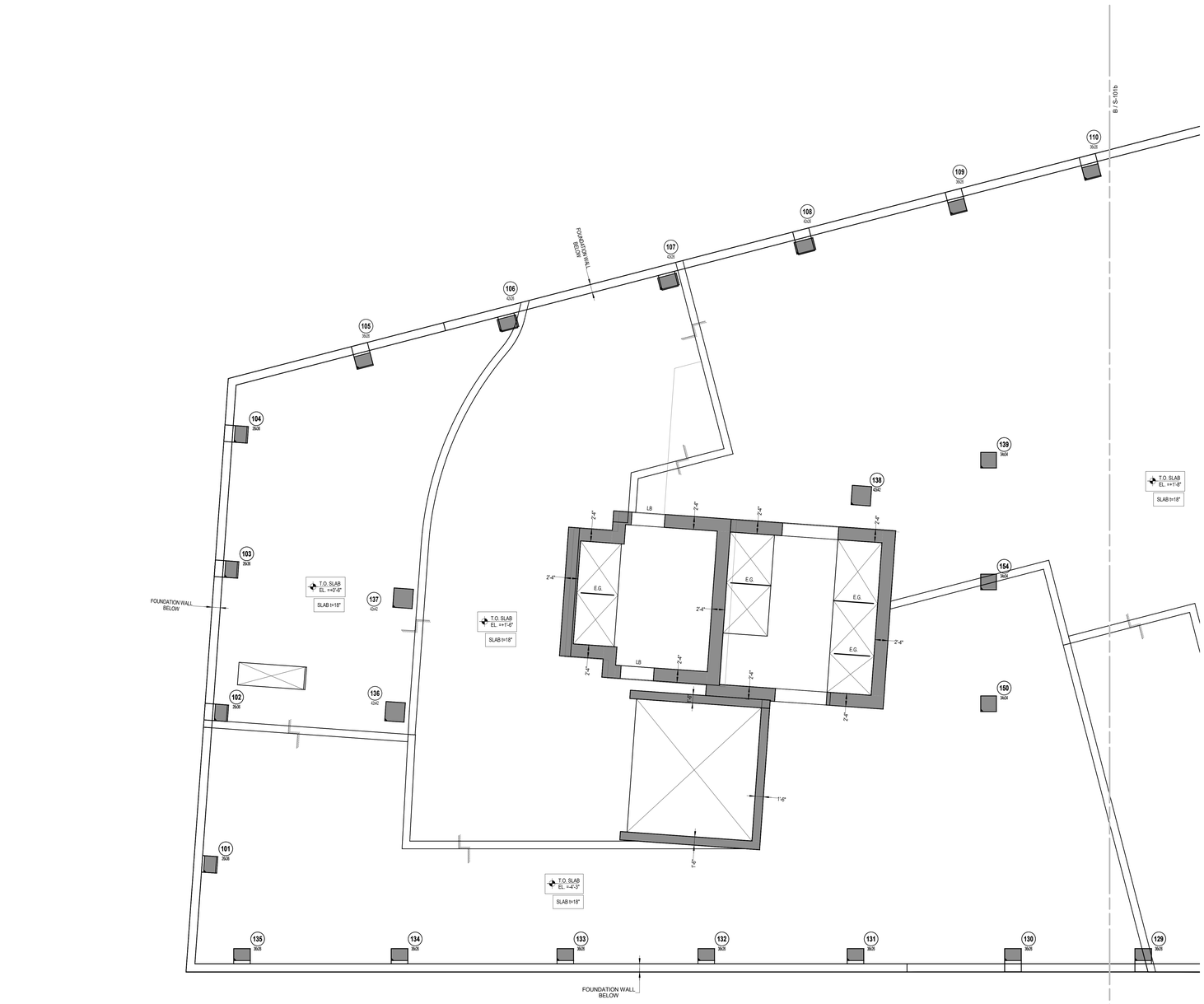

GROUND FLOOR FRAMING PLAN A

SCALE: 1/8" = 1'-0"

TOP OF SLAB ELEVATION U.O.N.:	SEE PLAN
SLAB THICKNESS U.O.N.:	AS SHOWN
SLAB CONCRETE STRENGTH:	SEE S-001

DRAWING NOTES:

1. SEE S-001 FOR GENERAL NOTES, DRAWING INDEX AND DESIGN CRITERIA/LOADS.
2. ALL ELEVATIONS SHOWN ARE BASED ON NAVD 88.
3. LB - INDICATES CONCRETE LINK BEAM. WIDTH OF LINK BEAM TO MATCH WALL THICKNESS.
4. EG - INDICATES HSS6x4x 4 ELEVATOR GUIDE RAIL SUPPORT BEAM.
5. BM-X - INDICATES CONCRETE FLOOR BEAM.
6. SEE S-500 SERIES DRAWINGS FOR CONCRETE SECTIONS AND DETAILS.
7. SEE S-700 SERIES FOR TYPICAL MASONRY DETAILS.
8. ALL OPENING DIMENSIONS SHOWN AS NORTH-SOUTH, EAST-WEST.
9. ADDITIONAL CONCRETE BEAMS MAY BE REQUIRED TO FRAME THE SLAB OPENINGS

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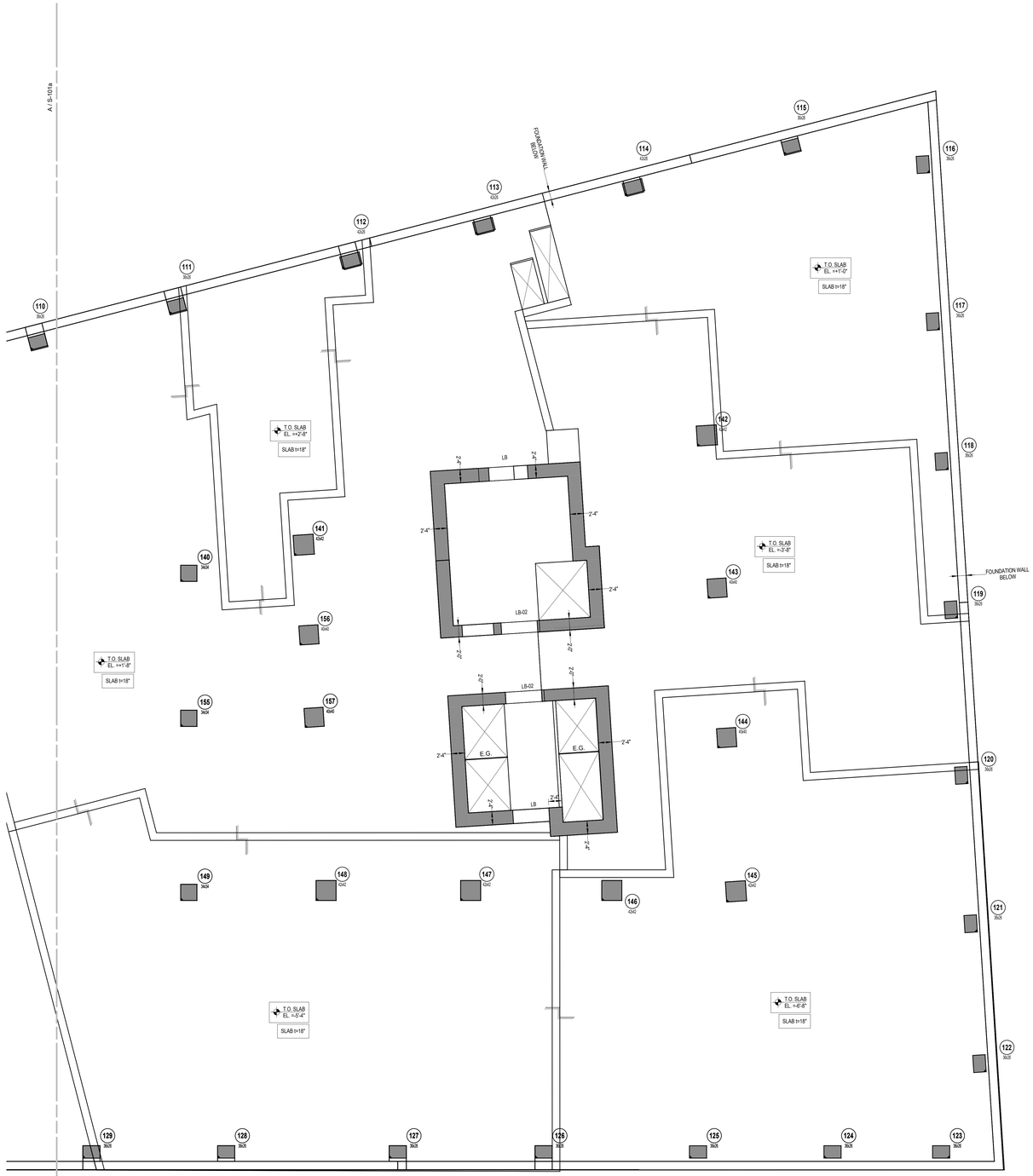

GROUND FLOOR LAYOUT PLAN - PART B

SCALE: 1/8" = 1'-0"

TOP OF SLAB ELEVATION U.O.N.:	SEE PLAN
SLAB THICKNESS U.O.N.:	AS SHOWN
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DRAWING NUMBER

S-101b

B-SCAN - DRAWING NUMBER

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APPENDIX C

REMEDIAL INVESTIGATION REPORT

APPENDIX D

CONSTRUCTION HEALTH AND SAFETY PLAN

CONSTRUCTION HEALTH AND SAFETY PLAN

for

250 WATER STREET
NEW YORK, NEW YORK
NYC Tax Block 98, Lot 1
NYSDEC BCP Site No. C231127

Prepared For:

The Howard Hughes Corporation
199 Water Street, 28th Floor
New York, New York

Prepared By:

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LANGAN

May 14, 2021
Langan Project No. 170381202

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1.0 INTRODUCTION

1.1 General

This Construction Health and Safety Plan (CHASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b)(4), *Hazardous Waste Operations and Emergency Response* during anticipated site work at 250 Water Street adjacent to the South Street Seaport Historic District in New York, New York (the "Site"). The Site is identified on the Manhattan Borough Tax Map as Block 98, Lot 1. This CHASP provides the minimum requirements for implementing site operations during future remedial measure activities. All contractors performing work on this site shall implement their own CHASP that, at a minimum, adheres to this CHASP. The contractor is responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this CHASP while onsite.

The management of the day-to-day site activities and implementation of this CHASP in the field is the responsibility of the site Langan Field Team Leader (FTL). Assistance in the implementation of this CHASP can also be obtained from the site Langan Health and Safety Officer (HSO) and the Langan Health and Safety Manager (HSM). Contractors operating on the site shall designate their own FTL, HSO and HSM. The content of this CHASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the work plan.

1.2 Site Location and Background

The site is approximately 48,057 square feet (1.10 acres) in area and is located at 250 Water Street in the South Street Seaport neighborhood of New York, New York (Block 98, Lot 1 on the Borough of Manhattan tax map). The site occupies the entire city block bordered by Pearl Street to the northwest (project north), Peck Slip to the northeast (project east), Water Street to the southeast (project south), and Beekman Street to the southwest (project west). It is used as an open-air, asphalt-covered commercial parking lot; a parking attendant kiosk and temporary storage shed are located near the center of the lot. The perimeter of the site is fenced with one automated barrier ingress/egress gate on Pearl Street. A site location map is provided as Figure 1.

The "project north" is perpendicular to Water Street and points towards Pearl Street. All directions described herein are referenced to the project north arrow unless otherwise noted.

According to the New York City Zoning Map 12b, the site is located in a C6-2A commercial

district. The C6-2A district is mapped within the South Street Seaport Subdistrict of the Special Lower Manhattan District. C6 districts allow for a wide range of mixed residential and commercial uses. According to the New York City Landmarks Preservation Commission, the site is located in the South Street Seaport Historic District.

Historical uses of the site include a factory (cast-iron stoves, boilers, radiators, and other unknown uses), an oil company, a printer, a metal works, a chemicals and glue company, a chemical company, thermometer factories/workshops, a garage with two 550-gallon underground storage tanks (USTs), a machine shop, and a gasoline service station.

1.3 Summary of Work Tasks

1.3.1 Excavation Observation and Screening

As part of the excavation activities, Langan personnel will observe soil excavation per the work plan. If encountered, debris from the demolition of a concrete slab may be segregated for separate disposal. Langan will report the location of the concrete debris stockpile and note if the contractor has complied with the concrete debris stockpile instructions when specified in the work plan.

Langan will screen excavated material for visual, olfactory, and instrumental indicators suggestive of a potential chemical or petroleum release. Instrument screening for the presence of Volatile Organic Compounds (VOCs) may be performed with a duly field-calibrated Photoionization Detector (PID) and/or Jerome J405 Mercury Vapor Analyzer. Contractors will excavate for utilities, foundation components and potential grading using heavy equipment and hand tools in such a manner as to avoid negatively impacting buried utilities or foundation components. Contractors will notify Langan personnel if they identify indications suggestive of a potential chemical or petroleum release.

Langan will coordinate trucking in cooperation with the soil disposal contractors. Langan will only sign non-hazardous manifests if instructed by the Project Manager (PM) and provide the specific language. Langan is not to sign hazardous waste manifests unless specifically instructed by the PM to do so. Langan will record the information associated with each manifest as specified in the work plan. Contaminated material shall be handled and property disposed in accordance with federal, state and city regulations, criteria and guidelines. If excavation occurs over several days, Langan will confirm that the contractor has placed a barrier around the excavation and stockpile to prevent 3rd party injury.

1.3.2 Soil Screening & Reporting

As part of excavation activities, the Langan personnel will report when they have observed visual

and olfactory indications of possible soil impact. Langan personnel will also report concentrations of VOCs above background when using a duly calibrated hand held PID (or equivalent) or mercury vapor above background when using a duly calibrated hand held Jerome J405 Mercury Vapor Analyzer (or equivalent).

1.3.3 Soil Sampling

As part of the excavation activities, soil samples (waste characterization, excavation endpoint, delineation, or quality assurance/quality control [QA/QC]) may be collected during construction, as required. Langan personnel will coordinate with the contractor in sampling soil (in accordance with the work plan, where applicable).

Soil samples excavation endpoint or delineation sampling (along with QA/QC samples) may be collected and subsequently submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory and analyzed in accordance with work plan specifications.

1.3.4 Characterization of Excavated Material

When required by the work plan, Langan personnel will characterize excavated soil or clean backfill in accordance with Langan standards.

1.3.5 Stockpiling

Visibly contaminated soil, if encountered, shall be segregated and stockpiled on at least 8 millimeters of plastic sheeting; reusable soil and fill shall be segregated and stockpiled separately from unusable fill, concrete and other debris; the stockpiles shall be kept covered with 8 millimeters thick plastic sheeting; the plastic sheeting covering the stockpiles shall be anchored firmly in place by weights, stakes, or both; the Contractor shall maintain the plastic sheeting.

1.3.6 Geophysical Investigation

Langan will conduct further intrusive field activities (i.e., soil borings). If required, Langan will retain a geophysical consultant to conduct a geophysical survey using ground penetrating radar (GPR) and electromagnetic detection equipment. Langan personnel will coordinate the geophysical survey. The objective of the survey will be to identify any underground storage tank (UST) structures, drains, underground utilities, and other subsurface anomalies that may be encountered during the investigation. During this time Langan personnel will inspect the site and confirm sample locations.

1.3.7 Hand Clearing of Borehole Locations

If there is no geophysical survey for utility clearance or the results of the geophysical survey are inconclusive at specific locations subject to intrusive work, Langan will instruct the drilling contractor to hand clear each location to confirm utilities or other known or suspected subsurface structures. Hand clearing of a soil boring location should extend to a depth of 5-feet and be about 1.5 times the anticipated diameter of the borehole when drilled. Langan personnel will confirm that hand clearing activities are completed to these specifications.

1.3.8 Groundwater Investigation and Sampling

Langan will collect additional groundwater data as part of the remedial program. Langan may contract a drilling contractor to install temporary or permanent monitoring wells or use existing monitoring wells to sample groundwater at the site. If used, the drilling contractor will contact the appropriate utility mark-out authority and make available to their drilling staff the verification number and effective dates. Langan will record the verification number and effective dates from the drillers. Langan will also note the location of marked out utilities on the site plan and scan the data into the project folder.

Groundwater samples will be collected from one or more of the new and if available, pre-existing monitoring wells in accordance with the Langan Low Flow Groundwater Sampling SOP (SOP #12). Groundwater samples will be submitted to an approved laboratory and analyzed for constituents as specified in the work plan. Temporary monitoring wells will be plugged and abandoned during the investigation in the manner. Permanent monitoring wells will be completed with a road box set in concrete. Permanent monitoring wells may be eventually backfilled and abandoned in accordance with State and Local regulations.

Groundwater samples will be submitted to a NYSDOH ELAP-certified laboratory in accordance with work plan specifications.

1.3.9 Construction Dewatering

The dewatering contractor shall be responsible for handling contaminated dewatering fluids in accordance with federal, state and local regulations. Dewatering fluids are to be discharged to the local sanitary sewer system after treatment and under approved regulatory permit. Alternatively, the contractor may provide containerized storage to allow for testing of groundwater prior to, and after, treatment and before disposal. If required, Langan field personnel may sample dewatering treatment system liquids from either a discharge standpipe or a storage tank. Dewatering samples will be submitted to an NYSDEP ELAP-certified laboratory for analysis.

1.3.10 Excavation Backfill

Areas of the site that were over-excavated may be backfilled to development grade (i.e., the grade required to complete construction of the foundation and sidewalk extension). Imported material should meet specifications defined in the work plan. Langan will observe and record trucks importing fill material and, when required by the work plan, collect appropriate samples for possible submission for analysis.

1.3.11 Decommissioning and Removal of Above Ground and Underground Storage Tanks

Langan will retain an underground storage tanks (USTs) decommissioning and removal contractor to furnish all labor and materials, equipment and incidentals required for the proper decontamination, removal and closure of any UST in accordance with federal, state and local regulations. The removal contractor will contact the appropriate utility mark-out authority and make available to their staff the verification number and effective dates. Langan personnel will monitor air with a calibrated PID and lower explosion limit (LEL) device downwind from the UST excavation and record the PID and LEL readings.

1.3.12 Installation of Waterproofing and Vapor Barrier

As specified in the work plan, Langan will observe a properly licensed contractor while installing the waterproofing membrane and vapor barrier system as specified in the work plan. Langan or other authorized personnel, as specified in the contract documents, will inspect the waterproofing and vapor barrier installation and record the work plan specified information as required.

1.3.13 Construction Activity Inspections and Observations

Langan will observe construction activities including the general oversight, observation of landscaping activities, and other select observation project management and supervision as specified in the work plan or in accordance with the construction documents, or special inspection requirements administered by the New York City Department of Buildings. Materials used for construction will be inspected by Langan for conformance to the design documents.

1.3.14 Equipment Decontamination

If samples are collected, then before the start of the day's sampling and after sampling each run, sampling equipment will be decontaminated by the decontamination process outlined Attachment B - Decontamination Procedures. Decontamination wastes and purge water will be temporarily stored on site pending analytical results.

1.3.15 Management of Investigative-Derived Waste

The investigative-derived waste (IDW) generated during this investigation may be stockpiled as defined under the stockpile section (above) or contained in DOT-approved 55-gallon drums. The drums will be temporarily stored on the site or as directed by the client representative. All drums will be filled between to two-thirds full to allow easy maneuvering during drum pickup and disposal. Drum labels are to be provided by Langan (Environmental Closet). All drums will be labeled as "IDW Pending Analysis" until sample data are reported from the laboratory. Drum labels will include date filled and locations where waste was generated along with the standard information required by the labels in accordance with the Langan SOP09, Drum Labeling.

Closed top drums are to be used to store liquids. Debris, including plastic sheeting, polyethylene tubing, personal protection equipment (PPE), decontamination debris, etc. will be segregated from and disposed in large heavy duty garbage bags and disposed of at the site. Excess unused glassware should be returned to the lab along with the last day of collection samples.

1.3.16 Drum Sampling

Excess or impacted soil and water that is drummed during the remedial action activities must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan personnel will collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

1.3.17 Surveying

If specified in the work plan, surveying activities may be completed by Langan. Surveying will be conducted by licensed surveyors.

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

The following briefly describes the health and safety (H&S) designations and general responsibilities that may be employed for this site. The titles have been established to accommodate the project needs and requirements and ensure the safe conduct of site activities. The H&S personnel requirements for a given work location are based upon the proposed site activities.

2.1 Langan Project Manager

The Langan Environmental PM is Paul McMahon, his responsibilities include:

- Ensuring that this CHASP is developed, current, and approved prior to on-site activities.
- Ensuring that all the tasks in the project are performed in a manner consistent with Langan's comprehensive *Health and Safety Program for Hazardous Waste Operations* and this CHASP.

2.2 Langan Corporate Health and Safety Manager

The Langan Corporate Health and Safety Manager (HSM) is Tony Moffa. His responsibilities include:

- Updating the *Construction Health and Safety Program for Hazardous Waste Operations*.
- Assisting the site Health and Safety Officer (HSO) with development of the HASP, updating CHASP as dictated by changing conditions, jobsite inspection results, etc. and approving changes to this CHASP.
- Assisting the HSO in the implementation of this CHASP and conducting Jobsite Safety Inspections and assisting with communication of results and correction of shortcomings found.
- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

2.3 Langan Site Health & Safety Officer

The Langan HSO is William Bohrer. His responsibilities include:

- Participating in the development and implementation of this CHASP.
- When on-site, assisting the Langan Field Team Leader in conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- Ensuring that proper PPE is available, worn by employees, and properly stored and maintained.
- Controlling entry into and exit from the site contaminated areas or zones.
- Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
- Monitoring site hazards and conditions.
- Knowing (and ensuring that all site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Resolving conflicts that may arise concerning safety requirements and working conditions.
- Reporting all incidents, injuries and near misses to the Langan Incident/Injury Hotline

immediately and the client representative.

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is to be determined. The FTL's responsibilities include:

- The management of the day-to-day site activities and implementation of this CHASP in the field.
- Participating in and/or conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- When a Community Air Monitoring Operating Program (CAMP) is part of the scope, the FTL will set up and maintaining community air monitoring activities and instructing the responsible contractor to implement organic vapor or dust mitigation when necessary.
- Overseeing the implementation of activities specified in the work plan.

2.5 Contractor Responsibilities

The contractor, if one is utilized, shall develop and implement their own CHASP for their employees, lower-tier subcontractors, and consultants. The contractor is responsible for their own health and safety and that of their subcontractors. Contractors operating on the site shall designate their own FTL, HSO and HSM. The contractor's CHASP will be at least as stringent as this Langan CHASP. The contractor must be familiar with and abide by the requirements outlined in their own CHASP. A contractor may elect to adopt Langan's CHASP as its own provided that it has given written notification to Langan, but where Langan's CHASP excludes provisions pertinent to the contractor's work (i.e., confined space entry); the contractor must provide written addendums to this CHASP. Additionally, the contractor must:

- Ensure their employees are trained in the use of all appropriate PPE for the tasks involved;
- Notify Langan of any hazardous material brought onto the job site or site related area, the hazards associated with the material, and must provide a material safety data sheet (MSDS) or safety data sheet (SDS) for the material;
- Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertinent to the work;
- Ensure their employees handling hazardous materials, if identified at the site, have received current training in the appropriate levels of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER) if hazardous waste is identified at the Site;
- Ensure their employees handling hazardous materials, if identified at the Site, have been fit-tested within the year on the type of respirator they will wear; and
- Ensure all air monitoring is in place pertaining to the health and safety of their employees

as required by OSHA 1910.120; and

- All contractors must adherer to all federal, state, and local regulatory requirements.

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES

A Task-Hazard Analysis (Table 1) was completed for general construction hazards that may be encountered at the site. The potential contaminants that might be encountered during the field activities and the exposure limits are listed in Table 2. Complete inventory of MSDS/SDS for chemical products used on site is included as Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Excavation and Soil Screening

Langan personnel will observe excavation and SOE activities including the general oversight, observation of landscaping activities, and other select observation project management and supervision as specified in the work plan or in accordance with the construction documents, or special inspection requirements administered by the New York City Department of Buildings. Materials used for construction may be inspected by Langan personnel for conformance to the design documents. Prior to entering excavation, Langan personnel will insure that excavation shoring conforms to proper shoring/benching/sloping techniques, at a minimum that soil and equipment is kept at least 2 feet from the edge of the excavation, that there is no water in the excavation, and that a competent person has inspected excavation prior to allow persons to enter. When entering excavation via a ladder, Langan personnel will only use ladders that are properly situated in accordance with the ladder section of the CHASP.

Sampling the soil requires the donning of chemical resistant gloves in addition to the standard PPE. Langan personnel are not to operate nor direct the use of excavation equipment. These tasks are to be completed by the excavation contractor.

3.1.2 Stockpile Sampling

Langan personnel are not to scale or otherwise climb stockpiles. If the soil sampling plan requires sampling from the stockpile above ground level, samples are to be obtained using suitable excavation equipment operated by the contractor (i.e. front end loader).

3.1.3 Geophysical Survey

Langan personnel are not permitted to operate or otherwise handle the geophysical equipment including any downhole geophysical equipment subsequently used to survey boreholes. When

boring locations are surveyed with surface geophysical equipment, the locations of the borings as well as possible utilities and other artifacts that may interfere with the subsurface investigation are to be marked with indelible paint, flags, or color tape (when marking indoor locations that the client has specifically requested not be marked with indelible paint). This information must also be added to the site map. When applying paint, proper PPE including at a minimum hand protections should be used.

3.1.4 Hand Clearing of Borehole Locations

Hand clearing will be completed by the contractor. Langan personnel are not permitted to operate or otherwise handle the contractor equipment. Langan will update the site map to include the locations of the cleared borehole locations as well as possible utilities and other artifacts that may interfere with the subsurface investigation.

3.1.5 Groundwater Investigation and Sampling

Sampling groundwater requires the donning of chemical resistant gloves in addition to the standard PPE and cut resistant gloves when cutting sampling-tubing to length. Langan personnel are not to operate drilling equipment nor assemble or install monitoring well equipment. These tasks are to be completed by the driller contractor.

3.1.6 Construction Activity Inspection

The contractor will operate equipment used during site construction. Langan personnel will observe construction activities in accordance with specification in the work plan and record the data the work plan requires. Construction activities are to be done exclusively by the contractor following their own health and safety specifications outlined in their HASPs. Langan personnel are not to operate or assist in the operation of equipment used in construction activities unless defined as part of an inspection or observation in the work plan.

3.1.7 Construction Dewatering

The contractor shall be responsible for handling all contaminated groundwater removed from the site in accordance with federal, state and local regulations; including any sampling, treatment and disposal. Dewatering discharge is likely to require treatment and in accordance with a NYSDEC SPDES permit. Alternatively, the contractor may provide sufficient containerized storage to allow for testing of groundwater prior to and after treatment and before disposal.

If required, Langan may sample dewatering treatment system liquids from either a discharge standpipe or a storage tank. Prior to collecting the samples, Langan will don the necessary PPE including nitrile gloves and if necessary, facial splash guard. Samples may be collected from either the direct discharge standpipe or from a sample port or valve built into the storage tank.

Sample ports and valves may only be sampled if they are accessible at ground level. Sampling from heights over 6 feet is prohibited unless Langan field personnel are fully accredited in fall protection and are wearing approved fall protection safety apparatus.

3.1.8 Removal of UST

If UST excavation and removal activity is initiated, Langan personnel will conduct air monitoring for lower explosion limit (LEL) conditions within the UST excavation itself. This task is to be performed using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation. Langan personnel are not to enter the UST excavation nor enter an excavated UST.

In addition to monitoring LEL, Langan personnel will monitor atmospheric VOC concentrations directly downwind of the UST excavation in accordance with standard CAMP procedures using calibrated air monitoring equipment.

3.1.9 Backfilling of Excavated Areas to Development Grade

The backfilling contractor will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards. Langan personnel may survey backfilling material with a calibrated PID; however, as they are not permitted to climb the material delivery truck, the contractor must provide samples from each truck as required.

3.1.10 Installation of Waterproofing and Vapor Barrier

Specifically trained contractors are to install waterproofing and vapor barrier. Langan personnel are there only to observe and record the data required in the work plan. Installation and assemblage of the waterproofing and vapor barrier is to be done exclusively by the contractor following their own health and safety specific CHASP.

3.1.11 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soil samples and cuttings may be containerized in 55-gallon drums for transport and disposal off site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan may collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

Langan personnel and contractors are not to move or open any orphaned (unlabeled) drum found on the site without approval of the project manager.

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

Physical hazards, which may be encountered during site operations for this project, are detailed in Table 1.

3.3.1 Explosion

No explosion hazards are expected for the scope of work at this site.

3.3.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72°F or above. Table 6 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to the Table 7 to assist in assessing when the risk for heat related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the HSO or the FTL, who shall be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:

- **Heat Cramps:** Painful spasm of arm, leg or abdominal muscles, during or after work
- **Heat Exhaustion:** Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature
- **Heat Stroke**: Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid

deep respirations, loss of consciousness, convulsions, coma. *This is a life threatening condition***.**

Do not permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

- **Heart rate:** Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100 beats per minute.
- **Oral temperature:** Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6°F. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

Prevention of Heat Stress - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, id., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature 50° to 60°F (10° to 16.6°C).
- Provide small disposal cups that hold about four ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat related illness.

3.3.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

- **Hypothermia -** Hypothermia is defined as a decrease in the patient core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.
- **Frostbite -** Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness - To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors.
- Assure the availability of enclosed, heated environment on or adjacent to the site.
- Assure the availability of dry changes of clothing.
- Assure the availability of warm drinks.
- Start (oral) temperature recording at the job site.
- At the FSO or Field Team Leader's discretion when suspicion is based on changes in a worker's performance or mental status.
- At a worker's request.
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
- As a screening measure whenever a worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

3.3.4 Noise

Work activities during the proposed activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used as necessary.

3.3.5 Hand and Power Tools

The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. All hand and power tools should be inspected for health and safety hazards prior to use. If deemed unserviceable/un-operable, notify supervisor and tag equipment out of service. Ground Fault Circuit Interrupters (GFCI) are required for all power tools requiring direct electrical service.

3.3.6 Slips, Trips and Fall Hazards

Care should be exercised when walking at the site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the site, with hazards communicated to all workers in the area.

3.3.7 Utilities (Electrocution and Fire Hazards)

3.3.7.1 Utility Clearance

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All excavation work will be preceded by review of available utility drawings and by notification of the subsurface work to the N.Y. One–Call-Center.

3.3.7.2 Lockout-Tagout

The potential adverse effects of electrical hazards include burns and electrocution, which could result in death. Therefore, there is a procedure that establishes the requirements for the lockout/tagout (LOTO) of energy isolating devices in accordance with the OSHA electrical lockout and tagging requirements as specified in 29 CFR 1926.417. This procedure will be used to ensure that all machines and equipment are isolated from potentially hazardous energy. If possible, equipment that could cause injury due to unexpected energizing, start-up, or release of stored energy will be locked/tagged before field personnel perform work activities.

Depending upon the specific work task involved, Langan's SSC or FTL will serve as the authorized lockout/tagout coordinator, implement the lockout/tagout procedure and will be responsible to locate, lock and tag valves, switches, etc.

SPECIAL NOTE: Project personnel will assume that all electrical equipment at surface, subsurface and overhead locations is energized, until equipment has been designated and confirmed as de-energized by a utility company representative. Langan will notify the designated utility representative prior to working adjacent to this equipment and will verify that the equipment is energized or de-energized in the vicinity of the work location.

No project work shall be performed by Langan personnel or subcontractors on or near energized electrical lines or equipment unless hazard assessments are completed in writing, reviewed by Langan's SSHO, and clearly communicated to the field personnel.

The FTL shall conduct a survey to locate and identify all energy isolating devices. They shall be certain which switches, valves or other isolating devices apply to the equipment. The lockout/tagout procedure involves, but is not limited to, electricity, motors, steam, natural gas, compressed air, hydraulic systems, digesters, sewers, etc.

3.3.8 Physical Hazard Considerations for Material Handling

There are moderate to severe risks associated with moving heavy objects at the site. The following physical hazards should be considered when handling materials at the site:

- Heavy objects will be lifted and moved by mechanical devices rather than manual effort whenever possible.
- The mechanical devices will be appropriate for the lifting or moving task and will be operated only by trained and authorized personnel.
- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects.
- Lifting devices will be inspected, certified, and labeled to confirm their weight capacities. Defective equipment will be taken out of service immediately and repaired or destroyed.
- The wheels of any trucks being loaded or unloaded will be chocked to prevent movement. Outriggers will be fully extended on a flat, firm surface during operation.
- Personnel will not pass under a raised load, nor will a suspended load be left unattended.
- Personnel will not be carried on lifting equipment, unless it is specifically designed to carry passengers.
- All reciprocating, rotating, or other moving parts will be guarded at all times.

- Accessible fire extinguishers, currently (monthly) inspected, will be available in all mechanical lifting devices.
- Verify all loads/materials are secure before transportation.

Material handling tasks that are unusual or require specific guidance will need a written addendum to this CHASP. The addendum must identify the lifting protocols before the tasks are performed. Upon approval, the plan must be reviewed with all affected employees and documented. Any deviation from a written plan will require approval by the Langan HSM.

3.3.9 Hearing Conservation

Under the construction industry standard, the maximum permissible occupational noise exposure is 90 dbA (8-hour TWA), and noise levels in excess of 90 dbA must be reduced through feasible administrative and engineering controls (20 CFR 1926.52). Hearing protection is required when working within 15 feet of vacuum extraction equipment and drill rigs.

3.4 Biological Hazards

3.4.1 Animals

There is a possibility of encountering wildlife including reptiles, rodents and other small and medium size mammals. The Langan personnel is to avoid interacting with any wildlife.

3.4.2 Insects

Ticks and other biting or stinging insects may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and insecticide to prevent bites and stings. After field work, Langan personnel should perform a complete visual inspection of their clothing to insure they are not inadvertently harboring ticks. If they do observe a tick bite, they are to contact the HSM or HSO and report the event.

3.4.3 Plants

Poisonous plants may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and applying preventative poison Ivy/Sumac lotion to prevent or limit effects of exposure. If after field work, Langan employees do observe a reaction to poisonous plant exposure, they are to contact the HSM or HSO and report the event.

3.4.4 Coronavirus

3.4.4.1 General Preventative Measures

Field personnel must follow general proper hygiene measures while in the field including:

- Avoid touching eyes, nose and mouth.
- Cover cough or sneeze with tissue, and throw in trash.
- Wash hands often with soap and water for 20 seconds after going to bathroom, before eating, after blowing nose, coughing or sneezing.
- Use hand sanitizer with at least 60% alcohol if soap and water are not available.
- Avoid physical contact with other people (e.g., no handshakes).
- Maintain a safe distance of at least 6 feet from other people (social distancing).
- Wear face coverings when around other worker to minimize spread of COVID-19 (may be required in certain states or locations).

3.4.4.2 Construction Trailers

Employees should avoid use of shared construction trailers or where employees cannot maintain a safe distance (minimum 6 feet) from other workers. If trailer use is needed, areas such as desks, phones, chairs and other common areas, should be cleaned and disinfected before and after use. Protocols should be developed to minimize trailer use to essential personal, restrict use from any workers who are ill or showing symptoms of being ill, and ensure a safe distance of 6 feet can be established between workers.

3.4.4.3 Communication

Include Coronavirus topics and prevention topics in daily tailgate meetings to ensure Coronavirus awareness is communicated daily. Discussions can focus on general topics including: social distancing, prevention measures for field personnel, signs and symptoms and recent news on the Coronavirus. Site-specific topics should include minimizing face-to-face contact, disinfecting/sterilizing field equipment, use of PPE to reduce exposure, site security and other potential exposure issues/concerns.

3.4.4.4 Sick/Ill Workers

No Langan employee is permitted to be on-site when ill and/or showing potential symptoms of the Coronavirus. Symptoms of the Coronavirus may appear 2-14 days after exposure and can range from mild to severe. The most common symptoms include: fever, fatigue, dry cough and shortness of breath. If an employee or subcontractor is observed being ill or exhibiting symptoms

of Coronavirus, employees must immediately utilize their Stop Work Authority and contact their project manager to address the situation. If an employee observes another worker onsite exhibiting symptoms of Coronavirus, immediately utilize Stop Work Authority and notify their project manager and site construction manager or safety officer. Work should resume when the safety and health of Langan and subcontractors is adequately addressed.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

There is potential for exposure to NAPL at this site. Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or ground water from wells containing NAPL) must be intrinsically safe. Equipment that directly contacts NAPL must also be resistant to organic solvents.

At a minimum, a PID should be used to monitor for VOCs when NAPL is observed. If NAPL is expected to be observed in an excavation or enclosed area, air monitoring must be started using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation.

When NAPL is present, Langan personnel are required to use disposable nitrile gloves at all times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

All contaminated disposables including PPE and sampling equipment must be properly disposed of in labeled 55-gallong drums.

3.6 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled or minimized. A JSA will be

performed at the beginning of each work day, and additionally whenever an employee begins a new task or moves to a new location. All JSAs must be developed and reviewed by all parties involved. A blank JSA form and documentation of completed JSAs are in Attachment G.

4.0 PERSONNEL TRAINING

4.1 Basic Training

Completion of an initial 40-hour HAZWOPER training program as detailed in OSHA's 29 CFR 1910.120(e) is required for all employees working on a site engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances, health hazards, or safety hazards as defined by 29 CFR 1910.120(a). Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, all employees must complete the OSHA 10 hour Construction Safety and Health training and supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

4.2 Initial Site-Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail all the provisions contained within this CHASP. For a HAZWOPER operation, training on the site must be for a minimum of 3 days. Specific issues that will be addressed include the hazards described in Section 3.0.

4.3 Tailgate Safety Briefings

Before starting work each day or as needed, the Langan HSO will conduct a brief tailgate safety meeting to assist site personnel in conducting their activities safely. Tailgate meetings will be documented in Attachment H. Briefings will include the following:

- Work plan for the day;
- Review of safety information relevant to planned tasks and environmental conditions;
- New activities/task being conducted;
- Results of Jobsite Safety Inspection Checklist;
- Changes in work practices;
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.

5.0 MEDICAL SURVEILLANCE

All personnel who will be performing field work involving potential exposure to toxic and hazardous substances (defined by 29 CFR 1910.120(a)) will be required to have passed an initial baseline medical examination, with follow-up medical exams thereafter, consistent with 29 CFR 1910.120(f). Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine.

Additionally, personnel who may be required to perform work while wearing a respirator must receive medical clearance as required under CFR 1910.134(e), *Respiratory Protection*. Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Results of medical evaluations are maintained by the HSM.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Levels of Protection

Langan will provide PPE to Langan employees to protect them from the specific hazards they are likely to encounter on-site. Direct hired contractors will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Based on anticipated site conditions and the proposed work activities to be performed at the site, Level D protection will be used. The upgrading/downgrading of the level of protection will be based on continuous air monitoring results as described in Section 6.0 (when applicable). The decision to modify standard PPE will be made by the site HSO or FTL after conferring with the PM. The levels of protection are described below.

Level D Protection (as needed)

- Safety glasses with side shields or chemical splash goggles
- Safety boots/shoes
- Coveralls (Tyvek® or equivalent)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection
- Reflective safety vest

Level D Protection (Modified, as needed)

- Safety glasses with sideshields or chemical splash goggles
- Safety boots/shoes (toe-protected)
- Disposable chemical-resistant boot covers
- Coveralls (polycoated Tyvek or equivalent to be worn when contact with wet contaminated soil, groundwater, or non-aqueous phase liquids is anticipated)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection (as needed)
- Personal floatation device (for work within 5 feet of the water)
- Reflective traffic vest

Level C Protection (as needed)

- Full or Half face, air-purifying respirator, with NIOSH approved HEPA filter
- Inner (latex) and outer (nitrile) chemical-resistant gloves
- Safety glasses with side shields or chemical splash goggles
- Chemical-resistant safety boots/shoes
- Hard hat
- Long sleeve work shirt and work pants
- Coveralls (Tyvek® or equivalent)
- Hearing protection (as needed)
- Reflective safety vest

The action levels used in determining the necessary levels of respiratory protection and upgrading to Level C are summarized in Table 4. The written Respiratory Protection Program is maintained by the HSM and is available if needed. The monitoring procedures and equipment are outlined in Section 6.0 (when applicable).

6.2 Respirator Fit-Test

All Langan employees who may be exposed to hazardous substances at the work site are in possession of a full- or half-face, air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

6.3 Respirator Cartridge Change-Out Schedule

Respiratory protection is required to be worn when certain action levels (Table 2) are reached. A

respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

- Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first.
- If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short the time period was the previous day they were used.

7.0 AIR QUALITY MONITORING AND ACTION LEVELS

7.1 Monitoring During Site Operations

Atmospheric air monitoring results will be collected and used to provide data to determine when exclusion zones need to be established and when certain levels of personal protective equipment are required. For all instruments there are site-specific action level criteria which are used in making field health and safety determinations. Other data, such as the visible presence of contamination or the steady state nature of air contaminant concentration, are also used in making field health and safety decisions. Therefore, the HSO may establish an exclusion zone or require a person to wear a respirator even though atmospheric air contaminant concentrations are below established CHASP action levels.

During site work involving disturbance of petroleum-impacted or fill material, real time air monitoring will be conducted for volatile organic compounds (VOCs). A photoionization detector (PID) and/or flame ionization detector (FID) will be used to monitor concentrations of VOCs at personnel breathing-zone height. A Jerome® J405 (or equivalent) will be used to monitor mercury vapor during the mercury-impacted soil hot spot removal. Air monitoring will be the responsibility of the HSO or designee. Air monitoring will be conducted during intrusive activities associated with the completion of excavation, debris removal, and soil grading. All manufacturers' instructions for instrumentation and calibration will be available onsite.

Subcontractors' air monitoring plans must be equal or more stringent as the Langan plan.

An air monitoring calibration log is provided in Attachment D of this CHASP.

7.1.1 Volatile Organic Compounds

Monitoring with a PID, such as a MiniRAE 2000 (10.6v) or equivalent will occur during intrusive work at the site. Colormetric Indicator Tubes for benzene may be used as backup for the PID, if measurements remain above background monitor every 2 hours. A work zone air monitoring station will continuously monitor the workers breathing zone and CAMP stations will continuously monitor the site perimeter. Instrument action levels for monitored gases are provided in Table 4.

7.1.2 PAHs and Metals

Based upon the previous site investigation, there soils contain PAHs and metals. During the ground-intrusive procedures which have the potential for creating airborne dust, a real-time airborne dust monitor such as a DustTrak will be used to continuously monitor for air particulates at the work zone and site perimeter. Instrument action levels for dust monitoring are provided in Table 4.

7.1.3 Mercury Vapor

Monitoring with a mercury vapor analyzer, such as a Jerome J405 or equivalent will occur during intrusive work at the site until the mercury-impacted soil hot spot is removed. The work zone will monitor by a handheld mercury vapor analyzer and CAMP stations will continuously monitor the site perimeter. Instrument action levels for monitored gases are provided in Table 4.

7.2 Monitoring Equipment Calibration and Maintenance

Instrument calibration shall be documented and included in a dedicated safety and health logbook or on separate calibration pages of the field book. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

All instruments shall be operated in accordance with the manufacturers' specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on site by the HSO for reference.

7.3 Determination of Background Levels

Background (BKD) levels for VOCs, mercury vapor, and dust will be established prior to intrusive activities during the background monitoring events. A notation of BKD levels will be referenced

in the daily monitoring log. BKD levels are a function of prevailing conditions. BKD levels will be taken in an appropriate upwind location as determined by the HSO.

Table 4 lists the instrument action levels.

8.0 COMMUNITY AIR MONITORING PROGRAM

Community air monitoring will be conducted in compliance with local standards or the NYSDOH generic CAMP outlined below:

Continuous monitoring at the perimeter of the site will be performed during ground-intrusive activities such as investigation and excavation. The CAMP will include perimeter CAMP stations, one weather station, and one handheld mercury vapor analyzer. CAMP stations will monitor for VOCs with a PID, for mercury vapor with a Jerome® J405, and dust emissions with equipment using real-time monitoring capable of measuring PM-10 (e.g., DustTrak). The day-to-day location of CAMP stations will be fluid and dynamic based on wind direction and work zone location and will take into account the location of sensitive receptors and ground level air-intakes. The weather and perimeter air monitoring stations will utilize a wireless telemetry system to monitor real-time wind direction, temperature, concentrations.

A portable PID will be used to monitor the work zone and for monitoring for VOCs during activities such as soil and groundwater sampling. A portable mercury vapor analyzer (Jerome® J505 or equivalent) will be used to capture instantaneous mercury vapor concentrations around the site and downwind from the work zone. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements. Particulate or dust will be monitored continuously with real-time field instrumentation that will meet, at a minimum, the performance standards from DER-10 Appendix 1B..

CAMP Action Levels

For VOC monitoring, the following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 parts per million (ppm) above background for the 15-minute average at the site perimeter, work activities will be halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background at the site perimeter, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the site persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the work zone or half the distance to the nearest potential receptor

or residential/commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm above background for the 15-minute average.

- If the downwind total VOC level persist above 25 ppm at the perimeter of the site, activities will be shut down.

All 15-minute readings will be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.
For dust monitoring with field instrumentation, the following actions will be taken based on instrumentation measurements:

- If the downwind particulate level is 100 µg/m³ greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work zone, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 µg/m³ above the background level and provided that no visible dust is migrating from the work zone.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m³ above the background level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

For mercury vapor monitoring with field instrumentation, the following actions will be taken based on instrumentation measurements:

- If the downwind mercury vapor level is greater than 1 µg/m³ for the 15-minute period, then work activities will be halted and monitoring continued. The source of the vapors will be identified, and corrective actions will be taken to abate emissions, and monitoring continued. Corrective actions will include covering any exposed stockpiles with polyethylene sheeting, and MERCON will be sprayed onto any exposed soil exhibiting elevated Jerome meter readings. If levels readily decrease (per instantaneous readings) below 1 µg/m³ above background, work activities will resume with continued monitoring.
- If mercury vapor levels within the work zone persist at levels in excess of 10 µg/m³ above background, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the mercury vapor level at the site perimeter, is below 1 µg/m³ above background for the 15-minute average.

8.1 Dust Suppression Techniques

Preventative measures for dust generation may include wetting site fill and soil, construction of

an engineered construction entrance with gravel pad, a truck wash area, covering soils with tarps, and limiting vehicle speeds to five miles per hour.

Work practices to minimize odors and vapors include limiting the time that the excavations remain open, minimizing stockpiling of contaminated-source soil, and minimizing the handling of contaminated material. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: direct load-out of soils to trucks for off-site disposal; use of chemical odorants in spray or misting systems; and, use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

9.0 WORK ZONES AND DECONTAMINATION

9.1 Site Control

Work zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas.

Any person working in an area where the potential for exposure to site contaminants exists will only be allowed access after providing the HSO with proper training and medical documentation.

Exclusion Zone (EZ) - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an EZ. Decontamination of field equipment will also be conducted in the Contaminant Reduction Zone (CRZ) which will be located on the perimeter of the EZ. The EZ and the CRZ will be clearly delineated by cones, tapes or other means. The HSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

9.2 Contamination Zone

9.2.1 Personnel Decontamination Station

Personal hygiene, coupled with diligent decontamination, will significantly reduce the potential for exposure.

9.2.2 Minimization of Contact with Contaminants

During completion of all site activities, personnel should attempt to minimize the chance of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and other physical contact with contamination as PPE is intended to minimize accidental contact. This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control over spray and runoff and to ensure that unprotected personnel working nearby are not affected.

9.2.3 Personnel Decontamination Sequence

Decontamination may be performed by removing all PPE used in EZ and placing it in drums/trash cans at the CRZ. Baby wipes should be available for wiping hands and face. Drums/trash cans will be labeled by the field crews in accordance with all local, state, and federal requirements. Management plans for contaminated PPE, and tools are provided below.

9.2.4 Emergency Decontamination

If circumstances dictate that contaminated clothing cannot be readily removed, then remove gross contamination and wrap injured personnel with clean garments/blankets to avoid contaminating other personnel or transporting equipment. If the injured person can be moved, he/she will be decontaminated by site personnel as described above before emergency responders handle the victim. If the person cannot be moved because of the extent of the injury (a back or neck injury), provisions shall be made to ensure that emergency response personnel will be able to respond to the victim without being exposed to potentially hazardous atmospheric conditions. If the potential for inhalation hazards exist, such as with open excavation, this area will be covered with polyethylene sheeting to eliminate any potential inhalation hazards. All emergency personnel are to be immediately informed of the injured person's condition, potential contaminants, and provided with all pertinent data.

9.2.5 Hand-Held Equipment Decontamination

Hand-held equipment includes all monitoring instruments as stated earlier, samples, hand tools, and notebooks. The hand-held equipment is dropped at the first decontamination station to be decontaminated by one of the decontamination team members. These items must be decontaminated or discarded as waste prior to removal from the CRZ.

To aid in decontamination, monitoring instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants. The instruments will be wiped clean using wipes or paper towels if contamination is visually evident. Sampling equipment, hand tools, etc. will be cleaned with non-phosphorous soap to remove any potentially contaminated soil, and rinsed with deionized water. All decontamination fluids will be containerized and stored on-site pending waste characterization sampling and appropriate off-site disposal.

9.2.6 Heavy Equipment Decontamination

All heavy equipment and vehicles arriving at the work site will be free from contamination from offsite sources. Any vehicles arriving to work that are suspected of being impacted will not be permitted on the work site. Potentially contaminated heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the HSO or his designee.

9.3 Support Zone

The support zone or cold zone will include the remaining areas of the job site. Break areas and support facilities (including equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone (if necessitated). Eating, smoking, and drinking will be allowed only in this area.

9.4 Communications

The following communications equipment will be utilized as appropriate.

- Telephones - A cellular telephone will be located with the HSO for communication with the HSM and emergency support services/facilities.
- Hand Signals - Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

Hand Signal	Meaning
Hand gripping throat	Out of air; cannot breathe
Grip partners wrists or place both hands around waist	Leave immediately without debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm alright; I understand
Thumbs down	No; negative
Simulated "stick" break with fists	Take a break; stop work

9.5 The Buddy System

When working in teams of two or more, workers will use the "buddy system" for all work activities to ensure that rapid assistance can be provided in the event of an emergency. This requires work groups to be organized such that workers can remain close together and maintain visual contact with one another. Workers using the "buddy system" have the following responsibilities:

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his/her partner's PPE.
- Notify the HSO or other site personnel if emergency service is needed.

10.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital are as follows:

New York Presbyterian Hospital
83 Gold Street/170 William Street
New York, New York
212-312-5000

A map with directions to the hospital are shown in Figure 2. This information will either be posted prominently at the site or will be available to all personnel at all times. Further, all field personnel, including the HSO & FTL, will know the directions to the hospital.

11.0 STANDING ORDERS/SAFE WORK PRACTICES

The standing orders, which consist of a description of safe work practices that must always be followed while on-site by Langan employees and contractors, are shown in Attachment A. The site HSO and FTL each have the responsibility for enforcing these practices. The standing orders will be posted prominently at the site, or are made available to all personnel at all times. Those who do not abide by these safe work practices will be removed from the site.

12.0 SITE SECURITY

No unauthorized personnel shall be permitted access to the work areas.

13.0 UNDERGROUND UTILITIES

As provided in Langan's Underground Utility Clearance Guidelines, the following safe work practices should be followed by Langan personnel and the contractor before and during subsurface work in accordance with federal, state and local regulations:

- Obtain available utility drawings from the property owner/client or operator.
- Provide utility drawings to the project team.
- In the field, mark the proposed area of subsurface disturbance (when possible).
- Ensure that the utility clearance system has been notified.
- Ensure that utilities are marked before beginning subsurface work.
- Discuss subsurface work locations with the owner/client and contractors.
- Obtain approval from the owner/client and operators for proposed subsurface work locations.
- Use safe digging procedures when applicable.
- Stay at least 10 feet from all equipment performing subsurface work.

14.0 SITE SAFETY INSPECTION

The Langan HSO or alternate will check the work area daily, at the beginning and end of each work shift or more frequently to ensure safe work conditions. The HSO or alternate must complete the Jobsite Safety Inspection Checklist, found in Attachment F. Any deficiencies shall be shared with the FTL, HSM and PM and will be discussed at the daily tailgate meeting.

15.0 HAND AND POWER TOOLS

All hand- and electric-power tools and similar equipment shall be maintained in a safe operating condition. All electric-power tools must be inspected before initial use. Damaged tools shall be removed immediately from service or repaired. Tools shall be used only for the purpose for which they were designed. All users must be properly trained in their safe operation.

16.0 EMERGENCY RESPONSE

16.1 General

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore,

contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures that are addressed in the following subsections include communications, local emergency support units, and preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. In case of emergency, in addition to 911, call *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

Should outside assistance be needed for accidents, fire, or release of hazardous substances, the emergency numbers will be available and posted at the site (Table 5) where a readily accessible telephone is made available for emergency use.

16.2 Responsibilities

16.2.1 Health and Safety Officer (HSO)

The HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The HSO is responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can notify OSHA within the required time frame.

16.2.2 Emergency Coordinator

The HSO or their designated alternate will serve as the Emergency Coordinator. The Emergency Coordinator is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. They are also responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The Emergency Coordinator is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized.

The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator is responsible for implementing the Emergency Response Plan.

16.2.3 Site Personnel

Project site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency. Project site personnel, including all subcontractors will be trained in the Emergency Response Plan.

16.3 Communications

Once an emergency situation has been stabilized, or as soon as practically, the injured Langan personnel should contact *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

16.4 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during investigative activities at the site, the Emergency Notification Numbers (Table 5) will be posted and provided to all personnel conducting work within the EZ.

Figure 2 shows the hospital route map. Outside emergency number 911 and local ambulance should be relied on for response to medical emergencies and transport to emergency rooms. Always contact first responders when there are serious or life threatening emergencies on the site. Project personnel are instructed not to drive injured personnel to the Hospital. In the event of an injury, provide first aid and keep the injured party calm and protected from the elements and treat for shock when necessary.

16.5 Pre-Emergency Planning

Langan will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this CHASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, immediately report it will be reported to the HSO. First-aid equipment will be available on site at the following locations:

- First Aid Kit: Contractor Vehicles
- Emergency Eye Wash: Contractor Vehicles

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely. Personnel with current first aid and CPR certification will be identified.

Only in non-emergency situations may an injured person be transported to an urgent care facility. Due to hazards that may be present at the site and the conditions under which operations are conducted, it is possible that an emergency situation may develop. Emergency situations can be characterized as injury or acute chemical exposure to personnel, fire or explosion, environmental release, or hazardous weather conditions.

16.8 Emergency Site Evacuation Routes and Procedures

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs as a result of the site investigation activities, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, the Langan Project Manager will be verbally notified immediately. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the nearest intersection to be accounted for and to receive further instructions.

In the event that an emergency situation arises, the FTL will implement an immediate evacuation of all project personnel due to immediate or impending danger. The FTL will also immediately communicate with the contractor to coordinate any needed evacuation of the property.

The FTL or Site Supervisor will give necessary instructions until the Designated Incident Commander (IC) assumes control. After the emergency has been resolved, the FTL or Site Supervisor will coordinate with the IC and indicate when staff should resume their normal duties. If dangers are present for those at the designated assembly point, another designated location of assembly will be established.

It will be the responsibility of the FTL or Site Supervisor to report a fire or emergency, assess the seriousness of the situation, and initiate emergency measures until the arrival of the local fire fighters or other first responders, should they be necessary. The FTL, working with emergency responders, may also order the closure of the Site for an indefinite period as long as it is deemed

necessary.

Under no circumstances will incoming visitors be allowed to proceed to the area of concern, once an emergency evacuation has been implemented. Visitors or other persons present in the area of the emergency shall be instructed to evacuate the area. The FTL will ensure that access roads are not obstructed and will remain on-site to provide stand-by assistance upon arrival of emergency personnel.

If it is necessary to temporarily control traffic in the event of an emergency, those persons controlling traffic will wear proper reflection warning vests until the arrival of police or fire personnel.

16.8.1 Designated Assembly Locations

All personnel will evacuate the site and assemble at a designated assembly location. The assembly location will be designated by Langan personnel and discussed during each shift's pre-job safety briefing.

16.8.2 Accounting for Personnel

All contractor and subcontractor supervisors are responsible for the accounting of all personnel assembled at the designed assembly area. The Designated Incident Commander shall be notified if personnel are not found.

16.9 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site and notification of the Langan Project Manager of the investigation activities. Portable fire extinguishers will be provided at the work zone. The extinguishers located in the various locations should also be identified prior to the start of work. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

16.9.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials.
- Storage of flammable liquids and gases away from oxidizers.
- Shutting off engines to refuel.
- Grounding and bonding metal containers during transfer of flammable liquids.
- Use of UL approved flammable storage cans.

- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities.

The person responsible for the control of fuel source hazards and the maintenance of fire prevention and/or control equipment is the HSO.

16.10 Significant Vapor Release

Based on the proposed tasks, the potential for a significant vapor release is low. However, if a release occurs, the following steps will be taken:

- Move all personnel to an upwind location. All non-essential personnel shall evacuate.
- Upgrade to Level C Respiratory Protection.
- Downwind perimeter locations shall be monitored for volatile organics.
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator shall notify the Langan Project Manager.
- Local emergency response coordinators will be notified.

16.11 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet (MSDS) will be followed, when necessary.

SKIN AND EYE: Use copious amounts of soap and water from eye-wash kits and portable hand wash stations.

CONTACT: Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Skin shall also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs. Affected items of clothing shall also be removed from contact with skin.

Providing wash water and soap will be the responsibility of each individual contractor or subcontractor on-site.

16.12 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted. The HSO or designee will accompany contaminated victims to the medical facility to advice on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on site,

a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

16.13 Adverse Weather Conditions

In the event of adverse weather conditions, the HSO will determine if work will continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds).
- Limited visibility (fog).
- Potential for electrical storms.
- Earthquakes.
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

16.14 Spill Control and Response

All small spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining proper waste characterization and the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill.

All contractor vehicles shall have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment shall be inspected prior to be

admitted on site. Any vehicle or piece of equipment that develops a leak will be taken out of service and removed from the job site.

The following seven steps shall be taken by the Emergency Coordinator:

1. Determine the nature, identity and amounts of major spills.
2. Make sure all unnecessary persons are removed from the spill area.
3. Notify the HSO immediately.
4. Use proper PPE in consultation with the HSO.
5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosion-proof equipment to contain or clean up the spill (diesel-only vehicles, air-operated pumps, etc.)
6. If possible, try to stop the leak with appropriate material.
7. Remove all surrounding materials that can react or compound with the spill.

In addition to the spill control and response procedures described in this HASP, Langan personnel will coordinate with the designated project manager relative to spill response and control actions. Notification to the Project Manager must be immediate and, to the extent possible, include the following information:

- Time and location of the spill.
- Type and nature of the material spilled.
- Amount spilled.
- Whether the spill has affected or has a potential to affect a waterway or sewer.
- A brief description of affected areas/equipment.
- Whether the spill has been contained.
- Expected time of cleanup completion. If spill cleanup cannot be handled by Langan's on-site personnel alone, such fact must be conveyed to the Project Manager immediately.

Langan shall not make any notification of spills to outside agencies. The client will notify regulatory agencies as per their reporting procedures.

16.15 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on site:

- Industrial first aid kit.
- Fire extinguishers (one per site).

16.16 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers.
- Refilling medical supplies.
- Recharging eyewashes and/or showers.
- Replenishing spill control supplies.

16.17 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the HSO and affected employee will complete and submit an Employee Exposure/Injury Incident Report (Attachment C) to the Langan Corporate Health and Safety Manager as soon as possible following the incident.

17.0 SPECIAL CONDITIONS

This guideline contains information and requirements for special conditions that may not be routinely encountered.

17.1 Scope

The guideline applies to the specific projects identified within this document. Additional provisions will be addressed in each Site-Specific HASP, as needed.

17.2 Responsibilities

Site Personnel - All site personnel must be alert to safety hazards on work sites and take action to minimize such hazards. Personnel must utilize the buddy system, watch for inappropriate behavior, and be alert to changes in site conditions.

Health and Safety Officer (HSO) - The HSO is responsible for considering these procedures in the development of site specific HASPs. The HSO shall schedule frequent "tail gate" safety briefings to enhance safety awareness and discuss potential problems.

17.3 Procedures

The procedures outlined below shall be followed when such conditions are encountered.

17.3.1 Ladders

Langan safety procedures shall be used to ensure employee safety when using ladders in the office or work sites. All ladders shall be coated or repaired to prevent injury to the employee from punctures or lacerations and to prevent snagging or clothing. Any wood ladders used must have an opaque covering except for identification or warning labels, which may be placed on one face only of a side rail.

17.3.1.1 Ladder Use

Employees shall only use ladders for the purposes, which they were designed and shall not be used as scaffolding. Ladders will be maintained and inspected prior to use for slip hazards including oil and grease. Employees shall use ladders only on stable and level surfaces unless the ladder is secured to prevent possible displacement. Ladders should not be used on slippery surfaces unless secured or provided with slip resistant feet to prevent accidental displacement. Ladders should not be used in locations where they could be displaced by workplace activities or traffic. Ladder rungs, cleats and steps shall be parallel, level and uniformly spaced when the ladder is in the use position.

Employees should not be carrying anything including equipment that could cause injury if there was a fall while utilizing the ladder. The top and bottom of the ladder area must remain clear while in use. When ascending and descending the ladder, employees must face the ladder.

Ladders shall not be loaded beyond the maximum intended load for which they were built or the manufacturer's rated capacity.

17.3.1.2 Portable Ladders

Rungs, cleats and steps for portable ladders and fixed ladders shall be spaced not less than 10 inches apart, nor more than 14 inches apart, as measured between center lines of the rungs, cleats and steps. When used to access an upper landing surface, the ladder side rails must extend at least three feet above the upper landing surface to which the ladder is used to gain access. If this is not possible, due to the ladders length, then the top of the ladder shall be secured at its top to a rigid support.

17.3.1.3 Step Stools

Rungs, cleats and steps of step stools shall not be less than 8 inches apart, nor more than 12 inches apart, as measured between center lines of the rungs, cleats and steps.

17.3.1.4 Extension Ladders

Rungs, cleats and steps of the base section of extension trestle ladders shall be spaced not less than 8 inches apart, nor more than 18 inches apart, as measured between center lines of the rungs, cleats and steps. The rung spacing on the extension section of the extension trestle ladder shall not be less than 6 inches nor more than 12 inches, as measured between center lines of the rungs, cleats and steps. Ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

17.3.1.5 Inspection

Ladders will be inspected for visible defects periodically, prior to utilization or after any occurrence that could have negatively affected the ladder. Portable ladders with defects including broken or missing rungs, cleats, or steps, broken or split rails, corroded components or other faulty or defective components shall not be used. The ladder will be immediately marked as defective, tagged as "Do Not Use" or blocked from being used and removed from service until repaired.

17.3.2 First Aid/Cardiopulmonary Resuscitation (CPR)

Langan field and office personnel will be encouraged to be trained in First Aid and Cardiopulmonary Resuscitation (CPR). Training will be provided free of charge by Langan to all employees. Employees will receive a training certificate that will be kept on file with the Health & Safety Coordinator (HSC). Training and certification will be provided by a credited provider such as American Red Cross or equivalent.

17.3.2.1 Emergency Procedures

Prior to work at sites the Langan employees certified in first aid and CPR will be identified in the site specific CHASP. Langan will endear to have at least one employee at a job site trained and able to render first aid and CPR. The site specific CHASP will contain first aid information on both potential chemical and physical hazards. Emergency procedures to be followed are in case of injury or illnesses are provided in the CHASP. The CHASP will include emergency contact information including local police and fire departments, hospital emergency rooms, ambulance services, on-site medical personnel and physicians. The CHASP will also include directions and contact information to the nearest emergency facility in case immediate medical attention is required. The emergency contact information will be conspicuously posted at the worksite.

Employees that are injured and require immediate medical attention shall call either 911 or the local posted emergency contacts. Employees should use ambulatory services to transport injured workers to the nearest facility for emergency medical care. In areas where 911 is not available, the telephone numbers of the physicians, hospitals, or ambulances shall be conspicuously posted.

17.3.2.2 First Aid Supplies

First aid supplies are readily available to all Langan employees when required. First aid kits are located in each Langan office. Portable first aid kits are available for employees to use at work sites. First aid kits should consist of items needed to treat employees for potential chemical and physical injuries. At a minimum, first aid kits should contain items to allow basic first aid to be rendered. Where the eyes or body of an employee may be exposed to corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use including eye wash.

First aid kits will be weatherproof with individual sealed packages of each item. All portable first aid kits shall be inspected by Langan employees before and after use to ensure all used items are replaced. When out in the field, employees shall check first aid kits weekly to ensure used items are replaced.

17.3.3 Hydrogen Sulfide

Langan employees with the potential to be exposed to hydrogen sulfide while at work sites shall have training in hydrogen sulfide awareness. The training will include identification of areas where employees could be exposed to hydrogen sulfide, health effects, permissible exposure limits, first-aid procedures and personnel protective equipment. Langan employees could be exposed to hydrogen sulfide while at job sites including petroleum refineries, hazardous waste treatment, storage and disposal facilities, uncontrolled hazardous waste sites and remediation projects.

17.3.3.1 Characteristics

Hydrogen sulfide is a colorless gas with a strong odor of rotten eggs that is soluble in water. Hydrogen sulfide is used to test and make other chemicals. It is also found as a by-product of chemical reactions, such as in sewer treatment. It is a highly flammable gas and a dangerous fire hazard. Poisonous gases are produced in fires including sulfur oxides. Hydrogen sulfide is not listed as a carcinogen.

17.3.3.2 Health Effects

Hydrogen Sulfide can affect employees if inhaled or through contact with skin or eyes. Acute (or short term) health effects of hydrogen sulfide exposure include irritation of the nose and throat, dizziness, confusion, headache and trouble sleeping. Inhalation of hydrogen sulfide can irritate the lungs causing coughing and/or shortness of breath. Higher levels of exposure can cause build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic (or long term) health effects of low levels of exposure to hydrogen sulfide can cause pain and redness of the eyes with blurred vision. Repeated exposure may cause bronchitis with cough, phlegm and shortness of breath.

17.3.3.3 Protective Clothing and Equipment

Respirators are required for those operations in which employees will be exposed to hydrogen sulfide above OSHA permissible exposure level. The maximum OSHA permissible exposure limit (PEL) for hydrogen sulfide is 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm) for an 8-hour workday and the maximum short-term exposure limit (STEL) is 10 ppm for any 10-minute period.

Where employees are exposed to levels up to 100 parts of hydrogen sulfide vapor per million parts of air (100 ppm), the following types of respiratory protection are allowed:

- Any powered, air purifying respirator with cartridge(s);
- Any air purifying, full-facepiece respirator (gas mask) with a chin style, front- or back-mounted canister;
- Any supplied air system with escape self-contained breathing apparatus, if applicable; and,
- Any self-contained breathing apparatus with a full facepiece.

Respirators used by employees must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval. Cartridges or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. Langan employees that have the potential to be exposed to hydrogen sulfide will be trained in the proper use of respirators. Respirator training is discussed under Langan's Respiratory Protection Program.

Employees with potential exposure to hydrogen sulfide, or when required by the client, will wear a portable hydrogen sulfide gas detector. The detector should have an audible, visual and vibrating alarm. The detector may also provide detection for carbon monoxide, sulfur dioxide and oxygen deficient atmospheres. The hydrogen sulfide monitor will, at a minimum, be calibrated

to detect hydrogen sulfide at a level of 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm). Many portable gas detectors will have factory defaults with a low level alarm at 10 ppm and a high level alarm at 15 ppm. Langan employees shall consult clients to determine if any site specific threshold levels exist.

If the hydrogen sulfide gas detector sounds and employees are not wearing appropriate respiratory protection, employees must immediately vacate the area and meet at the assigned emergency location. Langan employees may not re- enter the site without proper respiratory protection and approval from the client or property owner, if needed.

Employees shall wear PPE to prevent eye and skin contact with hydrogen sulfide. Employees must wear appropriate protective clothing including boots, gloves, sleeves and aprons, over any parts of their body that could be exposed to hydrogen sulfide. Non-vented, impact resistant goggles should be worn when working with or exposed to hydrogen sulfide.

17.3.3.4 Emergency and First Aid Procedures

Eye and Face Exposure

If hydrogen sulfide comes in contact with eyes, it should be washed out immediately with large amounts of water for 30 minutes, occasionally lifting the lower and upper eye lids. Seek medical attention immediately.

Skin Exposure

If hydrogen sulfide contaminates clothing or skin, remove the contaminated clothing immediately and wash the exposed skin with large amounts of water and soap. Seek medical attention immediately. Contaminated clothing should either be disposed of or washed before wearing again.

Breathing

If a Langan employee or other personnel breathe in hydrogen sulfide, immediately get the exposed person to fresh air. If breathing has stopped, artificial respiration should be started. Call for medical assistance or a doctor as soon as possible.

Safety Precautions

Hydrogen sulfide is a highly flammable gas and a dangerous fire hazard. Containers of hydrogen sulfide may explode in a fire situation. Poisonous gases are produced during fires.

Langan employees should contact property owners and operators prior to conducting work onsite to be aware of any site specific contingency plans, identify where hydrogen sulfide is used at the facility and be informed about additional safety rules or procedures.

17.3.4 Fire Protection/Extinguishers

Langan field personnel that have been provided with portable fire extinguishers for use at worksites will be trained to familiarize employees with general principles of fire extinguisher use and hazards associated with the incipient stage of firefighting. Training will be provided prior to initial assignment for field work and annually thereafter.

Portable fire extinguishers shall be visually inspected monthly and subjected to an annual maintenance check. Langan shall retain records of the annual maintenance date.

17.3.5 Overhead lines

When field work is performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before the work shall commence. If overhead lines are to be deenergized, arrangements shall be made with the client, property owner or organization that operates or controls the electric circuits involved to deenergize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

When unqualified Langan personnel are working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object they may contact cannot come closer to any unguarded, energized overhead line than the following distances:

1. For voltages to ground 50kV or below - 10 feet; and
2. For voltages to ground over 50kV - 10 feet, plus 4 inches for every 10kV over 50kV.

As previously indicated, Langan does not retain qualified employees to perform work on energized equipment.

17.3.5.1 Vehicle and Equipment Clearance

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 feet is maintained. If the voltage of the overhead lines is higher than 50kV, the clearance shall be increased 4 inches for every 10kV over that voltage.

If any of the following discussed conditions occur, the clearance may be reduced.

- If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10 kV over that voltage.
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless the employee is using protective equipment rated for the voltage; or the equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the overhead line than permitted.

If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

17.3.6 Trade Secret

Langan employees could potentially be provided trade secret information by the client or property owner when site specific information is provided about highly hazardous chemicals. Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Langan employees understand that this information should be kept confident and if required, may enter into a confidentially agreement with the client.

17.3.7 Bloodborne Pathogens

Langan employees that can reasonably anticipate exposure to blood or other potentially infectious material while at work sites shall have training in bloodborne pathogens. Applicable employees would include those trained in first aid and serving a designated role as an emergency medical care provider. Bloodborne pathogens are pathogenic microorganisms that are present in human

blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus and human immunodeficiency virus.

17.3.7.1 Training

Langan employees with potential occupational exposure to blood or other potentially infectious material must participate in a training program. Training must be conducted prior to initial assignment where there would be potential for exposure and annually thereafter within one year of previous training. The training program will be provided to Langan employees at no cost to them and during working hours.

Langan will ensure the training program shall consist of the following:

- An accessible copy of the regulatory text of 29 CFR 1910.1030 and an explanation of its contents;
- A general explanation of the epidemiology and symptoms of bloodborne diseases;
- An explanation of the modes of transmission of bloodborne pathogens;
- An explanation of Langan's exposure control plan and the means by which the employee can obtain a copy of the written plan;
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials;
- An explanation of the use and limitations of personal protective equipment (PPE) to prevent and reduce exposure;
- Information on the types, proper use, location, removal, handling and disposal of PPE;
- An explanation of the basis for selection of PPE;
- Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge;
- Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;
- An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available;
- Information on the post-exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident;
- An explanation of the signs and labels and/or color coding required by paragraph 29 CFR 1910.1030(g)(1); and,
- An opportunity for interactive questions and answers with the person conducting the training session.

Langan will develop and implement a written Exposure Control Plan, which will be designed to

eliminate or minimize employee exposure to bloodborne pathogens. The Exposure Control Plan will contain the following elements:

- An exposure determination for employees;
- The schedule and method of implementation for Methods of Compliance (29 CFR 191.1030(d)), Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up (29 CFR 1910.1030(f)), Communication of Hazards to Employees (29 CFR 1910.1030(g)) and (h) Recordkeeping (29 CFR 1910.1030(h));
- The procedure for the evaluation of circumstances surrounding exposure incidents;
- Ensure a copy of the Exposure Control Plan will be accessible to employees; and,
- The Exposure Control Plan shall be reviewed and updated at least annually.

Langan employees with occupational exposure to bloodborne pathogens include any employees trained in first aid that would be expected to provide emergency medical care. This determination is made without regards to the use of PPE, which could eliminate or minimize exposure.

Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for bloodborne pathogens. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

Work practice controls shall be used to eliminate or minimize employee exposure, if applicable. Since Langan employees will have occupational exposure only during rendering of first aid, personnel protective equipment will be utilized to reduce or minimize exposure. PPE that could be available to Langan personnel when administering first aid includes safety glasses, gloves, and Tyvek suits or sleeves. PPE and first aid kits will be provided to employees at no cost to them.

Langan employees that render first aid in office areas will have access to hand washing facilities or restrooms. For first aid rendered at field locations, first aid kits will contain an appropriate antiseptic hand cleanser and clean cloth/paper towels or antiseptic towelettes. After using antiseptic hand cleansers or towelettes, employees shall wash their hands with soap and running water as soon as feasible.

After administering first aid, potentially infectious materials, including towels, personnel protective equipment, clothes and bandages, shall be placed in a container, which prevents leakage during collection, handling, processing, storage, transport, or shipping. All PPE will be dispose of after use. Any equipment or working surfaces which was exposed to blood or potentially infectious materials due to an injury, will be decontaminated prior to reuse.

Langan will make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. These services will be available to the employee at no cost to them through a medical provider.

17.3.7.2 Recordkeeping

Langan will maintain training and medical records for each employee with occupational exposure to blood or potentially infectious materials. Medical and training records will be maintained by Langan's H&S Department.

Training records will include the following:

- Dates of the training sessions;
- Contents or a summary of the training sessions;
- Names and qualifications of persons conducting the training; and
- Names and job titles of all persons attending the training sessions.

Training records shall be maintained for 3 years from the date on which the training occurred. Medical records will be will be preserved and maintained for the duration of employment plus 30 years.

All records will be made available upon request to employees, the Assistant Secretary of Labor for Occupational Safety and Health, and Director of National Institute for Occupational Safety and Health Director of OSHA for examination and copying. Medical records must have written consent from employee before releasing.

If Langan ceases to do business, all records shall be transferred to the successor employer. The successor employer shall receive and maintain these records.

If there will not be a successor, Langan will notify current employees of their rights to access records at least three months prior to the cessation of business.

18.0 RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

18.1 Field Change Authorization Request

Any changes to the work to be performed that is not included in the CHASP will require an addendum that is approved by the Langan project manager and Langan HSM to be prepared.

Approved changes will be reviewed with all field personnel at a safety briefing.

18.2 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training, documentation of three-day OJT, and respirator fit-test records) and medical clearance for site work and respirator use will be maintained in the office and available upon request. Records for all subcontractor employees must also be available upon request. All employee medical records will be maintained by the HSM.

18.3 Onsite Log

A log of personnel on site each day will be kept by the HSO or designee.

18.4 Daily Safety Meetings ("Tailgate Talks")

Completed safety briefing forms will be maintained by the HSO.

18.5 Exposure Records

All personal monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be maintained by the HSO during site work. At the end of the project they will be maintained according to 29 CFR 1910.1020.

18.6 Hazard Communication Program/MSDS-SDS

Material safety data sheets (MSDS) of Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this CHASP (Attachment D). Langan's written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

18.7 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan incident/injury hotline at 1-800-952-6426, extension 4699 and the Project Manager to report the incident or near miss. The Project Manager will contact the client or client representative. A written report must be completed and submitted HSM within 24 hours of the incident. For emergencies involving personnel injury and/or exposure, employee will complete and submit the Langan incident/injury report to the Langan corporate health and safety manager as soon as possible following the incident. Accidents will be investigated in-depth to identify all causes and to recommend hazard control measures.

18.7.1 Accident and Injury Report Forms

18.7.1.1 Accident/Incident Report

All injuries, no matter how slight, shall be reported to the FTL and the PM immediately. The accident/incident report forms, attached in Attachment C will be filled out on all accidents by the applicable contractor supervision personnel, the FTL, or the HSO. Copies of all accident/incident reports shall be kept on-site and available for review. Project personnel will be instructed on the location of the first aid station, hospital, and doctor and ambulance service near the job. The emergency telephone numbers will be conspicuously posted in site vehicles near the work zone. First aid supplies will be centrally located and conspicuously posted between restricted and non-restricted areas to be readily accessible to all on the site.

18.7.1.2 First Aid Treatment Record

The first aid treatment record forms will be used for recording all non-lost time injuries treated by the project first-aid attendant, the local physician or hospital will be entered in detail on this record. "Minor" treatment of scratches, cuts, etc. will receive the same recording attention as treatment of more severe injuries.

18.7.1.3 OSHA Form 300

An OSHA Form 300 will be kept at the Langan Corporate Office in Parsippany, New Jersey. All recordable injuries or illnesses will be recorded on this form. Subcontractor employers must also meet the requirements of maintaining an OSHA 300 form. The Incident Report form used to capture the details of work-related injuries/illnesses meets the requirements of the OSHA Form 301 (supplemental record) and must be maintained with the OSHA Form 300 for all recordable injuries or illnesses.

19.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the site during planned construction activities. If confined spaces are identified, the contractor must implement their own confined space program that adheres to all applicable federal, state and local regulations. Confined spaces **will not** be entered by Langan personnel.

20.0 HASP ACKNOWLEDGEMENT FORM

All Langan personnel and contractors will sign this CHASP Compliance Agreement indicating that they have become familiar with this CHASP and that they understand it and agree to abide by it.

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

TABLES

TABLE 1
TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.17	Contaminated Soil or Groundwater-Dermal Contact	Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during construction activities or sampling.	Wear proper PPE; follow safe practices, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.17	Lacerations, abrasions, punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces	Wear proper PPE; follow safe practices	Clean wound, apply pressure and/or bandages; seek medical attention as required.
1.3.1 – 1.3.17	Contaminated Media Inhalation	Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation	Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.17	Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting techniques; Langan employees are not to carry contractor equipment or materials	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.17	Slips, trips, and falls	Slips, trips and falls due to uneven surfaces, cords, steep slopes, debris and equipment in work areas	Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from construction activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.17	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.17	Falling objects	Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.	Hard hats to be worn at all times while in work zones; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.17	Underground/ overhead utilities	Excavation equipment, drill rig auger makes contact with underground object; boom touches overhead utility	"One Call" before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.17	Insects (bees, wasps, hornet, mosquitoes, and spider)	Sings, bites	Insect Repellent; wear proper protective clothing (work boots, socks and light colored pants);field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on site.	Seek medical attention as required
1.3.1 – 1.3.17	Vehicle traffic / Heavy Equipment Operation	Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from construction activities and equipment	Seek medical attention as required

TABLE 2
CONTAMINANT HAZARDS OF CONCERN

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	1,1,2-Trichloro-1,2,2-trifluoroethane Chlorofluorocarbon-113 CFC-113 Freon® 113 Genetron® 113 Halocarbon 113 Refrigerant 113 TTE Frigen 113 TR Freon TF Trichlorotrifluoroethane	76-13-1	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation skin, throat, drowsiness, dermatitis; central nervous system depression; dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite. In animals: cardiac arrhythmias, narcosis,	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,1'-Biphenyl 1,1-Biphenyl Biphenyl Phenyl benzene Diphenyl	92-52-4	None	1 mg/m3 100 mg/m3	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,1-Dichloroethane Asymmetrical dichloroethane Ethylidene chloride 1,1-Ethylidene dichloride 1,1-DCA	75-34-3	PID	100 ppm 3000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the skin; central nervous system depression; liver, kidney, lung damage	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	1,2,4,5-Tetramethylbenzene	95-93-2	NA	None None	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,2,4-Trimethylbenzene	95-63-6	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,2-Dichlorobenzene	95-50-1	PID	50 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eye, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	1,2-Dichloroethane Ethylene dichloride 1,2-DCA DCE[1] Ethane dichloride Dutch liquid, Dutch oil Freon 150 Glycol dichloride	107-06-2	PID	1 ppm 50 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin absorption, skin and/or eye contact	irritation to the eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,2-Dichloroethene 1,2-Dichloroethylene 1,2-DCE Total 1,2-Dichloroethene cis-1,2-Dichloroethylene mixture of cis and trans Acetylene dichloride cis-Acetylene dichloride sym-Dichloroethylene cis-1,2-Dichloroethene cDCE 1,1-dimethyl-;dimethyl1,1-cyclohexane sym-Dichloroethylene Dichloroethylenes	159-59-2 156-60-5 540-59-0	PID	200 ppm 4000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene	108-67-8	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene	106-99-0	PID	1 ppm 2000 ppm	Vapor	inhalation, skin and/or eye contact (liquid)	irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.17	1,3-Dichlorobenzene m-Dichlorobenzol; m-Phenylene dichloride m-dichlorobenzene	541-73-1	PID	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,4-Dioxane 1,4-Dioxacyclohexane [1,4]Dioxane p-Dioxane [6]-crown-2 Diethylene dioxide Diethylene ether Dioxan Dioxane 1,4-Dioxane	123-91-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	Inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1H,1H,2H,2H.Perfluorooctanesulfonic Acid (6:2FTS) Sodium 1H,1H, 2H, 2H-Perfluorooctane Sulfonate (6:2)(6:2FTS) 6:2 Fluorinated Telomer Sulfonates (6:2FTS) Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	27619-97-2	NA	NA NA	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	2,2,4-Trimethylpentane Isooctane	540-84-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	2,4-Dimethylphenol 2,4-Xylenol m-Xylenol 1-Hydroxy-2,4-dimethylbenzene 2,4-Dimethylphenol 4-Hydroxy-1,3-dimethylbenzene 4,6-Dimethylphenol 1,3-Dimethyl-4-hydroxybenze	105-67-9	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	2-Butanone Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	2-Hexanone Butyl methyl ketone MBK Methyl butyl ketone Methyl n-butyl ketone	591-78-6	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	2-Methylnaphthalene β-methylnaphthalene	91-57-6	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion or skin absorption, eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	3,3'-Dichlorobenzidine 4-(4-Amino-3-chlorophenyl)-2-chloroaniline 4,4'-Diamino-3,3'-dichlorobiphenyl o,o'-Dichlorobenzidine 3,3'-Dichlorobiphenyl-4,4'-diamine 3,3'-Dichloro-4,4'-biphenyldiamine 3,3'-Dichloro-4,4'-diaminobiphenyl	91-94-1	None	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system;	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	4,4′-DDD Dichlorodiphenyldichloroethane 1,1'-(2,2-Dichloroethylidene)bis(4-chlorobenzene) p,p'-DDD	72-54-8	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	4-Isopropyltoulene 1-Methyl-4-(1-methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; 1-Methyl-4-isopropylbenzene Dolcymene Camphogen Paracymene Cymene p-Cymene p-Isopropyltoluene	99-87-6	PID	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	4-Methyl-2-pentanone Hexone Isobutyl methyl ketone Methyl isobutyl ketone MIBK	108-10-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact,	irritation to the skin, eyes, mucous membranes and upper respiratory tract; If ingested, it can cause vomiting	Eye: Irrigate immediately Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately

1.3.1 – 1.3.17	Acenaphthylene Cycopental(de)naphthalene, Acenaphthalene	208-96-8	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.17	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aldrin 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-endo-1,4-exo-5,8-dimethanonaphthalene HHDN Octalene	309-00-2	PID	0.25 ppm 5 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort); myoclonic jerks of limbs; clonic, tonic convulsions; coma; hematuria (blood in the urine), azotemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Alpha-BHC alpha-Hexachlorocyclohexane -alpha,2-alpha,3-beta,4-alpha,5-beta,6-beta-Hexachlorocyclohexane alpha-1,2,3,4,5,6-Hexachlorocyclohexane alpha-Benzenehexachloride α-1,2,3,4,5,6-hexachlorocyclohexane α-HCH α-Benzenehexachloride alpha-hexacloran(e) alpha-Lindane Alpha Hexachlorocyclohexane	319-84-6	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane possible carcinogenic, effects to liver, blood, and central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Alpha-Chlordane Alpha Chlordane a-Chlordane	5103-71-9	None	0.5 mg/m3 100 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aluminum	7429-90-5	None	0.5 mg/m3 50 mg/m3	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.17	Ammonia Nitrogen, Ammonia	7664-41-7	None	50 ppm 300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Anthracene	120-12-7	PID	0.2 mg/m3 80 mg/m3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to the skin, eyes, mucous membranes and upper respiratory tract, abdominal pain if ingested.	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention; Swallow: refer to medical attention
1.3.1 – 1.3.17	Antimony	7440-36-0	None	0.5 mg/m3 50 mg/m3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1016	12674-11-2	None	0.5 mg/m3 5 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1232	11141-16-5	None	0.5 mg/m3 5 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Aroclor 1242	53469-21-9	None	0.5 mg/m3 5 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1248	12672-26-6	None	0.5 mg/m3 5 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1254	11097-69-1	None	0.5 mg/m3 5 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1260	11096-82-5	None	0.5 mg/m3 5 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Arsenic	NA	None	0.5 mg/m3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Barium	10022-31-8	None	0.5 mg/m3 50 mg/m3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzene Benzol Phenyl hydride Alkyl benzene isomers	71-43-2	PID	3.19 mg/m3 1,595 mg/mg3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m3 80 mg/m3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m3 80 mg/m3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately; Breathing: move to fresh air; Swallow: Induce vomiting if conscious, seek medical attention immediately
1.3.1 – 1.3.17	Benzo(b)fluoranthene	205-99-2	PID	0.2 mg/m3 80 mg/m3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzo(g,h,i)perylene Benzo(ghi)perylene	191-24-2	PID	0.2 mg/m3 80 mg/m3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	NA	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

1.3.1 – 1.3.17	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m3 80 mg/m3 (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzoic acid Carboxybenzene E210 Dracylic acid Phenylmethanoic acid Benzenecarboxylic acid Benzoic acid isomer	65-85-0	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air
1.3.1 – 1.3.17	Benzyl butyl phthalate Butyl benzyl phthalate Butylbenzylphthalate	86-66-7	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Beryllium	7440-41-7	None	0.002 mg/m3 4 mg/m3	Soil	inhalation, skin and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air

1.3.1 – 1.3.17	Beta BHC Beta Hexachlorocyclohexane 1-alpha,2-beta,3-alpha,4-beta,5-alpha,6-beta-Hexachlorocyclohexane beta-1,2,3,4,5,6-Hexachlorocyclohexane Beta-BHC	319-85-7	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately	
1.3.1 – 1.3.17	Beta-Endosulfan Beta Endosulfan Endosulfan II (beta) Endosulfan II	33213-65-9	None	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: imme Skin: imme Breat Resp supp Swal atten imme
1.3.1 – 1.3.17	Bis(2-ethylhexyl)phthalate Bis(2-Ethylhexyl) Phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate bis(2-ethylexyl)phthalate Bis(2-Ethylhexyl) Phthalate	117-81-7	None	5 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately	

1.3.1 – 1.3.17	Cadmium	7440-43-9	None	0.005 mg/m³ 9 mg/m³	Soil	inhalation, ingestion	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Calcium	7440-70-2	None	NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Carbazole 9-azafluorene Dibenzopyrrole Diphenylenimine diphenyleneimide	86-74-8	None	NA NA	Soil	inhalation, skin absorption (liquid), skin and/or eye contact	irritation to eyes and skin, respiratory irritation	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

1.3.1 – 1.3.17	Carbon disulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.17	Carbon tetrachloride Carbon chloride Carbon tet Freon® 10 Halon® 104 Tetrachloromethane	56-23-5	PID	10 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Chlorobenzene benzene chloride monochlorobenzene Phenyl chloride Chlorobenzol MCB	108-90-7	PID	75 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Chloroform Methane trichloride Trichloromethane Chloro-3-methyl phenol	67-66-3	None	50 ppm 500 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Chromium Total Chromium Chromium, Total	7440-47-3	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Cobalt	7440-48-4	None	0.1mg/m^3 20 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Copper	7440-50-8	None	1.0 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Cumene Cumol Isopropylbenzene 2-Phenyl propane 1-methylethy lbenzene	98-82-8	PID	50 ppm 900 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Cyanide	57-12-5	None	5 mg/m^3 25 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	DDE 4,4-DDE 4,4’-DDE 1,1-bis-(4-chlorophenyl)-2,2-dichloroethene Dichlorodiphenyldichloroethylene p,p'-DDE	72-55-9	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Oral ingestion of food is the primary source of exposure for the general population. Acute and chronic ingestion may cause nausea, vomiting, diarrhea, stomach pain, headache, dizziness, disorientation, tingling sensation, kidney damage, liver damage, convulsions, coma, and death. 4,4' DDE may cross the placenta and can be excreted in breast milk	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	DDT 4,4-DDT 4,4’-DDT p,p’-DDT Dichlorodiphenyltrichloroethane 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane	50-29-3	None	1 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Delta BHC Delta-BHC Delta-hexachlorocyclohexane Delta Hexachlorocyclohexane	319-86-8	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; headache; nausea; clonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Dibenz(a,h)anthracene Dibenzo(a,h)anthracene Dibenzo[a,h]anthracene	53-70-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately
1.3.1 – 1.3.17	Dibenzofuran	132-64-9	None	NA NA	Soil	inhalation, absorption	irritation to eyes, and skin	Eyes: Irrigate immediately Skin: Soap wash promptly.
1.3.1 – 1.3.17	Dibutyl phthalate Di-n-butyl phthalate Butyl phthalate n-Butyl phthalate 1,2-Benzenedicarboxylic acid dibutyl ester o-Benzenedicarboxylic acid dibutyl ester DBP Palatinol C, Elaol Dibutyl-1,2-benzene-dicarboxylate Di-n-butylphthalate	84-74-2	None	5 mg/m^3 4000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, upper respiratory system, stomach	Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Dichlorodifluoromethane Difluorodichloromethane, Fluorocarbon 12 Freon 12 Freon® 12 Genetron® 12 Halon® 122 Propellant 12 Refrigerant 12 Dichlorodifluromethane	75-71-8	None	1000 pp, 15,000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

1.3.1 – 1.3.17	Dieldrin HEOD 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo exo-5,8-dimethanonaphthalene	60-57-1	PID	0.25 mg/m^3 50 mg/m^3	Groundwater Soil Water	inhalation, skin absorption, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; [potential occupational carcinogen]; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Diesel Fuel automotive diesel fuel oil No. 2 distillate diesoline diesel oil diesel oil light diesel oil No. 1-D summer diesel	68334-30-5	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Di-n-octyl phthalate Di-n-cotylphthalate Di-n-octylphthalate Di-sec octyl phthalate Dioctyl phthalate DEHP, Di(2-ethylhexyl)phthalate, DOP, bis-(2-Ethylhexyl)phthalate, Octyl phthalate	117-84-0	None	5 mg/m^3 5000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Endosulfan I Alpha Endosulfan	959-98-8	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Endosulfan sulfate 1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol, cyclic sulfate 6,7,8,9,10,10-hexachloro01,5,5a,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide	1031-07-8	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Hypersensitive to stimulation, sensation of prickling, tingling or creeping on skin. Headache, dizziness, nausea, vomiting, incoordination, tremor, mental confusion, hyperexcitable state. In severe cases: convulsions, seizures, coma and respiratory depression.	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Endrin 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo,endo-5,8-dimethanonaphthalene; Hexadrin	72-20-8	None	0.1 mg/m^3 2 mg/m^3	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethylic alcohol EtOH ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol	64-17-5	PID	1000 ppm 3300 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately

1.3.1 – 1.3.17	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-41-4	PID	435 mg/m³ 3,472 mg/m³	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Ethyl chloride Chloroethane Hydrochloric ether Monochloroethane Muriatic ether Hydrochloric ether	75-00-3	PID	1000 ppm 3800 ppm	Groundwater Soil Vapor	inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact	incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Fluoranthene Benzo(j, k)fluorene	206-44-0	PID	0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Fluorene	86-73-7	PID	0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attenti

1.3.1 – 1.3.17	Fuel Oil No. 2	68476-30-2	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Gasoline	8006-61-9	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Helium	7440-59-7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.17	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Goundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Hexachlorobenzene Perchlorobenzene Pentachlorophenylchloride Benzene hexachloride Phenyl perchloryl HCB BHC	118-74-1	NA	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Irritating to eyes, skin and mucous membranes. Prolonged periods of ingestion may cause cutaneous porphyria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Hexavalent Chromium Chromium VI Chromium, Hexavalent	18540-29-9	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Indeno(1,2,3-cd)pyrene Indeno(1,2,3-c,d)Pyrene Indeno[1,2,3-cd]Pyrene	193-39-5	None	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately, wash mouth with water
1.3.1 – 1.3.17	Iron	7439-89-6	None	10 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Isopropyl alcohol Iso-Propyl Alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol Isopropylalcohol	67-63-0	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Lead	7439-92-1	None	0.050 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation to the eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Lindane Gamma BHC HCH ã-Hexachlorocyclohexane gamma isomer of 1,2,3,4,5,6-Hexachlorocyclohexane gamma-Hexachlorocyclohexane	58-89-9	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; headache; nausea; clonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Magnesium	7439-95-4	None	15 mg/m^3 NA	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air

1.3.1 – 1.3.17	Manganese	7439-96-5	None	5 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, ingestion	aerosol is irritating to the respiratory tract	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	m-Cresol meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Mercury	7439-97-6	None	0.1 mg/m^3 10 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Methyl Chloride Chloromethane Monochloromethane Refrigerant-40 R-40	74-87-3	NA	100 ppm 2000 ppm	Groundwater Soil	inhalation, skin and/or eye contact	dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.17	Methyl chloroform Chlorothene 1,1,1-Trichloroethane 1,1,1-Trichloroethane-(stabilized) 1,1,1-TCA	71-55-6	PID	350 ppm 700 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias; liver damage	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.17	Methyl *tert*-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe Methyl tert butyl ether	1634-04-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Methylene Chloride Dichloromethane Methylene dichloride	75-09-2	PID	25 ppm 2300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3 179601-23-1	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Naphthalene Naphthalin Tar camphor White tar	91-20-3	PID	50 mg/m^3 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; hematuria (blood in the urine); dermatitis, optical neuritis	Eye: Irrigate immediately Skin: Molten flush immediately/solid-liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	n-Butylbenzene Butylbenzene 1-phenylbutane	104-51-8	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	N-ethyl perfluorooctane sulfonamido acetic acid NEtFOSAA N-Ethylperfluorooctanesulfonamide	4151-50-2	NA	NA NA	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Nickel	7440-02-0	None	NA 10 mg/m^3	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Nitrate	14797-55-8	None	NA NA	Groundwater Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, mucous membrane	Eye: Irrigate immediately Skin: Soap wash Breathing: Fresh air
1.3.1 – 1.3.17	N-methyl perfluorooctane-sulfonamidoacetic acid NMeFOSAA	2355-31-9	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Methane Hydrogen Sulfide Carbon Monoxide Nitrogen	7782-44-7 74-82-8 7783-08-4 830-08-0 7727-37-9	Multi-Gas PID	NA/NA NA/NA 10/100 ppm 50/1200 ppm NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support

1.3.1 – 1.3.17	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Isobutylene Nitrogen	 7782-44-7 115-11-7 7727-37-9	PID	 NA/NA NA/NA NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.17	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane	103-65-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	o-Cresol ortho-Cresol 2-Cresol o-Cresylic acid 1-Hydroxy-2-methylbenzene 2-Hydroxytoluene 2-Methyl phenol 2-Methylphenol 2-Metyhlphenol	95-48-7	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediatelyethylphhhhhhhhhh
1.3.1 – 1.3.17	o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6 179601-23-1	PID	100 ppm 900 ppm	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	p-Dichlorobenzene p-DCB 1,4-Dichlorobenzene para-Dichlorobenzene Dichlorocide	106-46-7	PID	75 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	p-Diethylbenzene 1,4-Diethylbenzene 1,4-Diethyl benzene	105-05-5	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; skin burns; in animals: central nervous system depression	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Pentachlorophenol PCP; Penta; 2,3,4,5,6-Pentachlorophenol	87-86-5	PID	0.5 mg/m^3 2.5 mg/m^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; sneezing, cough; lassitude (weakness, exhaustion), anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; dyspnea (breathing difficulty), chest pain; high fever; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Perfluorobutanesulfonic acid FC-98 Nonaflate Nonafluorobutanesulphonic acid Perfluorobutanesulfonic Acid Perfluorobutane sulfonate PFBS	375-73-5	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorobutanoic Acid Heptafluorobutyric acid Heptafluorobutanoic acid Perfluorobutyric acid PFBA	375-22-4	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorodecanesulfonic Acid PFDS	335-77-3	NA	NA NA	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorodecanoic acid PFDA	335-76-2	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Perfluorododecanoic acid Perfluoralauric acid Tricosafluorododecanoic acid PFDoA	307-55-1	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoroheptane sulfonic Acid Perfluoroheptane sulfonate Perfluoroheptanesulfonic acid PFHpS	375-92-8	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoroheptanoic acid Perfluoroheptanoic acid Tridecafluoroheptanoic acid PFHpA	375-85-9	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorohexanesulfonic Acid perfluorohexanesulfonate perfluorohexanesulfonic acid Perfluorohexane-1-sulphonic acid PFHxS	355-46-4	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Perfluorohexanoic Acid PFHxA	307-24-4	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoronoanoic Acid Perfluorononanoic Acid PFNA perfluoro-n-nonanoic acid perfluorononanoate	375-95-1	NA	None None	Groundwater	Groundwater	inhalation, skin or eye contact, ingestion; strong acid	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorooctanesulfonamide Erfluoroctylsulfonamide Perfluorooctane sulfonamide Heptadecafluorooctanesulphonamide Perfluorooctanesulfonic acid amide Deethylsulfluramid FC-99 PFOSA FOSA	754-91-6	NA	NA NA	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorooctanesulfonic Acid PFOS	1763-23-1	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Perfluorooctanoic Acid PFOA pentadecafluorooctanoic acid perfluorooctanoate perfluorocaprylic acid	335-67-1	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoropentanoic Acid PFPeA	2706-90-3	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoroundecanoic Acid PFUnA PFUnDA Perfluoroundecanoic Acid Henicosafluoroundecanoic Acid	4234-23-5	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	p-Ethyltoluene 4-Ethyltoluene 1-ethyl-4-methyl-benzene 1-methyl-4-ethylbenzene	622-96-8	NA	NA NA	Soil	ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Phenanthrene	85-01-8	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Phenol Carbolic acid Hydroxybenzene, Monohydroxybenzene Phenyl alcohol Phenyl hydroxide	108-95-2	PID	5 ppm 250 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine, skin burns; dermatitis; tremor, convulsions, twitching	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Posphate	14265-44-2	NA	0.1 mg/m^3 70 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Potassium	7440-09-7	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact inhalation, ingestion, skin and/or eye contact	eye: Causes eye burns. Skin: Causes skin burns. Reacts with moisture in the skin to form potassium hydroxide and hydrogen with much heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema.	Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.
1.3.1 – 1.3.17	Propylene dichloride Dichloro-1,2-propane 1,2-Dichloropropane	78-87-5	PIDL	75 ppm 400 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; in animals: central nervous system depression; [potential occupational carcinogen]	irritation to the eyes, skin, respiratory system; drowsiness, dizziness; liver, kidney damage; in animals: central nervous system depression; [potential occupational carcinogen]

1.3.1 – 1.3.17	p-Xylenes 1,4-Dimethylbenzene para-Xylene p-Xylol	106-42-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Pyrene benzo[def]phenanthrene	129-00-0	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	sec-Butylbenzene	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Selenium	7782-49-2	None	1 mg/m³ 0.2 mg/m³	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Silver	7440-22-4	None	0.01mg/m³ 10 mg/m³	Soil	inhalation, ingestion, skin and/or eye contact	blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Sodium	7440-23-5	None	NA NA	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Sodium 1H,1H,2H,2H-Perfluorodecane Sulfonate; 8:2 FTS	27619-96-1	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Styrene Ethenyl benzene Phenylethylene Styrene monomer Styrol Vinyl benzene	100-42-5	PID	100 ppm 700 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Sulfate	14808-79-8	None	NA NA	Groundwater Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, mucous membrane	Eye: Irrigate immediately Skin: Soap wash Breathing: Fresh air
1.3.1 – 1.3.17	Tert-Butyl Alcohol Tertiary Butyl Alcohol Tert-Butanol Butyl alcohol 2-Methyl-2-propanol Trimethyl carbinol TBA	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	tert-Butylbenzene *t*-Butylbenzene 2-Methyl-2-phenylpropane Pseudobutylbenzene	98-06-6	PID	10 ppm NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	eye, skin irritation; dry nose, throat; headaches; low blood pressure, tachycardia; abnormal cardiovascular system; central nervous system depression; hematopoietic depression	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Tetrachloroethylene Perchlorethylene Perchloroethylene PCE Perk Tetrachlorethylene Tetrachloroethene	127-18-4	PID	100 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Tetrahydrofuran Diethylene oxide 1,4-Epoxybutane Tetramethylene oxide THF	109-99-9	PID	200 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact, ingestion	irritation to the eyes, upper respiratory system; nausea, dizziness, headache, central nervous system depression	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immedi
1.3.1 – 1.3.17	Thallium	7440-28-0	None	0.1 mg/m^3 15 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Toluene Methyl benzene Methyl benzol Phenyl methane Toluol	108-88-3	PID	200 ppm 500 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, paresthesia; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Total PCBs Chlorodiphenyl (42% chlorine) Aroclor® 1242 PCB Polychlorinated biphenyl	53469-21-9	None	0.5 mg/m^3 5 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Total Petroleum Hydrocarbons TPH	CASID30220	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Total Xylenes Dimethylbenzene Xylol	1330-20-7	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Trans-1,2-Dichloroethene trans-1,2-Dichloroethylene tDEC trans-Acetylene dichloride	156-60-5	PID	200 ppm 4000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Trichloroethylene Ethylene trichloride TCE Trichloroethene Trilene	79-01-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Trivalent Chromium Chromium III Chromium, Trivalent	NA	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Vanadium	7440-62-2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

1.3.1 – 1.3.17	Vinyl Chloride Chloroethene Chloroethylen Ethylene monochloride Monochloroethene Monochloroethylene VC Vinyl chloride monomer (VCM)	75-01-4	PID	1 ppm NA	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.17	Zinc	7440-62-2	None	15 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation	chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Breathing: Respiratory support`

EXPLANATION OF ABBREVIATIONS

PID = Photoionization Detector
PEL = Permissible Exposure Limit (8-hour Time Weighted Average)
IDLH = Immediately Dangerous to Life and Health
ppm = part per million
mg/m^3 = milligrams per cubic meter

TABLE 3
Summary of Monitoring Equipment

Instrument	Operation Parameters
Photoionization Detector (PID)	**Hazard Monitored:** Many organic and some inorganic gases and vapors. **Application:** Detects total concentration of many organic and some inorganic gases and vapors. Some identification of compounds is possible if more than one probe is measured. **Detection Method:** Ionizes molecules using UV radiation; produces a current that is proportional to the number of ions. **General Care/Maintenance:** Recharge or replace battery. Regularly clean lamp window. Regularly clean and maintain the instrument and accessories. **Typical Operating Time:** 10 hours. 5 hours with strip chart recorder.
Oxygen Meter	**Hazard Monitored:** Oxygen (O_2). **Application:** Measures the percentage of O_2 in the air. **Detection Method:** Uses an electrochemical sensor to measure the partial pressure of O_2 in the air, and converts the reading to O_2 concentration. **General Care/Maintenance:** Replace detector cell according to manufacturer's recommendations. Recharge or replace batteries prior to explanation of the specified interval. If the ambient air is less than 0.5% C O_2, replace the detector cell frequently. **Typical Operating Time:** 8 – 12 hours.
Mercury Vapor Analyzer	**Hazard Monitored:** Mercury Vapor. **Application:** Detects total concentration of mercury in the air. **Detection Method:** Uses a gold film sensor. A thin gold film, in the presence of mercury vapor, undergoes an increase in electrical resistance proportional to the mass of mercury vapor in the sample. **General Care/Maintenance:** Recharge or replace battery. Regular change the intake filter. Replace the acidic gas filter as need. Regularly clean and maintain the instrument and accessories. **Typical Operating Time:** 8 – 12 hours.
Additional equipment (if needed, based on site conditions)	
Combustible Gas Indicator (CGI)	**Hazard Monitored:** Combustible gases and vapors. **Application:** Measures the concentration of combustible gas or vapor. **Detection Method:** A filament, usually made of platinum, is heated by burning the combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized in a flame. A current is produced in proportion to the number of carbon atoms present. **General Care/Maintenance:** Recharge or replace battery. Calibrate immediately before use. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.
Flame Ionization Detector (FID) with Gas Chromatography Option *(i.e., Foxboro Organic Vapor Analyzer (OVA))*	**Hazard Monitored:** Many organic gases and vapors (approved areas only). **Application:** In survey mode, detects the concentration of many organic gases and vapors. In gas chromatography (GC) mode, identifies and measures specific compounds. In survey mode, all the organic compounds are ionized and detected at the same time. In GC mode, volatile species are separated. **General Care/Maintenance:** Recharge or replace battery. Monitor fuel and/or combustion air supply gauges. Perform routine maintenance as described in the manual. Check for leaks. **Typical Operating Time:** 8 hours; 3 hours with strip chart recorder.

Instrument	Operation Parameters
Potable Infrared (IR) Spectrophotometer	**Hazard Monitored:** Many gases and vapors. **Application:** Measures concentration of many gases and vapors in air. Designed to quantify one or two component mixtures. **Detection Method:** Passes different frequencies of IR through the sample. The frequencies absorbed are specific for each compound. **General Care/Maintenance:** As specified by the manufacturer.
Direct Reading Colorimetric Indicator Tube	**Hazard Monitored:** Specific gas and vapors. **Application:** Measures concentration of specific gases and vapors. **Detection Method:** The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration. **General Care/Maintenance:** Do not use a previously opened tube even if the indicator chemical is not stained. Check pump for leaks before and after use. Refrigerate before use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate pump volume at least quarterly. Avoid rough handling which may cause channeling.
Aerosol Monitor	**Hazard Monitored:** Airborne particulate (dust, mist, fume) concentrations **Application:** Measures total concentration of semi-volatile organic compounds, PCBs, and metals. **Detection Method:** Based on light-scattering properties of particulate matter. Using an internal pump, air sample is drawn into the sensing volume where near infrared light scattering is used to detect particles. **General Care/Maintenance:** As specified by the mfr. Also, the instrument must be calibrated with particulates of a size and refractive index similar to those to be measured in the ambient air.
Monitox	**Hazard Monitored:** Gases and vapors. **Application:** Measures specific gases and vapors. **Detection Method:** Electrochemical sensor relatively specific for the chemical species in question. **General Care/Maintenance:** Moisten sponge before use; check the function switch; change the battery when needed.
Gamma Radiation Survey Instrument	**Hazard Monitored:** Gamma Radiation. **Application:** Environmental radiation monitor. **Detection Method:** Scintillation detector. **General Care/Maintenance:** Must be calibrated annually at a specialized facility. **Typical Operating Time:** Can be used for as long as the battery lasts, or for the recommended interval between calibrations, whichever is less.

TABLE 4
INSTRUMENTATION ACTION LEVELS

Photoionization Detector Action Levels	**Action Required**
Background to 5 ppm[1]	No Respirator, no further action
> 5 ppm but < 25 ppm for > 15 minutes[2]	Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated, contact HSO to review conditions and determine source and appropriate response action
>25ppm[3]	1. Activities will shut down 2. Evaluate potential causes of the excessive readings, activate mitigation measures until levels fall below 25 ppm
Particulate Monitoring Action Levels[4]	**Action Required**
Background to 100 µg/m³, no dust observed	No further action
Background to 100 µg/m³, dust observed leaving the work area	Dust suppression must be employed
100 to 150 µg/m³ at the downwind perimeter of the hot zone	Temporarily discontinue all activities and implement dust suppression techniques. Work may continue with dust suppression techniques provided that no visible dust is migrating from the work area.
>150 µg/m³ at the perimeter of the hot zone	Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated, contact HSO to review conditions and determine source and appropriate response action.
Mercury Vapor Action Levels	**Action Required**
Background to 1 µg/m^3	No further action
> 1 µg/m^3 but < 10 µg/m^3	Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated, contact HSO to review conditions and determine source and appropriate response action.
> 10 µg/m^3	1. Discontinue all work; all workers shall move to an area upwind of the jobsite. 2. Evaluate potential causes of the excessive readings, activate mitigation measures until levels fall below 10 µg/m^3

[1] 5 ppm level based on OSHA Short Term Exposure Limit (STEL) for benzene based on a 15-minute averages above site background (upwind parameter)
[2] 100 ppm level based on 1 percent being the OSHA Permissible Exposure Limit (PEL) for benzene (1 ppm), the cited value of 25 ppm is based on NYSDEP CAMP requirements
[3] 500 ppm level based on NIOSH Immediately Dangerous to Life and Health (IDLH) for benzene and toluene
[4] Particulate concentrations are 15 minute averages above site background (upwind parameter)

TABLE 5
EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department		911
Local Fire Department		911
Ambulance/Rescue Squad		911
Hospital	New York Presbyterian Hospital	911 or 212-312-5000
Langan Incident Hotline		800-952-6426 ex 4699
Medical Treatment Hotline	Incident Intervention	888-449-7787
Langan Environmental Project Manager	Paul McMahon	914-433-1157 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	Adam Meister	212-248-5168
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

Immediately following an injury, unless immediate emergency medical treatment is required, the injured employee must contact Incident Intervention® at 888-449-7787.

For all other incidents or near misses, unless emergency response is required, either the employee or a coworker must contact the Langan Incident Hotline at 1-(800)-9-LANGAN (ext. #4699).

1. TABLE 6
SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORING FOR FIT AND ACCLIMATED WORKERS[A]

Adjusted Temperature[b]	Normal Work Ensemble[c]	Impermeable Ensemble
90°F or above (32.2°C) or above	After each 45 min. of work	After each 15 min. of work
87.5°F (30.8°-32.2°C)	After each 60 min. of work	After each 30 min. of work
82.5°-87.5°F (28.1°-30.8°C)	After each 90 min. of work	After each 60 min. of work
77.5°-82.5°F (25.3°-28.1°C)	After each 120 min. of work	After each 90 min. of work
72.5°-77.5°F (22.5°-25.3°C)	After each 150 min. of work	After each 120 min. of work

a For work levels of 250 kilocalories/hour.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ^{o}F = ta ^{o}F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

TABLE 7

HEAT INDEX

	ENVIRONMENTAL TEMPERATURE (Fahrenheit)										
	70	**75**	**80**	**85**	**90**	**95**	**100**	**105**	**110**	**115**	**120**
RELATIVE HUMIDITY	**APPARENT TEMPERATURE***										
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	**130**
30%	67	73	78	84	90	96	104	113	123	**135**	**148**
40%	68	74	79	86	93	101	110	123	**137**	**151**	
50%	69	75	81	88	96	107	120	**135**	**150**		
60%	70	76	82	90	100	114	**132**	**149**			
70%	70	77	85	93	106	124	**144**				
80%	71	78	86	97	113	**136**					
90%	71	79	88	102	122						
100%	72	80	91	108							

*Combined Index of Heat and Humidity...what it "feels like" to the body
Source: National Oceanic and Atmospheric Administration

How to use Heat Index:
1. Across top locate Environmental Temperature
2. Down left side locate Relative Humidity
3. Follow across and down to find Apparent Temperature
4. Determine Heat Stress Risk on chart at right

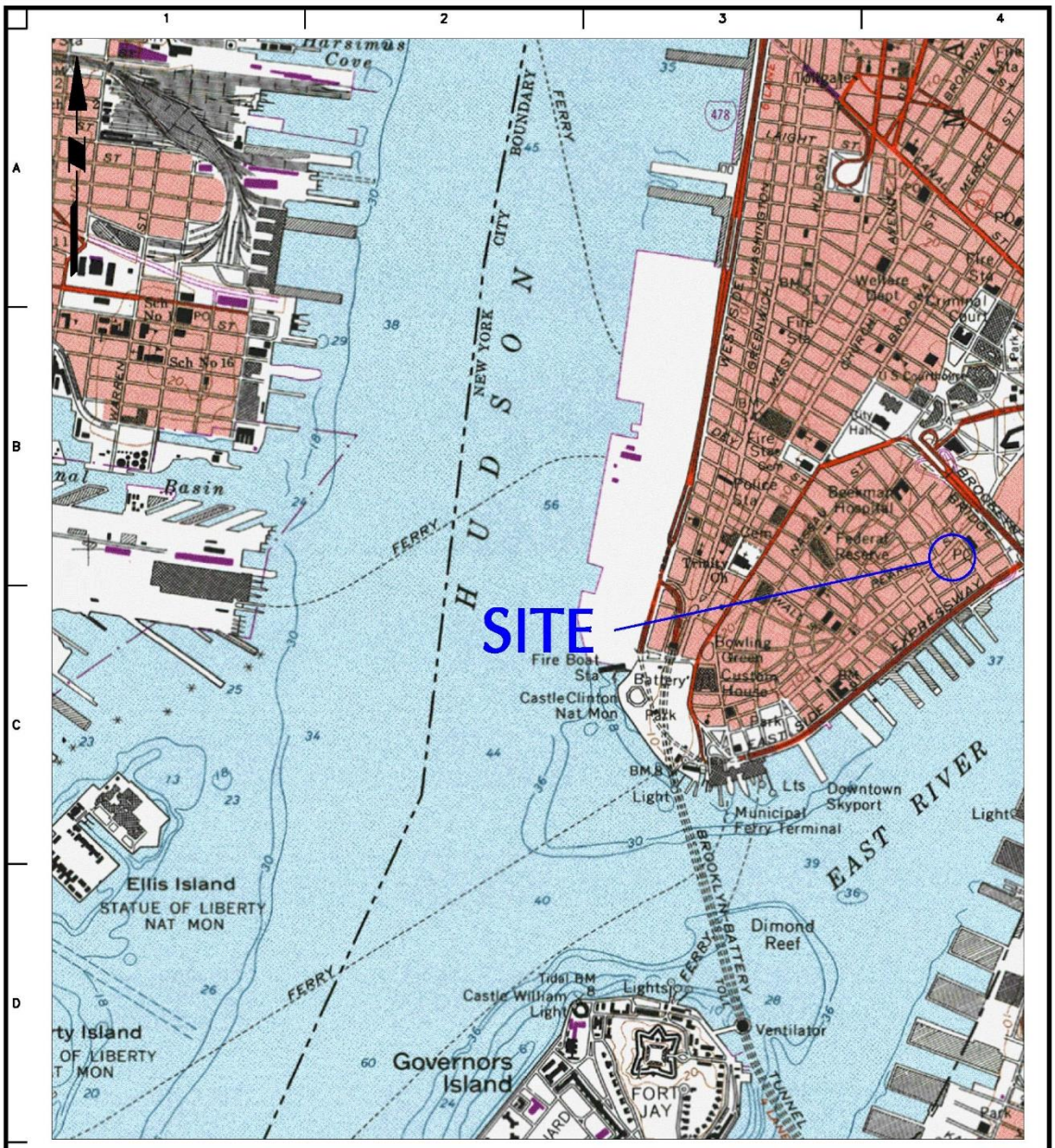
Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

Apparent Temperature	**Heat Stress Risk with Physical Activity and/or Prolonged Exposure**
90-105	Heat Cramps or Heat Exhaustion Possible
105-130	Heat Cramps or Heat Exhaustion Likely, Heat Stroke Possible
>130	Heatstroke Highly Likely

FIGURES

FIGURE 1

Site Location Map



NOTES:
1. BASE MAP REFERENCE: USGS 1976 JERSEY CITY, N.J. TOPOGRAPHIC QUADRANGLE MAP.

LANGAN
21 Penn Plaza, 360 West 31st Street, 8th Floor
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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

Project	250 WATER STREET BLOCK No. 98, LOT No. 1 NEW YORK NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	170381201
Date	08/18/2015
Scale	NTS
Drawn By / Checked By	DH / MLR
Figure No.	1
Sheet	1 of 2

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Filename: \\langan.com\data\NY\data2\170381201\Cadd Data - 170381201\2D-DesignFiles\Figure 1 - Site Location Map.dwg Date: 8/25/2015 Time: 15:21 User: dhannam Style Table: Langan.stb Layout: ANSI-BP

FIGURE 2
HOSPITAL ROUTE PLAN

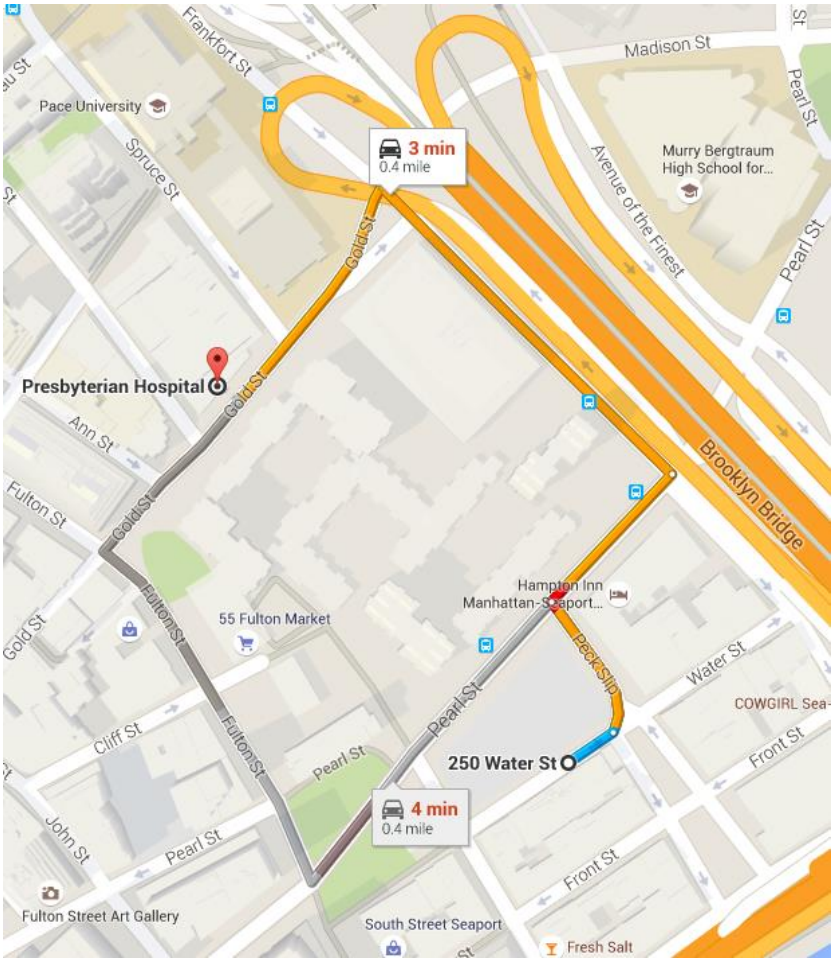
HOSPITAL ROUTE PLAN

Hospital Location: **New York Presbyterian Hospital**
83 Gold Street/170 William Street
New York, New York
212-312-5000

START: 250 Water Street, NY, NY

1. Head northeast on Water Street toward Peck Slip
2. Turn left at 1st cross street onto Peck Slip
3. Turn right onto Pearl Street
4. Turn left onto Frankfort Street
5. Turn left at the 1st cross street onto Gold Street, destination will be on the left.

END: New York Presbyterian Hospital, 83 Gold Street/170 William Street, NY, NY



ATTACHMENT A

STANDING ORDERS

STANDING ORDERS

GENERAL

- No smoking, eating, or drinking in this work zone.
- Upon leaving the work zone, personnel will thoroughly wash their hands and face.
- Minimize contact with contaminated materials through proper planning of work areas and decontamination areas, and by following proper procedures. Do not place equipment on the ground. Do not sit on contaminated materials.
- No open flames in the work zone.
- Only properly trained and equipped personnel are permitted to work in potentially contaminated areas.
- Always use the appropriate level of PPE.
- Maintain close contact with your buddy in the work zone
- Contaminated material will be contained in the Exclusion Zone (EZ).
- Report any unusual conditions.
- Work areas will be kept clear and uncluttered. Debris and other slip, trip, and fall hazards will be removed as frequently as possible.
- The number of personnel and equipment in the work zone will be kept to an essential minimum.
- Be alert to the symptoms of fatigue and heat/cold stress, and their effects on the normal caution and judgment of personnel.
- Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved quickly by the site HSO.

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to carrying passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- Ensure that heavy equipment operators and all other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10 feet in any direction of overhead power lines is prohibited.
- The locations of all underground utilities must be identified and marked out prior to initiating any subsurface activities.
- Check to insure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Ensure that all heavy equipment that is used in the EZ is kept in that zone until the job is done, and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

ATTACHMENT B

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	4. If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Face piece Removal	6. Face piece is removed (avoid touching face with fingers). Face piece deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL D DECONTAMINATION

Station 1:	Equipment Drop	1. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-resistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Boot, Gloves and Outer Garment Removal	4. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 5:	Field Wash	5. Hands and face are thoroughly washed. Shower as soon as possible.

EQUIPMENT DECONTAMINATION

GENERAL:

Equipment to be decontaminated during the project may include tools, monitoring equipment, respirators, sampling containers, laboratory equipment and drilling equipment.

All decontamination will be done by personnel in protective gear, appropriate for the level of decontamination, as determined by the site HSO. The decontamination work tasks will be split or rotated among support and work crews.

Depending on site conditions, backhoe and pumps may be decontaminated over a portable decontamination pad to contain wash water; or, wash water may be allowed to run off into a storm sewer system. Equipment needed may include a steam generator with high-pressure water, empty drums, screens, screen support structures, and shovels. Drums will be used to hold contaminated wash water pumped from the lined pit. These drums will be labeled as such.

Miscellaneous tools and equipment will be dropped into a plastic pail, tub, or other container. They will be brushed off and rinsed with a detergent solution, and finally rinsed with clean water.

MONITORING EQUIPMENT:

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The PID, HNu or OVA meter, for example, can be placed in a clear plastic bag, which allows reading of the scale and operation of knobs. The probes can be partially wrapped keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe.

RESPIRATORS:

Respirators will be cleaned and disinfected after every use. Taken from the drop area, the masks (with the cartridges removed and disposed of with other used disposable gear) will be immersed in a cleaning solution and scrubbed gently with a soft brush, followed by a rinse in plain warm water, and then allowed to air dry. In the morning, new cartridges will be installed. Personnel will inspect their own masks for serviceability prior to donning them. And, once the mask is on, the wearer will check the respirator for leakage using the negative and positive pressure fit check techniques.

ATTACHMENT C

EMPLOYEE EXPOSURE/ INJURY INCIDENT REPORT

EMPLOYEE INCIDENT/INJURY REPORT
LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

(Complete and return to Tony Moffa in the Doylestown Office)

Affected Employee Name: _____ Date: _____

Incident type: ☐ Injury ☐ Report Only/No Injury
☐ Near Miss ☐ Other: _____

EMPLOYEE INFORMATION (Person completing Form)

Employee Name: _____ Employee No: _____

Title: _____ Office Location: _____

Length of time employed or date of hire: _____

Mailing address: _____

_____

Sex: M ☐ F ☐ Birth date: _____

Business phone & extension: _____ Residence/cell phone: _____

ACCIDENT INFORMATION

Project: _____ Project #: _____

Date & time of incident: _____ Time work started & ended: _____

Site location: _____

Incident Type: Possible Exposure ☐ Exposure ☐ Physical Injury ☐

Names of person(s) who witnessed the incident:_____

Exact location incident occurred:

Describe work being done:_____

Describe what affected employee was doing prior to the incident occurring:

Describe in detail how the incident occurred:

Nature of the incident (List the parts of the body affected):

Person(s) to whom incident was reported (Time and Date):

List the names of other persons affected during this incident:

Possible causes of the incident (equipment, unsafe work practices, lack of PPE, etc.):

Weather conditions during incident:

MEDICAL CARE INFORMATION

Did affected employee receive medical care? Yes ☐ No ☐

If Yes, when and where was medical care received:

Provide name of facility (hospital, clinic, etc.):

Length of stay at the facility?

Did the employee miss any work time? Yes ☐ No ☐ Undetermined ☐

Date employee last worked: Date employee returned to work:

Has the employee returned to work? Yes ☐ No ☐

Does the employee have any work limitations or restrictions from the injury? : Yes ☐ No ☐

If Yes, please describe:

Did the exposure/injury result in permanent disability? Yes ☐ No ☐ Unknown ☐

If Yes, please describe:

HEALTH & SAFETY INFORMATION

Was the operation being conducted under an established site specific HEALTH AND SAFETY PLAN?
Yes ☐ No ☐ Not Applicable: ☐

Describe protective equipment and clothing used by the employee:

Did any limitations in safety equipment or protective clothing contribute to or affect exposure / injury? If so, explain:

Employee Signature Date

Langan Representative Date

ATTACHMENT D

CALIBRATION LOG

DATE:_____ **PROJECT:**_____

CALIBRATION LOG

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEETS

All Langan Field Personnel Completing This Work Plan Are To Have Real Time Accessibility To Material Safety Data Sheet (MSDs) or Safety Data Sheet (SDSs) Through Their Smart Phone.

The link is http://www.msds.com/
The login name is "drapehead"
The password is "2angan987"

If You Are Unable To Use the Smart Phone App, You Are To Bring Printed Copies of the MSDs/SDSs to the Site

ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST

Jobsite Safety Inspection Checklist

Date: _____ **Inspected By:** _____

Location: _____ **Project #:** _____

Check one of the following: **A:** Acceptable **NA**: Not Applicable **D**: Deficiency

	A	NA	D	Remark
1. CHASP available onsite for inspection?				
2. Health & Safety Compliance agreement (in HASP) appropriately signed by Langan employees and contractors?				
3. Hospital route map with directions posted on site?				
4. Emergency Notification List posted on site?				
5. First Aid kit available and properly stocked?				
6. Personnel trained in CPR/First Aid on site?				
7. MSDSs readily available, and all workers knowledgeable about the specific chemicals and compounds to which they may be exposed?				
8 Appropriate PPE being worn by Langan employees and contractors?				
9. Project site safe practices ("Standing Orders") posted?				
10. Project staff have 40-hr./8-hr./Supervisor HAZWOPER training?				
11. Project staff medically cleared to work in hazardous waste sites and fit-tested to wear respirators, if needed?				
12. Respiratory protection readily available?				
13. Health & Safety Incident Report forms available?				
14. Air monitoring instruments calibrated daily and results recorded on the Daily Instrument Calibration check sheet?				
15. Air monitoring readings recorded on the air monitoring data sheet/field log book?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr. HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily available?				
19. Mark outs of underground utilities done prior to initiating any subsurface activities?				
20. Decontamination procedures being followed as outlined in HASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground objects including utilities?				

23. Adequate size/type fire extinguisher supplied?				
24. Equipment at least 20 feet from overhead power lines?				
25. Evidence that drilling operator is responsible for the safety of his rig.				
26. Trench sides shored, layer back, or boxed?				
27. Underground utilities located and authorities contacted before digging?				
28. Ladders in trench (25-foot spacing)?				
29. Excavated material placed more than 2 feet away from excavation edge?				
30. Public protected from exposure to open excavation?				
31. People entering the excavation regarding it as a permit-required confined space and following appropriate procedures?				
32. Confined space entry permit is completed and posted?				
33. All persons knowledgeable about the conditions and characteristics of the confined space?				
34. All persons engaged in confined space operations have been trained in safe entry and rescue (non-entry)?				
35. Full body harnesses, lifelines, and hoisting apparatus available for rescue needs?				
36. Attendant and/or supervisor certified in basic first aid and CPR?				
37. Confined space atmosphere checked before entry and continuously while the work is going on?				
38. Results of confined space atmosphere testing recorded?				
39. Evidence of coordination with off-site rescue services to perform entry rescue, if needed?				
40. Are extension cords rated for this work being used and are they properly maintained?				
41. Are GFCIs provided and being used?				

Unsafe Acts: _____

_____

_____

_____

Notes: _____

_____

_____

_____

ATTACHMENT G

JOB SAFETY ANALYSIS FORM

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA TITLE: **JSA NUMBER:**	**DATE CREATED:** **CREATED BY**: **REVISION DATE:** **REVISED BY:**

Langan employees must review and revise the Job Safety Analysis (JSA) as needed to address the any site specific hazards not identified. Employees must provide their signatures on the last page of the JSA indicating they have review the JSA and are aware the potential hazards associated with this work and will follow the provided preventive or corrective measures.

PERSONAL PROTECTIVE EQUIPMENT REQUIRED: (PPE): ■ Required ☒ As Needed		
☐ Steel-toed boots	☐ Nitrile gloves	☐ Dermal Protection (Specify)
☐ Long-sleeved shirt	☐ Leather/ Cut-resistant gloves	☐ High visibility vest/clothing
☐ Safety glasses	☐Face Shield	☐ Hard hat
ADDITIONAL PERSONAL PROTECTIVE EQUIPMENT NEEDED (Provide specific type(s) or descriptions)		
☐ Air Monitoring:	☐ Respirators:	☐ Other:

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE OR CORRECTIVE ACTION
1.	1. 2.	1a. 1b. 2a. 2b.
2.	1.	1
Additional items identified in the field.		
Additional Items.		

If additional items are identified during daily work activities, please notify all relevant personnel about the change and document on this JSA.

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: COVID-19 Awareness – Site Work **JSA Number: JSA046-00**	
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Boots	☐ Long Sleeves	☐ Safety Vest (Class 2)	☐ Hard Hat	☐ Hearing Protection
☐ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☐ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Alcohol-based hand sanitizer, disinfectant wipes/spray				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. All Activities	1. Transmittal/exposure of COVID-19	1. Ask yourself and your managers – is this work essential? Can this be done remotely? 2. Stay home if sick or showing symptoms of COVID-19 (e.g. fever, cough, etc.). 3. Carry nitrile gloves, alcohol-based hand sanitizer, face coverings and disinfectant wipes/spray during field work. 4. Check federal, state, and/or local travel restrictions **prior** to travel. Many states, counties, and cities are passing strict "shelter-in-place" or business restrictions in response to COVID-19. 5. Immediately notify Beverly Williams or Rory Johnston (Supervisor if employee chooses) if you display symptoms of COVID-19. Symptoms include fever (over 100.4 F), cough, and shortness of breath. 6. Notify Beverly Williams or Rory Johnston, Supervisor and Coronavirus Task Force if you had close contact with an individual who tested positive or displayed symptoms of COVID-19. 7. Do not touch your face, to the extent possible. 8. Wear face coverings when around other worker to minimize spread of COVID-19. (May be required in certain states or locations.)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		9. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. Avoid gatherings of more than 10 people. Limit, to the extent possible, contact with public items/objects. 10. Clean your hands frequently with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, sneezing, or using the rest room. 11. If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry. 12. Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. 13. Clean and disinfect frequently touched surfaces daily, for example, cell phones, computer equipment, headsets, tables, doorknobs, light switches, countertops, handles, desks, toilets, faucets, and sinks.
2. Travel to Jobsite	1. Transmittal/exposure of COVID-19 between passengers 2. Transmittal/exposure of COVID-19 from previous occupants (rental and fleet vehicles) 3. Transmittal/exposure of COVID-19 while refueling	1. Limit the number of occupants to each vehicle to 2 people. Employees should sit as far away from each other as possible. 2. Disinfect high “hand-traffic” areas of the vehicle: Door handles, steering wheel, turn signal and control rods, dashboard controls, seatbelts, armrests, etc. To the extent possible, do not use recycled air for heat/AC and travel with the windows open. 3. Use hand sanitizer before and after pumping gas and only return to the inside of the vehicle after refueling is complete. 4. Wear nitrile gloves if available or disinfect the key pad, pump handle, and fuel grade button prior to use. 5. Recommend face coverings are worn to minimize spread of COVID-19.
3. Conduct Tailgate Safety Meeting & Complete H&S Paperwork	1. Transmittal/exposure of COVID-19 between meeting participants	1. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. 2. Recommend face coverings are worn when around other workers to minimize spread of COVID-19, 3. Hold meetings outside and keep in mind wind direction. To the extent possible, remain cross-wind from other people. 4. Designate a single person to maintain sign-in sheets/permits throughout the day to limit the passing of pens/clipboards between people. 5. Each person should complete their own JSA, even if they are completing similar tasks as others in order to limit the passing of paper/pens/clipboards between people. 6. Include COVID-19 topics and prevention measures in safety meetings.
4. Conduct Site Work	1. Transmittal/exposure of COVID-19 between site workers and public.	1. Practice social distancing maintaining 6 feet of distance between yourself and others. 2. Recommend face coverings are worn when around other workers to minimize spread of COVID-19, 3. To the extent possible, do not interact with the public. If it is necessary, politely explain you are practicing social distance and request they stay at least 6 feet away and they do not attempt to pass objects to you. 4. Wear nitrile gloves during site work underneath the appropriate gloves for your task. Utilize appropriate decontamination procedures, securely bag all waste (including nitrile gloves) generated during site work and dispose of.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		5. Do not share tools. Each person should be equipped with the tools to complete their task or tasks should be divided to remove the need to share tools. If tools must be shared, surfaces should be disinfected. 6. Clean and disinfect surfaces of rental tools and equipment upon receipt. To the extent possible rent equipment from Langan's internal equipment reservation center, where cleaning/disinfecting procedures can be verified.
5. Use of Construction Trailers	1. Transmittal/exposure of COVID-19 between site workers and others.	1. Avoid use of shared trailers, if possible. Minimize trailer use to essential personnel. 2. Practice social distancing; maintaining 6 feet of distance between yourself and others in trailer. 3. Clean and disinfect areas including desks, phones, chairs and other common areas, before and after use.
6. Purchasing Food from a Restaurant	1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.	1. To the extent possible, bring your own food. 2. If you must visit a restaurant, call ahead for take-out or "contactless delivery". Do not dine in. When picking up food, follow guidelines for Job Step #8: Purchasing Supplies at Retail/Shipping Centers. 3. Wash hands before and after eating.
7. Smoking Cigarettes	1. Transmittal/exposure of COVID-19 by touching mouth with hands	1. Cigarette smokers maybe at greater risk of complications arising from COVID-19. Nicotine patches/lozenges/gum, smoking cessation programs, and prescription medications may aid in "kicking the habit" if you decide to quit. 2. Wash hands thoroughly before and after smoking. 3. Discard cigarette butts properly. Do not light cigarettes from others and do not give cigarettes to others.
8. Hotel Stay	1. Transmittal/exposure of COVID-19 from previous occupants, hotel staff, common areas.	1. Verify the hotel chain/brand has modified cleaning procedures to reflect risk of COVID-19. Most hotel companies have issued statements on their websites and in email blasts reflecting these new procedures. 2. Use the front door, and not peripheral entrances. Front doors of hotels are generally automatic. 3. Request ground floor room to avoid elevator use and a room that has not be utilized in 48-72 hours. 4. If elevator use is required, do not directly touch elevator buttons with your hands. Do not ride elevators with other people, to the extent possible. 5. Bring disinfecting wipes or sanitizing spray. Upon arrival, disinfect high "hand-traffic" areas of the hotel room: Door handles, light switches, shower/sink faucet handles, TV remote, curtain/blind handles. Clean these surfaces daily. 6. Place the "Do Not Disturb" Sign on your door to prevent people (housekeeping) from entering your room. 7. Avoid common spaces and hotel sponsored events where crowds will be present. 8. Confirm hotel cleaning procedures have been modified to address COVID-19. Confirm no COVID-19 cases have occurred in hotel
9. Purchasing Supplies at Retail/Shipping Centers	1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.	1. Plan your travel to limit the need to visit retail/shipping centers. 2. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. If the store is too crowded/small, consider visiting another store or returning at a different time. 3. Avoid high "hand-traffic" items/areas like door handles (i.e. use your shoulder, hip/butt, or open with a disposable napkin/paper towel), credit cards terminals (i.e. use Apple/Android pay if available), shopping carts/baskets (i.e. bring your own shopping

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		bags), counter tops (i.e. ask clerk if you can hold the items while they are scanned) and bulk/buffet items (i.e. just avoid them). 4. Disinfect your hands before and after visiting a retail/shipping center.

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: Environmental Sampling **JSA Number:** JSA021-01 **A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.**	 S – *Stop,* what has changed? T – *Think* about the task E – *Evaluate* potential hazards P – *Plan* safe approach S - *Start* task / *Stop* & regroup

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☐ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☒ Fire Resistant Clothing	☐ Rubber Boots
☒ Insect/Animal Repellent	☒ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Tyvek Sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. Drive to sample location	1. Rough/Off Road terrain	1. Pay attention to road conditions such as road erosion, unprotected embankments, and soft road conditions.
2. Sample Collection (Walking)	1. Slip/Trips/Falls 2. Back strains 3. Wildlife (Insects, Stray animals, rodents) 4. Poisonous vegetation	1. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles. 2. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe and unsafe to carry. 3. Be aware of surroundings for the presence of wildlife. Do not approach stray animals. Carry and use animal repellant when needed/ Use bug spray when needed. 4. Keep skin covered/ Identify and avoid poisonous vegetation/ Clean areas after contact with suspected vegetation.
3. Sample Collection (Water)	1. Drowning Hazards 2. Chemical burns (when adding acid preservative to sample) 3. Back Strains 4. Ergonomic issues 5. Slip/Trips/Falls	1. Use buddy system/ Wear flotation vest if water is deeper than 2 feet or swift moving/ Select working area with stable footing. Do not attempt to cross or stand in swift moving water. 2. Wear proper PPE (Nitrile gloves, Tyvek Sleeves) 3. Use proper lifting techniques/ Use wheeled transport/ Obtain assistance where and when needed/ Consider load weight when evaluating what is safe or unsafe to carry. 4. When possible avoid bending over for long periods of time/ Use a small stool for sitting or knee pad for kneeling.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		5. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles/ Avoid standing water or slippery terrain.
4. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: 55-gallon Drum Sampling
JSA Number: JSA043-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☒ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: All Drums are required to be labeled. Langan employees do not open or move undocumented drums or unlabeled drums without proper project manager authorization.				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Unpack/Transport equipment to work area.	2. Back Strains 3. Slip/Trips/Falls 4. Cuts/Abrasions from equipment 4. Contusions from dropped equipment	1. Use proper lifting techniques/Use wheeled transport 2. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 3. Wear proper PPE (leather gloves, long sleeves). 4. Wear proper PPE (Langan approved safety shoes).
6. Open Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 2. Pressure from drums.	1. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches. 2. Open drum slowly to relieve pressure. Wear proper PPE: face shield and goggles; correct gloves; and over garments.
7. Collecting Soil/Fluid Sample	5. Irritation to eye from vapor, soil dust, or splashing 6. Irritation to exposed skin	5. Wear proper eye protection including safety glasses/ face shield/googles and when necessary, splash guard. If dust or vapor phase is present, wear appropriate safety breathing gear (1/2 mask or full face mask with correct filter) 6. Wear proper skin protection including nitrile gloves.
8. Closing Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.	6. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches.
9. Moving Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.	1. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	2. Back Strains	objects before handling / Wear leather/ cut-resistant gloves. Use non-metallic mallet and non-sparking tools/wrenches. 2. Use proper lifting techniques/Use wheeled transport
10. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Equipment Transportation and Set-up**
JSA Number: **JSA012-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
11. Transport equipment to work area	5. Back Strain 6. Slips/ Trips/ Falls 7. Traffic 8. Cuts/abrasions from equipment 9. Contusions from dropped equipment	1. Use proper lifting techniques / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
12. Moving equipment to its planned location	7. Pinch Hazard 8. Slips/ Trips/ Falls	1. Wear proper PPE (leather gloves) 2. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint
13. Equipment Set-up	6. Pinch Hazard 7. Cuts/abrasions to knuckles/hands 8. Back Strain	1. Wear proper PPE (leather gloves) 2. Wear proper PPE (leather gloves) 3. Use proper lifting techniques / Use wheeled transport
14. All activities	11. Slips/ Trips/ Falls 12. Hand injuries, cuts or lacerations during manual handling of materials 13. Foot injuries 14. Back injuries 15. Traffic 16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 17. High Noise levels 18. Overhead hazards	11. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 12. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 13. Wear Langan approved safety shoes 14. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	19. Heat Stress/ Cold Stress 20. Eye Injuries	15. Wear high visibility clothing & vest / Use cones or signs to designate work area 16. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 17. Wear hearing protection 18. Wear hard hat / Avoid areas were overhead hazards exist. 19. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 20. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Field Sampling**
JSA Number: **JSA022-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task / **Stop** & regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☐ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
15. Unpack/Transport equipment to work area.	10. Back Strains 11. Slip/Trips/Falls 12. Cuts/Abrasions from equipment 13. Contusions from dropped equipment	4. Use proper lifting techniques/Use wheeled transport 5. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 6. Wear proper PPE (leather gloves, long sleeves). 7. Wear proper PPE (Langan approved safety shoes).
16. Initial Site Arrival-Site Assessment	9. Traffic	7. Situational awareness (be alert of your surroundings). Secure area from through traffic.
17. Surface Water Sampling	9. Contaminated media. Skin/eye contact with biological agents and/or chemicals.	7. Wear appropriate PPE (Safety glasses, appropriate gloves). Review (MSDS for all chemicals being.
18. Sampling from bridges	3. Struck by vehicles	3. Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
19. Icing of Samples/ Transporting coolers/equipment from work area.	21. Back Strains 22. Slips/Trips/Falls 23. Cuts/Abrasions from equipment 24. Pinch/Crushing Hazards.	21. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 22. Have unobstructed path from work area. Aware of surroundings. 23. Wear proper PPE (Leather gloves, long sleeves) 24. Wear proper PPE (Leather gloves, long sleeves)
20. Site Departure	1. Contaminated PPE/Vehicle	1. Contaminated PPE should be disposed of on-site. Remove boots and soiled clothing for secure storage in trunk. Wash hands promptly.
21. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	handling of materials 3. Foot injuries 4. Back injuries 25. Traffic 26. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 27. High Noise levels 28. Overhead hazards 29. Heat Stress/ Cold Stress 30. Eye Injuries	before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 25. Wear high visibility clothing & vest / Use cones or signs to designate work area 26. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 27. Wear hearing protection 28. Wear hard hat / Avoid areas were overhead hazards exist. 29. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 30. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: Excavation Oversight **JSA Number:** JSA041-01 **A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.**	 **S** – ***Stop,*** *what has changed?* **T** – ***Think*** *about the task* **E** – ***Evaluate*** *potential hazards* **P** – ***Plan*** *safe approach* **S** - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
22. Transport equipment to work area	14. Back Strain 15. Slips/Trips/Falls 16. Traffic 17. Cuts/abrasions/contusions from equipment	8. Use proper lifting techniques / Use wheeled transport 9. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 10. Wear proper PPE (high visibility vest or clothing) 11. Wear proper PPE (leather gloves, long sleeves, safety shoes)
23.Earth Moving Equipment	10. Equipment running over employee	8. Ensure you have direct line of sight with operator of equipment; don't walk behind equipment; maintain a safe distance away from equipment. 9. Wear proper PPE (high vis vest/clothing)
24.Excavation	10. Excavation collapse 11. Confined space 12. Soil	8. Use proper shoring/benching/sloping techniques; Ladder is properly situated in excavation; no water in excavation; competent person has inspected excavation prior to allow employees to enter. 9. Langan employees are not authorized to enter a confined space; 10. Soil and equipment is kept atleast 2 feet from edge of excavation
25.Excavated soil	1. Hazardous substances	1. Use proper equipment to monitor excavated soil for contaminates; ensure levels do not exceed PEL's for contaminates; Wear proper PPE
26. All activities	31. Slips/ Trips/ Falls 32. Hand injuries, cuts or lacerations during manual handling of materials 33. Foot injuries 34. Back injuries	31. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 32. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	35. Traffic 36. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 37. High Noise levels 38. Overhead hazards 39. Heat Stress/ Cold Stress 40. Eye Injuries	33. Wear proper PPE (Langan approved safety shoes) 34. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 35. Wear high visibility clothing & vest / Use cones or signs to designate work area 36. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 37. Wear hearing protection 38. Wear hard hat / Avoid areas were overhead hazards exist. 39. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 40. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: Subsurface Investigation **JSA Number:** JSA030-01	 **S** – ***Stop,*** *what has changed?* **T** – ***Think*** *about the task* **E** – ***Evaluate*** *potential hazards* **P** – ***Plan*** *safe approach* **S** - ***Start*** *task / **Stop** & regroup*
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Dielectric Overshoes, Sun Block				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
27.Transport equipment to work area	18.Back/strain 19.Slip/Trip/Falls 20.Traffic 21.Cuts/abrasions/contusions from equipment 22.Accidents due to vehicle operations	12. Use proper lifting techniques/Use wheeled transport 13. Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures 14. Wear proper PPE (high visibility vest or clothing) 15. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes) 16. Observe posted speed limits/ Wear seat belts at all times
28.Traffic	1. Hit by moving vehicle	1. Use traffic cones and signage/ Use High visibility traffic vests and clothing/ Caution tape when working near active roadways.
29. Field Work (drilling, resistivity testing, and inspection)	1. Biological Hazards: insects, rats, snakes, poisonous plants, and other animals 2. Heat stress/injuries 3. Cold Stress/injuries 4. High Energy Transmission Lines 5. Underground Utilities 6. Electrical (soil resistivity testing)	41. Inspect work area to identify biological hazards. Wear light colored long sleeve shirt and long pants/ Use insect repellant as necessary/ Beware of tall grass, bushes, woods and other areas where ticks may live/ Avoid leaving garbage on site to prevent attracting animals/ Identify and avoid contact with poisonous plants/Beware of rats, snakes, or stray animals. 42. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block 43. Wear proper clothing/ dress in layers/ take regular breaks. 44. Avoid direct contact with high energy transmission lines/ position equipment at least 15 feet or as required by PSE&G from the transmission lines/ wear proper PPE (dielectric overshoes 15 kV minimum rating).

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		45. Call one-call service before performing intrusive field work/ Review utility mark-outs and available utility drawings (with respect to proposed work locations)/ Follow Underground Utility Guidelines 46. See AGI Sting R1 operating manual for specific concerns during operating instrument
30. All activities	41. Slips/ Trips/ Falls 42. Hand injuries, cuts or lacerations during manual handling of materials 43. Foot injuries 44. Back injuries 45. Traffic 46. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 47. High Noise levels 48. Overhead hazards 49. Heat Stress/ Cold Stress 50. Eye Injuries	47. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 48. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 49. Wear Langan approved safety shoes 50. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 51. Wear high visibility clothing & vest / Use cones or signs to designate work area 52. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 53. Wear proper hearing protection 54. Wear hard hat / Avoid areas were overhead hazards exist. 55. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 56. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Direct-Push Soil Borings
JSA Number: JSA004-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Half-face respirator, dust cartridges, PID (if applicable)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
31. Move equipment to work site	23. Back strain when lifting equipment 24. Slips/ Trips/ Falls while moving equipment 25. Traffic (if applicable) 26. Pinched fingers or running over toes during geoprobe set-up 27. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	17. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle 18. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift 19. Wear high visibility safety vests or clothing / Exercise caution 20. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times 21. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
32. Calibration of monitoring equipment	11. Skin or eye contact with calibration chemicals 12. Pinch fingers in monitoring equipment	10. Wear proper PPE (safety glasses/ goggles) 11. Wear proper PPE (leather gloves)
33. Set-up geoprobe rig	13. Geoprobe rig movement	11. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
34. Advance geoprobe rods below ground surface to desired depth	4. Underground utilities 5. High noise levels	4. Clean all subsurface soil borings to a minimum of 5 feet below grade 5. Wear proper PPE (hearing protection)
35. Remove and open acetate liner	51. Pinched fingers while removing macrocore	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 2. Wear proper PPE (cut-resistant or leather gloves)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Remove and open acetate liner (cont'd)	52. Cuts/lacerations when cutting acetate liner open 53. Exposure to hazardous vapors 54. Skin contact with contaminated soil	3. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 4. Wear proper PPE (nitrile gloves)
36. Sample Collections a) Monitor parameters b) Prepare sample containers and labels	1. Contact with potentially contaminated soil 2. Lacerations from broken sample bottles 3. Back strain while transporting full coolers 4. Internal exposure to contaminants and metals through inhalation of dust 5. Slips/ Trips/ Falls	1. Use monitoring devices / Wear proper PPE (safety glasses, nitrile gloves) 2. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage 6. Use proper lifting techniques / Do not lift heavy loads without assistance 7. Avoid creating dust / If necessary, wear a half mask respirator with applicable dust cartridge / Inspect respirator for damage and cleanliness prior to use / Clean respirator after each use and store in a clean, secure location 8. Be alert / Follow good housekeeping procedures
37. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Cuts/lacerations from acetate liner 2. Pinched fingers/hand while opening/closing drum 3. Skin contact with contaminated soil 4. Soil debris in eyes	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (nitrile gloves) 4. Wear proper PPE (safety glasses)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
8. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	1. Back, arm or shoulder strain from moving drums 2. Pinch fingers/hand in drum cart when moving drums 3. Pinch fingers/hand when operating lift-gate on vehicle 4. Contact with potentially contaminated groundwater when moving improperly sealed drums 5. Slips when moving drums 6. Drop drum on feet/toes	57. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 58. Wear proper PPE (cut-resistant or leather gloves) 59. Wear proper PPE (cut-resistant or leather gloves) 60. Wear proper PPE (nitrile gloves underneath work gloves) 61. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 62. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum
9. All activities 9. All activities (cont'd)	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date

Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: General Construction Activities
JSA Number: JSA010-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
38. Transport equipment to work area	28. Back Strain 29. Slips/ Trips/ Falls 30. Traffic 31. Cuts/abrasions from equipment 32. Contusions from dropped equipment	6. Use proper lifting techniques / Use wheeled transport 7. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 8. Wear proper PPE (high visibility vest or clothing) 9. Wear proper PPE (leather gloves, long sleeves) 10. Wear proper PPE (safety shoes)
39. Installation of piping from vapor wells to skid connections and from discharge pipping to effluent stack	13. Pinch fingers when connecting pipes 14. Slips/ Trips/ Falls 15. Machinery Hazards	3. Wear proper PPE (leather gloves) 4. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint 5. Wear proper PPE (safety vest) / Maintain safe distance from operating machinery
40. Remediation equipment installation	14. Back strain when lifting heavy equipment 15. Slips/ Trips/ Falls 16. Traffic	5. Use proper lifting techniques / Use wheeled transport / Minimize distance to vehicle 6. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray pain 7. Wear proper PPE (safety vest)
41. All activities	55. Slips/ Trips/ Falls 56. Hand injuries, cuts or lacerations during manual handling of materials 57. Foot injuries 58. Back injuries 59. Traffic	63. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 64. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 65. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	60. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 61. High Noise levels 62. Overhead hazards 63. Heat Stress/ Cold Stress 64. Eye Injuries	66. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 67. Wear high visibility clothing & vest / Use cones or signs to designate work area 68. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 69. Wear hearing protection 70. Wear hard hat / Avoid areas were overhead hazards exist. 71. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 72. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Site Inspection**
JSA Number: **JSA024-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☒ Rubber Boots
☒ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
42.Jobsite Pre-briefing	33.None	22. Review JSA, SOP's, and discuss hazards that may be present and control measures for present hazards while on-site.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
2. Working near railroads	1. Passing Trains. 2. Slip/Trips/Falls.	1. Wear reflective vest/ Stay away from tracks/ Do not cross tracks within 10 ft. of train car or when there is a train within view/listen for train horn. 2. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
3. Walking around site	6. Uneven terrain 7. Wildlife: Stray animals, mice/rats, vectors (i.e. mosquitoes, bees, etc.) 8. Weather: Heat/cold stress 9. Slip/Trips/Falls 10. Foot injuries 11. Eye injuries	9. Pay attention to surrounding area (puddles, wet, frozen, uneven areas); Mark with cones or spray paint. 10. Use bug spray/ Avoid stray animals/Use repellant when needed. 11. Dress for the correct weather situation/ Use sunscreen or protective clothing in sunlight, layers in cold weather/ Drink plenty of fluids/ Take breaks when needed. 4. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones. 5. Wear proper PPE (Langan approved safety shoes)/ Change wet socks during cold weather. 6. Wear proper PPE (safety glasses/goggles).
4. Working near road	1. Passing vehicles 2. Slip/Trips/Falls	1. Wear reflective vest/ Stay away from roadway/ Use buddy system/ Place signage or cones when needed. 2. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
5. All activities	65. Slips/ Trips/ Falls 66. Hand injuries, cuts or lacerations during manual handling of materials 67. Foot injuries 68. Back injuries 69. Traffic 70. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 71. High Noise levels 72. Overhead hazards 73. Heat Stress/ Cold Stress 74. Eye Injuries	73. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 74. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 75. Wear Langan approved safety shoes 76. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 77. Wear high visibility clothing & vest / Use cones or signs to designate work area 78. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 79. Wear hearing protection 80. Wear hard hat / Avoid areas were overhead hazards exist. 81. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 82. Wear safety glasses
Additional items.		

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Building Construction Oversight**
JSA Number: **JSA006-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task / **Stop** & regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
43. Transport equipment to work area	34. Back Strain 35. Slips/ Trips/ Falls 36. Traffic 37. Cuts/abrasions from equipment 38. Contusions from dropped equipment	11. Use proper lifting techniques / Use wheeled transport 12. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 13. Wear proper PPE (high visibility vest or clothing) 14. Wear proper PPE (leather gloves, long sleeves) 15. Wear proper PPE (safety shoes)
44. Drilling/anchor boilt installation	16. Hazards associated with drilling, flying objects, heavy equipment, ground level hazards and dust 17. Slips/ Trips/ Falls 18. Hazards associated with concrete work	6. Maintain a safe distance from drilling operation / Wear proper PPE (hard hat, safety glasses, safety shoes, safety vest) 7. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint / Wear the proper PPE (safety shoes) 8. Maintain a safe distance from pouring operation
45. Steel building erection	17. Overhead hazards, falling objects 18. Pinching/crushing hazards	8. Wear proper PPE (hard had, safety glasses, safety vest) / Be aware of overhead hazards and maintain a safe distance of at least 10 ft. 9. All personnel should make others aware of moving objects or their inten to move objects / Avoid areas where pinching and crushing hazards are possible
46. All activities	75. Slips/ Trips/ Falls 76. Hand injuries, cuts or lacerations during manual handling of materials 77. Foot injuries 78. Back injuries 79. Traffic	83. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 84. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 85. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	80. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 81. High Noise levels 82. Overhead hazards 83. Heat Stress/ Cold Stress 84. Eye Injuries	86. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 87. Wear high visibility clothing & vest / Use cones or signs to designate work area 88. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 89. Wear hearing protection 90. Wear hard hat / Avoid areas were overhead hazards exist. 91. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 92. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Groundwater Sampling
JSA Number: JSA008-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – *Stop,* what has changed?
T – *Think* about the task
E – *Evaluate* potential hazards
P – *Plan* safe approach
S - *Start* task / *Stop* & regroup

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☒ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Tyvek sleeves, Dermal Protection, PID				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
47. Transport equipment to work area	1. Back Strain 2. Slips/ Trips/ Falls 3. Traffic 4. Cuts/abrasions from equipment 5. Contusions from dropped equipment	1. Use proper lifting techniques / Use wheeled transport 2. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves) 5. Wear proper PPE (safety shoes)
48. Remove well cover	19. Scrape knuckles/hand 20. Strain wrist/bruise palm 21. Pinch fingers or hand	9. Wear proper PPE (leather gloves) 10. Using a hammer, tap the end of the wrench to loosen grip of bolts 11. Wear proper PPE (leather gloves)
49. Remove well cap and lock	19. Well can pops from pressure 20. Exposure to hazardous substances through inhalation or dermal exposure 21. Scrape knuckles/hand 22. Strain write/bruise palm	10. Remove cap slowly to relieve pressure / Do not place face over well when opening / Wear proper PPE (safety glasses) 11. Use direct air monitoring/reading instrument (i.e. PID) / Be familiar with and follow actions prescribed in the HASP / Wear proper PPE (nitrile gloves) 12. Wear proper PPE (leather gloves) 13. Using hammer, tap the end of the wrench to loosen grip
50. Measure head-space vapor levels	1. Exposure to hazardous substances through inhalation	1. Do not place face over well when collecting measurement
51. Remove dedicated tubing (if necessary)	1. Exposure to hazardous substances through inhalation or dermal exposure 2. Tubing swings around after removal	1. Wear proper PPE (nitrile gloves, Tyvek sleeves) 2. Wear proper PPE (safety glasses)
52. Set-up plastic sheeting for work site around the well	1. Lacerations when cutting plastic sheeting	1. Use scissors to cut plastic sheeting / Cut motions should always be away from body and body parts

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
53. Measure depth to water	1. Exposure to hazardous substances through inhalation or dermal exposure 2. Pinch fingers or hand in water level instrument	1. Wear proper PPE (nitrile gloves) 2. Wear proper PPE (leather gloves)
54. Calibrate monitoring equipment	1. Skin or eye contact with calibration chemicals 2. Pinch fingers or hand in monitoring equipment	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (leather gloves) / Avoid pinch points
55. Install sampling pump in well	1. Hand injuries during installation of pump 2. Lacerations when cutting tubing 3. Back strain during installation of pump 4. Physical hazards associated with manual lifting of heavy equipment 5. Back strain from starting generator 6. Burns from hot exhaust from generator 7. Electrical shock from improper use of generator and pump 8. Contaminated water spray from loose connections	1. Wear proper PPE (leather gloves, nitrile gloves) 2. Use safety tubing cutter 3. Use proper lifting techniques 4. Use proper lifting techniques / Use wheeled transport for heavy equipment 5. Use arm when starting generator / Do not over-strain if generator does not start 6. Do not touch generator near exhaust / Use proper handle to carry / Allow generator to cool down before moving 7. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord 8. Check all tubing connections to ensure they are tight and secure

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
10. Purge water	1. Contact with potentially contaminated groundwater 2. Back strain from lifting buckets of water 3. Tripping potential on sample discharge lines and pump electric line	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Use proper lifting techniques / Use wheeled transport 3. Organize discharge of electric line to keep out of way as much as possible / Mark potential tripping hazards with caution tape or safety cones
11. Sample water collection	1. Contact with potentially contaminated groundwater through dermal exposure 2. Contact with and burns from acid used for sample preservation 3. Tripping potential on sample discharge lines and pump electric line 4. Lacerations from broken sample bottles 5. Back strain when transporting coolers full of collected samples 6. Slips/ Trips/ Falls	1. Wear proper PPE (safety glasses, nitrile gloves) 2. Wear proper PPE (safety glasses, nitrile gloves) / Ensure sample bottle lids are secure before use and after sample collection 3. Organize line to keep out of the way as much as possible / Mark potential tripping hazards with caution tape or safety cones 4. Do not over-tighten bottle caps / Handle bottles safely to prevent breakage / Wrap glass bottles in bubble wrap, if possible 5. Use proper lifting techniques / Use wheeled transport / Seek assistance if coolers weight exceeds 50lbs. / Minimize distance to vehicle 6. Have unobstructed path to vehicle or collection point / Follow good housekeeping procedures / Do not lift/walk with coolers that are too heavy/difficult to lift
12. Remove pump and pack up equipment	1. Back strain when removing pump or lifting heavy equipment	1. Use proper lifting technique / Use wheeled transport for heavy equipment
13. Replace well cap and lock	1. Scrape fingers/hand 2. Strain wrist/bruise palm	1. Wear proper PPE (leather gloves) 2. Using hammer, tap the end of the well cap to tighten grip
14. Replace well cover	1. Scrape knuckles/hand 2. Strain write/bruise palm 3. Pinch fingers or hand	1. Wear proper PPE (leather gloves) 2. Using hammer, tap the end of the wrench to tighten the grip of the bolts 3. Wear proper PPE (leather gloves)
15. Transport drums to disposal staging location	1. Back, arm or shoulder strain from moving drums 2. Pinch hazard 3. Contact with potentially contaminated groundwater when moving improperly sealed drums 4. Slips/ Trips/ Falls when moving drum 5. Drop drum on feet/toes	1. Use drum cart for moving drums / Use proper lifting techniques / Obtain assistance, if needed 2. Wear proper PPE (leather gloves) 3. Wear proper PPE (nitrile gloves under leather gloves) / Properly seal drum to prevent leak 4. Ensure route to move drum to storage space is dry and free from obstructions 5. Wear proper PPE (safety shoes)
16. Place used PPE in designated disposal drum	1. Pressure build-up inside drum 2. Pinch hazard	1. Remove cap from bung hole in drum to relieve pressure 2. Wear proper PPE (leather gloves)
17. Decontaminate equipment	1. Splashing water/soap from decontamination 2. Contact with potentially contaminated groundwater through dermal exposure 3. Electrical shock from broken electric cords	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (safety glasses, dermal protection) 3. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord
18. All activities	85. Slips/ Trips/ Falls 86. Hand injuries, cuts or lacerations during manual handling of materials 87. Foot injuries 88. Back injuries 89. Traffic 90. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.)	93. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 94. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 95. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	91. High Noise levels 92. Overhead hazards 93. Heat Stress/ Cold Stress 94. Eye Injuries	96. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 97. Wear high visibility clothing & vest / Use cones or signs to designate work area 98. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 99. Wear hearing protection 100. Wear hard hat / Avoid areas were overhead hazards exist. 101. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 102. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: Well Installation **JSA Number: JSA019-01**	 **S** – ***Stop,*** *what has changed?* **T** – ***Think*** *about the task* **E** – ***Evaluate*** *potential hazards* **P** – ***Plan*** *safe approach* **S** - ***Start*** *task /* ***Stop*** *& regroup*
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

PERSONAL PROTECTIVE EQUIPMENT REQUIRED:				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: PID, Tyvek sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
56. Move equipment to work site	39. Back strain when lifting equipment	23. Use proper lifting technique (use legs for bending and lifting and not the back)/ Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle
	40. Slips/ Trips/ Falls while moving equipment	24. Use proper lifting technique (use legs for bending and lifting and not the back) / Use wheeled transport for heavy equipment / Get assistance when handling loads greater than 50 lbs. / Minimize distance to vehicle / Have unobstructed path to vehicle or collection point / Do not lift/walk with boxes that are heavy/difficult to lift
	41. Traffic (if applicable)	25. Wear high visibility safety vests or clothing / Exercise caution
	42. Pinched fingers or running over toes during geoprobe set-up	26. Wear proper PPE (cut-resistant gloves) / Stay alert, be aware of geoprobe rig at all times
	43. Overturn drilling rig while transporting to loading dock on flat-bed tow truck	27. Drill rig should be parked in center of flat-bed tow truck / Emergency brake shall be used at all times during transport on the flat-bed truck/ All unnecessary personnel should stay away from the flat-bed truck during moving activities
57. Calibration of monitoring equipment	22. Skin or eye contact with calibration chemicals 23. Pinch fingers in monitoring equipment	12. Wear proper PPE (safety glasses/ goggles) 13. Wear proper PPE (leather gloves)
14. Set-up geoprobe rig	23. Geoprobe rig movement	12. All field personnel should stay clear of the geoprobe rig while moving / Use a spotter when backing up the geoprobe
15. Advance geoprobe rods below ground surface to desired depth	12. Underground utilities 13. High noise levels	12. Clean all subsurface soil borings to a minimum of 5 feet below grade 13. Wear proper PPE (hearing protection)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
16. Remove and open acetate liner 5. Remove and open acetate liner (cont'd)	95. Pinched fingers while removing macrocore 96. Cuts/lacerations when cutting acetate liner open 97. Exposure to hazardous vapors 98. Skin contact with contaminated soil	5. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 6. Wear proper PPE (cut-resistant or leather gloves) 7. Do not place face over acetate liner when opening / Monitor hazardous vapors in air with PID / Upgrade PPE as necessary based on levels contained in the Health and Safety Plan 8. Wear proper PPE (nitrile gloves)
6. Remove excess soil from acetate liner and place in 55-gallon drum (IF NOT PERFORMED BY LANGAN, REMOVE!)	5. Cuts/lacerations from acetate liner 6. Pinched fingers/hand while opening/closing drum 7. Skin contact with contaminated soil 8. Soil debris in eyes	5. Wear proper PPE (cut-resistant or leather gloves) 6. Wear proper PPE (cut-resistant or leather gloves) 7. Wear proper PPE (nitrile gloves) 8. Wear proper PPE (safety glasses)
7. Attach hollow-stem augers to the geoprobe rig; Advance augers and attach additional augers until desired depth is reached	1. Strain wrist/bruise palm 2. Pinched fingers 3. Back Strain 4. Clothing entanglement 5. Carbon monoxide poisoning 6. Bruise toes/foot 7. High noise levels 8. Skin contact with contaminated soil	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Use proper lifting techniques 4. Wear proper work attire(no loose clothing/strings) 5. Properly ventilate work area 6. Wear proper PPE (safety shoes) 7. Wear proper PPE (hearing protection) 8. Wear proper PPE (Tyvek sleeves, nitrile gloves)
8. Install monitoring well	1. Pinched fingers 2. Lacerations/abrasions 3. Back Strain	1. Wear proper PPE (cut-resistant or leather gloves) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Use proper lifting techniques
9. Tremie-grout annulus space above bentonite seal	1. Back strain 2. Pinched fingers	1. Use proper lifting techniques 2. Wear proper PPE (cut-resistant or leather gloves)
10. Install flush-mount monitoring well pad	1. Splashed concrete 2. Pinched fingers 3. Cuts/lacerations	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (cut-resistant or leather gloves) 3. Wear proper PPE (cut-resistant or leather gloves)
11. Decontaminate equipment	1. Splashing water/soap 2. Contact with potentially contaminated groundwater/soil through dermal exposure 3. Electrical shock from broken electric cords	1. Wear proper PPE (safety glasses) 2. Wear proper PPE (safety glasses, dermal protection) 3. Properly plug in pump to generator / Do not allow the pump or generator to contact water / Check for breaks in the cord
12. Transport drums to central staging location (IF NOT PERFORMED BY LANGAN, REMOVE!)	7. Back, arm or shoulder strain from moving drums 8. Pinch fingers/hand in drum cart when moving drums 9. Pinch fingers/hand when operating lift-gate on vehicle 10. Contact with potentially contaminated groundwater when moving improperly sealed drums 11. Slips when moving drums 12. Drop drum on feet/toes	103. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 104. Wear proper PPE (cut-resistant or leather gloves) 105. Wear proper PPE (cut-resistant or leather gloves) 106. Wear proper PPE (nitrile gloves underneath work gloves) 107. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 108. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
13. All activities 13. All activities (cont'd)	11. Slips/ Trips/ Falls 12. Hand injuries, cuts or lacerations during manual handling of materials 13. Foot injuries 14. Back injuries 15. Traffic 16. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 17. High Noise levels 18. Overhead hazards 19. Heat Stress/ Cold Stress 20. Eye Injuries	11. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 12. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 13. Wear Langan approved safety shoes 14. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 15. Wear high visibility clothing & vest / Use cones or signs to designate work area 16. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 17. Wear hearing protection 18. Wear hard hat / Avoid areas were overhead hazards exist. 19. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 20. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Monitoring Well Development**
JSA Number: **JSA026-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – *Stop*, what has changed?
T – *Think* about the task
E – *Evaluate* potential hazards
P – *Plan* safe approach
S - *Start* task / *Stop* & regroup

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☒ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Tyvek Sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
58. Transport equipment to work area	44. Back Strains 45. Slips/Trips/Falls 46. Traffic 47. Cuts/Abrasions/Contusions from equipment	28. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment. 29. Minimize distance from work area/ unobstructed path to collection points and vehicle/ Follow good housekeeping procedures. 30. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed. 31. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
59. Measure depth of water	24. Exposure to hazardous substances 25. Pinched fingers	17. Wear proper PPE (Nitrile gloves, Safety glasses/Face shield). 18. Wear proper PPE (cut-resistant gloves).
60. Install Tremie pipe in the monitoring well and connect to water source.	24. Hand injuries during installation (pinched fingers/hands). 25. Back strain from holding Tremie pipe. 26. High pressure water spray.	13. Wear proper PPE (Nitrile gloves/cut-resistant gloves). 14. Use proper lifting techniques/ Use two personnel when lowering pump greater than 80 feet. 15. Ensure all hose connections are tight and secure/ Use proper PPE (face shield and safety glasses).
61. Install pump in to well a. Connect pump to sample tubing. b. Lower pump to desired depth in well. c. Connect sample tubing to flow cell d. Connect pump to power source	14. Hand injuries during pump installation and sample tubing cutting. 15. Back strain 16. Electric shock 17. Exhaust gases from generator 18. Burns from hot equipment	14. Wear proper PPE when installing pump and cutting sample tubing (Nitrile and cut-resistant gloves)/ Use tubing cutter. 15. Proper lifting techniques/ Two personnel when installing pump at depths greater than 80 feet/ Use buddy when lifting heavy loads (pump, generator)/Use wheeled transport. 16. Ensure equipment is (LO/TO: locked out/tagged out) prior to preforming any electrical connections/ Inspect wires for frays or cuts/Ensure generator is properly grounded prior to starting.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
(generator) e. Turn on power source (generator)		17. Position generator so that exhaust is flowing away from work area. 18. Do not touch exhaust or any hot part of generator/ Allow equipment time to cool down prior to carrying/ Use proper PPE (long sleeves, leather gloves)
62. Develop monitoring well a. Jet water into well using Tremie pipe b. Turn pump on and adjust to desired flow rate. c. Surge pump up and down well to remove sediment from screen d. Containerize all purge water from well.	99. Hand injuries 100. Face injuries 101. Contaminated spray from water	109. Wear proper PPE (cut-resistant gloves and nitrile gloves). 110. Wear proper PPE (face shield and safety glasses)/do not stand over well opening. 111. Wear proper PPE (Face shield and safety goggles)/Tyvek over garments/ Ensure all connections are secure and tight/ Tubing outlet is contained in an overflow container.
63. Drum staging area.	1. Back, Arm, and shoulder strain. 2. Pinch points 3. Cross contamination 4. Slip/Trips/Falls	1. Use proper lifting techniques/ Use drum carts when moving drums/ use buddy system for moving of drums if needed/Move drums shortest distance needed. 2. Keep fingers and feet away from pinch points/ Use proper PPE (cut-resistant gloves, Langan approved safety shoes) 3. Use proper PPE (Nitrile gloves, Tyvek sleeves) 4. Ensure pathway is clear prior to moving equipment/ Mark all hazards/ Use additional person as a spotter if needed.
64. Equipment pack-up	1. Back Strains 2. Slips/Trips/Falls 3. Traffic 4. Cuts/Abrasions/Contusions from equipment.	1. Use proper lifting techniques/ Use wheeled transport/ use buddy system when lifting equipment. 2. Minimize distance from work area/ Unobstructed path to collection points and vehicle/ Follow good housekeeping procedures. 3. Wear high-visibility vest or clothing/Exercise caution/ Use traffic cones or signage if needed. 112. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes).
65. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 102. Back injuries 103. Traffic 104. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 105. High Noise levels 106. Overhead hazards 107. Heat Stress/ Cold Stress 108. Eye Injuries	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 2. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 5. Wear high visibility clothing & vest / Use cones or signs to designate work area 6. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 7. Wear hearing protection 8. Wear hard hat / Avoid areas were overhead hazards exist. 9. Wear proper attire for weather conditions (sunscreen or protective clothing

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 10. Wear safety glasses.
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Hammer Drill**
JSA Number: **JSA049**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☒ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
66. Transport equipment to work area	48. Back Strain 49. Slips/ Trips/ Falls 50. Traffic 51. Cuts/abrasions from equipment 52. Contusions from dropped equipment	16. Use proper lifting techniques / Use wheeled transport 17. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 18. Wear proper PPE (high visibility vest or clothing) 19. Wear proper PPE (leather gloves, long sleeves) 20. Wear proper PPE (safety shoes)
67. Electrical Connection	26. Inpsect electrical cord to drill 27. Inspect hammer drill 28. Inspect extension cord 29. Test GFCI	12. Check the plug, insure all connections are in place, and check cord for frayed sections. If plug or cord are worn, do not use equipment until repaired 13. Inspect chuck for proper grasping and holding of bit, check that plastic housing is not cracked or missing pieces. Do not use if chuck doesn't work properly or housing is compromised. 14. Inspect extension cord, if worn or stripped pull from service and replace 15. Test GFCI, replace if GFCI fails
68. Drill Bit	1. Inspect drill bit	1. Replace if worn 2. Wear proper PPE (leather gloves) when installing and removing drill bit. 3. Ensure equipment is unplugged from electrical power when removing and installing drill bit.
69. Use of Hammer Drill	1. Hazards associated with using hammer drill, flying objects, heavy equipment, ground level hazards and dust 2. Slips/ Trips/ Falls 3. Hazards associated drilling into concrete slab	1. Maintain a safe distance from other site operations / Wear proper PPE (hard hat, safety glasses, safety shoes, safety vest, ear protection and leather gloves) 2. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark extension cord pathway with safety cones 3. Do not push hammer drill during use.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
70. All activities 4. All activities (cont'd)	109. Slips/ Trips/ Falls 110. Hand injuries, cuts or lacerations during manual handling of materials 111. Foot injuries 112. Back injuries 113. Traffic 114. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 115. High Noise levels 116. Overhead hazards 117. Heat Stress/ Cold Stress 118. Eye Injuries	113. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 114. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 115. Wear Langan approved safety shoes 116. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 117. Wear high visibility clothing & vest / Use cones or signs to designate work area 118. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 119. Wear hearing protection 120. Wear hard hat / Avoid areas were overhead hazards exist. 121. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 122. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	**Sign Name**	**Date**
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: Indoor Air Sampling
JSA Number: JSA007-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
T – ***Think*** *about the task*
E – ***Evaluate*** *potential hazards*
P – ***Plan*** *safe approach*
S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☒ Hearing Protection
☒ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: PID, Respiratory Protection (if necessary)				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
71. Building walkthrough and background contaminant removal	53. Slips / Trips/ Falls 54. Exposure to substances/vapors during removal	21. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint 22. Monitor indoor air concentrations with a PID / Wear proper PPE (nitrile gloves) / Wear proper respiratory protection if necessary
72. Transport equipment to work area	6. Back Strain 7. Slips/ Trips/ Falls 8. Traffic 9. Cuts/abrasions from equipment 10. Contusions from dropped equipment	6. Use proper lifting techniques / Use wheeled transport 7. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 8. Wear proper PPE (high visibility vest or clothing) 9. Wear proper PPE (leather gloves, long sleeves) 10. Wear proper PPE (safety shoes)
73. Mark out areas for indoor air sampling	30. Slips/ Trips/ Falls	16. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint
74. Set-up canisters and begin indoor air sampling	27. Dropping crates or canisters 28. Pinch hazard	14. Exercise caution when moving crates and canisters / Use proper housekeeping of materials during sample events / Do not carry too many items at one time / Perform several trips, if necessary 15. Wear proper PPE (leather gloves)
75. Sample collection	2. Dropping crates or canisters 3. Pinched fingers from opening valves	2. Exercise caution when moving crates and canisters / Use proper housekeeping of materials during sample events / Do not carry too many items at one time / Perform several trips, if necessary 3. Wear proper PPE (leather gloves) / Keep fingers away from pinch points
76. Pack up equipment	3. Back strain	3. Use proper lifting techniques / Use wheeled transport

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	4. Slips/ Trips/ Falls 5. Traffic	4. Be aware of potential trip hazards / Follow good housekeeping procedures / Minimize distance to vehicle 5. Wear proper PPE (safety vest)
77. All activities	119. Slips/ Trips/ Falls 120. Hand injuries, cuts or lacerations during manual handling of materials 121. Foot injuries 122. Back injuries 123. Traffic 124. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 125. High Noise levels 126. Overhead hazards 127. Heat Stress/ Cold Stress 128. Eye Injuries	123. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 124. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 125. Wear Langan approved safety shoes 126. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 127. Wear high visibility clothing & vest / Use cones or signs to designate work area 128. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 129. Wear hearing protection 130. Wear hard hat / Avoid areas were overhead hazards exist. 131. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 132. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Sub-slab soil gas temporary point installation and sampling**
JSA Number: **JSA037-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.



S – ***Stop,*** *what has changed?*
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S - ***Start*** *task /* ***Stop*** *& regroup*

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Shoes	☒ Long Sleeves	☒ Safety Vest (Class 2)	☒ Hard Hat	☐ Hearing Protection
☒ Safety Glasses	☒ Safety Goggles	☐ Face Shield	☒ Nitrile Gloves	☐ PVC Gloves
☒ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☒ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☒ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Tyvek Sleeves				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
78. Transport equipment to work site	55. Back injuries 56. Slips/Trips/Falls 57. Traffic 58. Hand injuries	32. Use proper lifting techniques/ Use wheeled transport/ Get assistance when need with moving equipment/ Minimize distance from vehicle 33. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures. 34. Wear proper PPE (High Visibility vest and clothing)/ Exercise caution (stay alert-stay alive) 35. Wear proper PPE (leather gloves)/ Keep finger and hands clear of pinch points.
79. Mark area for drilling	31. Slips/Trips/Falls	19. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
80. Drill sampling points with hammer drill	29. Eye injuries 30. Dust exposure 31. Hand injuries 32. Catch items (clothing) 33. Electric shock 34. Chemical atmosphere hazard (vapor) 35. Slips/Trips/Falls	16. Wear proper PPE (safety glasses) 17. Wear proper PPE (dust mask) 18. Wear proper PPE (leather gloves)/ Keep hands and fingers out of pinch points/ Avoid drill catching on ground and twisting wrist or hand/ Release drill grip if drill becomes caught/ Ensure drill is unplugged prior to inserting bit. 19. Tie up or tuck-in all loose clothing/ Maintain distance from drill 20. Inspect power cable for cuts or nicks before use/ Use GFCI outlet on power cord/ Do not use in wet conditions 21. Monitor air, vapors with Photo-ionization detector (PID)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		22. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
81. Measure vapor content and depth to bottom of hole	1. Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from opening of hole while collecting measurements
82. Set-up of shroud and sampling canister system	1. Hand injuries 2. Chemical atmosphere hazard (vapors) 3. Slips/Trips/Falls	1. Wear proper PPE (leather gloves, nitrile gloves)/ Keep fingers away from pinch points when installing pump/ Do not use open blades, use tubing cutter 2. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from opening of hole while collecting measurements 3. Minimize distance from vehicle/ Have unobstructed pathway to vehicle and collection points/ Mark tripping hazards with spray paint, cones, or caution tape/ Observe good housekeeping procedures
83. Purge soil gas	1. Chemical atmosphere hazard (vapors)	1. Monitor air, vapors with Photo-ionization detector (PID)/ Keep face away from exhaust port of pump
84. Sample collection (opening and closing valves)	1. Hand injuries	1. Wear proper PPE (leather gloves)/ Keep fingers away from pinch points
85. Sealing sampling holes	1. Back injuries 2. Concrete dust 3. Eye injuries	1. Use proper lifting techniques for lifting of cement bags 2. Wear proper PPE (dust mask) 3. Wear proper PPE (safety glasses)
86. All activities	129. Slips/ Trips/ Falls 130. Hand injuries, cuts or lacerations during manual handling of materials 131. Foot injuries 132. Back injuries 133. Traffic 134. Wildlife: Stray animals, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 135. High Noise levels 136. Overhead hazards 137. Heat or cold injuries 138. Eye Injuries	133. Be aware of potential trip hazards/ Follow good housekeeping procedures/ Mark significant hazards 134. Inspect for jagged/sharp edges, and rough or slippery surfaces/ Keep fingers away from pinch points/ Wipe off greasy, wet, slippery or dirty objects before handling/ Wear leather/ cut-resistant gloves Wear proper PPE (Langan approved safety shoes) 135. Use proper lifting techniques/ Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift/ Obtain assistance when possible 136. Wear high visibility clothing & vest/ Use cones or signs to designate work area 137. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray animals/ Carry and use animal repellant when needed/ Use bug spray when needed 138. Wear hearing protection 139. Wear hard hat/ Avoid areas were overhead hazards exist. 140. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather)/ Drink plenty of fluids to avoid dehydration/ Takes breaks as necessary to avoid heat/cold stress 141. Wear safety glasses

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

ATTACHMENT H

TAILGATE SAFETY BRIEFING FORM

LANGAN TAILGATE SAFETY BRIEFING

Date:_____ Time: _____

Leader:_____ Location:_____

Work Task:

_____

_____

SAFETY TOPICS (*provide some detail of discussion points*)

Chemical Exposure Hazards and Control:_____

_____

Physical Hazards and Control: _____

Air Monitoring: _____

PPE: _____

_____

Communications:_____

Safe Work Practices: _____

_____

Emergency Response: _____

Hospital/Medical Center Location: _____

Phone Nos.: _____

Other: _____

FOR FOLLOW-UP (the issues, responsibilities, due dates, etc.**)**

_____

_____

_____

ATTENDEES

PRINT NAME	COMPANY	SIGNATURE

APPENDIX E

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

for

250 WATER STREET
New York, New York
NYSDEC BCP Site No. C231127

Prepared for:
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c/o: The Howard Hughes Corporation
199 Water Street, 28th Floor
New York, NY 10038

Prepared by:
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May 14, 2021
Langan Project No. 170381202

LANGAN

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1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) was completed on behalf of 250 Seaport District, LLC (the Volunteer) for the proposed development located at 250 Water Street, New York, New York. This QAPP supports the Remedial Action Work Plan (RAWP) that was submitted to the New York State Department of Environmental Conservation (NYSDEC) as part of a New York State Brownfield Cleanup Program (BCP) application. The Participant intends to remediate the site in conjunction with redevelopment.

This QAPP specifies analytical methods to be used to ensure that data from the proposed RA are precise, accurate, representative, comparable, complete, and meet the sensitivity requirements of the project.

1.2 PROJECT OBJECTIVES

The RAWP covers earthwork to be completed during construction of the proposed development at the site. A Construction Health and Safety Plan (CHASP) and Community Air Monitoring Plan (CAMP) for the protection of on-site workers, the community, and the environment has been developed and will be implemented during remediation and construction activities. These objectives have been established in order to meet standards that will protect public health and the environment for the site.

1.3 SCOPE OF WORK

The RAWP will be executed by accomplishing the following tasks:

The selected on-site alternative II, a Track 2 remedy, will include the following tasks:

- Development and implementation of a CHASP and CAMP for the protection of on-site workers, visitors, and the environment during remediation activities
- As a pre-requisite to site remediation, removal of the surficial asphalt cover by the contractor and management of removed asphalt as construction and demolition (C&D) debris in accordance with Part 360 and 361 regulations.
- A remedial design investigation including waste characterization and supplemental delineation
- Excavation and removal of the mercury-impacted soil/fill hotspot at 302 Peal Street

- Excavation and removal of historic fill/soil across the site to meet RURR SCOs, including excavation below 15 feet for removal or treatment of grossly contaminated media (i.e. petroleum source material)
- Decommissioning and removal of USTs, in accordance with NYSDEC DER-10 5.4(b)(5)
- Appropriate off-site disposal of historic fill and soil removed from the site in accordance with federal, state, and local rules and regulations for handling, transport, and disposal
- Installation of support of excavation (SOE) necessary to facilitate remedial excavation
- Dewatering, as necessary, to accommodate remedial excavation and remediation of petroleum-impacted groundwater
- Screening for indications of contamination source areas during any intrusive site work by visual, olfactory, or instrumental methods
- Collection and analysis of confirmation soil samples, in accordance with DER-10, at the completion of the remedial excavation to document post-remediation soil quality
- Import of materials for backfill, where required, in compliance with: a) RURR or PGW SCOs, whichever is more stringent; b) 6 NYCRR Part 360 regulations; and c) federal, state, and local rules and regulations for handling and transport of material
- Completion of a soil vapor intrusion (SVI) evaluation
- Recording of an Environmental Easement (EE) to memorialize the remedial action and the institutional controls to ensure that future owners of the site continue to maintain these controls as required
- Preparation of an SMP that describes management of the ICs – Implementation of the SMP following completion of the remedy will be stipulated by the EE.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

The quality assurance and quality control objectives for all measurement data include:

- **Precision** – an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and/or matrix spike duplicates.
- **Accuracy** – a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. For soil and groundwater samples, accuracy will be determined through the assessment of the analytical results of field blanks, equipment blanks, and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), internal standards, laboratory method blanks, instrument calibration, and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.

  For soil vapor or air samples, analytical accuracy will be assessed by examining the percent recoveries that are added to each sample, internal standards, laboratory method blanks, and instrument calibration.
- **Representativeness** – expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that specified sampling and analysis techniques are used. Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is accomplished by following all applicable methods, laboratory-issued standard operating procedures (SOPs), the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.
- **Completeness** – the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.

- **Comparability** – expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis as documented in the QAPP, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** – the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection.

3.0 PROJECT ORGANIZATION

The execution of the RAWP will be overseen by Langan on behalf of 250 Seaport District, LLC. Langan will perform the sampling collection as described in the RAWP and will subcontract drilling, geophysical, and an Environmental Laboratory Approval Program (ELAP)-certified laboratory. Langan will also perform the data analysis, evaluation, and reporting tasks.

The analytical services (except mercury speciation) will be performed by Alpha Analytical Laboratories, Inc. (Alpha) of Mansfield, MA, New York State Department of Health (NYSDOH) ELAP certification number 11148. Data validation services will be performed by approved data validation contractor(s).

Key contacts for this project are as follows:

Personnel	Investigation Role	Contact Information
Mimi Raygorodetsky Langan	Project Leader/ Quality Assurance Officer	Phone – 212-479-5400 Email – mraygorodetsky@langan.com
Paul McMahon, P.E. Langan	Project Manager	Phone – 212-479-5400 Email – pmcmahon@langan.com
Michael Burke, PG, CHMM Langan	Qualified Environmental Professional	Phone – 212-479-5400 Email – mburke@langan.com
Jason Hayes, P.E. Langan	Project Engineer	Phone – 212-479-5400 Email – jhayes@langan.com
Tony Moffa, CHMM, CSP Langan	Langan Health & Safety Officer	Phone – 215-491-6500 Email – tmoffa@langan.com
William Bohrer, PG Langan	Field Safety Officer	Phone – 212-479-5400 Email – wbohrer@langan.com
Joseph Yanowitz. Langan	Field Team Leader	Phone – 212-479-5400 Email – jyanowitz@langan.com
Ben Rao Alpha Analytical Jane Huber Eurofins	Laboratory Contractor	Phone – 201-812-2633 Email – brao@alphalab.com Phone – 717-209-1438 Email – JaneHuber@EurofinsUS.com
Polly S. Newbold, DDMS Inc.	Data Validator	Phone – 908-479-1975 Email – PNewbold@ddmsinc.com

4.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

The overall quality assurance objective is to develop and implement procedures for sampling, laboratory analysis, field measurements, and reporting that will provide data of sufficient quality to evaluate the engineering controls on the site. The sample set, chemical analysis results, and interpretations must be based on data that meet or exceed quality assurance objectives established for the site. Quality assurance objectives are usually expressed in terms of accuracy or bias, sensitivity, completeness, representativeness, comparability, and sensitivity of analysis. Variances from the quality assurance objectives at any stage of the investigation will result in the implementation of appropriate corrective measures and an assessment of the impact of corrective measures on the usability of the data.

4.1 PRECISION

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates. Laboratory precision and sample heterogeneity also contribute to the uncertainty of field duplicate measurements. This uncertainty is taken into account during the data assessment process. For field duplicates, results less than 2x the reporting limit (RL) meet the precision criteria if the absolute difference is less than ±2x the RL and acceptable based on professional judgment. For results greater than 2x the RL, the acceptance criteria is a relative percent difference (RPD) of ≤50% (soil and air), <30% (water). RLs and method detection limits (MDL) are provided in Attachment B.

4.2 ACCURACY

Accuracy is the measurement of the reproducibility of the sampling and analytical methodology. It should be noted that precise data may not be accurate data. For the purpose of this QAPP, bias is defined as the constant or systematic distortion of a measurement process, which manifests itself as a persistent positive or negative deviation from the known or true value. This may be due to (but not limited to) improper sample collection, sample matrix, poorly calibrated analytical or sampling equipment, or limitations or errors in analytical methods and techniques.

Accuracy in the field is assessed through the use of field and equipment blanks and through compliance to all sample handling, preservation, and holding time requirements. All field blanks should be non-detect when analyzed by the laboratory. Any contaminant detected in an associated field or equipment blank will be evaluated against laboratory

blanks (preparation or method) and evaluated against field samples collected on the same day to determine potential for bias. Trip blanks are not required for non-aqueous matrices but are planned for non-aqueous matrices where high concentrations of VOCs are anticipated.

Laboratory accuracy is assessed by evaluating the percent recoveries of matrix spike/matrix spike duplicate (MS/MSD) samples, laboratory control samples (LCS), surrogate compound recoveries, and the results of method preparation blanks. MS/MSD, LCS, and surrogate percent recoveries will be compared to either method-specific control limits or laboratory-derived control limits. Sample volume permitting, samples displaying outliers should be reanalyzed. All associated method blanks should be non-detect when analyzed by the laboratory.

4.3 COMPLETENESS

Laboratory completeness is the ratio of total number of samples analyzed and verified as acceptable compared to the number of samples submitted to the fixed-base laboratory for analysis, expressed as a percent. Three measures of completeness are defined:

- Sampling completeness, defined as the number of valid samples collected relative to the number of samples planned for collection;
- Analytical completeness, defined as the number of valid sample measurements relative to the number of valid samples collected; and
- Overall completeness, defined as the number of valid sample measurements relative to the number of samples planned for collection.

Air, soil vapor, soil, and groundwater data will meet a 90% completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

4.4 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. Representativeness is dependent upon the adequate design of the sampling program and will be satisfied by ensuring that the scope of work is followed and that

specified sampling and analysis techniques are used. This is performed by following applicable SOPs and this QAPP. All field technicians will be given copies of appropriate documents prior to sampling events and are required to read, understand, and follow each document as it pertains to the tasks at hand.

Representativeness in the laboratory is ensured by compliance to nationally-recognized analytical methods, meeting sample holding times, and maintaining sample integrity while the samples are in the laboratory's possession. This is performed by following all applicable EPA methods, laboratory-issued SOPs, the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.5 COMPARABILITY

Comparability is an expression of the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling plan is followed and that sampling is performed according to the SOPs or other project-specific procedures. Analytical data will be comparable when similar sampling and analytical methods are used as documented in the QAPP. Comparability will be controlled by requiring the use of specific nationally-recognized analytical methods and requiring consistent method performance criteria. Comparability is also dependent on similar quality assurance objectives. Previously collected data will be evaluated to determine whether they may be combined with contemporary data sets.

4.6 SENSITIVITY

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project director will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project director will select the level of data assessment to ensure that only data meeting the project DQOs are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Attachment C. The frequency of associated field blanks and duplicate samples will be based on the recommendations listed in DER-10, and as described in Section 5.3.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. Additional sample volume is not required by the laboratory for this purpose. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

5.0 SAMPLE COLLECTION AND FIELD DATA ACQUISITION PROCEDURES

Soil sampling will be conducted in accordance with the established NYSDEC protocols contained in DER-10/Technical Guidance for Site Investigation and Remediation (May 2010). The following sections describe procedures to be followed for specific tasks.

5.1 FIELD DOCUMENTATION PROCEDURES

Field documentation procedures will include summarizing field data in field books and proper sample labeling. These procedures are described in the following sections.

5.1.1 Field Data and Notes

Field notebooks contain the documentary evidence regarding procedures conducted by field personnel. Hard cover, bound field notebooks will be used because of their compact size, durability, and secure page binding. The pages of the notebook will not be removed.

Entries will be made in waterproof, permanent blue or black ink. No erasures will be allowed. If an incorrect entry is made, the information will be crossed out with a single strike mark and the change initialed and dated by the team member making the change. Each entry will be dated. Entries will be legible and contain accurate and complete documentation of the individual or sampling team's activities or observations made. The level of detail will be sufficient to explain and reconstruct the activity conducted. Each entry will be signed by the person(s) making the entry.

The following types of information will be provided for each sampling task, as appropriate:

- Project name and number
- Reasons for being on-site or taking the sample
- Date and time of activity
- Sample identification numbers
- Geographical location of sampling points with references to the site, other facilities or a map coordinate system. Sketches will be made in the field logbook when appropriate
- Physical location of sampling locations such as depth below ground surface

- Description of the method of sampling including procedures followed, equipment used and any departure from the specified procedures
- Description of the sample including physical characteristics, odor, etc.
- Readings obtained from health and safety equipment
- Weather conditions at the time of sampling and previous meteorological events that may affect the representative nature of a sample
- Photographic information including a brief description of what was photographed, the date and time, the compass direction of the picture and the number of the picture on the camera
- Other pertinent observations such as the presence of other persons on the site, actions by others that may affect performance of site tasks, etc.
- Names of sampling personnel and signature of persons making entries

Field records will also be collected on field data sheets including boring logs, which will be used for geologic and drilling data during soil boring activities. Field data sheets will include the project-specific number and stored in the field project files when not in use. At the completion of the field activities, the field data sheets will be maintained in the central project file.

5.1.2 Sample Labeling

Each sample collected will be assigned a unique identification number in accordance with the sample nomenclature guidance included in Attachment D, and placed in an appropriate sample container. Each sample container will have a sample label affixed to the outside with the date and time of sample collection and project name. In addition, the label will contain the sample identification number, analysis required and chemical preservatives added, if any. All documentation will be completed in waterproof ink.

5.2 EQUIPMENT CALIBRATION AND PREVENTATIVE MAINTENANCE

A PID will be used during the sampling activities to evaluate work zone action levels and screen soil samples. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and the site HSO, and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a

minimum, field calibration and/or field equipment checking will be performed once daily, prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer's specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures have been followed. Documentation will include both scheduled and unscheduled maintenance.

5.3 SAMPLE COLLECTION

Soil Samples

Soil samples will be visually classified and field screened using a PID to assess potential impacts from VOCs and for health and safety monitoring. Soil samples collected for analysis of VOCs will be collected using either EnCore® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars.

Soil sampling for PFAS will be conducted in accordance with EPA Method 537 Field Sampling Guidelines. PFAS samples will be collected first in High Density Polyethylene

(HDPE)/polypropylene containers using sampling equipment either made with stainless steel, HDPE, or polypropylene. Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sun screen or clothing materials containing Gore-Tex™ or Tyvek® will be worn during sampling.

All soil samples being run for full Part 375/TCL parameters will be analyzed for PFAS by USEPA Method 537 Modified and 1,4-dioxane by USEPA Method 8270. Both methods listed above will be able to meet the reporting limits for PFAS (1 microgram per kilogram [µg/kg]) and 1,4-Dioxane (0.1 milligram per kilogram [mg/kg]) in soil.

After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected soil samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected soil sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

Groundwater Samples

Groundwater sampling will be conducted using low-flow sampling procedures following USEPA guidance ("Low Stress [low flow] Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells", EQASOP-GW 004, January 19, 2017).

During purging, field parameters should be measured, including: water level drawdown, purge rate, pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP), every five minutes using a water quality meter (Horiba U-52 or similar) and a depth-to-water interface probe that should be decontaminated between wells. Samples should generally not be collected until the field parameters have stabilized. Field parameters will be considered stable once three sets of measurements are within ±0.1 standard units for pH, ±3% for conductivity and temperature, ±10 millivolts for ORP, and ±10% for turbidity and dissolved oxygen. Purge rates should be adjusted to keep the drawdown in the well to less than 0.3 feet, as practical. Additionally, an attempt should be made to achieve a stable turbidity reading of less than 10 Nephelometric Turbidity Units (NTU) prior to sampling. If the turbidity reading does not stabilize at reading of less than 10 NTU for a given well, then both filtered and unfiltered samples should be collected from that well. If necessary, field filtration should be performed using a 0.45 micron disposable in-line filter. Groundwater samples should

be collected after parameters have stabilized as noted above or the readings are within the precision of the meter. Deviations from the stabilization and drawdown criteria, if any, should be noted on the sampling logs.

Groundwater sampling for PFAS and 1,4-dioxane will be performed in accordance with the NYSDEC-approved Groundwater Monitoring Plan, dated August 27, 2004, which specifies purging three to five well volumes prior to sample collection. The pump will be decontaminated with Alconox and water. Field personnel will wear nitrile gloves while collecting and handing groundwater samples.

Groundwater sampling for PFAS will be conducted in accordance with EPA Method 537 Field Sampling Guidelines. PFAS samples will be collected first in High Density Polyethylene (HDPE)/polypropylene containers using sampling equipment either made with stainless steel, HDPE, or polypropylene. Food and beverages will be prohibited near the sampling equipment. Additionally, no cosmetics, moisturizers, hand cream, sun screen or clothing materials containing Gore-Tex™ or Tyvek® will be worn during sampling.

Groundwater samples will analyzed for PFAS by USEPA Method 537 Modified and 1,4-dioxane by USEPA Method 8270 SIM. Both methods listed above will be able to meet the reporting limits for PFAS (2 nanograms per liter [ng/L]) and 1,4-Dioxane (0.35 micrograms per liter [µg/L]) in groundwater.

Samples should be collected directly into laboratory-supplied jars. After collection, all sample jars will be capped and securely tightened, and placed in iced coolers and maintained at 4°C ±2°C until they are transferred to the laboratory for analysis, in accordance with the procedures outlined in Section 5.4. Analysis and/or extraction and digestion of collected groundwater samples will meet the holding times required for each analyte as specified in Attachment C. In addition, analysis of collected groundwater sample will meet all quality assurance criteria set forth by this QAPP and DER-10.

A list of the PFCS is provided in Attachment B. Groundwater samples collected for analysis of per- and polyfluoroalkyl substances (PFAS) will be collected in accordance with the specialized protocol outlined in Attachment E.

Air Samples

Prior to sample collection, a pre-sampling inspection will be conducted to document chemicals and potential subsurface pathways at the Site. The pre-sampling inspection

will assess the potential for interference from chemical storage nearby or within the building. Air samples will be collected into laboratory-supplied, batch certified-clean 6-L Summa® canisters calibrated for a sampling rate of two hours. The pressure gauges on each calibrated flow controller should be monitored throughout sample collection. Sample collection should be stopped when the pressure reading reaches -4 mmHg.

Mercury vapor samples will be collected into laboratory-supplied glass sorbent tubes containing one section of 200 mg hopcalite. Glass sorbent tubes will be connected to personal sampling pumps pumping at 0.15 to 0.25 liters per minute (L/min) for 2 hours. Sample collection should be greater than 2 liter but not exceed 100 liters.

Sample Field Blanks, Equipment Blanks, and Duplicates

Field blanks will be collected for quality assurance purposes at a rate of one per 20 soil and groundwater investigation samples per analysis. Field blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Field blank samples will be analyzed for the complete list of analytes on the day of sampling. Trip blanks will be collected at a rate of one per day if soil samples are analyzed for VOCs during that day.

Equipment blanks will be collected for quality assurance purposes when soil and groundwater samples are being collected for PFAS at a rate of one per day per media. Equipment blanks will be obtained by pouring laboratory-demonstrated PFA-free water on or through a decontaminated field equipment following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Equipment blank samples will be analyzed for the NYSDEC list PFAS.

Duplicate soil and groundwater samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of 1 per 20 investigative soil samples per analysis and will be submitted to the laboratory as "blind" samples. If less than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

5.4 SAMPLE CONTAINERS AND HANDLING

Certified, commercially clean sample containers will be obtained from the analytical laboratory. If soil or groundwater samples are being collected, the laboratory will also prepare and supply the required trip blanks, equipment blanks, and field blank sample containers and reagent preservatives. Sample bottle containers, including the field and equipment blank containers, will be placed into plastic coolers by the laboratory. These coolers will be received by the field sampling team within 24 hours of their preparation in the laboratory. Prior to the commencement of field work, Langan field personnel will fill the plastic coolers with ice in Ziploc® bags (or equivalent) to maintain a temperature of 4° ±2° C.

Soil, groundwater and soil vapor samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Soil and groundwater samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. Blue ice will not be used to cool PFAS samples. The temperature in the coolers containing samples and associated field and equipment blanks will be maintained at a temperature of 4°±2°C while on-site and during sample shipment to the analytical laboratory.

Possession of samples collected in the field will be traceable from the time of collection until they are analyzed by the analytical laboratory or are properly disposed. Chain-of-custody procedures, described in Section 5.9, will be followed to maintain and document sample possession. Samples will be packaged and shipped as described in Section 5.6.

5.5 SPECIAL CONSIDERATIONS FOR PFAS SAMPLE COLLECTION

The following special considerations apply to the collection of groundwater samples for PFAS analysis to prevent cross-contamination:

- Field equipment will not contain Teflon®
- All sampling material will be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books will be used
- No plastic clipboards, binders, or spiral hard cover notebooks will be used
- No adhesives will be used
- No sharpies or permanent markers will be used; ball point pens are acceptable

- Aluminum foil will not be used
- PFAS samples will be kept in a separate cooler from other sampling containers
- Coolers will be filled only with regular ice

PFAS compound sampling protocol and the laboratories SOP for PFAS analysis are provided in Attachment E.

5.6 SAMPLE PRESERVATION

Sample preservation measures will be used in an attempt to prevent sample decomposition by contamination, degradation, biological transformation, chemical interactions and other factors during the time between sample collection and analysis. Preservation will commence at the time of sample collection and will continue until analyses are performed. Should chemical preservation be required, the analytical laboratory will add the preservatives to the appropriate sample containers before shipment to the office or field. Samples will be preserved according to the requirements of the specific analytical method selected, as shown in Attachment C.

5.6 SAMPLE SHIPMENT

5.6.1 Packaging

Soil sample containers will be placed in plastic coolers. Ice in Ziploc® bags (or equivalent) will be placed around sample containers. Cushioning material will be added around the sample containers if necessary. Chains-of-custody and other paperwork will be placed in a Ziploc® bag (or equivalent) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler.

5.6.2 Shipping

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

- All environmental samples will be transported to the laboratory by a laboratory-provided courier under the chain-of-custody protocols described in Section 5.9.

- Prior notice will be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory will be informed.

5.7 DECONTAMINATION PROCEDURES

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific HASP included in Appendix B of the RIWP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

1. Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
2. Generous tap water rinse
3. Distilled/de-ionized water rinse

Any field sampling equipment that is to be reused for PFAS sampling will be decontaminated in the field in accordance with the following procedures:

1. Alconox detergent and "PFAS-free" water scrub to remove visual contamination
2. Generous PFAS-free" water rinse

5.8 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable PPE) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Debris is expected to be transported to a local municipal landfill for disposal. If applicable, residual solids (e.g., leftover soil cuttings) will be placed back in the borehole from which it was sampled. If gross contamination is observed, soil will be collected and stored in Department of Transportation (DOT)-approved 55-gallon drums in a designated storage area at the Site. The residual materials stored in a designated storage area at the site for further characterization, treatment or disposal.

Residual fluids (such as purge water) will be collected and stored in DOT-approved (or equivalent) 55-gallon drums in a designated storage area at the site. The residual fluids will be transported to the on-site wastewater treatment plant or analyzed, characterized and disposed off-site in accordance with applicable federal and state regulations. Residual fluids such as decontamination water may be discharged to the ground surface, however,

if gross contamination is observed, the residual fluids will be collected, stored, and transported similar purge water or other residual fluids.

5.9 CHAIN OF CUSTODY PROCEDURES

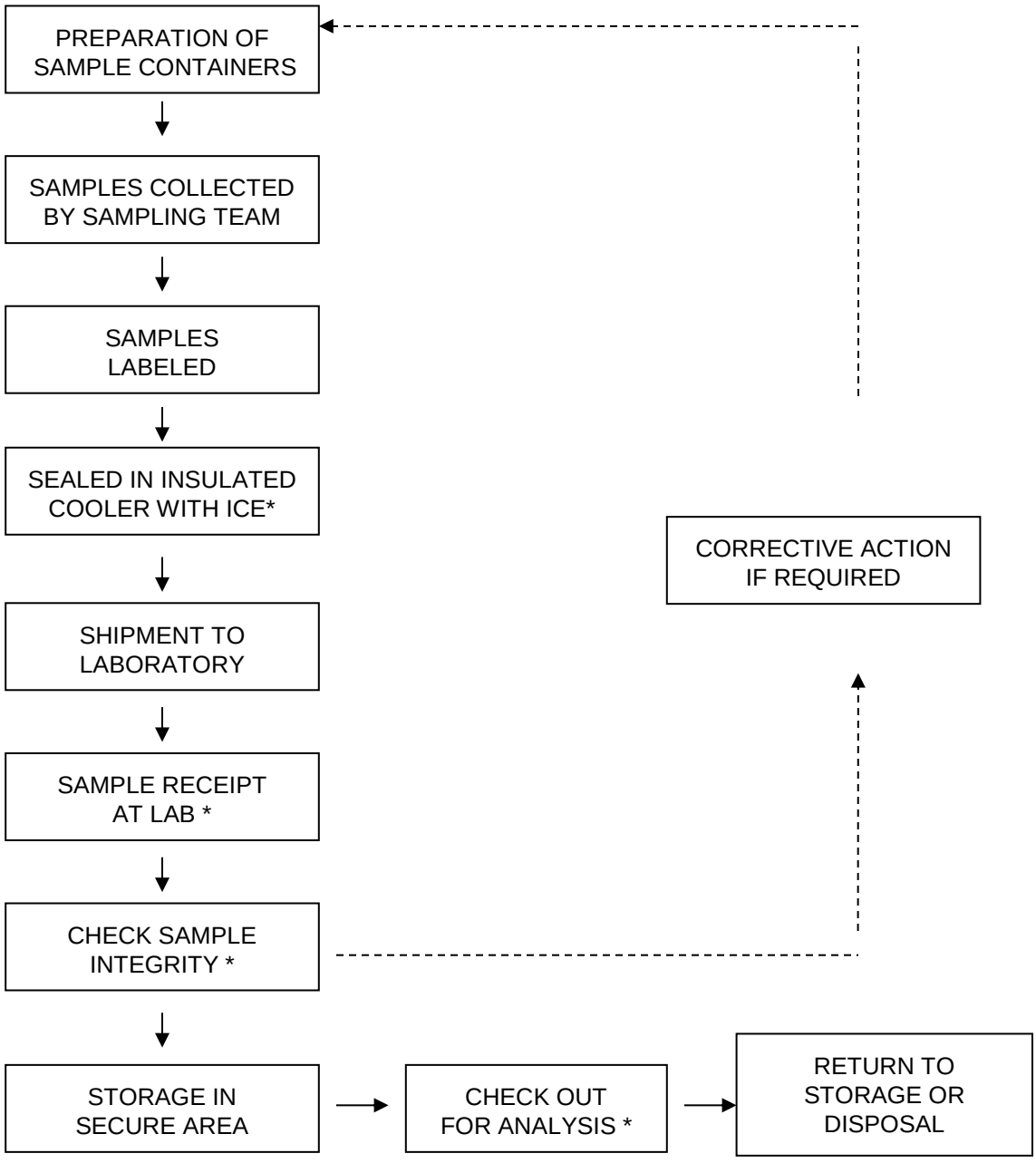
A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, storage and analysis to data reporting and disposal. Chain-of-custody refers to actual possession of the samples. Samples are considered to be in custody if they are within sight of the individual responsible for their security or locked in a secure location. Each person who takes possession of the samples, except the shipping courier, is responsible for sample integrity and safe keeping. Chain-of-custody procedures are provided below:

- Chain-of-custody will be initiated by the laboratory supplying the pre-cleaned and prepared sample containers. Chain-of-custody forms will accompany the sample containers.
- Following sample collection, the chain-of-custody form will be completed for the sample collected. The sample identification number, date and time of sample collection, analysis requested and other pertinent information (e.g., preservatives) will be recorded on the form. All entries will be made in waterproof, permanent blue or black ink.
- Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.
- When the form is full or when all samples have been collected that will fit in a single cooler, the sampling team leader will check the form for possible errors and sign the chain-of-custody form. Any necessary corrections will be made to the record with a single strike mark, dated, and initialed.

Sample coolers will be accompanied by the chain-of-custody form, sealed in a Ziploc® bag (or equivalent) and placed on top of the samples or taped to the inside of the cooler lid. If applicable, a shipping bill will be completed for each cooler and the shipping bill number recorded on the chain-of-custody form.

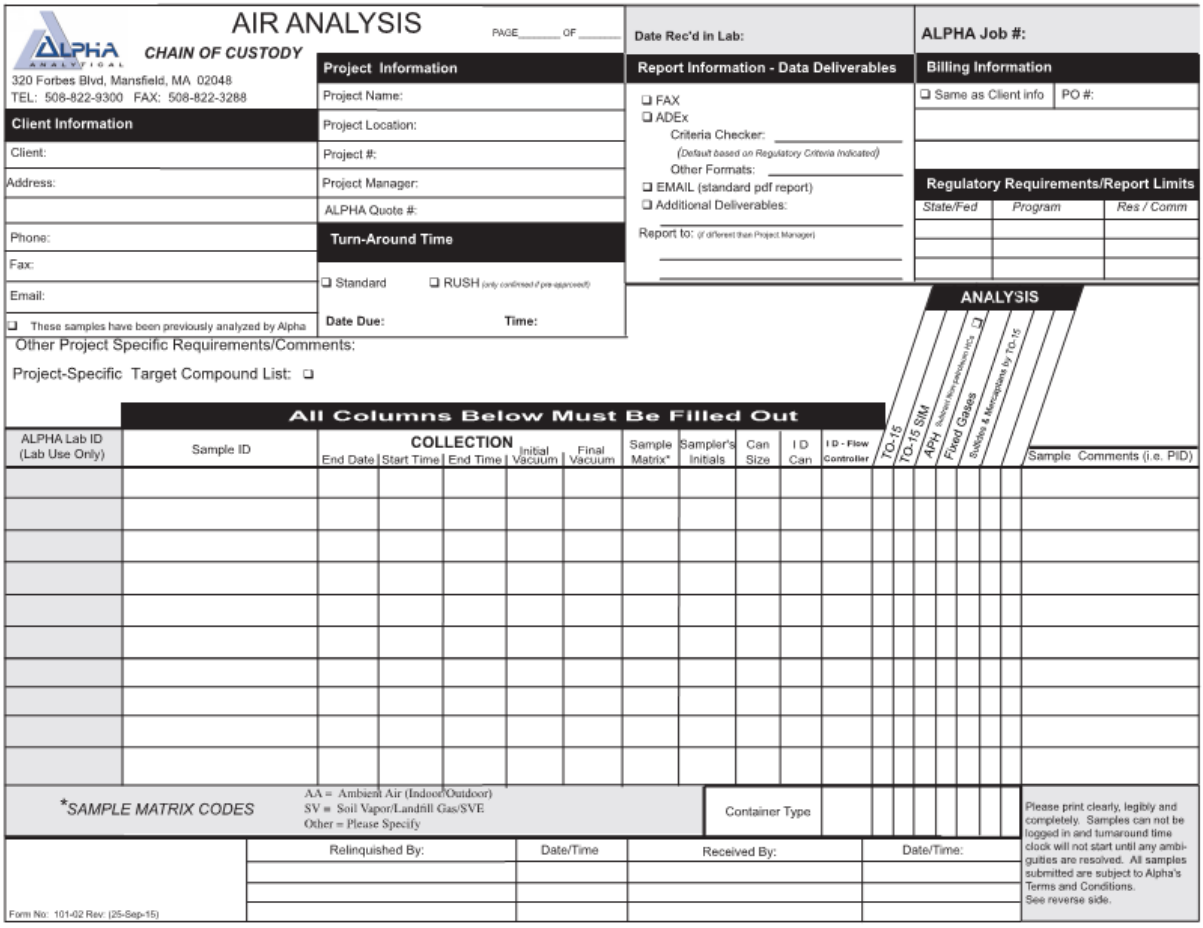
Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation for the chain-of-custody records, if applicable. When transferring custody of the samples, the individuals relinquishing and receiving custody of the samples will verify sample numbers and condition and will document the sample acquisition and transfer by signing and dating the chain-of-custody form. This process documents sample custody transfer from the sampler to the analytical laboratory. A flow chart showing a sample custody process is included as Figure 5.1, and chain-of-custody forms from Alpha are included as Figures 5.2 and 5.3.

Figure 5.1 Sample Custody



* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form – Air Sample



AIR ANALYSIS — CHAIN OF CUSTODY

PAGE_____ OF _____

ALPHA ANALYTICAL
320 Forbes Blvd, Mansfield, MA 02048
TEL: 508-822-9300 FAX: 508-822-3288

Client Information
Client:
Address:
Phone:
Fax:
Email:
❑ These samples have been previously analyzed by Alpha

Project Information
Project Name:
Project Location:
Project #:
Project Manager:
ALPHA Quote #:

Turn-Around Time
❑ Standard ❑ RUSH (only confirmed if pre-approved)
Date Due: Time:

Date Rec'd in Lab:

Report Information - Data Deliverables
❑ FAX
❑ ADEx
Criteria Checker:
(Default based on Regulatory Criteria Indicated)
Other Formats:
❑ EMAIL (standard pdf report)
❑ Additional Deliverables:
Report to: (if different than Project Manager)

ALPHA Job #:

Billing Information
❑ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed	Program	Res / Comm

Other Project Specific Requirements/Comments:

Project-Specific Target Compound List: ❑

ANALYSIS

All Columns Below Must Be Filled Out

ALPHA Lab ID (Lab Use Only)	Sample ID	COLLECTION End Date	Start Time	End Time	Initial Vacuum	Final Vacuum	Sample Matrix*	Sampler's Initials	Can Size	I D Can	I D - Flow Controller	TO-15	TO-15 SIM	APH (Solvent Fuel Petroleum HCs) ❑	Fixed Gases	Sulfides & Mercaptans by TO-15	Sample Comments (i.e. PID)

*SAMPLE MATRIX CODES
AA = Ambient Air (Indoor/Outdoor)
SV = Soil Vapor/Landfill Gas/SVE
Other = Please Specify

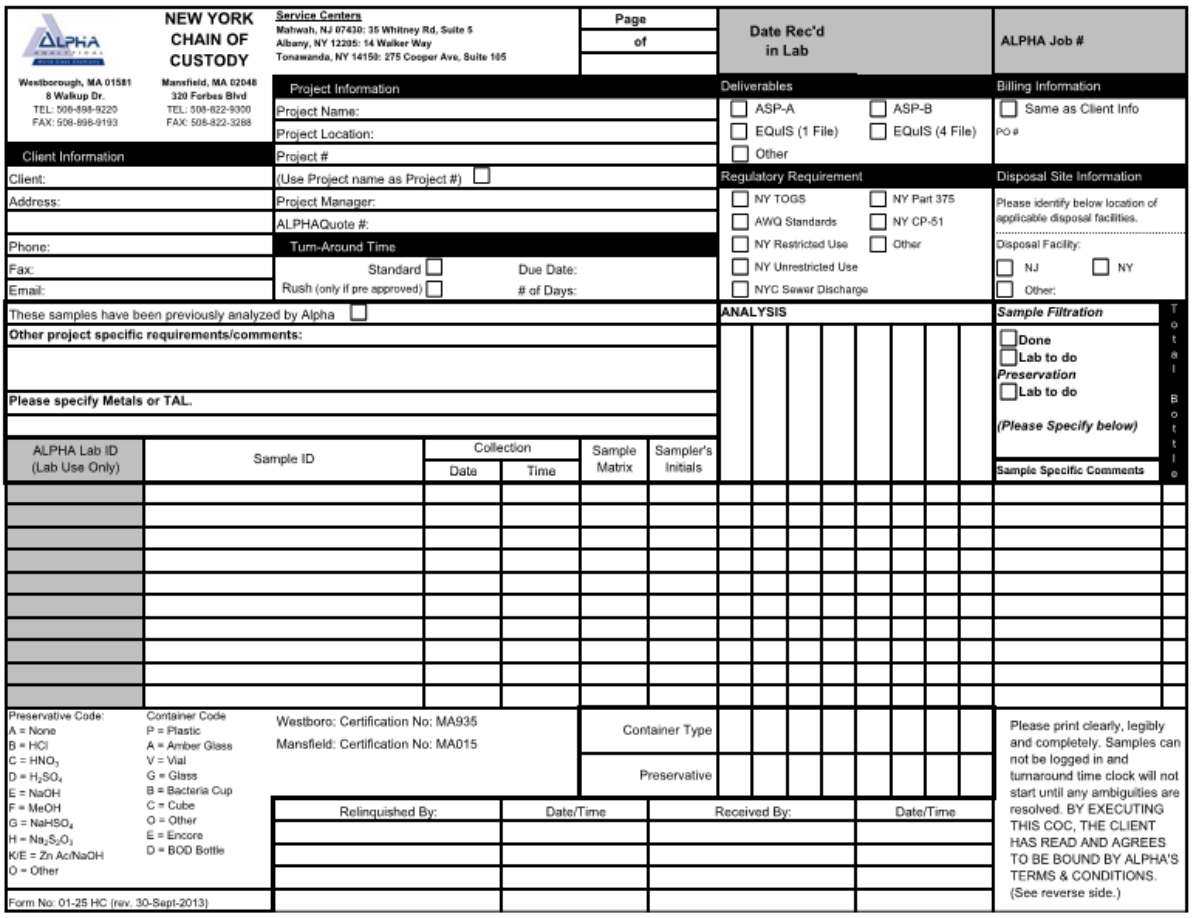
Container Type

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions. See reverse side.

Relinquished By:	Date/Time	Received By:	Date/Time:

Form No: 101-02 Rev: (25-Sep-15)

Figure 5.3 Sample Chain-of-Custody Form – Soil and Groundwater



NEW YORK CHAIN OF CUSTODY

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page of

Date Rec'd in Lab

ALPHA Job #

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Project Information
Project Name:
Project Location:
Project #
(Use Project name as Project #)
Project Manager:
ALPHAQuote #:

Turn-Around Time
Standard
Rush (only if pre approved)
Due Date:
# of Days:

Deliverables
ASP-A
ASP-B
EQuIS (1 File)
EQuIS (4 File)
Other

Regulatory Requirement
NY TOGS
NY Part 375
AWQ Standards
NY CP-51
NY Restricted Use
Other
NY Unrestricted Use
NYC Sewer Discharge

Billing Information
Same as Client Info
PO #

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
NJ
NY
Other:

Client Information
Client:
Address:
Phone:
Fax:
Email:

These samples have been previously analyzed by Alpha

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
Done
Lab to do
Preservation
Lab to do
(Please Specify below)

Total Bottles

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials	Sample Specific Comments

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type
Preservative

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Laboratory chain-of-custody will be maintained throughout the analytical processes as described in the laboratory's Quality Assurance (QA) Manual. The analytical laboratory will provide a copy of the chain-of-custody in the analytical data deliverable package. The chain-of-custody becomes the permanent record of sample handling and shipment.

5.10 LABORATORY SAMPLE STORAGE PROCEDURES

The subcontracted laboratory will use a laboratory information management system (LIMS) to track and schedule samples upon receipt by the analytical laboratories. Any sample anomalies identified during sample log-in must be evaluated on individual merit for the impact upon the results and the data quality objectives of the project. When irregularities do exist, the environmental consultant must be notified to discuss recommended courses of action and documentation of the issue must be included in the project file.

For samples requiring thermal preservation, the temperature of each cooler will be immediately recorded. Each sample and container will be will be assigned a unique laboratory identification number and secured within the custody room walk-in coolers designated for new samples. Samples will be, as soon as practical, disbursed in a manner that is functional for the operational team. The temperature of all coolers and freezers will be monitored and recorded using a certified temperature sensor. Any temperature excursions outside of acceptance criteria (i.e., below 2°C or above 6°C) will initiate an investigation to determine whether any samples may have been affected. Samples for VOCs will be maintained in satellite storage areas within the VOC laboratory. Following analysis, the laboratory's specific procedures for retention and disposal will be followed as specified in the laboratory's SOPs and/or QA manual.

6.0 DATA REDUCTION, VALIDATION, AND REPORTING

6.1 INTRODUCTION

Endpoint or investigation sampling data collected during the remedial activities will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

6.2 DATA REDUCTION

The Analytical Services Protocol (ASP) Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this cannot be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager will maintain close contact with the QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

6.3 DATA VALIDATION

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

- Verification of the QC sample results,
- Verification of the identification of sample results (both positive hits and non-detects),
- Recalculation of 10% of all investigative sample results, and
- Preparation of Data Usability Summary Reports (DUSR).

A DUSR will be prepared and reviewed by the QAO before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each SDG will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS and MSD results;
- Target compound identification;
- Chromatogram quality;
- Pesticide cleanup (if applicable);
- Compound quantitation and reported detection limits;
- System performance; and
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;
- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Duplicates;
- Matrix Spike;
- Furnace atomic absorption analysis QC;
- ICP serial dilutions; and
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" - Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" - Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- "N" – Tentative identification. Analyte is considered present in the sample;
- "R" – Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and
- No Flag - Result accepted without qualification.

7.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

7.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

7.2 SYSTEM AUDITS

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests, additional audits may occur.

7.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

7.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Non-compliances will be logged, and documented through audit findings, which are attached to and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings

8.0 CORRECTIVE ACTION

8.1 INTRODUCTION

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

8.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality

assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Project Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 12.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

FIGURE 8.1

CORRECTIVE ACTION REQUEST

Number: _____ Date: _____

TO: _____

You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____

CONDITION:

REFERENCE DOCUMENTS:

RECOMMENDED CORRECTIVE ACTIONS:

_____ _____ _____ _____ _____ _____

Originator Date Approval Date Approval Date

RESPONSE

CAUSE OF CONDITION

CORRECTIVE ACTION

(A) RESOLUTION

(B) PREVENTION

(C) AFFECTED DOCUMENTS

C.A. FOLLOWUP:

CORRECTIVE ACTION VERIFIED BY: _____ DATE:_____

9.0 REFERENCES

NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.

NYSDOH. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan

USEPA, 1986. SW-846 "Test Method for Evaluating Solid Waste," dated November 1986. U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 1987. Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7- U.S. Environmental Protection Agency, Washington, D.C.

USEPA, 1992a. CLP Organics Data Review and Preliminary Review. SOP No. HW-6, Revision #8, dated January 1992. USEPA Region II.

USEPA, 1992b. Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW 3/90. SOP No. HW-2, Revision XI, dated January 1992. USEPA Region II.

USEPA. Hazardous Waste Support Section. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15. SOP No. HW-31, Revision #6, dated June 2014.

ATTACHMENT A
Resumes

MICHAEL D. BURKE, PG, CHMM, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING AND REMEDIATION

Mr. Burke is a geologist/environmental scientist whose practice involves site investigation and remediation, transactional due diligence, environmental site assessments, in-situ remedial technology, and manufactured gas plant (MGP) site characterization and remediation. His additional services include multi-media compliance audits, sub-slab depressurization system design, non-hazardous and hazardous waste management, emergency response, community air monitoring programs, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) and New York State Brownfield Cleanup (NYS BCP) Programs; Inactive Hazardous Waste, and Spill Programs, and New York City Office of Environmental Remediation (OER) e-designated and New York City Voluntary Cleanup Program (NYC VCP) sites.

SELECTED PROJECTS

- 227-14 North Conduit Avenue, Industrial Wastewater Compliance, Jamaica, NY
- 420 Kent Avenue, NYS Brownfield Cleanup Program, Brooklyn, NY
- 572 Eleventh Avenue, NYC VCP, New York, NY
- Monian Site A, OER E-Designated Site, New York, NY
- 537 Sackett Street, Gowanus Canal Due Diligence/MGP Site, Brooklyn, NY
- ABC Blocks 25, 26 and 27, NYS Brownfield Cleanup Program Sites, Long Island City, NY
- 432 Rodney Street, NYS Brownfield Cleanup Program, Petroleum and Chlorinated Volatile Organic Compound Investigation and Remediation, Brooklyn, NY
- 787 Eleventh Avenue, NYS Brownfield Cleanup Program Site, New York, NY
- President Street at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 22-36 Second Avenue at Gowanus Canal, NYS Brownfield Cleanup Program Site, Brooklyn, NY
- 563 Sacket Street, NYS Brownfield Cleanup Program Site, MGP Investigation, and Remediation, Brooklyn, NY
- 156-162 Perry Street, NYS Brownfield Cleanup Program Site, New York, NY
- Christopher and Weehawken Streets, NYS Brownfield Cleanup Program, New York, NY
- Phelps Dodge Block 2529 (Lots 40, 50, and 45), Inactive Hazardous Waste Disposal Site, Maspeth NY
- 42-50 24th Street, NYS Brownfield Cleanup Program Site, Long Island City, NY
- Storage Deluxe (163 6th Street), OER E-Designation Site, New York, NY



EDUCATION

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

Certified Hazardous Materials Manager – CHMM No. 15998

LEED Accredited Professional (LEED AP)

OSHA Certification for Hazardous Waste Site Supervisor

OSHA 29 CFR 1910.120 Certification for Hazardous Waste Operations and Emergency Response

NJDEP Certification for Community Noise Enforcement

Troxler Certification for Nuclear Densometer Training

- Prospect Park Redevelopment, Landfill Reclamation, Prospect Park, NJ
- 431 Carroll Street, Gowanus Canal Due Diligence, Brooklyn, NY
- 76 4th Street Property, Gowanus Due Diligence, Brooklyn, NY
- Foxgate/MREC, Due Diligence and Solid Waste Compliance, Central Islip, NY
- 175-225 3rd Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
- New York University Tandon School of Engineering, Spill Investigation/Remediation Dual Phase Recovery, and Laser Fluorescence Investigation, Brooklyn, NY
- 2420-2430 Amsterdam Avenue, NYS Brownfield Cleanup Program/Board of Standards and Appeals Variance, New York, NY
- 170 Amsterdam Avenue, NYC VCP, New York, NY
- 538-540 Hudson Street, NYS Brownfield Cleanup Program (Former Gas Station), New York, NY
- 234 Butler Street, Gowanus Canal Due Diligence, Brooklyn, NY
- 550 Clinton Street, NYS Brownfield Cleanup Program E-Designation, Brooklyn, NY
- 111 Leroy Street, OER E-Designation Site, New York, NY
- 335 Bond Street, NYS Brownfield Cleanup Program, New York, NY
- Gowanus Canal Northside, NYS BCP Former Fuel Oil Terminal, Brooklyn, NY
- Multiple Buildings, Major Oil Storage Facility, Gowanus Canal Location, Brooklyn, NY
- 197-205 Smith Street at Gowanus Canal, MGP Due Diligence, Brooklyn, NY
- 450 Union Street at Gowanus Canal, NYS Brownfield Cleanup Program, Brooklyn, NY
- 86 Fleet Place, NYC VCP E-Designation, Brooklyn, NY
- New York University College of Nursing at 433 1st Avenue, NYS BCP, Bronx, NY
- Retail Building at 225 3rd Street, Brooklyn, NY
- 29-37 41st Avenue, NYS Brownfield Cleanup Program, Long Island City, NY
- 43-01 22nd Street, NYS Brownfield Cleanup Program, Long Island City, NY
- Compliance Audit for NYU at Washington Square Park, New York, NY
- Former Watermark Locations, NYS Brownfield Cleanup Program, Chlorinated Volatile Organic Compound Investigation and Remediation; AS/SVE, Brooklyn, NY
- Former Gas Station (1525 Bedford Avenue), Brooklyn, NY
- NYS Brownfield Cleanup Program at 514 West 24th Street, New York, NY
- Gowanus Canal Due Diligence at 76 4th Street, Brooklyn, NY
- Urban Health Plan, Medical Building, NYS Brownfield Cleanup Program CVOC Investigation and Remediation, Bronx, NY
- 420 East 54th Street, NYS Spill Closure, New York, NY
- Equity Residential at 160 Riverside Boulevard, NYS Spill Closure, New York, NY
- 357-359 West Street and 156 Leroy Street, NYC VCP, New York, NY
- Emergency Spill Response at 322 West 57th Street, Investigation and Closure, New York, NY

- Hurricane Sandy, Emergency Response at 21 West Street, New York, NY
- Hurricane Sandy, Emergency Response at 71 Pine Street, New York, NY
- Greenpoint Landing, NYC E-Designation, Brooklyn, NY
- 23-01 42nd Road, NYS Brownfield Cleanup Program, Long Island City, NY
- Greenpoint Waterfront Development, NYS Brownfield Cleanup Program, Brooklyn, NY
- 125th Street and Lenox Avenue, NYC VCP, New York, NY
- Whitehead Realty Solvent Site, Inactive Hazardous Waste site, CVOC
  Investigation and Remediation, Brooklyn, NY
- SunCap Property Group Environmental On-Call Consulting,
  Various Locations, Nationwide
- Consolidated Edison Company of New York, Underground Storage Tank On-Call Contract, Five Boroughs of New York City, NY
- Consolidated Edison Company of New York, Appendix B Spill Sites On-Call Contract, Five Boroughs of New York City, NY
- Meeker Avenue Plume Trackdown Site, Brooklyn, NY
- Distribution Facility, Superfund Redevelopment, Long Island City, NY
- Edison Properties, West 17th Street Development Site (Former MGP Site), New York, NY
- Con Edison on Governors Island, Dielectric Fluid Spill, Investigation and Remediation, New York, NY
- 144-150 Barrow Street, NYS Brownfield Cleanup Program, New York, NY
- West 17th Street Development, NYS Brownfield Cleanup Program, MGP Investigation and Remediation, New York, NY
- Montefiore Medical Center, Emergency Response, PCB Remediation, Bronx, NY
- New York University, 4 Washington Square Village Fuel Oil Remediation, New York, NY
- NYCSCA, Proposed New York City School Construction Sites,
  Five Boroughs of New York City, NY
- Con Edison, East 60th Street Generating Station, New York, NY
- Residential Building at 82 Irving Place, Environmental Remediation, New York, NY
- 1113 York Avenue, Storage Tank Closures, New York, NY
- Peter Cooper Village/Stuyvesant Town, Phase I ESA, New York, NY
- Superior Ink, Waste Characterization and Remedial Action Plans, New York, NY
- Bronx Mental Health Redevelopment Project, Phase I ESA, Bronx, NY
- 2950 Atlantic Avenue, Site Characterization Investigation, Brooklyn, NY
- Con Edison, East 74th Street Generating Station, Sediment Investigation, New York, NY
- Con Edison, First Avenue Properties, New York, NY
- Queens West Development Corp. Stage II, Long Island City, NY
- Article X Project Environmental Reviews, Various New York State Electrical Generation Sites, NY
- Poletti Generating Station, Astoria, NY
- Arthur Kill Generating Station, Staten Island, NY

- Distribution Facility, Phase I & Phase II ESA and Regulatory Compliance, Bohemia, NY
- Huntington Station Superfund Due Diligence, Huntington Station, NY
- Garvies Point Bulkhead, Glen Cove, NY
- Johnson & Hoffman Metal Stamping Facility, Environmental Compliance, Carle Place, NY
- Floral Park Storage Facility, Phase I and Phase II ESA
- Garden City Phase I ESAs at two sites, including part of a Superfund Site, Garden City, NY
- Huntington Station Storage Facility, Phase I and II ESA, Huntington Station, NY
- Trevor Day School, NYS Spill Site Expert Testimony, New York, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Burke, M., Ciambruschini, S., Nicholls, G., Tashji, A., Vaidya, S., "Redeveloping a Remediated MGP Site", MGP Symposium 2019, Atlantic City, NJ.

Jason J. Hayes, PE, LEED AP

Principal/Vice President
Environmental Engineering



18 years in the industry

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

Selected Projects

- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY
- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
- Purves Street Development, BCP Application, RAWP, and Phase II ESI, Long Island City, NY
- 267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
- New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- West & Watts (BCP Application), New York, NY

Education

M.S., Environmental Engineering
Columbia University

B.S., Chemistry, Environmental Toxicology
Humboldt State University

Business Administration (minor)
Humboldt State University

Professional Registration

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

CPR and First Aid Certification

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

Affiliations

US Green Building Council, NYC Chapter (USGBC), Communications Committee

Urban Land Institute (ULI), member

Commercial Real Estate Development Association (NAIOP), member

NYC Brownfield Partnership, member

- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY
- 627 Smith Street (RI and Report), Brooklyn, NY
- Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
- Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
- Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
- Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
- Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- Silvercup West (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
- 29 Flatbush, Tall Residential Building (Groundwater Studies, RIR and RAWP), Brooklyn, NY
- Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
- Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
- Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
- The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
- Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
- Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
- Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
- Proposed New York JETS Stadium (Phase I ESA), New York, NY
- Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
- 7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
- Peter Cooper Village, Environmental Subsurface Investigations, New York, NY

Selected Publications, Reports, and Presentations

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson Yards Development

Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

PAUL MCMAHON, PE

PROJECT MANAGER

ENVIRONMENTAL ENGINEERING

Mr. McMahon is an environmental engineer working in the NY Metro area. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), Voluntary Cleanup Program (VCP) and Spill Programs, and New York City Office of Environmental Remediation (NYCOER) "E" Designated and VCP sites. His field experience includes conducting Phase II Environmental Site Investigations (ESI), remedial investigations, and indoor air quality analysis Investigations, and performing remediation oversight. Mr. McMahon's most recent experience includes the preparation of investigation reports and investigation work plans, management of NYSDEC BCP remediation projects and NYSDEC spill remediation projects, design of submembrane depressurization systems, and development of remediation work plans.



EDUCATION

M.E., Environmental Engineering
Manhattan College

B.S., Civil Engineering
Washington University in St. Louis

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

10-Hour OSHA

40-Hour OSHA HAZWOPER

SELECTED PROJECTS

- 55 Bank Street, NYSDEC BCP Site Remediation Project Management,
  White Plains, NY
- 23-01 42nd Road, NYSDEC BCP Site Remediation Oversight and Project Management, Long Island City, NY
- 23-10 Queens Plaza South, NYSDEC BCP Remedial Investigation Report, Interim Remedial Measures Work Plan, and Remediation Project Management, Long Island City, NY
- Brooklyn Navy Yard Dock 72, Management of Environmental Oversight in Accordance with NYSDEC VCP Site Management Plan, Brooklyn, NY
- Purves Street Development, Tall Residential Building, Phase II ESI/NYSDEC BCP Remedial Investigation, Remedial Action Work Plan, and Site Remediation Project Management, Long Island City, NY
- 27-21 44th Drive, NYSDEC BCP Site Remediation Project Management, Long Island City, NY
- NYU Tandon School of Engineering, NYSDEC Spill Investigation and Remediation Project Management, Brooklyn, NY
- Parcel B West, East Harlem, Affordable Housing Development, NYSDEC BCP Remedial Investigation, Remedial Action Work Plan, and Site Remediation Project Management, New York, NY
- 267-273 West 87th Street, NYSDEC BCP Remedial Investigation and Remedial Action Work Plan, and Site Remediation Project Management, New York, NY
- DuPont-Stauffer Landfill, NYSDEC Superfund Site, Site Management Plan Compliance, Newburgh, NY
- 190 Riverside Drive, Fuel Oil Spill Emergency Response, Site Investigation, and Remediation, New York, NY
- 473 President Street, NYSDEC BCP Remedial Investigation, Interim Remedial Measures, Project Management, Brooklyn, NY

- 175-225 3rd Street, NYSDEC BCP Remedial Investigation, Project Management, Brooklyn, NY
- 322 West 57th Street, Sheffield Building Oversight of Emergency Spill Response, New York, NY
- Hudson Yards Terra Firma and Hudson Yards Platform, Construction Oversight and Community Air Monitoring Program, New York, NY
- Columbia University Manhattanville Redevelopment, Remediation Oversight and Community Air Monitoring Program, New York, NY

MIMI RAYGORODETSKY

SENIOR ASSOCIATE / VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Ms. Raygorodetsky sources and directs large, complex environmental remediation and redevelopment projects from the earliest stages of pre-development diligence, through the remediation/construction phase, to long-term operation and monitoring of remedial systems and engineering controls. She has a comprehensive understanding of federal, state and local regulatory programs and she uses this expertise to guide her clients through a preliminary cost benefit analysis to select the right program(s) given the clients' legal obligations, development desires and risk tolerance. She is particularly strong at integrating the requirements of selected programs and client development needs to develop and design targeted and streamlined diligence programs and remediation strategies. Ms. Raygorodetsky is also highly skilled in integrating remediation with construction on large urban waterfront projects, which tend to more complex than landside projects.



EDUCATION

B.A., Biology and Spanish Literature
Colby College

AFFILIATIONS

New York Women Executives in Real Estate (WX), Member

New York Building Congress, Council of Industry Women, Committee Member

New York City Brownfield Partnership, Founding Member and President

NYC Office of Environmental Remediation Technical Task Force, Committee Member

SELECTED PROJECTS

- 25 Kent Avenue, Due Diligence for Purchase of a Brownfields Location, Brooklyn, NY
- Ferry Point Waterfront Park, Redevelopment of a Former Landfill into a Park, Bronx, NY
- Battery Maritime Building (10 South Street), Phase I ESA, New York, NY
- Residential Development at 351-357 Broadway, Phase 1 ESA, New York, NY
- 450 Union Street, Phase I and Phase II Remediation (NYS DEC Brownfield Cleanup Program), New York, NY
- Echo Bay Center, NYS DEC Brownfield Cleanup Program, New York, NY
- 420 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
- 416 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
- 264 Fifth Avenue, Phase I ESA, New York, NY
- 262 Fifth Avenue, Phase I ESA, New York, NY
- ABC Blocks 25-27 (Mixed-Use Properties), Brownfield Cleanup Program, Long Island City, NY
- Residences at 100 Barrow Street, Phase I ESA, New York, NY
- Residences at 22-12 Jackson Avenue, Due Diligence for Building Sale, Long Island City, NY
- Residences at 2253-2255 Broadway, Phase I and Phase II Services, New York, NY
- Prince Point, Phase I ESA, Staten Island, NY
- 787 Eleventh Avenue (Office Building Renovation), Phase I UST Closure, New York, NY
- 218 Front Street/98 Gold Street, Planning and Brownfield Consulting, Brooklyn, NY
- Mark JCH of Bensonhurst, Phase I and HazMat Renovation, Brooklyn, NY
- 39 West 23rd Street, E-Designation Brownfield, New York, NY

- 250 Water Street, Phase I and Phase II Property Transaction, New York, NY
- 27-19 44th Drive, Residential Redevelopment, Long Island City, NY
- 515 West 42nd Street, E-Designation, New York, NY
- 310 Meserole Street, Due Diligence Property Purchase, Brooklyn, NY
- Former Georgetown Heating Plant, HazMat and Phase I ESA, Washington D.C.
- 80-110 Flatbush Avenue, Brooklyn, NY
- 132 East 23rd Street, New York, NY
- 846 Sixth Avenue, New York, NY
- Greenpoint Landing, Remediation/Redevelopment, Brooklyn, NY
- 711 Eleventh Avenue, Due Diligence/Owner's Representative, New York, NY
- Brooklyn Bridge Park, Pier 1, Waste Characterization and Remediation, Brooklyn, NY
- Post-Hurricane Sandy Mold Remediation, Various Private Homes, Far Rockaway, NY
- Brooklyn Bridge Park, One John Street Development, Pre-Construction Due Diligence and Construction Administration, Brooklyn, NY
- 7 West 21st Street, Brownfields Remediation, New York, NY
- 546 West 44th Street, Brownfields Remediation, New York, NY
- Post-Hurricane Sandy Mold Remediation, Various Private Homes, Nassau and Suffolk Counties, Long Island, NY
- 55 West 17th Street, Brownfield Site Support, New York, NY
- Pratt Institute, 550 Myrtle Avenue Renovations, Environmental Remediation, Brooklyn, NY
- 42-02 Crescent Street Redevelopment, Phase I and II Environmental, Long Island City, NY
- IAC Building (555 West 18th Street), New York, NY
- Retirement Communities on100-acre Parcels in ME, NJ, MA, CT, and NJ
- 363-365 Bond Street/400 Carroll Street, Brooklyn, NY
- 160 East 22nd Street, New York, NY
- 110 Third Avenue, New York, NY
- Lycee Francais (East 76th Street & York Avenue), New York, NY
- Winchester Arms Munitions Factory, New Haven, CT

MARLA MILLER, PE, BCEE

SENIOR PROJECT ENGINEER

ENVIRONMENTAL ENGINEERING

Ms. Miller has over 19 years of experience managing site characterization and remediation projects. She is a senior environmental engineer experienced in environmental permitting, industrial pretreatment, compliance monitoring, and water quality evaluation. She has a strong background in data validation, laboratory analyses, and sampling procedures for soil, water, and air matrices. Her expertise in data interpretation includes natural attenuation monitoring, petroleum hydrocarbon chromatography, and aqueous geochemistry.



SELECTED PROJECTS

Data Validation

- St. Joseph's Parish Redevelopment Data Quality Assessment (DQA) and Data Usability (DUE) preparation, New York, NY
- 175 – 225 3rd Street Data Usability Summary Report (DUSR), Brooklyn, NY
- 805 – 825 Atlantic Ave DUSR, Brooklyn, NY
- John Evans Superfund Site DUSR, Lansdale, PA
- 50 North Road (Nokia Chester), DQA and DUE preparation, Chester, NJ
- Data Validation/Data Management for Brownfields Site Assessment, Port St. Joe, FL*

Industrial Wastewater Pretreatment

- Industrial Wastewater Discharge Limit Development, Inland Empire Utilities Agency (IEUA), CA*
- Local Limits Study, Hopewell, VA*
- Local Limits Study, Mesa, AZ*
- Local Limits Development and Sewer Use Ordinance Development, Prescott, AZ*
- Implementation of Industrial Pretreatment Program, Prescott, AZ*
- Industrial Pretreatment Development, Queen Creek, AZ*
- Selenium Wastewater Treatment Options for Meat Packing Facility, Tolleson, AZ*
- Arizona Pollutant Discharge Elimination System (AZPDES) Permit Application Preparation, Phoenix, AZ
- Preparation of Sampling and Analysis Plan for Sub-Regional Operating Group (SROG) Local Limits Development, Phoenix and Surrounding Cities, AZ

EDUCATION

M.S., Environmental Engineering
University of California, Berkeley

B.S., Biology
Loyola Marymount University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in AZ

Board Certified Environmental Engineer (BCEE) – Hazardous Waste Management (09-10019)

CERTIFICATIONS

The Wastewater Treatment, Wastewater Collection, and Water Distribution Operator Certification

Grade 2
Water Treatment Operator Certification Grade 1

Backflow Tester Certification (AABP)

*Denotes projects performed prior to employment at Langan

Site Investigation/Remediation/Compliance

- Arizona Electric Power Cooperative (AEPCO) Apache Generating Station Arizona Protection Permit (APP), Wilcox, AZ
- Arizona Department of Environmental Quality (ADEQ) Water Quality Assurance Revolving Fund (WQARF) Projects, Phoenix and Gilbert, AZ
- Long-Term Monitoring Program and 5-Year CERCLA Review, Luke Air Force Base (AFB), Glendale, AZ*
- Development of Stormwater Prevention Pollution Plan (SWPPP) and Stormwater Flow Modeling, Luke AFB, Glendale, AZ*
- Site Investigation and Clean Closure for Confidential Industrial Client, Tempe, AZ*
- RCRA Facility Investigation/Corrective Measures Assessment, San Jose, CA*
- Technical Resource for X-Ray Fluorescence (XRF) Field Screening Program for Former Small Arms Firing Range, Nogales, AZ*
- Designed and Implemented Sampling Procedures for Volatile Emissions from Tailings Impoundment Using Flux Chambers, Henderson, CO*
- Conceptual Site Model and Statistical Evaluation for Water Treatment Plant, Denver, CO*

Mining Project

- Third-Party Construction Quality Assurance (CQA) for Geotextile-Lined Tailings Repository, Casa Grande, AZ*
- CQA For Reclamation at Smelter, Miami, AZ*
- XRF Field Screening for Excavation at Former Smelter Site, El Paso, TX*
- CQA for Reclamation Projects at Active Smelter, Miami, AZ

JOSEPH YANOWITZ

SENIOR STAFF ENGINEER

ENVIRONMENTAL ENGINEERING

Mr. Yanowitz is an environmental engineer with experience in excavation oversight, waste classification, Community Air Monitoring Programs (CAMP), and soil/groundwater sampling. He has provided cleanup services for sites in New York and New Jersey.



SELECTED PROJECTS

- 546 West 44th Street, New York, NY
- Riverside Center Parcel 1, 3 and 4, New York, NY
- 685 First Avenue, New York, NY
- 411 Broadway, New York, NY
- Storage Deluxe (163 6th Avenue), Brooklyn, NY
- Confidential Client, Hexavalent Chromium and MGP Remediation, Jersey City, NJ
- Buffalo River Sediment Dredging, Buffalo, NY
- Naval Weapons Industrial Reserve Plant (NWIR)–Bethpage Grumman Aerospace Corp., Northtrop Grumman Corporation, Bethpage, NY

EDUCATION

B.S., Environmental Engineering
State University of New York at Buffalo

PROFESSIONAL REGISTRATION

40-Hour OSHA HAZWOPER

10-Hour OSHA

ATTACHMENT B
Laboratory Reporting Limits and Method Detection Limits

ATTACHMENT B

AIR SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units	RL	MDL	Units
Volatile Organic Compounds								
EPA TO-15	Air	1,1,1,2-Tetrachloroethane	1.37	0.38	ug/m3	0.2	0.0547	ppbV
EPA TO-15	Air	1,1,1-Trichloroethane	1.09	0.31	ug/m3	0.2	0.057	ppbV
EPA TO-15	Air	1,1,2,2-Tetrachloroethane	1.37	0.38	ug/m3	0.2	0.0548	ppbV
EPA TO-15	Air	1,1,2-Trichloro-1,2,2-Trifluoroethane	1.53	0.39	ug/m3	0.2	0.0511	ppbV
EPA TO-15	Air	1,1,2-Trichloroethane	1.09	0.36	ug/m3	0.2	0.0667	ppbV
EPA TO-15	Air	1,1-Dichloroethane	0.81	0.31	ug/m3	0.2	0.0771	ppbV
EPA TO-15	Air	1,1-Dichloroethene	0.79	0.22	ug/m3	0.2	0.0566	ppbV
EPA TO-15	Air	1,1-Dichloropropene	0.91	0.32	ug/m3	0.2	0.0715	ppbV
EPA TO-15	Air	1,2,3-Trichlorobenzene	1.48	0.32	ug/m3	0.2	0.0436	ppbV
EPA TO-15	Air	1,2,3-Trichloropropane	1.21	0.46	ug/m3	0.2	0.0767	ppbV
EPA TO-15	Air	1,2,3-Trimethylbenzene	0.98	0.37	ug/m3	0.2	0.0751	ppbV
EPA TO-15	Air	1,2,4,5-Tetramethylbenzene	1.1	0.44	ug/m3	0.2	0.0795	ppbV
EPA TO-15	Air	1,2,4-Trichlorobenzene	1.48	0.45	ug/m3	0.2	0.0611	ppbV
EPA TO-15	Air	1,2,4-Trimethylbenzene	0.98	0.34	ug/m3	0.2	0.0694	ppbV
EPA TO-15	Air	1,2-Dibromo-3-chloropropane	1.93	0.72	ug/m3	0.2	0.0744	ppbV
EPA TO-15	Air	1,2-Dibromoethane	1.54	0.6	ug/m3	0.2	0.0779	ppbV
EPA TO-15	Air	1,2-Dichloro-1,1,2,2-tetrafluoroethane	1.4	0.29	ug/m3	0.2	0.0419	ppbV
EPA TO-15	Air	1,2-Dichlorobenzene	1.2	0.37	ug/m3	0.2	0.0614	ppbV
EPA TO-15	Air	1,2-Dichloroethane	0.81	0.22	ug/m3	0.2	0.0552	ppbV
EPA TO-15	Air	1,2-Dichloroethene (total)	0.79	0.23	ug/m3	0.2	0.0587	ppbV
EPA TO-15	Air	1,2-Dichloropropane	0.92	0.32	ug/m3	0.2	0.0697	ppbV
EPA TO-15	Air	1,3,5-Trimethylbenzene	0.98	0.29	ug/m3	0.2	0.0584	ppbV
EPA TO-15	Air	1,3-Butadiene	0.44	0.18	ug/m3	0.2	0.0799	ppbV
EPA TO-15	Air	1,3-Dichlorobenzene	1.2	0.38	ug/m3	0.2	0.0637	ppbV
EPA TO-15	Air	1,3-Dichloropropane	0.92	0.36	ug/m3	0.2	0.0776	ppbV
EPA TO-15	Air	1,3-Dichloropropene, Total	0.91	0.31	ug/m3	0.2	0.0693	ppbV
EPA TO-15	Air	1,4-Dichlorobenzene	1.2	0.25	ug/m3	0.2	0.0418	ppbV
EPA TO-15	Air	1,4-Dioxane	0.72	0.28	ug/m3	0.2	0.078	ppbV
EPA TO-15	Air	1-Methylnaphthalene	5.82	1.66	ug/m3	1	0.286	ppbV
EPA TO-15	Air	2,2,4-Trimethylpentane	0.93	0.31	ug/m3	0.2	0.0659	ppbV
EPA TO-15	Air	2,2-Dichloropropane	0.92	0.27	ug/m3	0.2	0.0581	ppbV
EPA TO-15	Air	2-Butanone	1.47	0.15	ug/m3	0.5	0.0522	ppbV
EPA TO-15	Air	2-Ethylthiophene	0.92	0.26	ug/m3	0.2	0.0571	ppbV
EPA TO-15	Air	2-Hexanone	0.82	0.25	ug/m3	0.2	0.0604	ppbV
EPA TO-15	Air	2-Methylnaphthalene	5.82	0.16	ug/m3	1	0.0273	ppbV
EPA TO-15	Air	2-Methylthiophene	0.8	0.32	ug/m3	0.2	0.0789	ppbV
EPA TO-15	Air	3-Chloropropene	0.63	0.25	ug/m3	0.2	0.0812	ppbV
EPA TO-15	Air	3-Methylthiophene	0.8	0.27	ug/m3	0.2	0.0669	ppbV
EPA TO-15	Air	4-Ethyltoluene	0.98	0.38	ug/m3	0.2	0.0776	ppbV
EPA TO-15	Air	4-Methyl-2-pentanone	2.05	0.25	ug/m3	0.5	0.0607	ppbV
EPA TO-15	Air	Acetaldehyde	4.5	0.99	ug/m3	2.5	0.547	ppbV
EPA TO-15	Air	Acetone	2.38	0.64	ug/m3	1	0.269	ppbV
EPA TO-15	Air	Acetonitrile	0.34	0.13	ug/m3	0.2	0.0761	ppbV
EPA TO-15	Air	Acrolein	1.15	0.26	ug/m3	0.5	0.114	ppbV
EPA TO-15	Air	Acrylonitrile	1.09	0.17	ug/m3	0.5	0.079	ppbV
EPA TO-15	Air	Benzene	0.64	0.17	ug/m3	0.2	0.0537	ppbV
EPA TO-15	Air	Benzothiophene	2.74	0.26	ug/m3	0.5	0.0468	ppbV
EPA TO-15	Air	Benzyl chloride	1.04	0.33	ug/m3	0.2	0.0645	ppbV
EPA TO-15	Air	Bromobenzene	0.79	0.31	ug/m3	0.2	0.079	ppbV
EPA TO-15	Air	Bromodichloromethane	1.34	0.44	ug/m3	0.2	0.0656	ppbV
EPA TO-15	Air	Bromoform	2.07	0.54	ug/m3	0.2	0.0523	ppbV
EPA TO-15	Air	Bromomethane	0.78	0.27	ug/m3	0.2	0.0696	ppbV
EPA TO-15	Air	Butane	0.48	0.11	ug/m3	0.2	0.0442	ppbV
EPA TO-15	Air	Butyl Acetate	2.38	0.54	ug/m3	0.5	0.114	ppbV
EPA TO-15	Air	Carbon disulfide	0.62	0.11	ug/m3	0.2	0.0345	ppbV
EPA TO-15	Air	Carbon tetrachloride	1.26	0.3	ug/m3	0.2	0.0471	ppbV
EPA TO-15	Air	Chlorobenzene	0.92	0.36	ug/m3	0.2	0.0789	ppbV
EPA TO-15	Air	Chlorodifluoromethane	0.71	0.22	ug/m3	0.2	0.0626	ppbV

ATTACHMENT B

AIR SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units	RL	MDL	Units
EPA TO-15	Air	Chloroethane	0.53	0.2	ug/m^3	0.2	0.0767	ppbV
EPA TO-15	Air	Chloroform	0.98	0.22	ug/m^3	0.2	0.0452	ppbV
EPA TO-15	Air	Chloromethane	0.41	0.2	ug/m^3	0.2	0.0958	ppbV
EPA TO-15	Air	cis-1,2-Dichloroethene	0.79	0.23	ug/m^3	0.2	0.0587	ppbV
EPA TO-15	Air	cis-1,3-Dichloropropene	0.91	0.34	ug/m^3	0.2	0.0745	ppbV
EPA TO-15	Air	Cyclohexane	0.69	0.23	ug/m^3	0.2	0.0656	ppbV
EPA TO-15	Air	Decane (C10)	1.16	0.28	ug/m^3	0.2	0.0484	ppbV
EPA TO-15	Air	Dibromochloromethane	1.7	0.64	ug/m^3	0.2	0.0747	ppbV
EPA TO-15	Air	Dibromomethane	1.42	0.34	ug/m^3	0.2	0.0476	ppbV
EPA TO-15	Air	Dichlorodifluoromethane	0.99	0.23	ug/m^3	0.2	0.0466	ppbV
EPA TO-15	Air	Dichlorofluoromethane	0.84	0.24	ug/m^3	0.2	0.0572	ppbV
EPA TO-15	Air	Dodecane (C12)	1.39	0.39	ug/m^3	0.2	0.0564	ppbV
EPA TO-15	Air	Ethyl Acetate	1.8	0.47	ug/m^3	0.5	0.131	ppbV
EPA TO-15	Air	Ethyl Alcohol	4.71	1.02	ug/m^3	2.5	0.542	ppbV
EPA TO-15	Air	Ethyl ether	0.61	0.18	ug/m^3	0.2	0.0591	ppbV
EPA TO-15	Air	Ethylbenzene	0.87	0.24	ug/m^3	0.2	0.0555	ppbV
EPA TO-15	Air	Ethyl-Tert-Butyl-Ether	0.84	0.22	ug/m^3	0.2	0.0515	ppbV
EPA TO-15	Air	Heptane	0.82	0.23	ug/m^3	0.2	0.0553	ppbV
EPA TO-15	Air	Hexachlorobutadiene	2.13	0.78	ug/m^3	0.2	0.0732	ppbV
EPA TO-15	Air	Indane	0.97	0.38	ug/m^3	0.2	0.0795	ppbV
EPA TO-15	Air	Indene	0.95	0.29	ug/m^3	0.2	0.0608	ppbV
EPA TO-16	Air	iso-Propyl Alcohol	1.23	0.28	ug/m^3	0.5	0.114	ppbV
EPA TO-17	Air	Isopropyl Ether	0.84	0.27	ug/m^3	0.2	0.0656	ppbV
EPA TO-18	Air	Isopropylbenzene	0.98	0.21	ug/m^3	0.2	0.043	ppbV
EPA TO-19	Air	Methanol	6.55	0.96	ug/m^3	5	0.736	ppbV
EPA TO-20	Air	Methyl Methacrylate	2.05	0.61	ug/m^3	0.5	0.148	ppbV
EPA TO-21	Air	Methyl tert butyl ether	0.72	0.16	ug/m^3	0.2	0.0452	ppbV
EPA TO-22	Air	Methylene chloride	1.74	0.65	ug/m^3	0.5	0.188	ppbV
EPA TO-23	Air	Naphthalene	1.05	0.23	ug/m^3	0.2	0.0432	ppbV
EPA TO-24	Air	n-Butylbenzene	1.1	0.35	ug/m^3	0.2	0.0639	ppbV
EPA TO-25	Air	n-Heptane	0.82	0.23	ug/m^3	0.2	0.0553	ppbV
EPA TO-26	Air	n-Hexane	0.7	0.18	ug/m^3	0.2	0.0518	ppbV
EPA TO-27	Air	Nonane (C9)	1.05	0.34	ug/m^3	0.2	0.0644	ppbV
EPA TO-28	Air	n-Propylbenzene	0.98	0.27	ug/m^3	0.2	0.0559	ppbV
EPA TO-29	Air	o-Chlorotoluene	1.04	0.25	ug/m^3	0.2	0.0487	ppbV
EPA TO-30	Air	Octane	0.93	0.2	ug/m^3	0.2	0.0421	ppbV
EPA TO-31	Air	o-Xylene	0.87	0.27	ug/m^3	0.2	0.0631	ppbV
EPA TO-32	Air	p/m-Xylene	1.74	0.6	ug/m^3	0.4	0.139	ppbV
EPA TO-33	Air	p-Chlorotoluene	1.04	0.4	ug/m^3	0.2	0.0764	ppbV
EPA TO-34	Air	Pentane	0.59	0.14	ug/m^3	0.2	0.0475	ppbV
EPA TO-35	Air	p-Isopropyltoluene	1.1	0.33	ug/m^3	0.2	0.0608	ppbV
EPA TO-36	Air	Propane	0.9	0.21	ug/m^3	0.5	0.114	ppbV
EPA TO-37	Air	Propylene	0.86	0.16	ug/m^3	0.5	0.0929	ppbV
EPA TO-38	Air	sec-Butylbenzene	1.1	0.4	ug/m^3	0.2	0.0731	ppbV
EPA TO-39	Air	Styrene	0.85	0.34	ug/m^3	0.2	0.0799	ppbV
EPA TO-40	Air	tert-Butyl Alcohol	1.52	0.18	ug/m^3	0.5	0.0599	ppbV
EPA TO-41	Air	tert-Butylbenzene	1.1	0.22	ug/m^3	0.2	0.0402	ppbV
EPA TO-42	Air	Tertiary-Amyl Methyl Ether	0.84	0.33	ug/m^3	0.2	0.0795	ppbV
EPA TO-43	Air	Tetrachloroethene	1.36	0.51	ug/m^3	0.2	0.0758	ppbV
EPA TO-44	Air	Tetrahydrofuran	1.47	0.18	ug/m^3	0.5	0.0622	ppbV
EPA TO-45	Air	Thiophene	0.69	0.18	ug/m^3	0.2	0.0528	ppbV
EPA TO-46	Air	Toluene	0.75	0.24	ug/m^3	0.2	0.0628	ppbV
EPA TO-47	Air	Total HC As Hexane	39.34	0.2	ug/m^3	10	0.0518	ppbV
EPA TO-48	Air	Total VOCs As Toluene	37.69	0.24	ug/m^3	10	0.0628	ppbV
EPA TO-49	Air	trans-1,2-Dichloroethene	0.79	0.29	ug/m^3	0.2	0.074	ppbV
EPA TO-50	Air	trans-1,3-Dichloropropene	0.91	0.31	ug/m^3	0.2	0.0693	ppbV
EPA TO-51	Air	Trichloroethene	1.07	0.38	ug/m^3	0.2	0.071	ppbV
EPA TO-52	Air	Trichlorofluoromethane	1.12	0.23	ug/m^3	0.2	0.0416	ppbV
EPA TO-53	Air	Undecane	1.28	0.34	ug/m^3	0.2	0.0528	ppbV
EPA TO-54	Air	Vinyl acetate	3.52	0.2	ug/m^3	1	0.0567	ppbV
EPA TO-55	Air	Vinyl bromide	0.87	0.31	ug/m^3	0.2	0.0699	ppbV
EPA TO-56	Air	Vinyl chloride	0.51	0.14	ug/m^3	0.2	0.0533	ppbV
EPA TO-57	Air	Xylene (Total)	0.87	0.27	ug/m^3	0.2	0.0631	ppbV

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METALS by 6009(M) (AIR MEDIA)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Mercury, Total	7439-97-6	0.02	0.002	ug/cart	90-110			20	20		30 days	1 - Sorbent Tube (Disposable)

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

ATTACHMENT B

GROUNDWATER SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units
Volatile Organic Compounds					
EPA 8260C	Groundwater	1,1,1,2-Tetrachloroethane	0.5	0.164	ug/L
EPA 8260C	Groundwater	1,1,1-Trichloroethane	0.5	0.158	ug/L
EPA 8260C	Groundwater	1,1,2,2-Tetrachloroethane	0.5	0.144	ug/L
EPA 8260C	Groundwater	1,1,2-Trichloro-1,2,2-Trifluoroethane	10	0.148	ug/L
EPA 8260C	Groundwater	1,1,2-Trichloroethane	0.75	0.144	ug/L
EPA 8260C	Groundwater	1,1-Dichloroethane	0.75	0.21	ug/L
EPA 8260C	Groundwater	1,1-Dichloroethene	0.5	0.142	ug/L
EPA 8260C	Groundwater	1,1-Dichloropropene	2.5	0.173	ug/L
EPA 8260C	Groundwater	1,2,3-Trichlorobenzene	2.5	0.234	ug/L
EPA 8260C	Groundwater	1,2,3-Trichloropropane	5	0.176	ug/L
EPA 8260C	Groundwater	1,2,4,5-Tetramethylbenzene	2	0.542	ug/L
EPA 8260C	Groundwater	1,2,4-Trichlorobenzene	2.5	0.22	ug/L
EPA 8260C	Groundwater	1,2,4-Trimethylbenzene	2.5	0.191	ug/L
EPA 8260C	Groundwater	1,2-Dibromo-3-chloropropane	2.5	0.327	ug/L
EPA 8260C	Groundwater	1,2-Dibromoethane	2	0.193	ug/L
EPA 8260C	Groundwater	1,2-Dichlorobenzene	2.5	0.184	ug/L
EPA 8260C	Groundwater	1,2-Dichloroethane	0.5	0.132	ug/L
EPA 8260C	Groundwater	1,2-Dichloropropane	1.75	0.133	ug/L
EPA 8260C	Groundwater	1,3,5-Trimethylbenzene	2.5	0.174	ug/L
EPA 8260C	Groundwater	1,3-Dichlorobenzene	2.5	0.186	ug/L
EPA 8260C	Groundwater	1,3-Dichloropropane	2.5	0.212	ug/L
EPA 8260C	Groundwater	1,4-Dichlorobenzene	2.5	0.187	ug/L
EPA 8260C	Groundwater	1,4-Diethylbenzene	2	0.392	ug/L
EPA 8270 SIM Isotope Dilution	Groundwater	1,4-Dioxane	0.15	0.075	ug/L
EPA 8260C	Groundwater	2,2-Dichloropropane	2.5	0.204	ug/L
EPA 8260C	Groundwater	2-Butanone	5	1.94	ug/L
EPA 8260C	Groundwater	2-Hexanone	5	0.515	ug/L
EPA 8260C	Groundwater	4-Ethyltoluene	2	0.34	ug/L
EPA 8260C	Groundwater	4-Methyl-2-pentanone	5	0.416	ug/L
EPA 8260C	Groundwater	Acetone	5	1.46	ug/L
EPA 8260C	Groundwater	Acrolein	5	0.633	ug/L
EPA 8260C	Groundwater	Acrylonitrile	5	0.43	ug/L
EPA 8260C	Groundwater	Benzene	0.5	0.159	ug/L
EPA 8260C	Groundwater	Bromobenzene	2.5	0.152	ug/L
EPA 8260C	Groundwater	Bromochloromethane	2.5	0.138	ug/L
EPA 8260C	Groundwater	Bromodichloromethane	0.5	0.192	ug/L
EPA 8260C	Groundwater	Bromoform	2	0.248	ug/L
EPA 8260C	Groundwater	Bromomethane	1	0.256	ug/L
EPA 8260C	Groundwater	Carbon disulfide	5	0.299	ug/L
EPA 8260C	Groundwater	Carbon tetrachloride	0.5	0.134	ug/L
EPA 8260C	Groundwater	Chlorobenzene	0.5	0.178	ug/L
EPA 8260C	Groundwater	Chloroethane	1	0.134	ug/L
EPA 8260C	Groundwater	Chloroform	0.75	0.162	ug/L
EPA 8260C	Groundwater	Chloromethane	2.5	0.176	ug/L
EPA 8260C	Groundwater	cis-1,2-Dichloroethene	0.5	0.187	ug/L
EPA 8260C	Groundwater	cis-1,3-Dichloropropene	0.5	0.144	ug/L
EPA 8260C	Groundwater	Cyclohexane	10	0.271	ug/L
EPA 8260C	Groundwater	Dibromochloromethane	0.5	0.149	ug/L
EPA 8260C	Groundwater	Dibromomethane	5	0.363	ug/L
EPA 8260C	Groundwater	Dichlorodifluoromethane	5	0.245	ug/L
EPA 8260C	Groundwater	Ethyl ether	2.5	0.15	ug/L
EPA 8260C	Groundwater	Ethylbenzene	0.5	0.168	ug/L
EPA 8260C	Groundwater	Hexachlorobutadiene	0.5	0.217	ug/L
EPA 8260C	Groundwater	Isopropylbenzene	0.5	0.187	ug/L
EPA 8260C	Groundwater	Methyl Acetate	10	0.234	ug/L
EPA 8260C	Groundwater	Methyl cyclohexane	10	0.396	ug/L
EPA 8260C	Groundwater	Methyl tert butyl ether	1	0.16	ug/L
EPA 8260C	Groundwater	Methylene chloride	3	0.289	ug/L
EPA 8260C	Groundwater	Naphthalene	2.5	0.216	ug/L
EPA 8260C	Groundwater	n-Butylbenzene	0.5	0.192	ug/L
EPA 8260C	Groundwater	n-Propylbenzene	0.5	0.173	ug/L
EPA 8260C	Groundwater	o-Chlorotoluene	2.5	0.17	ug/L
EPA 8260C	Groundwater	o-Xylene	1	0.33	ug/L
EPA 8260C	Groundwater	p/m-Xylene	1	0.332	ug/L
EPA 8260C	Groundwater	p-Chlorotoluene	2.5	0.185	ug/L
EPA 8260C	Groundwater	p-Isopropyltoluene	0.5	0.188	ug/L
EPA 8260C	Groundwater	sec-Butylbenzene	0.5	0.181	ug/L
EPA 8260C	Groundwater	Styrene	1	0.359	ug/L
EPA 8260C	Groundwater	tert-Butyl Alcohol	10	0.899	ug/L
EPA 8260C	Groundwater	tert-Butylbenzene	2.5	0.185	ug/L
EPA 8260C	Groundwater	Tetrachloroethene	0.5	0.181	ug/L
EPA 8260C	Groundwater	Toluene	0.75	0.161	ug/L
EPA 8260C	Groundwater	trans-1,2-Dichloroethene	0.75	0.163	ug/L
EPA 8260C	Groundwater	trans-1,3-Dichloropropene	0.5	0.164	ug/L
EPA 8260C	Groundwater	trans-1,4-Dichloro-2-butene	2.5	0.173	ug/L
EPA 8260C	Groundwater	Trichloroethene	0.5	0.175	ug/L
EPA 8260C	Groundwater	Trichlorofluoromethane	2.5	0.161	ug/L
EPA 8260C	Groundwater	Vinyl acetate	5	0.311	ug/L
EPA 8260C	Groundwater	Vinyl chloride	1	0.0699	ug/L
EPA 8260C	Groundwater	Xylenes, Total	1	0.33	ug/L

ATTACHMENT B

GROUNDWATER SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units
		Semivolatile Organic Compounds			
EPA 8270D	Groundwater	1,2,4,5-Tetrachlorobenzene	10	0.357	ug/L
EPA 8270D	Groundwater	1,2,4-Trichlorobenzene	5	0.21	ug/L
EPA 8270D	Groundwater	1,2-Dichlorobenzene	2	0.302	ug/L
EPA 8270D	Groundwater	1,3-Dichlorobenzene	2	0.35	ug/L
EPA 8270D	Groundwater	1,4-Dichlorobenzene	2	0.323	ug/L
EPA 8270D	Groundwater	2,3,4,6-Tetrachlorophenol	5	0.59	ug/L
EPA 8270D	Groundwater	2,4,5-Trichlorophenol	5	0.748	ug/L
EPA 8270D	Groundwater	2,4,6-Trichlorophenol	5	0.775	ug/L
EPA 8270D	Groundwater	2,4-Dichlorophenol	5	0.564	ug/L
EPA 8270D	Groundwater	2,4-Dimethylphenol	5	0.578	ug/L
EPA 8270D	Groundwater	2,4-Dinitrophenol	20	1.4081	ug/L
EPA 8270D	Groundwater	2,4-Dinitrotoluene	5	1.05	ug/L
EPA 8270D	Groundwater	2,6-Dinitrotoluene	5	0.89	ug/L
EPA 8270D	Groundwater	2-Chloronaphthalene	2	0.455	ug/L
EPA 8270D	Groundwater	2-Chlorophenol	2	0.58	ug/L
EPA 8270D	Groundwater	2-Methylnaphthalene	2	0.355	ug/L
EPA 8270D	Groundwater	2-Methylphenol	5	0.703	ug/L
EPA 8270D	Groundwater	2-Nitroaniline	5	0.956	ug/L
EPA 8270D	Groundwater	2-Nitrophenol	10	1.05	ug/L
EPA 8270D	Groundwater	3,3'-Dichlorobenzidine	5	0.478	ug/L
EPA 8270D	Groundwater	3-Methylphenol/4-Methylphenol	5	0.72	ug/L
EPA 8270D	Groundwater	3-Nitroaniline	5	0.668	ug/L
EPA 8270D	Groundwater	4,6-Dinitro-o-cresol	10	1.36	ug/L
EPA 8270D	Groundwater	4-Bromophenyl phenyl ether	2	0.428	ug/L
EPA 8270D	Groundwater	4-Chloroaniline	5	0.835	ug/L
EPA 8270D	Groundwater	4-Chlorophenyl phenyl ether	2	0.355	ug/L
EPA 8270D	Groundwater	4-Nitroaniline	5	0.83	ug/L
EPA 8270D	Groundwater	4-Nitrophenol	10	1.09	ug/L
EPA 8270D	Groundwater	Acenaphthene	2	0.284	ug/L
EPA 8270D	Groundwater	Acenaphthylene	2	0.372	ug/L
EPA 8270D	Groundwater	Acetophenone	5	0.428	ug/L
EPA 8270D	Groundwater	Anthracene	2	0.2	ug/L
EPA 8270D	Groundwater	Atrazine	10	0.794	ug/L
EPA 8270D	Groundwater	Azobenzene	2	0.537	ug/L
EPA 8270D	Groundwater	Benzaldehyde	5	0.986	ug/L
EPA 8270D	Groundwater	Benzidine	20	5.24	ug/L
EPA 8270D	Groundwater	Benzo(a)anthracene	2	0.323	ug/L
EPA 8270D	Groundwater	Benzo(a)pyrene	2	0.658	ug/L
EPA 8270D	Groundwater	Benzo(b)fluoranthene	2	0.371	ug/L
EPA 8270D	Groundwater	Benzo(ghi)perylene	2	0.574	ug/L
EPA 8270D	Groundwater	Benzo(k)fluoranthene	2	0.3	ug/L
EPA 8270D	Groundwater	Benzoic Acid	50	1.0104	ug/L
EPA 8270D	Groundwater	Benzyl Alcohol	2	0.677	ug/L
EPA 8270D	Groundwater	Biphenyl	2	0.237	ug/L
EPA 8270D	Groundwater	Bis(2-chloroethoxy)methane	5	0.596	ug/L
EPA 8270D	Groundwater	Bis(2-chloroethyl)ether	2	0.409	ug/L
EPA 8270D	Groundwater	Bis(2-chloroisopropyl)ether	2	0.597	ug/L
EPA 8270D	Groundwater	Bis(2-Ethylhexyl)phthalate	3	0.928	ug/L
EPA 8270D	Groundwater	Butyl benzyl phthalate	5	1.13	ug/L
EPA 8270D	Groundwater	Caprolactam	10	0.3895	ug/L
EPA 8270D	Groundwater	Carbazole	2	0.374	ug/L
EPA 8270D	Groundwater	Chrysene	2	0.304	ug/L
EPA 8270D	Groundwater	Dibenzo(a,h)anthracene	2	0.438	ug/L
EPA 8270D	Groundwater	Dibenzofuran	2	0.218	ug/L
EPA 8270D	Groundwater	Diethyl phthalate	5	0.393	ug/L
EPA 8270D	Groundwater	Dimethyl phthalate	5	0.333	ug/L
EPA 8270D	Groundwater	Di-n-butylphthalate	5	0.768	ug/L
EPA 8270D	Groundwater	Di-n-octylphthalate	5	1.2	ug/L
EPA 8270D	Groundwater	Fluoranthene	2	0.401	ug/L
EPA 8270D	Groundwater	Fluorene	2	0.32	ug/L
EPA 8270D	Groundwater	Hexachlorobenzene	2	0.396	ug/L
EPA 8270D	Groundwater	Hexachlorobutadiene	2	0.417	ug/L
EPA 8270D	Groundwater	Hexachlorocyclopentadiene	20	0.585	ug/L
EPA 8270D	Groundwater	Hexachloroethane	2	0.298	ug/L
EPA 8270D	Groundwater	Indeno(1,2,3-cd)Pyrene	2	0.433	ug/L
EPA 8270D	Groundwater	Isophorone	5	0.787	ug/L
EPA 8270D	Groundwater	Naphthalene	2	0.332	ug/L
EPA 8270D	Groundwater	Nitrobenzene	2	0.401	ug/L
EPA 8270D	Groundwater	NitrosoDiPhenylAmine(NDPA)/DPA	2	0.34	ug/L
EPA 8270D	Groundwater	n-Nitrosodimethylamine	2	0.498	ug/L
EPA 8270D	Groundwater	n-Nitrosodi-n-propylamine	5	0.645	ug/L
EPA 8270D	Groundwater	P-Chloro-M-Cresol	2	0.543	ug/L
EPA 8270D	Groundwater	Pentachlorophenol	10	3.22	ug/L
EPA 8270D	Groundwater	Phenanthrene	2	0.23	ug/L
EPA 8270D	Groundwater	Phenol	5	0.27	ug/L
EPA 8270D	Groundwater	Pyrene	2	0.524	ug/L
EPA 8270D-SIM	Groundwater	2-Chloronaphthalene	0.2	0.035	ug/L
EPA 8270D-SIM	Groundwater	2-Methylnaphthalene	0.2	0.045	ug/L
EPA 8270D-SIM	Groundwater	Acenaphthene	0.2	0.035	ug/L
EPA 8270D-SIM	Groundwater	Acenaphthylene	0.2	0.035	ug/L
EPA 8270D-SIM	Groundwater	Anthracene	0.2	0.035	ug/L
EPA 8270D-SIM	Groundwater	Benzo(a)anthracene	0.2	0.016	ug/L
EPA 8270D-SIM	Groundwater	Benzo(a)pyrene	0.2	0.039	ug/L
EPA 8270D-SIM	Groundwater	Benzo(b)fluoranthene	0.2	0.016	ug/L
EPA 8270D-SIM	Groundwater	Benzo(ghi)perylene	0.2	0.042	ug/L
EPA 8270D-SIM	Groundwater	Benzo(k)fluoranthene	0.2	0.042	ug/L
EPA 8270D-SIM	Groundwater	Chrysene	0.2	0.038	ug/L
EPA 8270D-SIM	Groundwater	Dibenzo(a,h)anthracene	0.2	0.039	ug/L
EPA 8270D-SIM	Groundwater	Fluoranthene	0.2	0.038	ug/L
EPA 8270D-SIM	Groundwater	Fluorene	0.2	0.037	ug/L
EPA 8270D-SIM	Groundwater	Hexachlorobenzene	0.8	0.032	ug/L
EPA 8270D-SIM	Groundwater	Hexachlorobutadiene	0.5	0.036	ug/L
EPA 8270D-SIM	Groundwater	Hexachloroethane	0.8	0.03	ug/L
EPA 8270D-SIM	Groundwater	Indeno(1,2,3-cd)Pyrene	0.2	0.04	ug/L
EPA 8270D-SIM	Groundwater	Naphthalene	0.2	0.043	ug/L
EPA 8270D-SIM	Groundwater	Pentachlorophenol	0.8	0.22	ug/L
EPA 8270D-SIM	Groundwater	Phenanthrene	0.2	0.015	ug/L
EPA 8270D-SIM	Groundwater	Pyrene	0.2	0.04	ug/L

ATTACHMENT B

GROUNDWATER SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units
		Pesticides			
EPA 8081B	Groundwater	4,4'-DDD	0.04	0.00464	ug/L
EPA 8081B	Groundwater	4,4'-DDE	0.04	0.00381	ug/L
EPA 8081B	Groundwater	4,4'-DDT	0.04	0.00432	ug/L
EPA 8081B	Groundwater	Aldrin	0.02	0.00216	ug/L
EPA 8081B	Groundwater	Alpha-BHC	0.02	0.00439	ug/L
EPA 8081B	Groundwater	Beta-BHC	0.02	0.0056	ug/L
EPA 8081B	Groundwater	Chlordane	0.2	0.0463	ug/L
EPA 8081B	Groundwater	cis-Chlordane	0.02	0.00666	ug/L
EPA 8081B	Groundwater	Delta-BHC	0.02	0.00467	ug/L
EPA 8081B	Groundwater	Dieldrin	0.04	0.00429	ug/L
EPA 8081B	Groundwater	Endosulfan I	0.02	0.00345	ug/L
EPA 8081B	Groundwater	Endosulfan II	0.04	0.00519	ug/L
EPA 8081B	Groundwater	Endosulfan sulfate	0.04	0.00481	ug/L
EPA 8081B	Groundwater	Endrin	0.04	0.00429	ug/L
EPA 8081B	Groundwater	Endrin aldehyde	0.04	0.0081	ug/L
EPA 8081B	Groundwater	Endrin ketone	0.04	0.00477	ug/L
EPA 8081B	Groundwater	Heptachlor	0.02	0.0031	ug/L
EPA 8081B	Groundwater	Heptachlor epoxide	0.02	0.00415	ug/L
EPA 8081B	Groundwater	Lindane	0.02	0.00434	ug/L
EPA 8081B	Groundwater	Methoxychlor	0.2	0.00684	ug/L
EPA 8081B	Groundwater	Toxaphene	0.2	0.0627	ug/L
EPA 8081B	Groundwater	trans-Chlordane	0.02	0.00627	ug/L
		Polychlorinated Biphenyls			
EPA 8082A	Groundwater	Aroclor 1016	0.083	0.05478	ug/L
EPA 8082A	Groundwater	Aroclor 1221	0.083	0.05312	ug/L
EPA 8082A	Groundwater	Aroclor 1232	0.083	0.03071	ug/L
EPA 8082A	Groundwater	Aroclor 1242	0.083	0.05976	ug/L
EPA 8082A	Groundwater	Aroclor 1248	0.083	0.05063	ug/L
EPA 8082A	Groundwater	Aroclor 1254	0.083	0.03403	ug/L
EPA 8082A	Groundwater	Aroclor 1260	0.083	0.03154	ug/L
EPA 8082A	Groundwater	Aroclor 1262	0.083	0.02905	ug/L
EPA 8082A	Groundwater	Aroclor 1268	0.083	0.03735	ug/L
EPA 8082A	Groundwater	PCBs, Total	0.083	0.02905	ug/L
		Herbicides			
EPA 8151A	Groundwater	2,4,5-T	2	0.531	ug/L
EPA 8151A	Groundwater	2,4,5-TP (Silvex)	2	0.539	ug/L
EPA 8151A	Groundwater	2,4-D	10	0.498	ug/L
		Metals			
EPA 6010A	Groundwater	Aluminum, Dissolved	0.01	0.00169	mg/L
EPA 6010A	Groundwater	Aluminum, Total	0.01	0.00169	mg/L
EPA 6010A	Groundwater	Antimony, Dissolved	0.0005	0.0000699	mg/L
EPA 6010A	Groundwater	Antimony, Total	0.0005	0.0000699	mg/L
EPA 6010A	Groundwater	Arsenic, Dissolved	0.0005	0.000123	mg/L
EPA 6010A	Groundwater	Arsenic, Total	0.0005	0.000123	mg/L
EPA 6010A	Groundwater	Barium, Dissolved	0.0005	0.0000625	mg/L
EPA 6010A	Groundwater	Barium, Total	0.0005	0.0000625	mg/L
EPA 6010A	Groundwater	Beryllium, Dissolved	0.0005	0.00015	mg/L
EPA 6010A	Groundwater	Beryllium, Total	0.0005	0.00015	mg/L
EPA 6010A	Groundwater	Cadmium, Dissolved	0.0002	0.00005	mg/L
EPA 6010A	Groundwater	Cadmium, Total	0.0002	0.00005	mg/L
EPA 6010A	Groundwater	Calcium, Dissolved	0.1	0.032	mg/L
EPA 6010A	Groundwater	Calcium, Total	0.1	0.032	mg/L
EPA 6010A	Groundwater	Chromium, Dissolved	0.001	0.000253	mg/L
EPA 6010A	Groundwater	Chromium, Total	0.001	0.000253	mg/L
EPA 7196A	Groundwater	Chromium, Hexavalent, Dissolved	0.01	0.003	mg/L
EPA 7196A	Groundwater	Chromium, Hexavalent, Total	0.01	0.003	mg/L
EPA 6010A	Groundwater	Cobalt, Dissolved	0.0002	0.0000621	mg/L
EPA 6010A	Groundwater	Cobalt, Total	0.0002	0.0000621	mg/L
EPA 6010A	Groundwater	Copper, Dissolved	0.001	0.000262	mg/L
EPA 6010A	Groundwater	Copper, Total	0.001	0.000262	mg/L
EPA 6010A	Groundwater	Iron, Dissolved	0.05	0.012	mg/L
EPA 6010A	Groundwater	Iron, Total	0.05	0.012	mg/L
EPA 6010A	Groundwater	Lead, Dissolved	0.001	0.000129	mg/L
EPA 6010A	Groundwater	Lead, Total	0.001	0.000129	mg/L
EPA 6010A	Groundwater	Magnesium, Dissolved	0.07	0.0223	mg/L
EPA 6010A	Groundwater	Magnesium, Total	0.07	0.0223	mg/L
EPA 6010A	Groundwater	Manganese, Dissolved	0.001	0.000302	mg/L
EPA 6010A	Groundwater	Manganese, Total	0.001	0.000302	mg/L
EPA 7470A	Groundwater	Mercury, Dissolved	0.0002	0.000066	mg/L
EPA 7470A	Groundwater	Mercury, Total	0.0002	0.000066	mg/L
EPA 6010A	Groundwater	Nickel, Dissolved	0.0005	0.0000865	mg/L
EPA 6010A	Groundwater	Nickel, Total	0.0005	0.0000865	mg/L
EPA 6010A	Groundwater	Potassium, Dissolved	0.1	0.0193	mg/L
EPA 6010A	Groundwater	Potassium, Total	0.1	0.0193	mg/L
EPA 6010A	Groundwater	Selenium, Dissolved	0.005	0.001	mg/L
EPA 6010A	Groundwater	Selenium, Total	0.005	0.001	mg/L
EPA 6010A	Groundwater	Silver, Dissolved	0.00025	0.0000779	mg/L
EPA 6010A	Groundwater	Silver, Total	0.00025	0.0000779	mg/L
EPA 6010A	Groundwater	Sodium, Dissolved	0.1	0.0161	mg/L
EPA 6010A	Groundwater	Sodium, Total	0.1	0.0161	mg/L
EPA 6010A	Groundwater	Thallium, Dissolved	0.0002	0.0000566	mg/L
EPA 6010A	Groundwater	Thallium, Total	0.0002	0.0000566	mg/L
EPA 6010A	Groundwater	Vanadium, Dissolved	0.005	0.000551	mg/L
EPA 6010A	Groundwater	Vanadium, Total	0.005	0.000551	mg/L
EPA 6010A	Groundwater	Zinc, Dissolved	0.01	0.00256	mg/L
EPA 6010A	Groundwater	Zinc, Total	0.01	0.00256	mg/L
		Other			
SM21 5210B	Groundwater	Biological Oxygen Demand	2	1.1	mg/L
SM21 5220C	Groundwater	Chemical Oxygen Demand	20	5.7	mg/L
SM21 5310B, SW8469060	Groundwater	Total Organic Carbon	1	0.35	mg/L
ASTM516-90,02	Groundwater	Sulfate	5	1.1	mg/L
SM21 4500 S F	Groundwater	Sulfide	2	0.94	mg/L
EPA 353.2	Groundwater	Nitrate	0.1	0.018	mg/L
SM 21 4500 NO2 B	Groundwater	Nitrite	0.1	0.001	mg/L
EPA 365.4/4500PE	Groundwater	Total Phosphorous	0.1	0.04	mg/L
SM18 4500 NH3F	Groundwater	Ammonia	0.1	0.034	mg/L
N/A	Groundwater	Naphthalene Dioxygenase (NAH)	100	5000	cells/mL
N/A	Groundwater	Napthalene Inducible Dioxygenase (NIDA)	100	5000	cells/mL
N/A	Groundwater	Phenol Hydroxylase (PHE)	100	5000	cells/mL
N/A	Groundwater	Naphthyl-2-methyl-succinate synthase (NMS)	100	5000	cells/mL
N/A	Groundwater	Naphthalene Carboxylase (ANC)	100	5000	cells/mL

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Langan Engineering & Environmental

1,4 Dioxane via EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 250ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,4-Dioxane	123-91-1	150	33.9	ng/l	40-140	30	40-140	30	30			
1,4-Dioxane-d8	*17647-74-4*									*15-110*		
1,4-Dioxane-d8 (IS)	17647-74-4			ng/l								

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

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Langan Engineering & Environmental

NY PFAAs via EPA 537(M)-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 2 Plastic/1 Plastic/1 H20 Plastic

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.408	ng/l	67-148	30	67-148	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.396	ng/l	63-161	30	63-161	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.238	ng/l	65-157	30	65-157	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.328	ng/l	69-168	30	69-168	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.2252	ng/l	58-159	30	58-159	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.376	ng/l	69-177	30	69-177	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.236	ng/l	63-159	30	63-159	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	2	1.332	ng/l	49-187	30	49-187	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2	0.688	ng/l	61-179	30	61-179	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.312	ng/l	68-171	30	68-171	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.504	ng/l	52-151	30	52-151	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.304	ng/l	63-171	30	63-171	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	1.212	ng/l	56-173	30	56-173	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	2	0.648	ng/l	60-166	30	60-166	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.26	ng/l	60-153	30	60-153	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.98	ng/l	38-156	30	38-156	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.58	ng/l	46-170	30	46-170	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.804	ng/l	45-170	30	45-170	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.372	ng/l	67-153	30	67-153	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.3272	ng/l	48-158	30	48-158	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.248	ng/l	59-182	30	59-182	30	30			
PFOA/PFOS, Total		2	0.236	ng/l				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*2-156*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*16-173*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*31-159*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*21-145*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*30-139*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*47-153*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*36-149*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*1-244*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*34-146*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*42-146*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*38-144*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*7-170*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*1-181*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*40-144*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*1-87*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*23-146*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*24-161*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*33-143*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

ATTACHMENT B

SOIL SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units
Volatile Organic Compounds					
EPA 8260C/5035	Soil	1,1,1,2-Tetrachloroethane	0.001	0.000318	mg/kg
EPA 8260C/5035	Soil	1,1,1-Trichloroethane	0.001	0.0001108	mg/kg
EPA 8260C/5035	Soil	1,1,2,2-Tetrachloroethane	0.001	0.0001008	mg/kg
EPA 8260C/5035	Soil	1,1,2-Trichloro-1,2,2-Trifluoroethane	0.02	0.000274	mg/kg
EPA 8260C/5035	Soil	1,1,2-Trichloroethane	0.0015	0.000304	mg/kg
EPA 8260C/5035	Soil	1,1-Dichloroethane	0.0015	0.0000856	mg/kg
EPA 8260C/5035	Soil	1,1-Dichloroethene	0.001	0.000262	mg/kg
EPA 8260C/5035	Soil	1,1-Dichloropropene	0.005	0.0001414	mg/kg
EPA 8260C/5035	Soil	1,2,3-Trichlorobenzene	0.005	0.0001476	mg/kg
EPA 8260C/5035	Soil	1,2,3-Trichloropropane	0.01	0.0001626	mg/kg
EPA 8260C/5035	Soil	1,2,4,5-Tetramethylbenzene	0.004	0.0001302	mg/kg
EPA 8260C/5035	Soil	1,2,4-Trichlorobenzene	0.005	0.0001818	mg/kg
EPA 8260C/5035	Soil	1,2,4-Trimethylbenzene	0.005	0.0001414	mg/kg
EPA 8260C/5035	Soil	1,2-Dibromo-3-chloropropane	0.005	0.000396	mg/kg
EPA 8260C/5035	Soil	1,2-Dibromoethane	0.004	0.0001744	mg/kg
EPA 8260C/5035	Soil	1,2-Dichlorobenzene	0.005	0.0001532	mg/kg
EPA 8260C/5035	Soil	1,2-Dichloroethane	0.001	0.0001134	mg/kg
EPA 8260C/5035	Soil	1,2-Dichloropropane	0.0035	0.000228	mg/kg
EPA 8260C/5035	Soil	1,3,5-Trimethylbenzene	0.005	0.0001434	mg/kg
EPA 8260C/5035	Soil	1,3-Dichlorobenzene	0.005	0.000135	mg/kg
EPA 8260C/5035	Soil	1,3-Dichloropropane	0.005	0.0001452	mg/kg
EPA 8260C/5035	Soil	1,4-Dichlorobenzene	0.005	0.0001384	mg/kg
EPA 8260C/5035	Soil	1,4-Diethylbenzene	0.004	0.0001598	mg/kg
EPA 8260C/5035	Soil	1,4-Dioxane	0.1	0.01442	mg/kg
EPA 8260C/5035	Soil	2,2-Dichloropropane	0.005	0.000226	mg/kg
EPA 8260C/5035	Soil	2-Butanone	0.01	0.000272	mg/kg
EPA 8260C/5035	Soil	2-Hexanone	0.01	0.000666	mg/kg
EPA 8260C/5035	Soil	4-Ethyltoluene	0.004	0.000124	mg/kg
EPA 8260C/5035	Soil	4-Methyl-2-pentanone	0.01	0.000244	mg/kg
EPA 8260C/5035	Soil	Acetone	0.01	0.001036	mg/kg
EPA 8260C/5035	Soil	Acrolein	0.025	0.00806	mg/kg
EPA 8260C/5035	Soil	Acrylonitrile	0.01	0.000514	mg/kg
EPA 8260C/5035	Soil	Benzene	0.001	0.000118	mg/kg
EPA 8260C/5035	Soil	Bromobenzene	0.005	0.000208	mg/kg
EPA 8260C/5035	Soil	Bromochloromethane	0.005	0.000276	mg/kg
EPA 8260C/5035	Soil	Bromodichloromethane	0.001	0.0001732	mg/kg
EPA 8260C/5035	Soil	Bromoform	0.004	0.000236	mg/kg
EPA 8260C/5035	Soil	Bromomethane	0.002	0.000338	mg/kg
EPA 8260C/5035	Soil	Carbon disulfide	0.01	0.001102	mg/kg
EPA 8260C/5035	Soil	Carbon tetrachloride	0.001	0.00021	mg/kg
EPA 8260C/5035	Soil	Chlorobenzene	0.001	0.000348	mg/kg
EPA 8260C/5035	Soil	Chloroethane	0.002	0.000316	mg/kg
EPA 8260C/5035	Soil	Chloroform	0.0015	0.00037	mg/kg
EPA 8260C/5035	Soil	Chloromethane	0.005	0.000294	mg/kg
EPA 8260C/5035	Soil	cis-1,2-Dichloroethene	0.001	0.0001428	mg/kg
EPA 8260C/5035	Soil	cis-1,3-Dichloropropene	0.001	0.0001176	mg/kg
EPA 8260C/5035	Soil	Cyclohexane	0.02	0.000146	mg/kg
EPA 8260C/5035	Soil	Dibromochloromethane	0.001	0.0001536	mg/kg
EPA 8260C/5035	Soil	Dibromomethane	0.01	0.0001636	mg/kg
EPA 8260C/5035	Soil	Dichlorodifluoromethane	0.01	0.0001908	mg/kg
EPA 8260C/5035	Soil	Ethyl ether	0.005	0.00026	mg/kg
EPA 8260C/5035	Soil	Ethylbenzene	0.001	0.0001274	mg/kg
EPA 8260C/5035	Soil	Hexachlorobutadiene	0.005	0.000228	mg/kg
EPA 8260C/5035	Soil	Isopropylbenzene	0.001	0.0001038	mg/kg
EPA 8260C/5035	Soil	Methyl Acetate	0.02	0.00027	mg/kg
EPA 8260C/5035	Soil	Methyl cyclohexane	0.004	0.0001546	mg/kg
EPA 8260C/5035	Soil	Methyl tert butyl ether	0.002	0.0000844	mg/kg
EPA 8260C/5035	Soil	Methylene chloride	0.01	0.001104	mg/kg
EPA 8260C/5035	Soil	Naphthalene	0.005	0.0001384	mg/kg
EPA 8260C/5035	Soil	n-Butylbenzene	0.001	0.0001148	mg/kg
EPA 8260C/5035	Soil	n-Propylbenzene	0.001	0.0001092	mg/kg
EPA 8260C/5035	Soil	o-Chlorotoluene	0.005	0.0001598	mg/kg
EPA 8260C/5035	Soil	o-Xylene	0.002	0.0001718	mg/kg
EPA 8260C/5035	Soil	p/m-Xylene	0.002	0.0001978	mg/kg
EPA 8260C/5035	Soil	p-Chlorotoluene	0.005	0.0001328	mg/kg
EPA 8260C/5035	Soil	p-Isopropyltoluene	0.001	0.000125	mg/kg
EPA 8260C/5035	Soil	sec-Butylbenzene	0.001	0.000122	mg/kg
EPA 8260C/5035	Soil	Styrene	0.002	0.000402	mg/kg
EPA 8260C/5035	Soil	tert-Butyl Alcohol	0.06	0.00292	mg/kg
EPA 8260C/5035	Soil	tert-Butylbenzene	0.005	0.0001354	mg/kg
EPA 8260C/5035	Soil	Tetrachloroethene	0.001	0.0001402	mg/kg
EPA 8260C/5035	Soil	Toluene	0.0015	0.0001948	mg/kg
EPA 8260C/5035	Soil	trans-1,2-Dichloroethene	0.0015	0.000212	mg/kg
EPA 8260C/5035	Soil	trans-1,3-Dichloropropene	0.001	0.0001208	mg/kg
EPA 8260C/5035	Soil	trans-1,4-Dichloro-2-butene	0.005	0.000392	mg/kg
EPA 8260C/5035	Soil	Trichloroethene	0.001	0.000125	mg/kg
EPA 8260C/5035	Soil	Trichlorofluoromethane	0.005	0.000388	mg/kg
EPA 8260C/5035	Soil	Vinyl acetate	0.01	0.0001322	mg/kg
EPA 8260C/5035	Soil	Vinyl chloride	0.002	0.0001174	mg/kg
EPA 8260C/5035	Soil	Xylenes, Total	0.002	0.0001978	mg/kg

ATTACHMENT B

SOIL SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units
Semivolatile Organic Compounds					
EPA 8270D	Soil	1,2,4,5-Tetrachlorobenzene	0.1665	0.0515817	mg/kg
EPA 8270D	Soil	1,2,4-Trichlorobenzene	0.1665	0.0545787	mg/kg
EPA 8270D	Soil	1,2-Dichlorobenzene	0.1665	0.0546453	mg/kg
EPA 8270D	Soil	1,3-Dichlorobenzene	0.1665	0.0524808	mg/kg
EPA 8270D	Soil	1,4-Dichlorobenzene	0.1665	0.050616	mg/kg
EPA 8270D	Soil	2,3,4,6-Tetrachlorophenol	0.1665	0.028305	mg/kg
EPA 8270D	Soil	2,4,5-Trichlorophenol	0.1665	0.053946	mg/kg
EPA 8270D	Soil	2,4,6-Trichlorophenol	0.0999	0.0314019	mg/kg
EPA 8270D	Soil	2,4-Dichlorophenol	0.14985	0.053946	mg/kg
EPA 8270D	Soil	2,4-Dimethylphenol	0.1665	0.049617	mg/kg
EPA 8270D	Soil	2,4-Dinitrophenol	0.7992	0.227772	mg/kg
EPA 8270D	Soil	2,4-Dinitrotoluene	0.1665	0.0359307	mg/kg
EPA 8270D	Soil	2,6-Dinitrotoluene	0.1665	0.042624	mg/kg
EPA 8270D	Soil	2-Chloronaphthalene	0.1665	0.054279	mg/kg
EPA 8270D	Soil	2-Chlorophenol	0.1665	0.050283	mg/kg
EPA 8270D	Soil	2-Methylnaphthalene	0.1998	0.0531801	mg/kg
EPA 8270D	Soil	2-Methylphenol	0.1665	0.053613	mg/kg
EPA 8270D	Soil	2-Nitroaniline	0.1665	0.046953	mg/kg
EPA 8270D	Soil	2-Nitrophenol	0.35964	0.051948	mg/kg
EPA 8270D	Soil	3,3'-Dichlorobenzidine	0.1665	0.044289	mg/kg
EPA 8270D	Soil	3-Methylphenol/4-Methylphenol	0.23976	0.054612	mg/kg
EPA 8270D	Soil	3-Nitroaniline	0.1665	0.045954	mg/kg
EPA 8270D	Soil	4,6-Dinitro-o-cresol	0.4329	0.060939	mg/kg
EPA 8270D	Soil	4-Bromophenyl phenyl ether	0.1665	0.038295	mg/kg
EPA 8270D	Soil	4-Chloroaniline	0.1665	0.043956	mg/kg
EPA 8270D	Soil	4-Chlorophenyl phenyl ether	0.1665	0.0506493	mg/kg
EPA 8270D	Soil	4-Nitroaniline	0.1665	0.044955	mg/kg
EPA 8270D	Soil	4-Nitrophenol	0.2331	0.053946	mg/kg
EPA 8270D	Soil	Acenaphthene	0.1332	0.034299	mg/kg
EPA 8270D	Soil	Acenaphthylene	0.1332	0.0311355	mg/kg
EPA 8270D	Soil	Acetophenone	0.1665	0.051615	mg/kg
EPA 8270D	Soil	Anthracene	0.0999	0.0277056	mg/kg
EPA 8270D	Soil	Atrazine	0.1332	0.0377289	mg/kg
EPA 8270D	Soil	Azobenzene	0.1665	0.044622	mg/kg
EPA 8270D	Soil	Benzaldehyde	0.21978	0.067266	mg/kg
EPA 8270D	Soil	Benzidine	0.54945	0.130203	mg/kg
EPA 8270D	Soil	Benzo(a)anthracene	0.0999	0.0326007	mg/kg
EPA 8270D	Soil	Benzo(a)pyrene	0.1332	0.0407259	mg/kg
EPA 8270D	Soil	Benzo(b)fluoranthene	0.0999	0.033633	mg/kg
EPA 8270D	Soil	Benzo(ghi)perylene	0.1332	0.034632	mg/kg
EPA 8270D	Soil	Benzo(k)fluoranthene	0.0999	0.0317682	mg/kg
EPA 8270D	Soil	Benzoic Acid	0.53946	0.168498	mg/kg
EPA 8270D	Soil	Benzyl Alcohol	0.1665	0.051282	mg/kg
EPA 8270D	Soil	Biphenyl	0.37962	0.0549117	mg/kg
EPA 8270D	Soil	Bis(2-chloroethoxy)methane	0.17982	0.0504162	mg/kg
EPA 8270D	Soil	Bis(2-chloroethyl)ether	0.14985	0.0466866	mg/kg
EPA 8270D	Soil	Bis(2-chloroisopropyl)ether	0.1998	0.058608	mg/kg
EPA 8270D	Soil	Bis(2-Ethylhexyl)phthalate	0.1665	0.043623	mg/kg
EPA 8270D	Soil	Butyl benzyl phthalate	0.1665	0.0325341	mg/kg
EPA 8270D	Soil	Caprolactam	0.1665	0.045954	mg/kg
EPA 8270D	Soil	Carbazole	0.1665	0.0357975	mg/kg
EPA 8270D	Soil	Chrysene	0.0999	0.0327006	mg/kg
EPA 8270D	Soil	Dibenzo(a,h)anthracene	0.0999	0.0322344	mg/kg
EPA 8270D	Soil	Dibenzofuran	0.1665	0.0555777	mg/kg
EPA 8270D	Soil	Diethyl phthalate	0.1665	0.0351981	mg/kg
EPA 8270D	Soil	Dimethyl phthalate	0.1665	0.042291	mg/kg
EPA 8270D	Soil	Di-n-butylphthalate	0.1665	0.0321345	mg/kg
EPA 8270D	Soil	Di-n-octylphthalate	0.1665	0.040959	mg/kg
EPA 8270D	Soil	Fluoranthene	0.0999	0.0305694	mg/kg
EPA 8270D	Soil	Fluorene	0.1665	0.0477189	mg/kg
EPA 8270D	Soil	Hexachlorobenzene	0.0999	0.0310356	mg/kg
EPA 8270D	Soil	Hexachlorobutadiene	0.1665	0.046953	mg/kg
EPA 8270D	Soil	Hexachlorocyclopentadiene	0.47619	0.106893	mg/kg
EPA 8270D	Soil	Hexachloroethane	0.1332	0.0302697	mg/kg
EPA 8270D	Soil	Indeno(1,2,3-cd)Pyrene	0.1332	0.036963	mg/kg
EPA 8270D	Soil	Isophorone	0.14985	0.044289	mg/kg
EPA 8270D	Soil	Naphthalene	0.1665	0.055278	mg/kg
EPA 8270D	Soil	Nitrobenzene	0.14985	0.039627	mg/kg
EPA 8270D	Soil	NitrosoDiPhenylAmine(NDPA)/DPA	0.1332	0.034965	mg/kg
EPA 8270D	Soil	n-Nitrosodimethylamine	0.333	0.0539127	mg/kg
EPA 8270D	Soil	n-Nitrosodi-n-propylamine	0.1665	0.049617	mg/kg
EPA 8270D	Soil	P-Chloro-M-Cresol	0.1665	0.048285	mg/kg
EPA 8270D	Soil	Pentachlorophenol	0.1332	0.035631	mg/kg
EPA 8270D	Soil	Phenanthrene	0.0999	0.0325674	mg/kg
EPA 8270D	Soil	Phenol	0.1665	0.049284	mg/kg
EPA 8270D	Soil	Pyrene	0.0999	0.0323676	mg/kg

ATTACHMENT B

SOIL SAMPLES
LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

Method	Matrix	Analyte	RL	MDL	Units
		Pesticides			
EPA 8081B	Soil	4,4'-DDD	0.007992	0.00285048	mg/kg
EPA 8081B	Soil	4,4'-DDE	0.007992	0.00184815	mg/kg
EPA 8081B	Soil	4,4'-DDT	0.014985	0.0064269	mg/kg
EPA 8081B	Soil	Aldrin	0.007992	0.00281385	mg/kg
EPA 8081B	Soil	Alpha-BHC	0.00333	0.00094572	mg/kg
EPA 8081B	Soil	Beta-BHC	0.007992	0.0030303	mg/kg
EPA 8081B	Soil	Chlordane	0.064935	0.0264735	mg/kg
EPA 8081B	Soil	cis-Chlordane	0.00999	0.00278388	mg/kg
EPA 8081B	Soil	Delta-BHC	0.007992	0.0015651	mg/kg
EPA 8081B	Soil	Dieldrin	0.004995	0.0024975	mg/kg
EPA 8081B	Soil	Endosulfan I	0.007992	0.00188811	mg/kg
EPA 8081B	Soil	Endosulfan II	0.007992	0.00267066	mg/kg
EPA 8081B	Soil	Endosulfan sulfate	0.00333	0.00158508	mg/kg
EPA 8081B	Soil	Endrin	0.00333	0.0013653	mg/kg
EPA 8081B	Soil	Endrin aldehyde	0.00999	0.0034965	mg/kg
EPA 8081B	Soil	Endrin ketone	0.007992	0.00205794	mg/kg
EPA 8081B	Soil	Heptachlor	0.003996	0.00179154	mg/kg
EPA 8081B	Soil	Heptachlor epoxide	0.014985	0.0044955	mg/kg
EPA 8081B	Soil	Lindane	0.00333	0.00148851	mg/kg
EPA 8081B	Soil	Methoxychlor	0.014985	0.004662	mg/kg
EPA 8081B	Soil	Toxaphene	0.14985	0.041958	mg/kg
EPA 8081B	Soil	trans-Chlordane	0.00999	0.00263736	mg/kg
		Polychlorinated Biphenyls			
EPA 8082A	Soil	Aroclor 1016	0.0335	0.0026465	mg/kg
EPA 8082A	Soil	Aroclor 1221	0.0335	0.0030887	mg/kg
EPA 8082A	Soil	Aroclor 1232	0.0335	0.0039262	mg/kg
EPA 8082A	Soil	Aroclor 1242	0.0335	0.0041004	mg/kg
EPA 8082A	Soil	Aroclor 1248	0.0335	0.0028274	mg/kg
EPA 8082A	Soil	Aroclor 1254	0.0335	0.0027537	mg/kg
EPA 8082A	Soil	Aroclor 1260	0.0335	0.0025527	mg/kg
EPA 8082A	Soil	Aroclor 1262	0.0335	0.0016616	mg/kg
EPA 8082A	Soil	Aroclor 1268	0.0335	0.0048575	mg/kg
EPA 8082A	Soil	Total PCBs	0.0335	0.0016616	mg/kg
		Herbicides			
EPA 8151A	Soil	2,4-D	0.1665	0.0051615	mg/kg
EPA 8151A	Soil	2,4,5-TP (Silvex)	0.1665	0.0044289	mg/kg
EPA 8151A	Soil	2,4,5-T	0.1665	0.0104895	mg/kg
		Metals			
EPA 6010C	Soil	Aluminum	4	0.8	mg/kg
EPA 6010C	Soil	Antimony	2	0.32	mg/kg
EPA 6010C	Soil	Arsenic	0.4	0.08	mg/kg
EPA 6010C	Soil	Barium	0.4	0.12	mg/kg
EPA 6010C	Soil	Beryllium	0.2	0.04	mg/kg
EPA 6010C	Soil	Cadmium	0.4	0.028	mg/kg
EPA 6010C	Soil	Calcium	4	1.2	mg/kg
EPA 6010C	Soil	Chromium	0.4	0.08	mg/kg
EPA 7196A	Soil	Hexvalent Chromium	0.8	0.16	mg/kg
EPA 6010C	Soil	Cobalt	0.8	0.2	mg/kg
EPA 6010C	Soil	Copper	0.4	0.08	mg/kg
EPA 6010C	Soil	Iron	2	0.8	mg/kg
EPA 6010C	Soil	Lead	2	0.08	mg/kg
EPA 6010C	Soil	Magnesium	4	0.4	mg/kg
EPA 6010C	Soil	Manganese	0.4	0.08	mg/kg
EPA 7473	Soil	Mercury	0.08	0.016896	mg/kg
EPA 6010C	Soil	Nickel	1	0.16	mg/kg
EPA 6010C	Soil	Potassium	100	16	mg/kg
EPA 6010C	Soil	Selenium	0.8	0.12	mg/kg
EPA 6010C	Soil	Silver	0.4	0.08	mg/kg
EPA 6010C	Soil	Sodium	80	12	mg/kg
EPA 6010C	Soil	Thallium	0.8	0.16	mg/kg
EPA 6010C	Soil	Vanadium	0.4	0.04	mg/kg
EPA 6010C	Soil	Zinc	2	0.28	mg/kg
		Other			
ASTM D422-63	Soil	Grain Size	N/A	N/A	N/A
SM21 5210B	Soil	Biological Oxygen Demand (BOD)	N/A	N/A	N/A
SM21 5220C	Soil	Chemical Oxygen Demand (COD)	100	28	mg/kg
EPA 9040C	Soil	pH	N/A	N/A	N/A
SM21 5310B, SW8469060	Soil	Total Organic Carbon (TOC)	1000	160	mg/kg
ASTM516-90,02	Soil	Sulfate	50	7	mg/kg
SM21 4500 S F	Soil	Sulfide	4	1.5	mg/kg
EPA 351.2	Soil	Total Kjeldahl Nitrogen (TKN)	5	1.2	mg/kg
EPA 365.4/4500PE	Soil	Total Phosphorous	10	0.24	mg/kg
SM18 4500 NH3F	Soil	Ammonia	5	1.8	mg/kg

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1,4 Dioxane via EPA 8270D-SIM (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Glass 250ml/8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,4-Dioxane	123-91-1	8	2.04	ug/kg	40-140	30	40-140	30	30			
1,4-Dioxane-d8	*17647-74-4*									*15-110*		
1,4-Dioxane-d8 (IS)	17647-74-4			ug/kg								

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

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Langan Engineering & Environmental

NY PFAAs via EPA 537(M)-Isotope Dilution (SOIL)

Holding Time: 28 days
Container/Sample Preservation: 1 - Plastic 8oz unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	1	0.0227	ug/kg	71-135	30	71-135	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	1	0.046	ug/kg	69-132	30	69-132	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	1	0.039	ug/kg	72-128	30	72-128	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	1	0.0525	ug/kg	70-132	30	70-132	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	1	0.0451	ug/kg	71-131	30	71-131	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	1	0.0605	ug/kg	67-130	30	67-130	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	1	0.0419	ug/kg	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	1	0.1795	ug/kg	64-140	30	64-140	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	1	0.1365	ug/kg	70-132	30	70-132	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	1	0.075	ug/kg	72-129	30	72-129	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	1	0.13	ug/kg	68-136	30	68-136	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	1	0.067	ug/kg	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	1	0.287	ug/kg	65-137	30	65-137	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	1	0.2015	ug/kg	63-144	30	63-144	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	1	0.0468	ug/kg	64-136	30	64-136	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	1	0.153	ug/kg	59-134	30	59-134	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	1	0.098	ug/kg	67-137	30	67-137	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	1	0.0845	ug/kg	61-139	30	61-139	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	1	0.07	ug/kg	69-135	30	69-135	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	1	0.2045	ug/kg	66-139	30	66-139	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	1	0.054	ug/kg	69-133	30	69-133	30	30			
PFOA/PFOS, Total		1	0.0419	ug/kg				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*60-153*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*65-182*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*70-151*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*61-147*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*62-149*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*63-166*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*62-152*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*32-182*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*61-154*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*65-151*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*65-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*25-186*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*45-137*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*64-158*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*1-125*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*42-136*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*56-148*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*26-160*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

PFAS Compound Analyte List for Soil And Groundwater Samples

Compound Name	Analytical Method
Perfluorohexanoic acid (PFHxA)	USEPA Method 537 Modified
Perfluoroheptanoic acid (PFHpA)	
Perfluorooctanoic acid (PFOA)	
Perfluorobutanoic acid (PFBA)	
Perfluoropentanoic acid (PFPeA)	
Perfluorononanoic acid (PFNA)	
Perfluorodecanoic acid (PFDA)	
Perfluoroundecanoic acid (PFUA/PFUdA)	
Perfluorododecanoic acid (PFDoA)	
Perfluorotridecanoic acid (PFTriA/PFTrDA)	
Perfluorotetradecanoic acid (PFTA/PFTeDA)	
Perfluorobutanesulfonic acid (PFBS)	
Perfluorohexanesulfonic acid (PFHxS)	
Perfluoroheptanesulfonic acid (PFHpS)	
Perfluorodecanesulfonic acid (PFDS)	
Perfluorooctanesulfonic acid (PFOS)	
N-methyl perfluorooctanesulfonamidoacetic acid (N-MeFOSAA)	
N-ethyl perfluorooctanesulfonamidoacetic acid (N-EtFOSAA)	
6:2 Fluorotelomer sulfonate (6:2 FTS)	
8:2 Fluorotelomer sulfonate (8:2 FTS)	
Perfluoroctancesulonamide (FOSA)	

Notes:

1. PFAS - per- and polyfluoroalkyl substances



Hg Selective Sequential Extractions (SSE):

General Method Description:

The following describes the method developed by Eurofins Frontier Global Sciences that uses a selective sequential extraction technique to accurately assess the type and concentration of mercury compounds typically found in contaminated geological sites. This method provides specific information about the expected mobility and bioaccessability of various compounds which offers a behavioural profile of the contaminant and data that can be used to assess its potential effect.

Step	Extractant	Description	Typical Compounds
F0	headspace gas	vapor equilibrium	Hg^0
F1	deionized water	water	$HgCl_2$, $HgSO_4$
F2	pH 2 HCl/HO Ac	"stomach acid"	HgO
F3	1N KOH	organo-complexed	Hg-humics, Hg_2Cl_2
F4	$12NHNO_3$	strong-complexed	mineral lattice, Hg_2, Hg^0
F5	aqua regia	cinnabar	HgS, m-HgS, HgSe, HgAu
F6	HNO_3/HCl/HF	mineral-bound	Hg in crystal lattice
FS	-	sum	total Hg

Scope:

This method is for the selective extraction of geological samples (soils, sediments, ores, mine tailings, etc.), with the goal of determining the biogeochemically relevant associations of inorganic Hg within, and leachability of inorganic Hg from, the solid phase.

When applied exactly as written, this method defines the following extraction fractions (F-0 through F-5, and F-S). The representativeness of each fraction varies from sample to sample, depending upon ancillary parameters such as TOC, soil pH, co-leached substances (i.e., Cl^-, $SO_4^=$, etc.) and actual solid phase speciation of the analyte. Additional ancillary chemistry measurements or kinetic studies may be required to fully interpret the extraction pattern for each sample.

Basic Principles:

Prior to digestion, the sample should be sieved through a 2-mm plastic mesh screen to remove large chunks, and as an aid in homogenization. Inherently fine-grained samples do not need to be sieved prior to extraction.

Fresh samples should be extracted in a form as close to their natural state as possible. Under no circumstances should samples be dried or pulverized prior to extraction, as this may lead to dramatic changes in leachability.

This method involves the sequential extraction of the ***same sample aliquot*** through a sequence of different extractants of increasing chemical strength. Recovery in a wide range of geological materials, as the sum of the selective extraction fractions was found to typically be 100 ± 15% (Table 2).

Summary Table of Eurofins Frontier Global Sciences' Mercury Selective Extraction Procedure

Fraction	Extraction Conditions	Expected Species	Expected Mobility	Expected water solubility range (20° Celsius, 1 atm)
F-0	Ambient temperature gaseous purging	Free elemental Hg	Relatively low mobility	Saturates at a concentration between 25-50 µg/L
F-1	Reagent water	Water soluble Hg salts such as $HgCl_2$, $Hg(NO_3)_2$	Highly mobile	Soluble (1 to 10 g/100 mL, $HgCl_2$ 6.57 g/100 mL)
F-2	Hydrochloric acid at a pH less than 2	Low pH soluble salts of mercury	Relatively low mobility	Slightly soluble (0.1 to 1 g/100 mL)
F-3	1 N potassium hydroxide	Organic bound mercury compounds (Hg(II) bound to sludge or humic matter)	Mobility strongly dependant on various factors	Solubility is strongly dependant on several factors including redox conditions and presence of competing complexing agents)
F-4	12 N nitric acid	All other non sulfide or silicate bound mercury compounds (can include amalgamated elemental mercury)	Low mobility	Insoluble less than 0.1 g/100 mL. Redox conditions can strongly affect the species and subsequent solubility.
F-5	Aqua regia	Sulfide bound mercury compounds only	Relatively immobile	Insoluble (HgS solubility is 2.943E-25 g/100 mL)
F-6	Combination of aqua regia and hydrofluoric acid	Silicate or aluminosilicate bound mercury compounds	Relatively immobile	Insoluble (solubility lower than HgS)

Detailed Description Of Each Step:

Volatile Elemental Mercury (Hg^o) This test is performed by placing a measured mass of the soil sample in a trace clean, teflon bomb vessel with an inlet and outlet and allowing and srubbed, Hg free nitrogen to pass over and purge the samples of free gaseous elemental Hg which in turn is captured at the outlet of the vessel using an EPA I-05/EPA 30B Hg sorbent trap. The trap is then digested using EFGS-009 and analyzed for Total Hg which represents free elemental gaseous Hg that came off the sample and reported in ng Hg (gaseous elemental Hg / gram of soil sample).

F-1 Water Soluble Mercury. Mercury extracted in this test is useful in assessing the potential leaching of soils by rain or groundwater, and is a reasonably good (±50%) predictor of the performance of the sample on an official TCLP or EP-toxicity leaching test. At high solid phase concentrations, the water soluble salts such as $HgCl_2$, $Hg(NO_3)_2$, etc., will appear largely in this fraction, but as total Hg concentrations decrease, the percentage found in this fraction decreases dramatically, due to adsorption of the free Hg on the soil particles. This fraction is extremely dependent upon the co-leached soil components such as Cl-, I-, DOC, and pH. Increases in any of these co-leached Hg complexing agents will generally greatly increase the solubility of water-soluble mercury compounds.

F-2 pH 2 Soluble Mercury. Mercury extracted in this fraction is a surrogate for what might be extracted by the human stomach upon ingestion, or of leachability under the conditions of acid mine drainage or other industrial process. In cases where the sample contains high TOC, this fraction is usually the lowest in Hg, because of readsorption of Hg(II) by coagulated humic matter at this pH. High concentrations of pH 2 leachable Hg might warrant additional testing that more accurately models the human digestive tract in terms of pH regime and contact time, or acid mine drainage conditions present at the contaminated site.

F-3 1N KOH Extractable Mercury. Under the conditions of this extraction, most of the Hg associated with humic organic matter appears to be solubilized, while none of the HgS is co-solubilized. 1N KOH soluble Hg dominates marine and freshwater sediments, as well as the soil humus layer. Not only does most of the CH_3Hg in the sample also leach out in this fraction, but also this fraction has been found to strongly correlate with *in situ* CH_3Hg concentrations, and the potential methylatability of the sample. The contribution of the CH_3Hg content to the total Hg extracted is usually small, but if high concentrations of methyl Hg (greater than 1% of total) are measured in the samples (FGS-045), a correction might be appropriate. The most appropriate way to correct this data is to also measure CH_3Hg directly on the 1N KOH extract, and subtract it from the measured total Hg value on the same extract.

F-4 12N HNO_3 Soluble Mercury. This fraction serves largely to separate out all remaining non-HgS, so that the final measured fraction may safely be taken to represent the HgS content of the sample. In cases where F-0 detected a saturation level of Hg^0, and the fractions F-1 through F-3 are small by comparison to F-4, the latter fraction may be interpreted as representing essentially the total Hg^0 content of the sample. At lower Hg concentrations in natural samples, much of the non-humic bound Hg(II) is found in this fraction, because it is strongly adsorbed to the particle surfaces, and so not leachable by the weak extractants F-1 and F-2.

F-5 Aqua Regia Soluble Mercury (Residue). If the previous steps of the extraction scheme have been carried out accurately, this fraction consists of the cinnabar and meta-cinnabar (HgS) content of the samples. Also included in this fraction, if present in the sample) would be HgSe, and amalgams of Hg with noble metals such as gold and platinum. Hg is leached from the surface of these amalgams, but the bulk concentrations require the dissolution of the noble metal particles, which is accomplished readily by aqua regia.

F-6 Mineral-Bound Mercury. For hard mineral samples, such as bauxite, the F5 (aqua regia) step is not vigorous enough to release all mercury from the crystal lattice. In samples of this type, an aggressive HF Bomb digest is necessary to recover all the mercury in the sample (SOP FGS-111).

F-S Total Mercury by the Sum of Species. The sum of all of the fractions, F-0 through F-6 is the total Hg in the sample. It is ***inadvisable*** to try to measure total Hg (FGS-137) on a separate aliquot of the sample, unless this is being done only for the purpose of assessing sample homogeneity. For real-world samples, heterogeneity is often so great that direct comparison of selective extraction on one aliquot and total Hg on a separate aliquot will produce misleading conclusions (such as that there is a "missing" Hg species, in cases where the total is much greater than the sum of species). For very fine, homogeneous samples such as CRMs, F-S should compare to the independently measured total to within ± 20%.

This leaching is optimized for and only applicable to Hg analysis. Other leaching procedures are necessary to obtain reliable and biogeochemically meaningful results for other trace metals.

This method is a protocol for the extraction only. All recovered aqueous fractions are then analyzed by an appropriate Hg quantification technique. Because of its low detection limits and high tolerance for complex matrices, EPA Method 1631 (ref 10.2), with preparation described in Frontier SOP FGS-012 (Total Hg in aqueous media) and analysis in EFGS-137 (Total Hg analysis) are recommended, as indicated in the text below.

Typical Minimum Detection Limits/Minimum Reporting Limits For Each Fraction:

Soil/Sediment

Analyte	MDL	MRL	Units	Duplicate RPD	Matrix Spike %Recovery	Matrix Spike RPD	Blank Spike/LCS %Recovery	Blank Spike/LCS RPD
Elemental Hg in soil/sediment by CV-AFS (EPA 1631 Mod)								
Mercury (0)	0.344	2.00	ng/g	24	71 - 125	25	80 - 120	24
SSE of Hg in solids (F1) (FGS-069)								
Mercury F-1	1.00	3.12	ng/g	25	75 - 125	25	0 - 125	25
SSE of Hg in solids (F2) (FGS-069)								
Mercury F-2	1.00	3.12	ng/g	25	75 - 125	25	0 - 125	25
SSE of Hg in solids (F3) (FGS-069)								
Mercury F-3	2.00	6.25	ng/g	25	75 - 125	25	0 - 125	25
SSE of Hg in solids (F4) (FGS-069)								
Mercury F-4	5.00	15.6	ng/g	25	75 - 125	25	0 - 125	25
SSE of Hg in solids (F5) (FGS-069)								
Mercury F-5	0.110	1.00	ng/g	25	75 - 125	25	0 - 125	25

ATTACHMENT C
Analytical Methods/Quality Assurance Summary Table

ATTACHMENT C

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Field Parameters	Laboratory Parameters	Analytical Methods	Sample Preservation	Sample Container Volume and Type	Sample Hold Time	Field Duplicate Samples	Field Blank Samples	Media Blank Samples	Equipment Blank Samples	Trip Blank Samples	Ambient Air Samples	MS/MSD Samples
Soil	Total VOCs via PID	Part 375 + TCL VOCs	EPA 8260C	Cool to 4°C	Two 40-ml VOC vials with 5ml H_2O, one with MeOH or 3 En Core Samplers (separate container for % solids)	14 days	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	NA	NA	NA	1 per 20 samples
		Part 375 + TCL SVOCs	EPA 8270D	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis							
		Part 375 + TAL Metals + Cyanide	EPA 6010C, EPA 7470A, EPA 7196A, EPA 9014/9010C	Cool to 4°C	2 oz. amber glass jar	6 months, except mercury 28 days							
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis							
		Part 375 + TCL PCBs	EPA 8082A	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis							
		NYSDEC List PFAS	EPA 537 Modified	Cool to 4°C	8 oz. HDPE jar	14 days to extract, 28 days after extraction to analysis				1 per day			
		1,4-Dioxane	8270 SIM	Cool to 4°C	4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis				NA			
Groundwater	Temperature, Turbidity, pH, ORP, Conductivity, DO	Part 375 + TCL VOCs	EPA 8260C	Cool to 4°C; HCl to pH <2;no headspace	Three 40-mL VOC vials with Teflon®-lined cap	Analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	NA	NA	1 per shipment of VOC samples	NA	1 per 20 samples
		Part 375 + TCL SVOCs	EPA 8270D	Cool to 4°C	Two 1-Liter amber glass	7 days to extract, 40 days after extraction to analysis							
		Part 375 + TAL Metals	EPA 6010C, EPA 7470A	HNO_3	250 ml plastic	6 months, except Mercury 28 days							
		Hexavalent Chromium	EPA 7196A	Cool to 4°C	250 ml plastic	24 hours							
		Cyanide	SM 4500 C/E	NaOH plus 0.6g ascorbic acid	250 ml plastic	14 days							
		Part 375 + TCL Pesticides	EPA 8081B	Cool to 4°C	Two 1-Liter Amber Glass for Pesticides/PCB	7 days to extract, 40 days after extraction to analysis							
		PCBs	EPA 8082A	Cool to 4°C		7 days to extract, 40 days after extraction to analysis							
		PFAS	EPA 537 Modified	Cool to 4°C	Two 250 mL HDPE	14 days to extract, 28 days after extraction to analysis				1 per day			
		1,4-dioxane	8270 SIM	Cool to 4°C	One 1 -Liter Amber Glass	7 days to extract, 40 days after extraction to analysis				NA			
Soil Vapor	Total VOCs, Oxygen, LEL, CO, and H_2S, with MultiGas Meter	TO-15 Listed VOCs	TO-15	Ambient Temperature	2.7-Liter Summa Canister	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	NA	NA	NA	NA	1 per 20 samples (minimum 1)	NA
Ambient/Indoor Air	Total VOCs via PID				6-Liter Summa Canister		NA	NA	NA	NA			
Soil Vapor	Mercury Vapor via Jerome J405	Mercury Vapor	EPA 6009	Ambient Temperature	Glass Sorbent Tube containing one section of 200 mg Hopcalite	Analyze within 30 days of collection	1 per 20 samples (minimum 1)	NA	3 per set	NA	NA	1 per 20 samples (minimum 1)	NA

Notes:
1. PID - Photoionization Detector
2. VOC - Volatile organic compound
3. EPA - Environmental Protection Agency
4. TCL - Target compound list
5. TAL - Target analyte list
6. ORP - Oxidation reduction potential
7. DO - Dissolved oxygen
8. LEL - Lower explosive limit
9. CO -Carbon monoxide
10. H_2S - Hydrogen sulfide
11. PFAS - Per-fluoroalkyl substances
12. HDPE - High-Density Polyethylene

ATTACHMENT D
Sample Nomenclature

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SAMPLE NOMENCLATURE

The sample nomenclature outlined below provides consistency between sample events and projects but, most importantly, establish unique sample IDs that will avoid confusion months or years after the sample has been collected. Furthermore, unique sample IDs are required for any data submitted to the NYSDEC in EDD format or being uploaded to an EQuIS database.

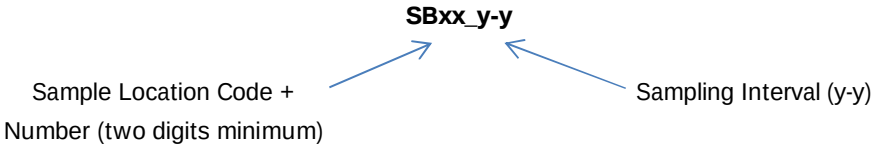
1.0 INVESTIGATION LOCATION CODES

SB	Soil Boring	SV	Soil Vapor Point
WC	Waste Characterization Boring	IA	Indoor Air
TP	Test Pit	AA	Ambient Air
EPSW	Endpoint Location (Sidewall)	SVE	Vapor Extraction Well
EPB	Endpoint Location (Bottom)	DS	Drum
MW	Monitoring Well	IDW	Investigation Derived Waste
TMW	Temporary Monitoring Well	SL	Sludge
SW	Surface Water	FP	Free Product

2.0 SAMPLE NOMENCLATURE

Each sample at a site must have a unique value.

- **Soil/Sediment Samples:**



Sample Type	Sample Location Code	Sampling Depth or Interval (feet bgs or approx. elevation)	Sample Name
Phase II/Remedial Investigation			
Grab Soil Sample	SB01	2 to 4	SB01_2-4
	SB02	4	SB02_4
Waste Characterization			
Grab Soil Sample	WC01	2 to 4	WC01_2-4
	WC02	4	WC02_4
Composite Soil Sample from one or more locations	COMP01 or COMP02 + COMP03	0 to 10 (Fill)	COMP01_0-10

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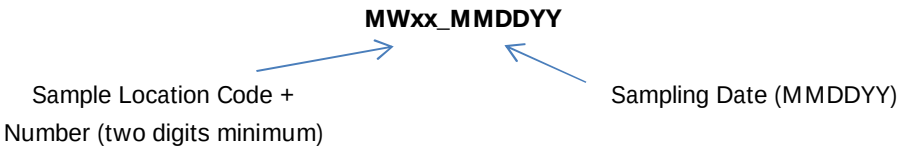
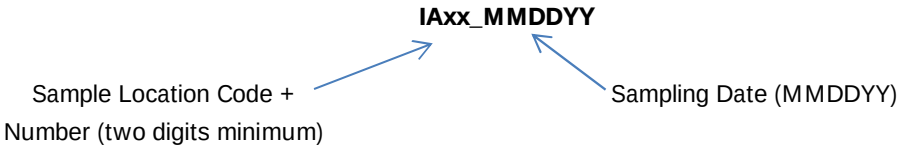
Sample Type	Sample Location Code	Sampling Depth or Interval (feet bgs or approx. elevation)	Sample Name
Endpoint Sampling			
Grab Soil Sample	EPSW01_N	5	EPSW01_N_5
	EPSW01_S	5	EPSW01_S_5
	EPSW01_E	5	EPSW01_E_5
	EPSW01_W	5	EPSW01_W_5
	EPB01	6	EPB01_6

- **Groundwater/Surface Water Samples:**



Sample Type	Sample Location Code	Sampling Date	Sample Name
Groundwater Sample	MW01	02/21/2013	MW01_022113

- **Air/Soil Vapor Samples:**



Sample Type	Sample Location Code	Date	Sample Name
Air Sample	IA01	02/21/2013	IA01_022113
Soil Vapor Sample	SV01	02/21/2013	SV01_022113
Vapor Extraction Well Sample	SVE01 (INLET/MIDPOINT/OUTLET)	02/21/2013	SVE01_IN_022113 SVE01_ MID_022113 SVE01_ OUT_022113

- **QA/QC Samples:**

Sample Matrix Codes

SO	Soil	AS	Air
SE	Sediment	SV	Soil Vapor
GW	Groundwater	SL	Sludge
SW	Surface Water	FP	Free Product

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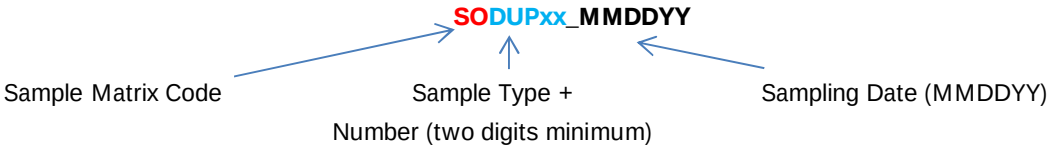
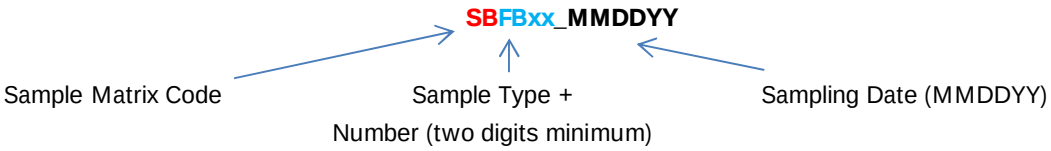
- Duplicates Samples



Sample Type	Parent Sample Code	Date	Sample Name
Groundwater Duplicate Sample (DUP)	MW01_022113	02/21/2013	GWDUP01_022113
Soil boring Duplicate Sample (DUP)	SBP01_022113	02/21/2013	SODUP01_022113
Grab Waste Characterization	WC01	02/21/2013	WCDUP01_022113
Composite Waste Characterization	COMP01	02/21/2013	COMPDUP01_022113

- Field Blanks and Trip Blanks



Sample Type	Date	Sample Name
Groundwater Field Blank (FB)	02/21/2013	GWFB01_022113
Groundwater Trip Blank (TB)	02/21/2013	GWTB01_022113
Soil Field Blank	02/21/2013	SOFB01_022113
Soil Trip Blank	02/21/2013	SOTB01_022113

- Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Parent Sample Name_MS or MSD

Sample Type	Sample Location	Parent Sample Name	Sample Name
Matrix Spike Soil (MS)	SB01	SB01_2-4	SB01_2-4_MS
Matrix Spike Soil Duplicate (MSD)	SB01	SB01_2-4	SB01_2-4_MSD
Matrix Spike GW (MS)	MW01	MW01	MW01_MS
Matrix Spike GW Duplicate (MSD)	MW01	MW01	MW01_MSD

3.0 NOTES

1. The sample location code should not exceed 20 characters and the sample name should not exceed 40 characters.
2. Sample location code (**SB01, MW01, etc.)** is a sequential number (starting with 01) and should be a minimum of two digits.
3. Sample Interval (SB01_**0-5**) is separated from the sample location code with an underscore, and the top and bottom interval with a dash. Soil and sediment sample intervals should always be in

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feet. Soil and sediment sample intervals should contain no "/" or "()" or unit.

4. Sample date (MW01_**022113**) is separated from the sample location code with an underscore and should be provided in MMDDYY format [the date should contain no "/" or "-"].
5. If groundwater samples are collected from multiple intervals within one well, you may assign a letter designation (in lower case) to the well ID to differentiate between intervals (i.e., MW01a_022113, MW01b_022113, and MW01c_022113). The letter "a" would indicate the shallowest interval and "c" the deepest. The actual depth intervals should be documented in the project field book or field sheets and the letter designations should be used consistently between sampling events.
6. According to USEPA's Contract Laboratory Program (CLP) Guidance for Field Samplers (January 2011), field duplicate samples should remain "blind" to the laboratory (i.e., they should have separate CLP Sample numbers). Assign two separate (unique) CLP sample numbers (i.e., one number to the field sample and one to the duplicate). Submit blind to the laboratory. (http://www.epa.gov/superfund/programs/clp/download/sampler/CLPSamp-01-2011.pdf)

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ATTACHMENT E
Perfluorinated Compound Sampling Protocol

Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The sampling procedure used must be consistent with the NYSDEC March 1991 SAMPLING GUIDELINES AND PROTOCOLS
http://www.dec.ny.gov/regulations/2636.html with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE) and polypropylene. Additional materials may be acceptable if proven not to contain PFCs. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse should be considered for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
2. Cap the bottles with an acceptable cap and liner closure system.
3. Label the sample bottles.
4. Fill out the chain of custody.
5. Place in a cooler maintained at 4 ± 2º Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS)

Reference: EPA Method 537, Version 1.1, September 2009, EPA Document #: EPA/600/R-08/09

EPA Method 537.1, Version 1, November 2018, EPA Document #: EPA/600/R-18/352

Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 5.2, .2019

1. Scope and Application

Matrices: Drinking water, Non-potable Water, and Soil Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

1.1 This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water and soil Matrices. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters for the compounds listed in Table 1.

1.2 The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.

1.3 This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

2.1 A 250-mL water sample is fortified with extracted internal standards (EIS) and passed through a solid phase extraction (WAX) cartridge containing a mixed mode, Weak Anion Exchange, reversed phase, water-wettable polymer to extract the method analytes and isotopically-labeled compounds. The compounds are eluted from the solid phase in two fractions with methanol followed by a small amount of 2% ammonium hydroxide in methanol solution. The extract is concentrated with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 80:20% (vol/vol) methanol:water. A 3 µl injection is made into an LC equipped with a C18 column that is interfaced to an MS/MS. The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

2.2 Method Modifications from Reference

None.

Table 1

Parameter	Acronym	CAS
PERFLUOROALKYL ETHER CARBOXYLIC ACIDS (PFECAs)		
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	62037-80-3
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
PERFLUOROALKYLCARBOXILIC ACIDS (PFCAs)		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA *	307-24-4
Perfluoroheptanoic acid	PFHpA *	375-85-9
Perfluorooctanoic acid	PFOA *	335-67-1
Perfluorononanoic acid	PFNA *	375-95-1
Perfluorodecanoic acid	PFDA *	335-76-2
Perfluoroundecanoic acid	PFUnA *	2058-94-8
Perfluorododecanoic acid	PFDoA *	307-55-1
Perfluorotridecanoic acid	PFTrDA *	72629-94-8
Perfluorotetradecanoic acid	PFTA *	376-06-7
Perfluorohexadecanoic acid	PFHxDA	67905-19-5
Perfluorooctadecanoic acid	PFODA	16517-11-6
PERFLUOROALKYLSULFONATES (PFASs)		
Perfluorobutanesulfonic acid	PFBS *	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS *	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS *	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5

*** also reportable via the standard 537 method**

Table 1 Cont.

Parameter	Acronym	CAS
CHLORO-PERFLUOROALKYLSULFONATE		
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9Cl-PF3ONS	756426-58-1
PERFLUOROOCTANESULFONAMIDES (FOSAs)		
Perfluorooctanesulfonamide	PFOSA	754-91-6
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2
TELOMER SULFONATES		
1H,1H,2H,2H-perfluorohexane sulfonate (4:2)	4:2FTS	27619-93-8
1H,1H,2H,2H-perfluorooctane sulfonate (6:2)	6:2FTS	27619-97-2
1H,1H,2H,2H-perfluorodecane sulfonate (8:2)	8:2FTS	39108-34-4
1H,1H,2H,2H-perfluorododecane sulfonate (10:2)	10:2FTS	120226-60-0
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS		
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA *	2355-31-9
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA *	2991-50-6
NATIVE PERFLUOROOCTANESULFONAMIDOETHANOLS (FOSEs)		
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	NMeFOSE	24448-09-7
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	NEtFOSE	1691-99-2

*** also reportable via the standard 537 method**

3. Reporting Limits

The reporting limit for PFAS's is 2 ng/L for aqueous samples (20 ng/L for HFPO-DA) and 1 ng/g (10 ng/g for HFPO-DA) for soil samples.

4. Interferences

4.1 PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.

4.2 Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such

as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.2. **Subtracting blank values from sample results is not permitted.**

4.3 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.

4.4 SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

5.1 The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.

5.2 All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.

5.3 PFOA has been described as "likely to be carcinogenic to humans." Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

6.1.1 Samples must be collected in two (2) 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap.

6.1.2 The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.

6.1.3 Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.

6.1.5 After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.

6.1.6 Field Reagent Blank (FRB)

6.1.6.1 A FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time. At the laboratory, fill the field blank sample bottle with reagent water and preservatives, seal, and ship to the sampling site along with the sample bottles. For each FRB shipped, an empty sample bottle (no preservatives) must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the reagent water into the empty shipped sample bottle, seal and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS's were not introduced into the sample during sample collection/handling.

The reagent water used for the FRBs must be initially analyzed for method analytes as a MB and must meet the MB criteria in Section 9.2.1 prior to use. This requirement will ensure samples are not being discarded due to contaminated reagent water rather than contamination during sampling.

6.2 Sample Collection for Soil and Sediment samples.

Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided.

6.3 Sample Preservation

Not applicable.

6.4 Sample Shipping

Samples must be chilled during shipment and must not exceed 10 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction, but should not be frozen.

NOTE: Samples that are significantly above 10° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.5 Sample Handling

6.5.1 Holding Times

6.5.1.1 Water samples should be extracted as soon as possible but must be extracted within 14 days. Soil samples should be extracted within 28 days. Extracts are stored at < 10 ° C and analyzed within 28 days after extraction.

7. Equipment and Supplies

7.1 SAMPLE CONTAINERS – 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.

7.2 POLYPROPYLENE BOTTLES – 4-mL narrow-mouth polypropylene bottles.

7.3 CENTRIFUGE TUBES – 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.

7.4 AUTOSAMPLER VIALS – Polypropylene 0.7-mL autosampler vials with polypropylene caps.

7.4.1 NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.

7.5 POLYPROPYLENE GRADUATED CYLINDERS – Suggested sizes include 25, 50, 100 and 1000-mL cylinders.

7.6 Auto Pipets – Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.

7.7 PLASTIC PIPETS – Polypropylene or polyethylene disposable pipets.

7.8 ANALYTICAL BALANCE – Capable of weighing to the nearest 0.0001 g.

7.9 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

7.9.1 SPE CARTRIDGES – 0.5 g SPE cartridges containing a reverse phase copolymer characterized by a weak anion exchanger (WAX) sorbent phase.

7.9.2 VACUUM EXTRACTION MANIFOLD – A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB (Sect. 9.2.1).

7.9.3 SAMPLE DELIVERY SYSTEM – Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8" O.D. x 1/16" I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB (Sect. 9.2.1) and LCS (Sect. 9.3) QC requirements. The PTFE transfer tubes may be used, but an MB must be run on each PFTE transfer tube and the QC requirements in Section 13.2.2 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, MBs will need to be rotated among the ports and must meet the QC requirements of Sections 13.2.2 and 9.2.1.

7.10 Extract Clean-up Cartridge – 250 mg 6ml SPE Cartridge containing graphitized polymer carbon

7.11 EXTRACT CONCENTRATION SYSTEM – Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 65 °C.

7.12 LABORATORY OR ASPIRATOR VACUUM SYSTEM – Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.

7.13 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM

7.13.1 LC SYSTEM – Instrument capable of reproducibly injecting up to 10-µL aliquots, and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase bottle will volatilize the ammonium acetate mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

NOTE: During the course of method development, it was discovered that while idle for more than one day, PFAS's built up in the PTFE solvent transfer lines. To prevent long delays in purging high levels of PFAS's from the LC solvent lines, they were replaced with PEEK tubing and the PTFE solvent frits were replaced with stainless steel frits. It is not possible to remove all PFAS background contamination, but these measures help to minimize their background levels.

7.13.2 LC/TANDEM MASS SPECTROMETER – The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.

7.13.3 DATA SYSTEM – An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.

7.13.4 ANALYTICAL COLUMN – An LC BEH C_{18} column (2.1 x 50 mm) packed with 1.7 µm d_p C_{18} solid phase particles was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

8. Reagents and Standards

8.1 GASES, REAGENTS, AND SOLVENTS – Reagent grade or better chemicals should be used.

8.1.1 REAGENT WATER – Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/3 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

8.1.2 METHANOL (CH_3OH, CAS#: 67-56-1) – High purity, demonstrated to be free of analytes and interferences.

8.1.3 AMMONIUM ACETATE ($NH_4C_2H_3O_2$, CAS#: 631-61-8) – High purity, demonstrated to be free of analytes and interferences.

8.1.4 ACETIC ACID (H_3CCOOH, CAS#: 64-19-7) - High purity, demonstrated to be free of analytes and interferences.

8.1.5 1M AMMONIUM ACETATE/REAGENT WATER – High purity, demonstrated to be free of analytes and interferences.

8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) – To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into I Liter of REAGENT WATER.

8.1.7 Methanol/Water (80:20) – To prepare a 1 Liter bottle, mix 200 ml of REAGENT WATER with 800 ml of METHANOL.

8.1.8 AMMONIUM HYDROXIDE (NH_3, CAS#: 1336-21-6) – High purity, demonstrated to be free of analytes and interferences.

8.1.9 Sodium Acetate ($NaOOCCH_3$, CAS#: 127-09-3) – High purity, demonstrated to be free of analytes and interferences.

8.1.10 25 mM Sodium Acetate Buffer – To prepare 250mls, dissolve .625 grams of sodium acetate into 100 mls of reagent water. Add 4 mls Acetic Acid and adjust the final volume to 250 mls with reagent water.

8.1.11 NITROGEN – Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).

8.1.12 ARGON – Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.

8.2 STANDARD SOLUTIONS – When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

NOTE: Stock standards and diluted stock standards are stored at ≤4 °C.

8.2.1 ISOTOPE DILUTION Extracted Internal Standard (ID EIS) STOCK SOLUTIONS - ID EIS stock standard solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.2 ISOTOPE DILUTION Extracted Internal Standard PRIMARY DILUTION STANDARD (ID EIS PDS) – Prepare the ID EIS PDS at a concentration of 500 ng/mL. The ID PDS is prepared in 80:20% (vol/vol) methanol:water. The ID PDS is stable for 6 months when stored at ≤4 °C.

Table 2

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Vol. of EIS Stock (mL)	Final Vol. of EIS PDS (mL)	Final Conc. of EIS PDS (ng/mL)
M4PFBA	1000	1.0	2.0	500
M5PFPeA	1000	1.0	2.0	500
M5PFHxA	1000	1.0	2.0	500
M4PFHpA	1000	1.0	2.0	500
M8PFOA	1000	1.0	2.0	500
M9PFNA	1000	1.0	2.0	500
M6PFDA	1000	1.0	2.0	500
M7PFUdA	1000	1.0	2.0	500
MPFDoA	1000	1.0	2.0	500
M2PFTeDA	1000	1.0	2.0	500
M2PFHxDA	50,000	.02	2.0	500
d3-N-MeFOSA	50,000	.02	2.0	500
d5-N-EtFOSA	50,000	.02	2.0	500
d7-N-MeFOSE	50,000	.02	2.0	500
d9-N-EtFOSE	50,000	.02	2.0	500
M8FOSA	1000	1.0	2.0	500
d3-N-MeFOSAA	1000	1.0	2.0	500
d5-N-EtFOSAA	1000	1.0	2.0	500
M3PFBS	929	1.0	2.0	464.5
M3PFHxS	946	1.0	2.0	473
M8PFOS	957	1.0	2.0	478.5
M2-4:2FTS	935	1.0	2.0	467.5
M2-6:2FTS	949	1.0	2.0	474.5
M2-8:2FTS	958	1.0	2.0	479
M3HFPO-DA	50,000	.4	2.0	10,000

8.2.3 ANALYTE STOCK STANDARD SOLUTION – Analyte stock standards are stable for at least 6 months when stored at 4 °C. When using these stock standards to prepare a PDS, care must be taken to ensure that these standards are at room temperature and adequately vortexed.

8.2.4 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only. ANALYTE PRIMARY SPIKING STANDARD – Prepare the spiking standard at a concentration of 500 ng/mL in methanol. The spiking standard is stable for at least two months when stored in polypropylene centrifuge tubes at room temperature.

Table 3

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
PFBA	2000	1	4	500
PFPeA	2000	1	4	500
PFHxA	2000	1	4	500
PFHpA	2000	1	4	500
PFOA	2000	1	4	500
PFNA	2000	1	4	500
PFDA	2000	1	4	500
PFUdA	2000	1	4	500
PFDoA	2000	1	4	500
PFTrDA	2000	1	4	500
PFTeDA	2000	1	4	500
FOSA	2000	1	4	500
N-MeFOSAA	2000	1	4	500
N-EtFOSAA	2000	1	4	500
L-PFBS	1770	1	4	442.5
L-PFPeS	1880	1	4	470
L-PFHxSK	1480	1	4	370
Br-PFHxSK	344	1	4	86
L-PFHpS	1900	1	4	475
L-PFOSK	1460	1	4	365
Br-PFOSK	391	1	4	97.75
L-PFNS	1920	1	4	480
L-PFDS	1930	1	4	482.5
4:2FTS	1870	1	4	467.5
6:2FTS	1900	1	4	475
8:2FTS	1920	1	4	480

8.2.5 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only.

Table 4

Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)
ADONA	2000	1	4	500
PFHxDA	2000	1	4	500
PFODA	2000	1	4	500
HFPO-DA	100,000	.4	4	10,000
9ClPF3ONS	50,000	0.04	4	500
11ClPF3OUdS	50,000	0.04	4	500

8.2.6 LOW, MEDIUM AND HIGH LEVEL LCS – The LCS's will be prepared at the following concentrations and rotated per batch; 2 ng/L, 40 ng/L, 500 ng/l for drinking waters. The analyte PDS contains all the method analytes of interest at various concentrations in methanol. The analyte PDS has been shown to be stable for six months when stored at ≤4 °C.

8.2.7 Isotope Dilution Labeled Recovery Stock Solutions (ID REC) – ID REC Stock solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.

8.2.8 Isotope Dilution Labeled Recovery Primary Dilution Standard (ID REC PDS) - Prepare the ID REC PDS at a concentration of 500 ng/mL. The ID REC PDS is prepared in 80:20% (vol/vol) methanol:water. The ID REC PDS is stable for at least six months when stored in polypropylene centrifuge tubes at ≤4 °C.

Table 5

Analyte	Conc. of REC Stock (ng/mL)	Vol. of REC Stock (mL)	Final Vol. of REC PDS (mL)	Final Conc. of REC PDS (ng/mL)
M2PFOA	2000	1	4	500
M2PFDA	2000	1	4	500
M3PFBA	2000	1	4	500
M4PFOS	2000	1	4	500

8.2.9 CALIBRATION STANDARDS (CAL) –

Current Concentrations (ng/mL): 0.5, 1.0, 5.0, 10.0, 50.0, 125, 150, 250, 500

Prepare the CAL standards over the concentration range of interest from dilutions of the analyte PDS in methanol containing 20% reagent water. 20 µl of the EIS PDS and REC PDS are added to the CAL standards to give a constant concentration of 10 ng/ml. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity. The CAL standards may also be used as CCVs (Sect. 9.8). To make calibration stock standards:

Table 6

Calibration Standard Concentration	Final Aqueous Cal STD Level Concentration	Final Soil Cal STD Level Concentration	24 compound stock added (ul)	PFHxDA Stock added (ul)	500 ng/ml PFHxDA dilution added (ul)	PFODA Stock added (ul)	500 ng/ml PFODA dilution added (ul)	ADONA, HFPO-DA, 11Cl-PF3OUdS, 9Cl-PF3ONS Stock added (ul)	500 ng/ml ADONA dilution added (ul)	Final Volume in MeOH/H_2O (82:20)
.5 ng/ml	2 ng/L	.25 ng/g	6.25		25		25		25	25 mls
1 ng/ml	4 ng/L	.5 ng/g	5		20		20		20	10 mls
5 ng/ml	20 ng/L	1 ng/g	25		100		100		100	10 mls
10 ng/ml	40 ng/L	5 ng/g	125	5		5		5		25 mls

50 ng/ml	200 ng/L	25 ng/g	250	10		10		10		10 mls
125 ng/ml	500 ng/L	62.5 ng/g	625	25		25		25		10 mls
150 ng/ml	600 ng/L	75 ng/g	750	30		30		30		10 mls
250 ng/ml	1000 ng/L	125 ng/g	625							5 mls
500 ng/ml	2000 ng/L	250 ng/g	1250							5 mls

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 MINIMUM REPORTING LIMIT (MRL) CONFIRMATION

9.1.1 Fortify, extract, and analyze seven replicate LCSs at 2 ng/l. Calculate the mean measured concentration (*Mean*) and standard deviation for these replicates. Determine the Half Range for the prediction interval of results (HR_{PIR}) using the equation below

$$HR_{PIR} = 3.963s$$

Where:

s = the standard deviation
3.963 = a constant value for seven replicates.

9.1.2 Confirm that the upper and lower limits for the Prediction Interval of Result ($PIR = Mean \pm HR_{PIR}$) meet the upper and lower recovery limits as shown below

The Upper PIR Limit must be ≤150% recovery.

$$\frac{Mean + HR_{PIR}}{Fortified\ Concentration} \times 100\% \leq 150\%$$

The Lower PIR Limit must be ≥ 50% recovery.

$$\frac{Mean - HR_{PIR}}{Fortified\ Concentration} \times 100\% \geq 50\%$$

9.1.3 The RL is validated if both the Upper and Lower PIR Limits meet the criteria described above. If these criteria are not met, the RL has been set too low and must be determined again at a higher concentration.

9.2 Blank(s)

9.2.1 **METHOD BLANK (MB)** - A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that

interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, it is highly recommended that the analyst maintain a historical record of MB data.

9.2.2 **FIELD REAGENT BLANK (FRB)** - The purpose of the FRB is to ensure that PFAS's measured in the Field Samples were not inadvertently introduced into the sample during sample collection/handling. Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the RL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.

9.3 Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicates (LCSD)

9.3.1 An LCS is required with each extraction batch. The fortified concentration of the LCS may be rotated between low, medium, and high concentrations from batch to batch. Default limits of 50-150% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{A \times 100}{B}$$

Where:

A = measured concentration in the fortified sample
B =fortification concentration.

9.3.2 Where applicable, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS The RSD's must fall within ≤30% of the true value for medium and high level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = \frac{|LCS - LCSD|}{(LCS + LCSD) / 2} \times 100$$

9.3.3 **If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.**

9.4 Labeled Recovery Standards (REC)

The analyst must monitor the peak areas of the REC(s) in all injections during each analysis day.

9.5 Extracted Internal Standards (EIS)

9.5.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final

chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation

$$\%R = (A / B) \times 100$$

Where:

A = calculated EIS concentration for the QC or Field Sample
B = fortified concentration of the EIS.

9.5.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria,the data must be reanalyzed.

9.6 Matrix Spike (MS)

9.6.1 Analysis of an MS is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. 9.6); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second MS, or MSD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain MSDs will not require the extraction of a field sample duplicate. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be established for each. Over time, MS data should be documented by the laboratory for all routine sample sources.

9.6.2 Within each extraction batch, a minimum of one Field Sample is fortified as an MS for every 20 Field Samples analyzed. The MS is prepared by spiking a sample with an appropriate amount of the Analyte Stock Standard (Sect. 8.2.3). Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration. Calculate the percent recovery (%*R*) for each analyte using the equation

$$\%R = \frac{(A - B)}{C} \times 100$$

Where:

A = measured concentration in the fortified sample
B = measured concentration in the unfortified sample
C = fortification concentration.

9.6.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be

matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Laboratory Duplicate

9.7.1 FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) – Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.

9.7.2 Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation

$$RPD = \frac{|FD1 - FD2|}{(FD1 + FD2) / 2} \times 100$$

9.7.3 RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7.4 If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = \frac{|MS - MSD|}{(MS + MSD) / 2} \times 100$$

9.7.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.8 Initial Calibration Verification (ICV)

9.8.1 As part of the IDC (Sect. 13.2), and after each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ±

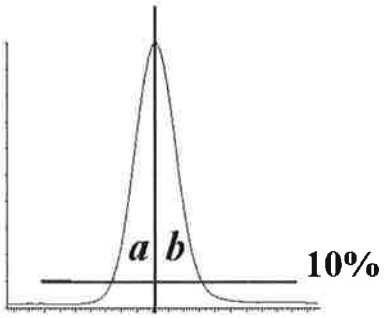
30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedureto locate and correct the problem.

9.9 Continuing Calibration Verification (CCV)

9.9.1 CCV Standards are analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch. See Section 10.7 for concentration requirements and acceptance criteria.

9.10 Method-specific Quality Control Samples

9.10.1 PEAK ASYMMETRY FACTOR – A peak asymmetry factor must be calculated using the equation below during the IDL and every time a calibration curve is generated. The peak asymmetry factor for the first two eluting peaks in a midlevel CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.



$$A_s = b / a$$

Where:

A_s = peak asymmetry factor
b = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex
a = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

9.11 Method Sequence

- CCV-LOW
- MB
- LCS
- LCSD
- MS
- Duplicate or MSD
- Field Samples (1-10)
- CCV-MID
- Field Samples (11-20)
- CCV-LOW

10. Procedure

10.1 Equipment Set-up

10.1.1 This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements (Sect. 9.2).

10.1.2 Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect 10.3.4) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. 10.3.4).

10.1.3 **NOTE:** The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.2 Sample Preparation and Extraction of Aqueous Samples

10.2.1 Samples are preserved, collected and stored as presented in Section 6.

The entire sample that is received must be sent through the SPE cartridge. In addition, the bottle must be solvent rinsed and this rinse must be sent through the SPE cartridge as well. The method blank (MB) and laboratory control sample (LCS) must be extracted in exactly the same manner (i.e., must include the bottle solvent rinse). It should be noted that a water rinse alone is not sufficient. This does not apply to samples with high concentrations of PFAS that are prepared using serial dilution and not SPE.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 250mL HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may **NOT** be transferred to a graduated cylinder for volume measurement.

10.2.3 The MB, LCS and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.

10.2.4 Adjust the QC and sample pH to 3 by adding acetic acid in water dropwise

10.2.5 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC, cap and invert to mix.

10.2.6 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.3 Cartridge SPE Procedure

10.3.1 CARTRIDGE CLEAN-UP AND CONDITIONING – DO NOT allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 3 X 5 mL of 2% ammonium hydroxide in methanol, followed by 5mls of methanol. Next, rinse each cartridge with 5 mls of the 25 mM acetate buffer, followed by 15 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 4-5 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.3.2 SAMPLE EXTRACTON – Adjust the vacuum so that the approximate flow rate is approximately 4 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.3.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample bottles with 4 ml reagent water followed by 4 ml 25 mM acetate buffer at pH 4 and draw the aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5-10 min at high vacuum (10-15 in. Hg). **NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.**

10.3.4 SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 1 – Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 12 mls of methanol and draw the aliquot through the sample transfer tubes and cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 2 In a separate collection vial, rinse the sample bottles with 12 mL of 2% ammonium hydroxide in methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. To the final extract, add 50 ul of acetic acid.

NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section 10.3.3, the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.

CLEAN-UP CARTRIDGE ELUTION, Elute the clean-up cartridge with 8 additional mls of methanol and draw the aliquot through the cartridge. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

10.3.5 Fractions 1 and 2 are to be combined during the concentration stage (section10.6)

10.4 Sample Prep and Extraction Protocol for Soils

10.4.1 Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) intoa 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean sand is used.

10.4.2 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC.

10.4.3 If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.4.4 To all samples, add 10 mls of methanol, cap, vortex for 25 seconds at 3000RPM and mix for 30 minutes using a shaker table of tumbler at 120RPM.

10.4.5 Following mixing, sonicate each sample for 30 minutes and let samples sit overnight (at least 2 hours is required for RUSH samples).

10.4.6 Centrifuge each sample at 3500RPM for 10 minutes.

10.4.7 Remove supernatant, and reserve for clean-up.

10.5 Extract Clean-up

10.5.1 CARTRIDGE CLEAN-UP AND CONDITIONING –. Rinse each cartridge with 15 mL of methanol and discard. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.

10.5.2 Adjust the vacuum so that the approximate flow rate is 1-2 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.

10.5.3 SAMPLE BOTTLE AND CARTRIDGE RINSE – After the entire sample has passed through the cartridge, rinse the sample collection vial with two 1-mL aliquots of methanol and draw each aliquot through the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).

10.5.4 If extracts are not to be immediately evaporated, cover collection tubes and store at ambient temperature till concentration.

10.6 Extract Concentration

10.6.1 Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (60-65 °C) to remove all the water/methanol mix. Add the appropriate amount of 80:20% (vol/vol) methanol:water solution and 20 µl of the ID REC PDS (Sect. 8.2.7) to the collection vial to bring the volume to 1 mL and vortex. Transfer two aliquots with a plastic pipet (Sect. 7.6) into 2 polypropylene autosampler vials.

NOTE: It is recommended that the entire 1-mL aliquot not be transferred to the autosampler vial because the polypropylene autosampler caps do not reseal after injection. Therefore, do not store the extracts in the autosampler vials as evaporation losses can occur occasionally in these autosampler vials. Extracts can be split between 2 X 700 µl vials (Sect. 7.4).

10.7 Sample Volume Determination

10.7.1 If the level of the sample was marked on the sample bottle, use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. Determine to the nearest 10 mL.

10.7.2 If using weight to determine volume, weigh the empty bottle to the nearest 10 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight (Sect. 10.2.2). Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration (Sect. 11.2).

10.8 Initial Calibration - Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.

10.8.1 ESI-MS/MS TUNE

10.8.1.1 Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.

10.8.1.2 Optimize the [M-H]- for each method analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.

10.8.1.3 Optimize the product ion for each analyte by infusing approximately 0.5-1.0 µg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions and the sulfonic acids have similar MS/MS conditions.

10.8.2 Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Cautions: LC system components, as well as the mobile phase constituents, contain many of the method analytes in this method. Thus, these PFAS's will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep background levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, prior to daily use, flush the column with 100% methanol for at least 20 min before initiating a sequence. It may be necessary on some systems to flush other LC components such as wash syringes, sample needles or any other system components before daily use.

10.8.3 Inject a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. If analyzing for PFTA, ensure that the LC

conditions are adequate to prevent co-elution of PFTA and the mobile phase interferants. These interferants have the same precursor and products ions as PFTA, and under faster LC conditions may co-elute with PFTA. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ±0.5 daltons around the product ion mass were used for quantitation.

10.8.4 Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.

10.8.4.1 If broad, split or fronting peaks are observed for the first two eluting chromatographic peaks (if only two analytes are being analyzed, both must be evaluated), change the initial mobile phase conditions to higher aqueous content until the peak asymmetry ratio for each peak is 0.8 – 1.5. The peak asymmetry factor is calculated as described in Section 9.9.1 on a mid-level CAL standard. The peak asymmetry factor must meet the above criteria for the first two eluting peaks during the IDL and every time a new calibration curve is generated. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

10.8.5 Prepare a set of CAL standards as described in Section 8.2.5. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity.

10.8.6 The LC/MS/MS system is calibrated using the IS technique. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve **must always** be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model.

10.8.7 CALIBRATION ACCEPTANCE CRITERIA – A linear fit is acceptable if the coefficient of determination (r^2) is greater than 0.99. When quantitated using the initial calibration curve, each calibration point, except the lowest point, for each analyte should calculate to be within 70-130% of its true value. The lowest CAL point should calculate to be within 50-150% of its true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is

recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

10.8.7.1 CAUTION: When acquiring MS/MS data, LC operating conditions must be carefully reproduced for each analysis to provide reproducible retention times. If this is not done, the correct ions will not be monitored at the appropriate times. As a precautionary measure, the chromatographic peaks in each window must not elute too close to the edge of the segment time window.

10.9 CONTINUING CALIBRATION CHECK (CCV) – Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a "sample" is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.

10.9.1 Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.

10.9.2 Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each analyte for medium level CCVs must be within ± 30% of the true value with an allowance of 10% of the reported analytes to be greater than 30%, but less than 40%. The calculated amount for each EIS must be within ± 50% of the true value. The calculated amount for the lowest calibration point for each analyte must be within ± 50%. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken (Sect. 10.7.4) which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. **If the CCV fails because the calculated concentration is greater than 130% (150% for the low-level CCV) for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.**

10.9.3 REMEDIAL ACTION – Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration (Sect 10.6) and verification of sensitivity by analyzing a CCV at or below the RL (Sect 10.7).

10.10 EXTRACT ANALYSIS

10.10.1 Establish operating conditions equivalent to those summarized in Tables 6-8 of Section 16. Instrument conditions and columns should be optimized prior to the initiation of the IDC.

10.10.2 Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.

10.10.3 Calibrate the system by either the analysis of a calibration curve (Sect. 10.6) or by confirming the initial calibration is still valid by analyzing a CCV as described in Section 10.7. If establishing an initial calibration, complete the IDC as described in Section 13.2.

10.10.4 Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.

10.10.5 At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.

10.10.6 The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to insure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

11. Data Evaluation, Calculations and Reporting

11.1 Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 7.

11.2 Calculate analyte concentrations using the multipoint calibration established in Section 10.6. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.6 where:

C_{ex} = (Area of target analyte * Concentration of Labeled analog) / (area of labeled analog * CF)

C_s = (C_{ex} / sample volume in ml) * 1000

C_{ex} = The concentration of the analyte in the extract
CF = calibration factor from calibration.

11.3 Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.

11.4 PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to the linear and branch isomers of these compounds (Sect. 10.6.4.1). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.

11.5 Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

12.1 Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.

12.2 All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

13.1.1 The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

13.2.1 The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section 10.6.

13.2.2 INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND – Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an MB is reasonably free of contamination and that the criteria in Section 9.2.1 are met. If an automated extraction system is used, an MB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.

13.2.3 INITIAL DEMONSTRATION OF PRECISION (IDP) – Prepare, extract, and analyze four to seven replicate LCSs fortified near the midrange of the initial calibration curve according to the procedure described in Section 10. Sample preservatives as described in Section 6.2.1 must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.

13.2.4 INITIAL DEMONSTRATION OF ACCURACY (IDA) – Using the same set of replicate data generated for Section 13.2.3, calculate average recovery. The average recovery of the replicate values must be within ± 30% of the true value.

13.2.5 INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR – Peak asymmetry factors must be calculated using the equation in Section 9.10.1 for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.

13.2.6 Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.

13.2.7 The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

14.1 Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.

14.2 This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.

14.3 The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

15. Referenced Documents

Chemical Hygiene Plan – ID 2124

SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 7: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 MeOH/H_2O)	100% Methanol
Initial	100.0	0.0
1.0	100.0	0.0
2.2	85.0	15.0
11	20.0	80.0
11.4	0.0	100.0
12.4	100.0	00.0
15.5	100.0	0.0
Waters Aquity UPLC ® $BEHC_{18}$ 2.1 x 50 mm packed with 1.7 µm BEH C_{18} stationary phase Flow rate of 0.4 mL/min 2-5 µL injection		

Table 8: ESI-MS Method Conditions

ESI Conditions	
Polarity	Negative ion
Capillary needle voltage	.5 kV
Cone Gas Flow	25 L/hr
Nitrogen desolvation gas	1000 L/hr
Desolvation gas temp.	500 °C

Table 9: Method Analyte Source, Retention Times (RTs), and EIS References

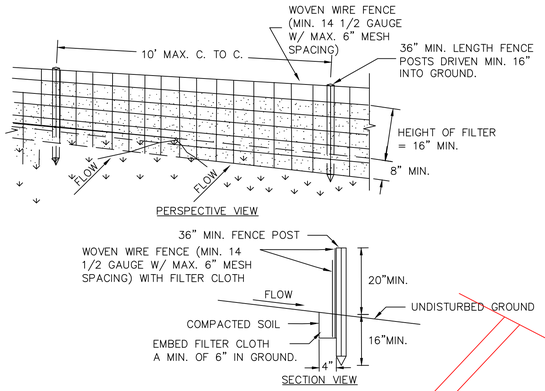
#	Analyte	Transition	RT	IS	Type
1	M3PBA	216>171	2.65		REC
2	PFBA	213 > 169	2.65	2: M4PFBA	
3	M4PFBA	217 > 172	2.65	1: M3PBA	EIS
4	PFPeA	263 > 219	5.67	4: M5PFPEA	
5	M5PFPEA	268 > 223	5.66	1: M3PBA	EIS
6	PFBS	299 > 80	6.35	6: M3PFBS	
7	M3PFBS	302 > 80	6.35	29:M4PFOS	EIS
8	FtS 4:2	327 > 307	7.47	9: M2-4:2FTS	

#	Analyte	Transition	RT	IS	Type
9	M2-4:2FTS	329 > 81	7.47	29:M4PFOS	EIS
10	PFHxA	303 > 269	7.57	10: M5PFHxA	
11	M5PFHxA	318 > 273	7.57	19:M2PFOA	EIS
12	PFPeS	349 > 80	7.88	18: M3PFHxS	
13	PFHpA	363 > 319	8.80	14: M4PFHpA	
14	M4PFHpA	367 > 322	8.80	19:M2PFOA	EIS
15	L-PFHxS	399 > 80	8.94	18: M3PFHxS	
16	br-PFHxS	399 > 80	8.72	18: M3PFHxS	
17	PFHxS Total	399 > 80	8.94	18: M3PFHxS	
18	M3PFHxS	402 > 80	8.94	29:M4PFOS	EIS
19	MPFOA	415 > 370	9.7		REC
20	PFOA	413 > 369	9.7	23: M8PFOA	
21	br-PFOA	413 > 369	9.48	23: M8PFOA	
22	PFOA Total	413 > 369	9.7	23: M8PFOA	
23	M8PFOA	421 > 376	9.7	19: M2PFOA	EIS
24	FtS 6:2	427 > 407	9.66	25: M2-6:2FTS	
25	M2-6:2FTS	429 > 409	9.66	29:M4PFOS	EIS
26	PFHpS	449 > 80	9.78	33: M8PFOS	
27	PFNA	463 > 419	10.41	33: M8PFOS	
28	M9PFNA	472 > 427	10.41	19: M2PFOA	EIS
29	M4PFOS	501 > 80	10.45		REC
30	PFOS	499 > 80	10.45	33: M8PFOS	
31	br-PFOS	499 > 80	10.27	33: M8PFOS	
32	PFOS Total	499 > 80	10.45	33: M8PFOS	
33	M8PFOS	507 > 80	10.45	29: M4PFOS	EIS
34	FtS 8:2	527 > 507	10.99	38: M2-8:2FTS	
35	M2-8:2FTS	529 > 509	10.99	29:M4PFOS	EIS
36	M2PFDA	515 > 470	11.00		REC
37	PFDA	513 > 469	11.00	38: M6PFDA	
38	M6PFDA	519 > 474	11.00	36: M2PFDA	EIS
39	PFNS	549 > 80	11.02	33:M8PFOS	
40	NMeFOSAA	570 > 419	11.41	41: D3-NMeFOSAA	
41	d3-NMeFOSAA	573 > 419	11.41	36: M2PFDA	EIS
42	PFOSA	498 > 78	11.48	29: M8FOSA	
43	M8FOSA	506 > 78	11.48	19: M2PFOA	EIS
44	PFUnDA	563 > 519	11.51	41: M7-PFUDA	
45	M7-PFUDA	570 > 525	11.51	36: M2PFDA	EIS
46	PFDS	599 > 80	11.51	33:M8PFOS	
47	NEtFOSAA	584 > 419	11.68	48: d5-NEtFOSAA	

#	Analyte	Transition	RT	IS	Type
48	d5-NEtFOSAA	589 > 419	11.68	36: M2PFDA	EIS
49	PFDoA	613 > 569	11.96	50: MPFDOA	
50	MPFDOA	615 > 570	11.96	36: M2PFDA	EIS
51	PFTriA	663 > 619	12.34	50: MPFDOA	
52	PFTeA	713 > 669	12.6	53: M2PFTEDA	
53	M2PFTEDA	715 > 670	12.6	36: M2PFDA	EIS
54	M3HFPO-DA	329>285	7.97	19: M2PFOA	EIS
55	HFPO-DA	332>287	7.97	54: M3HFPO-DA	
56	ADONA	377>251	8.00	23: M8PFOA	
57	PFHxDA	813>769	13.20	59: M2PFHxDA	
58	PFODA	913>869	13.50	59: M2PFHxDA	
59	M2PFHxDA	815>770	13.20	36:M2PFDA	EIS
60	NEtFOSA	526>169	11.00	61: NMeFOSA	
61	NMeFOSA	512>169	10.50	63: d3-NMeFOSA	
62	d3-NMeFOSA	515>169	10.50	29: M4PFOS	EIS
63	d5-NEtFOSA	531>169	11.00	29: M4PFOS	EIS
64	NMeFOSE	556>122	11.25	66: d7-NMeFOSE	
65	NEtFOSE	570>136	10.75	67: d9-NEtFOSE	
66	d7-NMeFOSE	563>126	11.25	29: M4PFOS	EIS
67	d9-NEtFOSE	579>142	10.75	29: M4PFOS	EIS
68	FtS 10:2	627>607	11.50	25: M2-6:2FTS	
69	PFDoS	699>99	12.50	33: M8PFOS	

APPENDIX F

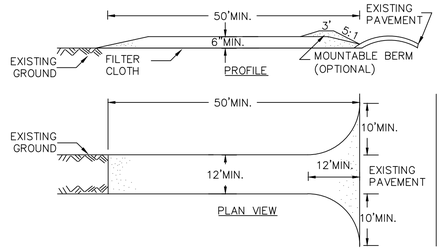
EROSION AND SEDIMENT CONTROL PLAN



CONSTRUCTION SPECIFICATIONS

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES OR STAPLES. POSTS SHALL BE STEEL EITHER "T" OR "U" TYPES OR HARDWOOD.
2. FILTER CLOTH TO BE TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID-SECTION. FENCE SHALL BE WOVEN WIRE, 12 1/2 GAUGE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILENKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL BE MUTUAL MISF 1776 OR APPROVED EQUIVALENT.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN "BULGES" DEVELOP IN THE SILT FENCE.

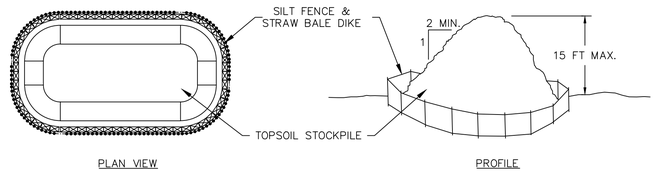
1 SILT FENCE
N.T.S.



CONSTRUCTION SPECIFICATIONS

1. STONE SIZE – USE 2" STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH – NOT LESS THAN 50 FEET (EXCEPT ON A SINGLE RESIDENCE LOT WHERE A 30 FOOT MINIMUM LENGTH WOULD APPLY).
3. THICKNESS – NOT LESS THAN SIX (6) INCHES.
4. WIDTH – TWELVE (12) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS. TWENTY-FOUR (24) FOOT IF SINGLE ENTRANCE TO SITE.
5. FILTER CLOTH – WILL BE PLACED OVER THE ENTIRE AREA PRIOR TO PLACING OF STONE.
6. SURFACE WATER – ALL SURFACE WATER FLOWING OR DIVERTED TOWARD CONSTRUCTION ENTRANCES SHALL BE PIPED ACROSS THE ENTRANCE. IF PIPING IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE – THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY, AND ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACTED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND SHALL DRAIN INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND NECESSARY MAINTENANCE SHALL BE PROVIDED AFTER EACH RAIN.

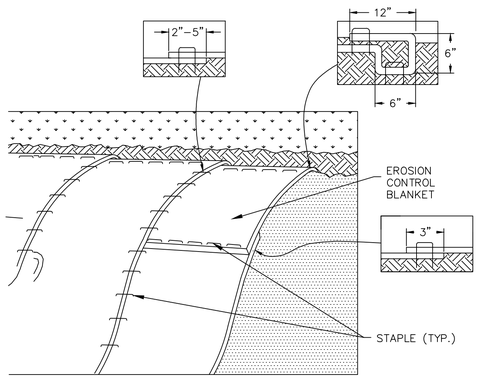
2 STABILIZED CONSTRUCTION ENTRANCE
N.T.S.



NOTES:

1. SOIL STOCKPILES WILL BE SITUATED IN A DRY AREA ON TOP OF A LAYER OF POLYETHYLENE SHEETING IN ACCORDANCE WITH THE NYSDEC-APPROVED REMEDIAL ACTION WORK PLAN. ALL JOINTS IN THE UNDERLYING POLY SHEETING WILL OVERLAP WITH A MINIMUM OF 3-FEET AT THE ENDS.
2. THE POLY SHEETING SHALL BE SECURED IN PLACE WITH TIE DOWNS AND/OR WEIGHTS SUCH AS SAND BAGS AT THE END OF EACH WORKDAY AND DURING ADVERSE WEATHER CONDITIONS.
3. SILT FENCE AND STRAW BALES MUST BE PLACED CONTINUOUSLY AROUND THE PERIMETER OF ALL STOCKPILES.
4. IMMEDIATELY APPLY TEMPORARY SEEDING TO ALL STOCKPILES THAT WILL BE INACTIVE FOR 21 DAYS OR LONGER. IN LIEU OF SEEDING, STOCKPILES MAY BE COVERED WITH A SECURE TARP.
5. REFER TO SPECIFICATION.

3 MATERIAL STOCKPILE
N.T.S.



4 EROSION CONTROL BLANKET INSTALLATION
N.T.S.

WARNING:
IT IS A VIOLATION OF THE NYS EDUCATION LAW ARTICLE 145 FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, TO ALTER THIS ITEM IN ANY WAY.

Date	Description	No.
REVISIONS		

SIGNATURE DATE SIGNED
PROFESSIONAL XXXXXXXXXX
STATE LIC. No. XXXXX

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
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Project
250 WATER STREET
BLOCK No. 98, LOT No. 1
NEW YORK **NEW YORK**

Figure Title
SOIL SEDIMENTATION & EROSION PLAN

Project No.	Drawing No.
170381202	**1**
Date: **2/18/2021**	
Drawn By: **AS**	
Checked By: **PM**	Sheet 1 of 1

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LANGAN PROJECT NO. ########

Filename: \\langan.com\data\NY\data2\170381202\Project Data\CAD\02\SheetFiles\Environmental\BCP RAWP\Sediment Erosion Control Plan.dwg Date: 2/18/2021 Time: 14:23 User: astappenbeck Style Table: Langan.stb Layout: DETAILS

APPENDIX G

CITIZEN PARTICIPATION PLAN

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
250 Water Street
NYSDEC BCP Site No. C231127

Revised April 2020

C231127
250 Water Street
New York, NY 10038

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3. Major Issues of Public Concern 9

4. Site Information 10

5. Investigation and Cleanup Process 14

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Appendix D - Brownfield Cleanup Program Process 29

* * * * *

Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant:	**250 Seaport District, LLC ("Volunteer")**
Site Name:	**250 Water Street ("site")**
Site Address:	**250 Water Street**
Site County:	**New York**
Site Number:	**C231127**

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at: http://www.dec.ny.gov/chemical/8450.html.

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process
- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process
- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community
- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision-making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web-site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.

The site contact list includes, at a minimum:
- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;

- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html.

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

- Project documents will be available at the recently launched DECinfo Locator, an interactive map that lets you access many DEC documents and public data about the environmental

quality of specific sites in New York State. See https://www.dec.ny.gov/pubs/109457.html for more information.

Additional communication tools (e.g., website) are under consideration and will be utilized as appropriate to keep the public informed during implementation of DEC-approved work plans.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

As of the date that the Citizen Participation Plan was accepted by the NYSDEC, the significant threat determination for the site had not yet been made.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at http://www.dec.ny.gov/regulations/2590.html

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repositories	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Public meeting with NYSDEC about proposed RI Work Plan • Conduct 30-day public comment period	Before NYSDEC approves RI Work Plan. Thirty-day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 30-day public comment period.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Action Work Plan (RAWP):	
• Distribute fact sheet to site contact list about draft RAWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RAWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RAWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

The following possible major issues of public concern were identified: air quality, storm preparedness and protection, soil/materials management, material transport off-site, health of workers and community, nuisance odors, noise, construction-related traffic, and communication with the community. These issues are of most concern to students, parents, and faculty of the adjoining schools; adjacent property owners, residents, and businesses; and site workers. These issues will be addressed in the Remedial Investigation (RI) Work Plan, Remedial Action Work Plan (RAWP), Community Air Monitoring Program (CAMP), site-specific Health and Safety Plan (HASP) and Construction HASP (CHASP) for the project. These documents will undergo public notice and are subject to approval by the NYSDEC and the New York State Department of Health (NYSDOH) prior to work being performed.

Based on previous investigations, historical uses of the property included a factory (unknown manufacturing), an oil company, a printer, a metal works, a chemicals and glue company, a chemical company, a trucking company, a thermometer factory, thermometer workshops, a garage with two 550-gallon underground storage tanks (USTs), a machine shop, and a gasoline service station.

Contaminants of concern include petroleum-related volatile organic compounds[1] (VOCs), semi-volatile organic compounds[2] (SVOCs), polychlorinated biphenyls[3] (PCBs), and metals, including mercury and lead. Contaminants are discussed in further detail in Section 4. The identified contaminants will be assessed, delineated and remediated in accordance with NYSDEC-approved work plans.

Site information is available through Project Contacts mentioned in Section 2 and Appendix A. The BCP Application, which includes the previous site investigations and identifies future reports that will be prepared for the NYSDEC, is available in the document repository discussed above in Section 2 and in Appendix A. The RI Work Plan and RAWP will include schedules for planned work.

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[1]VOCs are typically associated with fuel oil, gasoline, chlorinated solvents (e.g. dry cleaner fluids), degreasing agents, paint, varnishes, and, adhesives

[2]SVOCs are typically associated with fuel oil and combustion byproducts

[3]PCBs are typically associated with electrical equipment including transformers, capacitors, insulation material, and fluorescent light ballasts

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

While the Site is not located within an Environmental Justice Area, all future fact sheets will be translated into Spanish and Traditional Chinese. For additional information, visit: https://statisticalatlas.com/tract/New-York/New-York-County/001501/Race-and-Ethnicity

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

The site is approximately 48,057 square feet (1.10 acre) in area, is located at 250 Water Street in the South Street Seaport neighborhood of Manhattan, New York, and is identified as Block 98, Lot 1 on the Borough of Manhattan tax map. The site occupies the entire city block bordered by Pearl Street to the northwest, Peck Slip to the northeast, Water Street to the southeast, and Beekman Street to the southwest. The site is used as an open-air asphalt-covered commercial parking lot with a 400-vehicle capacity; a parking attendant kiosk and temporary storage shed are near the center of the lot. The perimeter of the site is fenced with one automated barrier ingress/egress gate on Pearl Street.

The site is located in an urban setting that is characterized by commercial, institutional, and residential properties. The site is bordered by Pearl Street followed by multiple-story residential buildings (at least one with a first-floor parking garage) known as Southbridge Towers and Bright Beginnings NYC (a preschool and child care facility) to the northwest, Peck Slip followed by a seven-story institutional building (Peck Slip School - P.S. 343) to the northeast, Water Street followed by multiple five- and six-story residential and commercial buildings and the Blue School Elementary School to the southeast, and Beekman Street followed by a seven-story residential and commercial building to the southwest.

According to the American Land Title Association (ALTA) and the National Society of Professional Surveyors (NSPS) Land Title Survey, prepared by Langan in June 2018, the site elevation ranges from about elevation (el) 7 to el 16 feet NAVD88. The topography of the site slopes downward towards the southeast.

According to the New York City Zoning Map 12b, the site is located in a C6-2A commercial district. The C6-2A district is mapped within the South Street Seaport Sub-district of the Special Lower Manhattan District. C6 districts allow for a wide range of mixed residential and commercial uses. According to the New York City Landmarks Preservation Commission, the site is located in the South Street Seaport historic district.

History of Site Use, Investigation, and Cleanup

The site and surrounding area are located in an urban setting historically characterized by residential, commercial, and industrial development. Historical uses of the site include a factory, an oil company, a printer, a metal works, a chemicals and glue company, a chemical company, thermometer factories/workshops, a garage with two 550-gallon underground storage tanks (USTs), a machine shop, and a gasoline service station.

Previously, the site was the subject of two Phase I environmental site assessments and a Phase II environmental subsurface investigation, which are documented in the following reports:

- *September 2015 Phase I Environmental Site Assessment (ESA) prepared by Langan*
- *November 2015 Phase II Environmental Site Investigation Report prepared by Langan*
- *September 2018 Phase I Environmental Site Assessment (ESA) prepared by Langan*

The following is a summary of each report listed above:

<u>September 2015 Phase I Environmental Site Assessment prepared by Langan</u>

Langan prepared a Phase I ESA for the site in accordance with the ASTM E-1527-13 standard for Peck Slip Associates, LLC, the previous owner of the site. The following summarizes the recognized environmental conditions (RECs) identified in this Phase I ESA:

- Historical use of the site as a factory, an oil company, a printer, a metal works, a chemicals and glue company, a chemical company, a trucking company, a thermometer factory, a garage with two 550-gallon USTs, a machine shop, and a gasoline service station.
- The presence of historic fill at the site.
- Historical use of adjoining and surrounding properties as a metals works, an "oils" facility, trucking companies, a garage, a machine shop, a printer, a substation, an automobile repair facility, a mercury warehouse[4], and facilities with petroleum bulk storage.

4 The business "Mercury Warehouse & Storage Co Inc" was identified in the Environmental Data Resources Inc. City Directory sourced from R.L. Polk & Company for 245 Water Street in 1920.

Based on additional research conducted by Langan after the completion of the Phase I ESA the historical site use as a trucking company was determined to be located off-site.

November 2015 Phase II Environmental Site Investigation Report prepared by Langan

In preparation for the future sale of the site, the former property owner commissioned a Phase II ESI to investigate the findings of the September 2015 Phase I ESA prepared by Langan. The Phase II ESI was designed as a preliminary due-diligence type of investigation to provide some subsurface data to potential future purchasers and was not intended to fully characterize subsurface conditions on the site. The Phase II ESI included a geophysical survey, advancement and sampling of 10 soil borings (21 soil samples), installation and sampling of 5 temporary groundwater monitoring wells (5 groundwater samples), and installation and sampling of 5 temporary soil vapor points (5 soil vapor and 1 ambient air sample). The following summarizes the findings of the Phase II ESI:

- Stratigraphy – A historic fill layer, predominantly consisting of loose grey brown fine to medium sand with varying proportions of silt, gravel, brick, concrete, wood and ash, extends from sidewalk grade to depths ranging from about 6 to 14.5 feet bgs. Native soil consisting of sands with varying proportions of gravel and silt underlies the historic fill material.
- Hydrogeology – Groundwater was encountered at depths ranging from about 7 feet bgs in the southern portion of the site to about 14 feet bgs in the northern portion of the site. Inferred groundwater flow is to the southeast towards the East River.
- Potential USTs – The geophysical survey identified an anomaly consistent with an UST inside the eastern boundary of the site along Peck Slip.
- Petroleum Spill – Based on field observations and analytical results from soil and groundwater samples, a spill was reported to the NYSDEC on October 13, 2015 and Spill No. 1507371 was assigned.
- Soil – Petroleum impacts were observed in four borings on the eastern portion of the site in the vicinity of the potential UST. Petroleum-related compounds (volatile organic compounds [VOC] and semivolatile organic compounds [SVOC]); total polychlorinated biphenyls (PCB); and nine metals, including mercury, were detected at concentrations above the 6 NYCRR Part 375 Unrestricted Use (UU) Soil Cleanup Objectives (SCOs) and/or Restricted Use Restricted-Residential (RURR) SCOs. The highest detections of mercury (63 milligrams per kilogram [mg/kg] to 120 mg/kg) were identified in one soil boring that, based on historic mapping and the current site survey, was measured by

Langan to have been advanced within the limits of a historical on-site thermometer factory.

- Groundwater – Petroleum-related VOCs and SVOCs were identified in groundwater at concentrations exceeding NYSDEC Division of Water Technical and Operation Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs) for Class GA (drinking water) in the eastern and northwestern portions of the site. A total of 14 VOCs and 9 SVOCs were detected above TOGS Class GA SGVs. A petroleum-like odor and sheen were observed in purge water from two monitoring wells. Eleven metals were detected in total concentrations exceeding TOGS Class GA SGVs. Dissolved antimony, iron, magnesium, manganese, and sodium were detected in filtered samples at concentrations exceeding TOGS Class GA SGVs. These metals are likely related to area-wide and naturally-occurring brackish groundwater conditions.
- Soil Vapor – Soil vapor sampling results indicate the presence of several VOCs, including chlorinated solvents and petroleum-related compounds, above ambient air concentrations. When the detected concentrations of trichloroethene (TCE) in soil vapor are applied to the NYSDOH decision matrices (in the absence of a co-located indoor air sample), the recommended actions range from "no further action" to "mitigate".

Soil, groundwater, and sub-slab vapor sample locations and analytical results that exceed applicable regulatory criteria are presented on Figures 3, 4, and 5, respectively.

September 2018 Phase I Environmental Site Assessment prepared by Langan

Langan prepared a Phase I ESA for the site for the current property owner prior to purchase in accordance with ASTM E-1527-13 standards, which took account of the November 2015 Phase II ESI. The following summarizes the findings specific to the site:

- One REC was identified as Hazardous Substances and Petroleum on the site; this was based on the Phase II ESI, which identified the following:
    - A petroleum release in the eastern portion of the site
    - Mercury above regulatory criteria in soil
    - Chlorinated solvents and petroleum-related compounds in soil vapor

  Petroleum, mercury and chlorinated solvent impacts may relate to historical use of the site and/or adjoining properties.

- One Business Environmental Risk was identified as Historic Fill:

- Contaminants associated with historic fill, specifically SVOCs and metals at potentially hazardous concentrations, were detected in soil across the site.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a Volunteer. This means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination on-site, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the site and to contamination that has migrated from the site.

The Applicant in its Application proposes that the site will be used for restricted mixed-use commercial and residential purposes.

To achieve this goal, the Applicant will conduct investigation and cleanup activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement (BCA) executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Applicant must develop a remedial investigation work plan, which is subject to public comment.

The site investigation has several goals:

1) Define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2) Identify the source(s) of the contamination;
3) Assess the impact of the contamination on public health and the environment; and
4) Provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

The Applicant submitted a draft "Remedial Investigation Work Plan" to NYSDEC for review and approval. NYSDEC made the draft plan available to the public review during a 30-day public comment period. There was an extended comment period of 105 days (from September 30, 2019 through January 16, 2020) and on September 16, 2019 the NYSDEC, NYSDOH and Langan

attended a Manhattan Community Board 1 Environmental Protection Committee meeting on September 16, 2019 to present the draft RIWP to the public and receive comment. By the conclusion of the Draft RIWP comment period, hundreds of letters and emails providing comment were received from local elected officials, school officials, local community groups and organizations, adjacent residents, businesses, environmental consultants and the general public. Finally, the NYSDEC and the NYSDEC has been consulting with the community's environmental consultants while finalizing the RIWP.

There will be continued engagement with the community's environmental consultants during the implementation of the remedial investigation. The public will also be kept informed of RI progress through the periodic issuance of updates and attending community board meetings by the NYSDEC and NYSDOH.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC. The public will receive a fact sheet describing the RI results before the RI Report is approved.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a "significant threat," it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if

appropriate, approve the investigation report. NYSDEC would then issue a "Certificate of Completion" (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a "Remedial Work Plan". The Remedial Work Plan describes the Applicant's proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the FER. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering* control is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Rafi Alam
Project Manager
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, NY 12233-7016
Tel: -518-402-8606
Email: rafi.alam@dec.ny.gov

Thomas V. Panzone
Public Participation Specialist
NYSDEC Region 2
Office of Communications Services
47-40 21st Street
Long Island City, NY 11101-5401
Tel: 718-482-4953
Email: Thomas.panzone@dec.ny.gov

New York State Department of Health (NYSDOH):

Sarita Wagh
Project Manager
NYSDOH
Empire State Plaza, Corning Tower, Room 1787
Albany, NY 12237
Phone: (518) 402-7860
Email: BEEI@health.ny.gov

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

New York Public Library – Chatham Square Branch
33 E Broadway
New York, NY 10002
(212) 964-6598

Manhattan Community Board No. 1
Tammy Meltzer, Chairperson
1 Centre Street, Room 2202
New York, NY 10007
(212) 669-7070

Appendix B - Site Contact List

Chief Executive Officer
Mayor Bill de Blasio
City Hall
260 Broadway
New York, NY 10007

New York City Comptroller
Hon. Scott M. Stringer
Brian Cook, Staff
Michael Stinson, Staff
Dylan Hewitt, Staff
1 Centre Street
New York, NY 10007

Public Advocate
Jumaane Williams
1 Centre Street, 15th Floor
New York, NY 10007

U.S. Senator
Hon. Charles Schumer
780 Third Avenue, Suite 2301
New York, NY 10017

U.S. Senator
Hon. Kirsten Gillibrand
780 Third Avenue, Suite 2601
New York, NY 10017

NYS Assembly Member – 65th Assembly District
Hon. Yuh-Line Niou
Laurence Hong, Head of Staff
64 Fulton Street, Room 302
New York, NY 10038

NYC Councilmember – District 1
Hon. Margaret S. Chin
Gigi Li, Staff
Marian Guerra, Staff
101 Lafayette Street, 9th Floor
New York, NY 10013

Manhattan Borough President
Hon. Gale A. Brewer
Andrew Chang, Staff
Matthew Washington, Staff
1 Centre Street, 19th Floor
New York, NY 10007

NYC Office of Environmental Remediation
Mark McIntyre, Director
Shaminder Chawla, Deputy Director
100 Gold Street, 2nd Floor
New York, New York 10038

Manhattan Community Board No. 1
Tammy Meltzer, Chairperson
Alice Blank, Environmental Committee Chairwoman
Paul Goldstein, Committee Member
Diana Switaj, Staff CP1
Lucian Reynolds
1 Centre Street, Room 2202
New York, NY 10007
(212) 669-7070

U.S. House of Representatives – 10th District
Hon. Jerrold Nadler
201 Varick Street, Suite 669
New York, NY 10014

NYS Senator – District 26
Hon. Brian Kavanagh
Danielle Zuckerman, Staff
Nicholas Stabile, Staff
Chantel Cabrera, Staff
Lizzie Lee, Staff
250 Broadway, Room 2011
New York, NY 10007

NYC Department of City Planning
Marisa Lago, Commissioner
120 Broadway, 31st Floor
New York, NY 10271

NYC Department of Environmental Protection
Vincent Sapienza, Commissioner
59-17 Junction Boulevard
Flushing, NY 11373

NYC Department of Transportation
Polly Trottenberg, Commissioner
55 Water Street, 9th Floor
New York, NY 10041

NYC Department of Environmental Protection
Attn: Julie Stein
Office of Environmental Planning & Assessment
59-17 Junction Blvd, 13th Floor
Flushing, NY 11373

County Clerk of New York County
Milton Tingling
Manhattan County Clerk
60 Centre Street, Room 161
New York, NY 10007

NYS Department of Environmental Conservation
Rafi Alam, Project Manager
Rodney Rivera, Special Assistant
Mike Komoroske
Gerard Burke, Director Remedial Bureau B
Jane O'Connell, Regional Hazardous Waste Remediation Engineer
625 Broadway Street
Albany, NY 12233

NYS Department of Health
Scarlett McLaughlin, Public Health Specialist
Stephanie Selmer, Public Health Specialist
Empire State Plaza
Corning Tower, Room 1787
Albany, NY 12237

Local news media from which the community typically obtains information:

New York Daily News
4 New York Plaza
New York, NY 10004

New York Post
1211 Avenue of the Americas
New York, NY 10036

NY 1 Spectrum News
75 Ninth Avenue
New York, NY 10011

Downtown Express (The Villager)
One Metrotech Center North, 10th Floor
Brooklyn, NY 11201

The Tribeca Tribune
14 Murray Street #232
New York, NY 10007

The Broadsheet
375 South End Avenue
New York, NY 10280

WPIX 11 New York
220 East 42nd Street
New York, NY 10017

The public water supply that services the area where the Site is located:

Site drinking water is provided by New York City from surface watersheds in the Catskills in upstate New York. Contact information for the water supplier is:

Public Water Supplier:
Vincent Sapienza, Commissioner
New York City Department of Environmental Protection
59-17 Junction Boulevard, 13th Floor
Flushing, NY 11373

New York City Municipal Water Finance Authority
255 Greenwich Street, 6th Floor
New York, NY 10007

New York City Water Board - Department of Environmental Protection
59-17 Junction Boulevard, 8th Floor
Flushing, NY 11373

Any person who has requested to be placed in the site contact list:

A list of people who have requested to be placed on the site contact list is included in the attached Table 1.

The administrator of any school or day care facility located on or near the site:
There are no schools or day care facilities located on the site. The following are schools or day care facilities located within ½ mile of the site:

The Peck Slip School P.S. 343
(about 30 feet NE from the site)
Maggie Siena, Principal
Casey Corey, Asst. Principal
Katherine Issel, PTA Co-President
Lauren Ghashghaei, Pre-K, Site Coordinator
1 Peck Slip
New York, NY 10038
(212) 312-6260

Blue School
(about 30 feet S from the site)
Gina Farrar, Head of School
Renee Rolleri, Co-Founder, Board Member
Brooke Ferris, Board Executive Assistant
Tom Fusillo, Consultant
241 Water Street
New York, NY 10038
(212) 228-6341

Bright Beginnings
(about 315 feet NW from the site)
80 Beekman Street
New York, NY 10036
(347) 948-7130

Kidville FiDi
(about 700 feet W from the site)
40 Gold Street
New York, NY 10038
(212) 566-2020

Spruce Street School P.S. 397
(about 1,100 feet NW from the site)
Attn: Nancy Harris, Principal
8 Spruce Street
New York, NY 10038
(212) 266-4800

Murray Bergtraum High School for Business Careers
(about 1,150 feet N from the site)
Naima J. Cook, Administrator
411 Pearl Street
New York, NY 10038
(212) 964-9610

Downtown Little School
(about 1,300 feet NW from the site)
Attn: Kate Delacorte
15 Dutch Street
New York, NY 10038
(212) 791-1300

Sitters Studio
(about 1,100 feet SW from the site)
Kristina Wilson, Chief Executive Officer
125 Maiden Ln #206
New York, NY 10038
(646)246-6024

Pace University School of Performing Arts
(about 1,200 feet NW of the site)
Jorge Luis Cacheiro, Executive Director
140 Williams Street
New York, NY 10038
(212) 618-6100

Hamilton-Madison House
(about 1,700 feet NE from the site)
Anthony Giorgio, Administrator
50 Madison Street
New York, NY 10038
(212) 349-3724

Bright Horizons at 20 Pine
(about 1,700 feet W from the site)
Jessica Trujillo, Administrator
Plaza Entrance, 20 Pine Street, 1st Floor
New York, NY 10005
(212) 509-1580

Alfred E Smith P.S. 001
(about 2,000 feet NE from the site)
Amy Hom, Administrator
8 Henry Street
New York, NY 10038
(212) 267-4133

Montessori School of Manhattan
(about 1,200 feet W of the site)
Bridie L. Gauthier, Head of School
2 Gold Street
New York, NY 10038
(212)742-2830

New York City Housing Authority's Smith Day Care Center
(about 1,500 feet E from the site)
10 Catherine Slip
New York, NY 10038
(212) 427-8542

Paradigm Kids
(about 1,700 feet W from the site)
8 Liberty Place
New York, NY 10038
(917) 475-1119

Jacob August Riis P.S. 126
(about 1,800 feet NE from the site)
Carlos Romero, Principal
80 Catherine Street
New York, NY 10038
(212) 962-2188

Mei Wah Day Care Center
(about 2,100 feet NE from the site)
Pastor Luke Park, Administrator
69 Madison Street
New York, NY 10002
(212) 349-2703

High School of Economics & Finance
(about 2,500 feet NW from the site)
Michael Stanzione, Administrator
100 Trinity Place
New York, NY 10006
(212) 346-0708

Leadership and Public Service High School
(about 2,500 feet NW from the site)
Philip Santos, Administrator
90 Trinity Place
New York, NY 10006
(212) 346-0007

Preschool of America
(about 2,600 feet E from the site)
Cathy Makropoulos, Administrator
25 Market Street
New York, NY 10002
(212) 577-2710

Wegweiser & Wegweiser, LLC
2 Gold St
New York, NY10038

Community, Civic, Religious and other Educational Institutions:

Our Lady of Victory Church
Attn: Rev. Myles P. Murphy
60 South William Street
New York, NY 10005
Phone: (212) 422-5535

Chinese United Methodist Church
Attn: Pastor Luke Park
69 Madison Street
New York, NY 10002
Phone: (212) 267-6464

Trinity Church
Attn: Rev. Dr. William Lupfer
75 Broadway
New York, NY 10006
Phone: (212) 602-0800

River NYC Church
Attn: Pastor Sara Furste
90 Trinity Place
New York, NY 10006
Phone: (646) 467-8694

Saint Peter's Roman Catholic Church
Attn: Rev. Jarlath Quinn
22 Barclay Street
New York, NY 10007
Phone: (212) 233-8355

Saint Paul's Chapel of Trinity Church Wall Street
Attn: Rev. Dr. William Lupfer
209 Broadway
New York, NY 10007
(212) 602-0800

Wall Street Synagogue
47 Beekman Street
New York, NY 10038
Phone: (212) 227-7800

Masjid Manhattan, Inc.
30 Cliff Street
New York, NY 10038
Phone: (212) 766-1865

Chinese Evangel Mission Church
Attn: Pastor John Jackson
97 Madison Street
New York, NY 10002
Phone: (212) 571-1083

Episcopal Church of Our Savior
Attn: Rev. Canon Ada Wong Nagata, D. Min.
48 Henry Street
New York, NY 10002
Phone: (212) 233-2899

Saint James Roman Catholic Church
32 James Street
New York, NY 10038

Saint Andrews Roman Catholic Church
Attn: Rev. Myles P. Murphy
20 Cardinal Hayes Place
New York, NY 10007
Phone: (212) 962-3972

Church of the Transfiguration
Attn: Rev. Peter Lo
29 Mott Street
New York, NY 10013
Phone: (212) 962-5157

New York Nichiren Buddhist Temple
64 Fulton Street
New York, NY 10038
Phone: (646) 251-9078

Chinese Conservative Baptist Church
Attn: Pastor Kevin Liu
103 Madison Street
New York, NY 10002
Phone: (212) 962-6040

Grace Gratitude Buddhist Temple
48 East Broadway
New York, NY 10002
Phone: (212) 962-1223

Life Center Church NYC/JHOP
75 Maiden Ln
New York, NY 10038

FDNY Enginer 4 Ladder 15 Decon Unit
42 South Street
New York, NY 10005

United Synagogue of Conservative Judaism
120 Broadway
New York, NY 10271
Phone: (212) 533-7800

Chabad of Tribeca/Soho Jewish Center
54 Reade Street
New York, NY 10007
Phone: (212) 566-6764

House Church in NYC Inc.
48 Market Street
New York, NY 10002
Phone: (212) 748-1737

Mariner's Temple Baptist Church
Attn: Pastor Henrietta Carter
8 Oliver Street
New York, NY 10038
Phone: (212) 233-0423

John Street Church
Attn: Pastor Stephanie Bennett
44 John Street
New York, NY 10038
Phone: (212) 269-0014

Huang Da Xian Taoist Temple
20 Bowery
New York, NY 10013
Phone: (212) 349-6221

Lab/Shul
125 Maiden Ln #8B
New York, NY 10038

FDNY Engine 6
49 Beekman Street
New York, NY 10038
Phone: (212) 570-4206

FDNY Engine 10 Ladder 10
124 Liberty Street
New York, NY 10006

Southbridge Adult & Senior
90 Beekman Street
New York, NY 10038

Metropolitan Waterfront Alliance
Attn: Roland Lewis
President & CEO
217 Water Street, Suite 300
New York, NY 10038

City Hall Neighborhood Senior Center
100 Gold Street
New York, NY 10038

1st Precinct Police Council
Attn: Antony Notaro, President
16 Ericsson Place
New York, NY 10013

Save Our Seaport
Attn: Michael Kramer, Member
michaelkramermk@gmail.com
Caroline Miller, Member
cmiller117@gmail.com
David Sheldon, Member
davidthepalace@verizon.net

NYPD 5th Precinct
Attn: Tommy Ng
19 Elizabeth Street
New York, NY 100163
(212) 334-0711

Children First New York City
Attn: Grace Lee, Parent
Maggie Dallal, Parent
Megan Malvern, Parent
Emily Hellstrom, Parent
Rebecca Tekula, Parent
273 Water Street
New York, NY 10038

Kingdom of Hall Jehovah's Witnesses
334 Pearl Street
New York, NY 10038

Consolidated Edison Corporate Affairs
Attn: Caroline Kretz, Director
4 Irving Place, Room 1428
New York, NY 10003

South Bridge Towers
Attn: John Fratta, Board President
JohnSBTBoard@gmail.com
Elaine Kennedy, Board Secretary
Elainesbtboard@gmail.com
Jill Zilker, General Manager
jillz@prcny.com
90 Beekman Street
New York, NY 10038

Alliance for Downtown NY
Attn: Jessica Lappin, President
120 Broadway, Suite 3340
New York, NY 10271

Community Consultants

Excel Environmental Resources, Inc.
Attn: Lawra Dodge
111 North Center Drive
North Brunswick, NJ 08902

Brooklyn Bridge South Neighborhood Association
Attn: Linda Rocher
6 Bowery 6th Floor
New York, NY 10013

Residents, owners, and occupants of the site and properties adjacent to the site:

The contact information for the current owner and operator of the proposed brownfield site is:

250 Seaport District, LLC
c/o The Howard Hughes Corporation
Attn: Saul Scherl
Adam Meister
199 Water Street, No 28
NY NY 10038
646-762-4755

LAZ Parking
333 West 39th Street, Suite 602
New York, NY 10018
(212) 967-4875

Adjacent properties include:

Symposium Realty Corp.
117 Beekman Street
New York, NY 10038

Blue School Inc.
233 Water Street
New York, NY 10038
(212) 228-6341

Joshua Levine
245 Water Street
New York, NY 10038

The Beekman Landing Condominium
130 Beekman Street
New York, NY 10038

The Blue Man Creativity Center Inc.
237 Water Street
New York, NY 10038
(212) 227-3722

247 Water St Condo
247 Water Street
New York, NY 10038

VHJC Holding Corp.
251 Water Street
New York, NY 10038

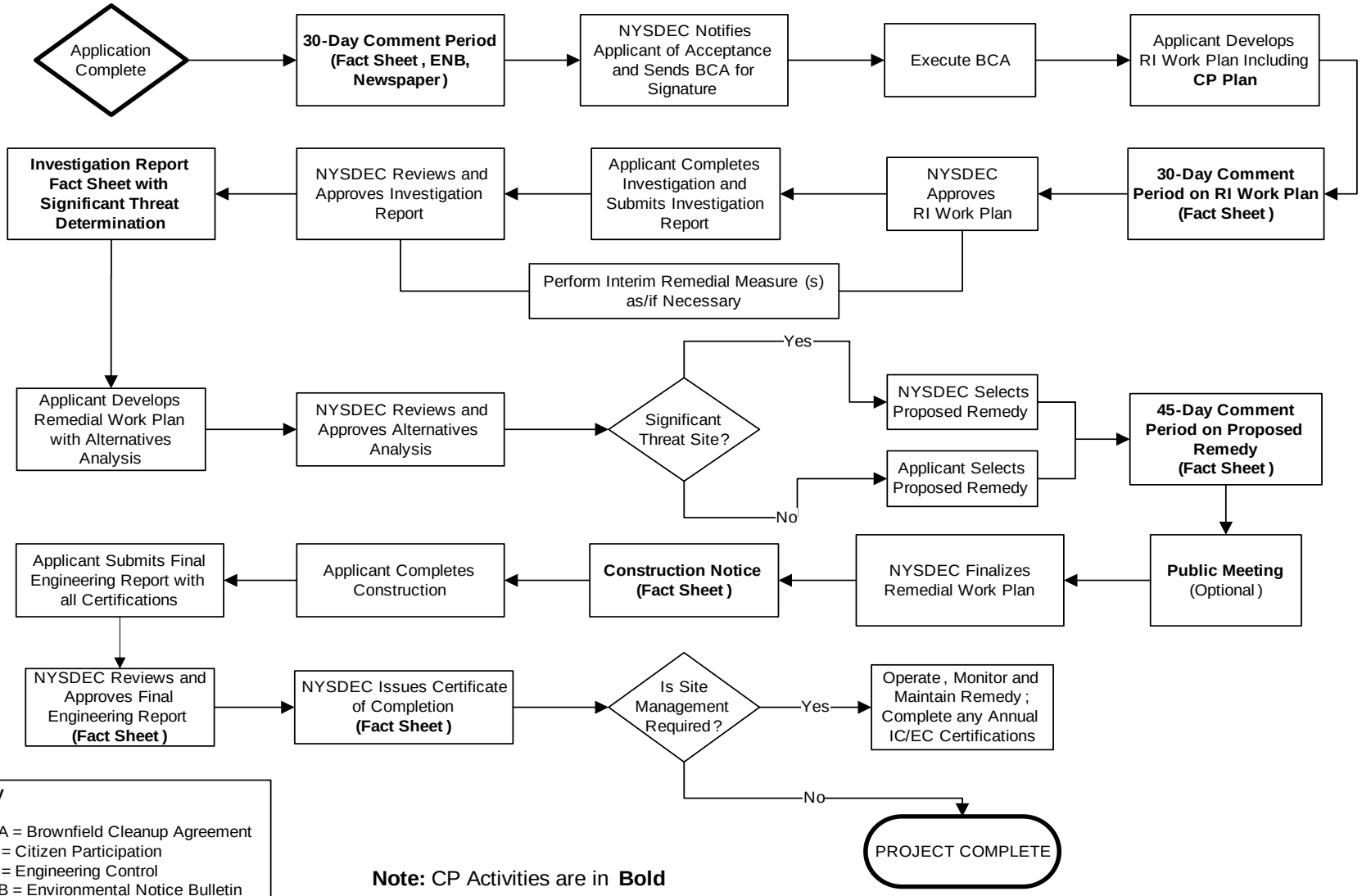
Peck Slip School P.S. 343
1 Peck Slip
New York, NY 10038
(212) 312-6260

Southbridge Towers Inc.
80 Gold Street
New York, NY 10038
(212) 267-6190

Appendix C - Site Location Map



Appendix D– Brownfield Cleanup Program Process



Key

BCA = Brownfield Cleanup Agreement
CP = Citizen Participation
EC = Engineering Control
ENB = Environmental Notice Bulletin
IC = Institutional Control
RI = Remedial Investigation

Note: CP Activities are in **Bold**

Table 1 - Request To Be Added To Site Contact List
Citizen Participation Plan
250 Water Street
New York, New York
Langan Project No. 170381202
NYSDEC BCP Site No. C231127

First Name	Last Name	Address	Apt./Suite	City	State	Zip	Email	Phone Number
Paul	Kefer	90 Beekman St		New York	NY	10038		
Bright Beginnings		80 Beekman Street		New York	NY	10038		
Stacey	Shub	100 Beekman Street		New York	NY	10038	staceyshub@gmail.com	
Pete	Dever	80 John Street		New York	NY	10038	dever@macguffin.com	917-972-1931
Mary	Kwon	33 Gold Street		New York	NY	10038	Makwon@outlook.com	
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APPENDIX H

PROJECT PERSONNEL RESUMES

JASON J. HAYES, PE, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

SELECTED PROJECTS

- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY
- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
- Purves Street Development, BCP Application, RAWP, and Phase II ESI, Long Island City, NY
- 267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
- New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- West & Watts (BCP Application), New York, NY
- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY



EDUCATION

M.S., Environmental Engineering Columbia University

B.S., Chemistry, Environmental Toxicology Humboldt State University

Business Administration (minor) Humboldt State University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

CPR and First Aid Certification

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

AFFILIATIONS

US Green Building Council, NYC Chapter (USGBC), Communications Committee

- 627 Smith Street (RI and Report), Brooklyn, NY
- Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
- Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
- Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
- Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
- Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- Silvercup West (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
- 29 Flatbush, Tall Residential Building (Groundwater Studies, RIR and RAWP), Brooklyn, NY
- Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
- Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
- Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
- The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
- Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
- Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
- Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
- Proposed New York JETS Stadium (Phase I ESA), New York, NY
- Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
- 7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
- Peter Cooper Village, Environmental Subsurface Investigations, New York, NY

Urban Land Institute (ULI), member

Commercial Real Estate Development Associations (NAIOP), member

NYC Brownfield Partnership, member

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson Yards Development

Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

PAUL MCMAHON, PE

SENIOR PROJECT MANAGER

ENVIRONMENTAL ENGINEERING

Mr. McMahon is an environmental engineer working in the NY Metro area. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), Voluntary Cleanup Program (VCP) and Spill Programs, and New York City Office of Environmental Remediation (NYCOER) "E" Designated and VCP sites. His field experience includes conducting Phase II Environmental Site Investigations (ESI), remedial investigations, and indoor air quality analysis Investigations, and performing remediation oversight. Mr. McMahon's most recent experience includes the preparation of investigation reports and investigation work plans, management of NYSDEC BCP remediation projects and NYSDEC spill remediation projects, design of submembrane depressurization systems, and development of remediation work plans.



EDUCATION

M.E., Environmental Engineering
Manhattan College

B.S., Civil Engineering
Washington University in St. Louis

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

10-Hour OSHA

40-Hour OSHA HAZWOPER

SELECTED PROJECTS

- 55 Bank Street, NYSDEC BCP Site Remediation Project Management,
  White Plains, NY
- 23-01 42nd Road, NYSDEC BCP Site Remediation Oversight and Project Management, Long Island City, NY
- 23-10 Queens Plaza South, NYSDEC BCP Remedial Investigation Report, Interim Remedial Measures Work Plan, and Remediation Project Management, Long Island City, NY
- Brooklyn Navy Yard Dock 72, Management of Environmental Oversight in Accordance with NYSDEC VCP Site Management Plan, Brooklyn, NY
- Purves Street Development, Tall Residential Building, Phase II ESI/NYSDEC BCP Remedial Investigation, Remedial Action Work Plan, and Site Remediation Project Management, Long Island City, NY
- 27-21 44th Drive, NYSDEC BCP Site Remediation Project Management, Long Island City, NY
- NYU Tandon School of Engineering, NYSDEC Spill Investigation and Remediation Project Management, Brooklyn, NY
- Parcel B West, East Harlem, Affordable Housing Development, NYSDEC BCP Remedial Investigation, Remedial Action Work Plan, and Site Remediation Project Management, New York, NY
- 267-273 West 87th Street, NYSDEC BCP Remedial Investigation and Remedial Action Work Plan, and Site Remediation Project Management, New York, NY
- DuPont-Stauffer Landfill, NYSDEC Superfund Site, Site Management Plan Compliance, Newburgh, NY
- 190 Riverside Drive, Fuel Oil Spill Emergency Response, Site Investigation, and Remediation, New York, NY
- 473 President Street, NYSDEC BCP Remedial Investigation, Interim Remedial Measures, Project Management, Brooklyn, NY

- 175-225 3rd Street, NYSDEC BCP Remedial Investigation, Project Management, Brooklyn, NY
- 322 West 57th Street, Sheffield Building Oversight of Emergency Spill Response, New York, NY
- Hudson Yards Terra Firma and Hudson Yards Platform, Construction Oversight and Community Air Monitoring Program, New York, NY
- Columbia University Manhattanville Redevelopment, Remediation Oversight and Community Air Monitoring Program, New York, NY

ANTHONY MOFFA, JR., ASP, CHMM, COSS

ASSOCIATE/CORPORATE HEALTH AND SAFETY MANAGER

Anthony is Langan's Corporate Health & Safety Manager and is responsible for managing health and safety compliance in all Langan office locations. He has nearly 20 years of experience in the health and safety field. He is responsible for ensuring compliance with all federal and state occupational health and safety laws and development and implementation of corporate health and safety policies. His responsibilities include reviewing and updating Langan's Corporate Health and Safety Program and assisting employees in the development of site specific Health & Safety Plans. He maintains and manages health and safety records for employees in all Langan office locations including medical evaluations, respirator fit testing, and Hazardous Waste Operations and Emergency Response training. He is also responsible for documentation and investigation of work-related injuries and incidents and sharing this information with employees to assist in the prevention of future incidents. He is also the chairman of the Corporate Health & Safety Committee and Health & Safety Leadership Team that meet periodically throughout the year. He is responsible for coordinating and providing health and safe training to Langan employees. He was formerly the Environmental, Health and Safety Coordinator at a chemical manufacturer. His experience included employee hazard communications, development of material safety data sheets for developed products, respirator fit testing and conducting required Occupational Health & Safety Association and Department of Transportation training.



EDUCATION

B.S., Physics
West Chester University

PROFESSIONAL REGISTRATION

Associate Safety Professional (ASP)

Certified Hazardous Material Manager (CHMM)

Certified Occupational Safety Specialist (COSS)

AFFILIATIONS

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

Geoprofessional Business Association

MIMI RAYGORODETSKY

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Ms. Raygorodetsky sources and directs large, complex environmental remediation and redevelopment projects from the earliest stages of pre-development diligence, through the remediation/construction phase, to long-term operation and monitoring of remedial systems and engineering controls. She has a comprehensive understanding of federal, state and local regulatory programs and she uses this expertise to guide her clients through a preliminary cost benefit analysis to select the right program(s) given the clients' legal obligations, development desires and risk tolerance. She is particularly strong at integrating the requirements of selected programs and client development needs to develop and design targeted and streamlined diligence programs and remediation strategies. Ms. Raygorodetsky is also highly skilled in integrating remediation with construction on large urban waterfront projects, which tend to more complex than landside projects.



EDUCATION

B.A., Biology and Spanish Literature
Colby College

AFFILIATIONS

New York Women Executives in Real Estate (WX) - Board Member; Networking and Special Events Committee Co-Chair

New York Building Congress, Council of Industry Women - Committee Member

New York City Brownfield Partnership - Founding Member and President

NYC Office of Environmental Remediation Technical Task Force - Committee Member

SELECTED PROJECTS

- 25 Kent Avenue, Due Diligence for Purchase of a Brownfields Location, Brooklyn, NY
- Ferry Point Waterfront Park, Redevelopment of a Former Landfill into a Park, Bronx, NY
- Battery Maritime Building (10 South Street), Phase I ESA, New York, NY
- Residential Development at 351-357 Broadway, Phase 1 ESA, New York, NY
- 450 Union Street, Phase I and Phase II Remediation (NYS DEC Brownfield Cleanup Program), New York, NY
- Echo Bay Center, NYS DEC Brownfield Cleanup Program, New York, NY
- 420 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
- 416 Kent Avenue, NYS DEC Brownfield Cleanup Program, Brooklyn, NY
- 264 Fifth Avenue, Phase I ESA, New York, NY
- 262 Fifth Avenue, Phase I ESA, New York, NY
- ABC Blocks 25-27 (Mixed-Use Properties), Brownfield Cleanup Program, Long Island City, NY
- Residences at 100 Barrow Street, Phase I ESA, New York, NY
- Residences at 22-12 Jackson Avenue, Due Diligence for Building Sale, Long Island City, NY
- Residences at 2253-2255 Broadway, Phase I and Phase II Services, New York, NY
- Prince Point, Phase I ESA, Staten Island, NY
- 787 Eleventh Avenue (Office Building Renovation), Phase I UST Closure, New York, NY
- 218 Front Street/98 Gold Street, Planning and Brownfield Consulting, Brooklyn, NY
- Mark JCH of Bensonhurst, Phase I and HazMat Renovation, Brooklyn, NY
- 39 West 23rd Street, E-Designation Brownfield, New York, NY

- 250 Water Street, Phase I and Phase II Property Transaction, New York, NY
- 27-19 44th Drive, Residential Redevelopment, Long Island City, NY
- 515 West 42nd Street, E-Designation, New York, NY
- 310 Meserole Street, Due Diligence Property Purchase, Brooklyn, NY
- Former Georgetown Heating Plant, HazMat and Phase I ESA, Washington D.C.
- 80-110 Flatbush Avenue, Brooklyn, NY
- 132 East 23rd Street, New York, NY
- 846 Sixth Avenue, New York, NY
- Greenpoint Landing, Remediation/Redevelopment, Brooklyn, NY
- 711 Eleventh Avenue, Due Diligence/Owner's Representative, New York, NY
- Brooklyn Bridge Park, Pier 1, Waste Characterization and Remediation, Brooklyn, NY
- Post-Hurricane Sandy Mold Remediation, Various Private Homes, Far Rockaway, NY
- Brooklyn Bridge Park, One John Street Development, Pre-Construction Due Diligence and Construction Administration, Brooklyn, NY
- 7 West 21st Street, Brownfields Remediation, New York, NY
- 546 West 44th Street, Brownfields Remediation, New York, NY
- Post-Hurricane Sandy Mold Remediation, Various Private Homes, Nassau and Suffolk Counties, Long Island, NY
- 55 West 17th Street, Brownfield Site Support, New York, NY
- Pratt Institute, 550 Myrtle Avenue Renovations, Environmental Remediation, Brooklyn, NY
- 42-02 Crescent Street Redevelopment, Phase I and II Environmental, Long Island City, NY
- IAC Building (555 West 18th Street), New York, NY
- Retirement Communities on100-acre Parcels in ME, NJ, MA, CT, and NJ
- 363-365 Bond Street/400 Carroll Street, Brooklyn, NY
- 160 East 22nd Street, New York, NY
- 110 Third Avenue, New York, NY
- Lycee Francais (East 76th Street & York Avenue), New York, NY
- Winchester Arms Munitions Factory, New Haven, CT

JOSEPH YANOWITZ

SENIOR STAFF ENGINEER

ENVIRONMENTAL ENGINEERING

Mr. Yanowitz is an environmental engineer working in the NY Metro area and has provided cleanup services for sites in New York and New Jersey. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP), Voluntary Cleanup Program (VCP) and Spill Programs, and New York City Office of Environmental Remediation (NYCOER) "E" Designated and VCP sites. His field experience includes conducting Phase II Environmental Site Investigations (ESI), remedial investigations, and indoor air quality analysis Investigations, and performing remediation oversight. Mr. Yanowitz's most recent experience includes the preparation of Phase I Environmental Site Assessment (ESA), investigation reports, and investigation work plans, management of NYSDEC BCP remediation projects and NYSDEC spill remediation projects, design of submembrane depressurization systems (SMDS), and development of remediation work plans.



EDUCATION

B.S., Environmental Engineering
State University of New York at Buffalo

PROFESSIONAL REGISTRATION

40-Hour OSHA HAZWOPER

10-Hour OSHA

SELECTED PROJECTS

- The Shops at Atlas Park – Parcel B, NYSDEC BCP Site Management Plan Project Management, Queens, NY
- Columbia University Manhattanville, Chemical Injection Oversight and NYSDEC Spill Remediation Project Management, New York, NY
- 40-36 24th Street, Phase II ESI and NYCOER VCP Remedial Investigation, Remedial Investigation Report, Remedial Action Work Plan, and Site Remediation Project Management, Long Island City, NY
- 250 Water Street, Phase I ESA and NYSDEC BCP Application and Remedial Investigation Report, New York, NY
- 1 Huron Street, SMDS designs, Brooklyn, NY
- 27-01 Jackson Avenue, NYSDEC BCP Application, Remedial Investigation Report, and Remedial Action Work Plan, Long Island City, NY
- 26-32 Jackson Avenue, NYSDEC BCP Application, Remedial Investigation, Remedial Investigation Report, and Remedial Action Work Plan, Long Island City, NY
- Brooklyn Navy Yard Dock 72, Environmental Oversight in Accordance with NYSDEC VCP Site Management Plan, Brooklyn, NY
- Riverside Center Parcel 1, 3 and 4, NYCOER VCP Remediation/Construction Oversight and Community Air Monitoring Program New York, NY
- Confidential Client, Hexavalent Chromium and MGP Remediation Oversight and Project Management, Jersey City, NJ
- Buffalo River Sediment Dredging, Buffalo, NY
- Naval Weapons Industrial Reserve Plant (NWIR)–Bethpage Grumman Aerospace Corp., Northtrop Grumman Corporation, Bethpage, NY

APPENDIX I

PROJECT /REMEDIATION SCHEDULE

Appendix I - Remediation Schedule
Remedial Action Work Plan

250 Water Street
New York,NY
Langan Project No. 170381202
BCP No.: C231127

Item	Action	2021 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	2022 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	RIR and RAWP - Preparation and Submittal																								
2	RIR and RAWP - NYSDEC Review																								
3	RIR and RAWP - Public Comment Period																								
4	NYSDEC Issues DD																								
5	Remedial Design Invesigation and Reporting																								
6	RAWP Implementation/Construction																								
7	FER/SMP/EE																								
8	Certificate of Completion																								

1. The estimated scheduling of items 4 through 7 will be contingent on the timing of acceptance of the Remedial Action Work Plan
2. FER - Final Engineering Report
3. SMP - Site Management Plan
4. EE - Environmental Easement
5. RIR - Remedial Invesigation Report
6. RAWP - Remedial Action Work Plan