INTERIM REMEDIAL MEASURE WORK PLAN

for

RED HOOK SMITH STREET
627-661 SMITH STREET
BROOKLYN, NEW YORK
NYSDEC BCP No. C224163

Prepared For:

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TABLE OF CONTENTS

FIGURES

APPENDICES

CERTIFICATION

I Jason Hayes, P.E., certify that I am currently a NYS registered professional engineer as defined in *Title 6 of the New York Codes, Rules and Regulations* (6 NYCRR) Part 375 and that this Interim Remedial Measure Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

Jason Hayes, P.E.

NYS P.E. # 089491

1.0 INTRODUCTION

1.1 General

This Interim Remedial Measure (IRM) Work Plan was prepared on behalf of CF Smith LLC and Red Hook Developers Holdings, LLC (the Volunteer) for the Red Hook Smith Street site, located at 627-661 Smith Street in Brooklyn, 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, where necessary, remediate the site under the May 2013 Brownfield Cleanup Agreement (BCA) for Site No. C224163. The northern portion of the site (NYC Tax Block 493, Lot 1) was previously subject to NYSDEC review under the Spills Program (Spill No. 05-00510, reported on April 12, 2005). The spill was closed by the NYSDEC on May 31, 2013 when the site was enrolled in the BCP. The site was also previously subject to a NYSDEC Consent Order to remediate Spill No. 05-00510. NYSDEC terminated the Consent Order on August 6, 2012 to allow the site to be admitted into the BCP.

This IRM Work Plan describes the procedures for installation of a new sealed-seam, steel sheet pile cutoff wall along the eastern and southern extents of the site, and associated soil removals in advance of implementation of a Remedial Action Work Plan (RAWP). The objective of the new sealed-seam, steel sheet pile cutoff wall is to prevent migration of hydrocarbon free product/ non-aqueous phase liquid (NAPL) to the Gowanus Canal from the prior coal tar and roofing material manufacturing operation that were present on the site in the early 20th century.

This IRM Work Plan was prepared in accordance with the process and requirements of the BCP and the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10). Work described herein will be coordinated with the United States Environmental Protection Agency (USEPA), considering the adjacent waterway (i.e., Gowanus Canal) is a federal Superfund site.

1.2 Site Description

The site is located in the Red Hook neighborhood of Brooklyn, New York and is identified as Block 493, Lot 1, and Block 495, Lot 1 on the New York City Brooklyn Borough Tax Map. The approximately 85,400-square-foot site was formerly developed with an approximately 63,500-square-foot one-story warehouse that was demolished in early 2018. Remaining site features include an asphalt-paved parking lot and concrete slabs and foundations associated with the former warehouse.

The site is located along the Gowanus Canal at the mouth of the Gowanus Bay. The site is bounded by 595 Smith Street to the north, the Gowanus Canal to the east, the mouth of the Gowanus Canal to the south, and Smith Street to the west. The site waterfront makes up about 750 linear feet of the Gowanus Canal. The waterfront consists of an about 750-foot-long timber-

pile-supported relieving platform with a timber fender system that wraps around 659 Smith Street, and a 250-foot-long rubble embankment with remnant timber cribbing protruding from the embankment along 627 Smith Street. A Site Location Map is provided as Figure 1 and a Site Plan is included as Figure 2.

1.3 Proposed Development

Potential commercial or industrial development scenarios are being considered; however, there is currently no finalized development plan. The site will be developed consistent with the applicable zoning. A new bulkhead cutoff wall will be installed along the Gowanus Canal on the east and south side of the site prior to development to prevent potential migration of grossly-impacted hydrocarbon material and impacted groundwater to the Gowanus Canal.

1.4 Site Physical Conditions

1.4.1 Topography

The topography of the site is relatively flat, gently sloping to the east-southeast toward the Gowanus Canal. Site grade ranges from about elevation (el.) 5[1] in the northwest to el. 4 in the southeast along the Gowanus Canal. The topography of the site generally slopes down from northwest to southeast, and the surrounding area generally slopes east toward the Gowanus Canal. Properties north and northwest of the site are generally at a higher elevation (up-gradient).

1.4.2 Site Geology

Predominant geological surface features were not observed at the site. Soil and bedrock stratigraphy throughout Brooklyn typically consists of a layer of historic fill that overlies glacial till, decomposed unconsolidated bedrock, and bedrock. The USGS "Geologic Map of New York City and Adjacent Part of New Jersey" indicates the bedrock underlying the site is part of the Hartland Formation. The Hartland Formation is comprised of mica schist and quartz-feldspar granulite, with localized intrusions of granite and pegmatite. Top of rock is expected to be over 150 feet below grade surface (bgs).

Based on the findings of previous environmental and geotechnical investigations, the site stratigraphy consists of a historic fill layer beneath concrete and asphalt-paved surfaces that is predominately black, red, and brown, coarse to fine sand with varying amounts of silt, gravel, wood, brick, ceramic, slag, coal, and asphalt to depths ranging from about 4 to 28 feet bgs. The historic fill layer is underlain by sands and silty sands from about 38 to 42 feet bgs with silt and clay lenses at varying depths. The silt and clay layers are potential confining layers. Clay lenses ranging from 1 to 4 feet thick were observed between approximately 20 and 30 feet bgs and clay

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

and silt lenses ranging from 1.5 to 6 feet thick were observed between approximately 32 and 40 feet bgs at boring locations GB01 through GB04 during the 2015 Supplemental Remedial Investigation (SRI) in the eastern portion of the site. The sand and silty sand layer with intermittent silt and clay lenses is underlain by native sands ranging from 19 to 22 feet thick and was observed between approximately 38 and 64 feet bgs. A clay layer with a thickness of about 4 to 13 or more feet was observed between about 58 and 71 feet bgs in all soil borings completed during the 2015 SRI in the eastern portion of the site.

1.4.3 Hydrogeologic Conditions

Groundwater flow is typically topographically influenced, as shallow groundwater tends to originate in areas of topographic highs and flows toward areas of topographic lows, such as rivers, stream valleys, ponds, and wetlands. A broader, interconnected hydrogeologic network often governs groundwater flow at depth or in the bedrock aquifer. Groundwater depth and flow direction are also subject to hydrogeologic and anthropogenic variables such as precipitation, evaporation, extent of vegetation cover, and coverage by impervious surfaces. Other factors influencing groundwater include depth to bedrock, the presence of artificial fill, and variability in local geology and groundwater sources or sinks. Infiltration of precipitation to the water table is minimal at the site due to the presence of asphalt-paved and concrete-covered areas throughout the site. Rainwater that does infiltrate into the ground percolates downwards toward the water table and flows toward the Gowanus Canal.

Groundwater underlying the site ranges from approximately el. 3.7 to el. 1.5 NAVD88, based on gauging of site wells during the 2014 SRI on February 26, 2014, the 2015 SRI on August 26, 2015, and the 2017 Pre-Design Supplemental Investigation on September 5, 2017. The highest groundwater elevation, el. 3.7 was documented at MW-03 located in the western portion of the site. The lowest groundwater elevation, el. 1.5, was documented at GB04/OW01 located in the asphalt-paved parking lot in the eastern portion of the site adjacent to the Gowanus Canal. Groundwater flow is to the east/southeast, toward the Gowanus Canal. Underground utilities and other subsurface structures may locally influence the direction of groundwater flow.

Groundwater in this part of New York City is not used as a potable (drinking) water source. The potable water supply is provided to the site by the City of New York and is derived from surface impoundments in the Croton, Catskill, and Delaware watersheds.

1.5 Site History

1.5.1 Gowanus Canal History

The site is located in a historically industrial and manufacturing area along the Gowanus Canal. In the 1840s, the canal was a natural estuary (Gowanus Creek) surrounded by farmland and refineries. In 1849, construction began to convert the estuary into a transportation system to

promote industrial growth and commerce. Construction of the canal was completed by 1869, and by 1870 the surrounding areas had become urbanized with manufactured gas plants, coal yards, and factories. As part of construction, land was artificially created by filling in parts of the original Gowanus Creek and over excavated areas for construction of the bulkhead. Due to the proximity to the Gowanus Canal, the site was likely subject to significant land filling of undocumented quality.

1.5.2 Site History

Block 493 (northern portion of the site)

Block 493 was operated by Barrett Manufacturing Company, Storage and Shipping in the early 1900's until approximately 1938. Colonial Sand and Stone Company occupied Block 493 in the mid 1950's. Black Diamond Cargo Line, Pittston Stevedoring Cargo Storage and Bridgestone Cargo Storage followed Colonial Sand and Stone from the early 1960's to the 1990's. Block 493 operated as a cargo storage facility until circa 2007. Barrett Manufacturing, utilized coal tar storage tanks as part of their production of coal tar and roofing material.

Block 495 (southern portion of the site)

Block 495 was occupied by American Ice Company in the early 1900's. NY Knickerbocker Real Estate Company occupied Block 495 in the 1910's and Smith Street Dock Corporation and Seaboard Storage followed NY Knickerbocker from around 1930 to 1950. Marra Bros Inc. (Cargo Storage), Pittston Stevedoring Cargo Storage and Bridgestone Cargo Storage occupied Block 495 from the late 1960's to the 1990's. Block 493 operated as a cargo storage facility until circa 2007.

1.6 Previous Environmental Investigation Findings

Prior to the Volunteer's involvement with the site, several investigations and reports were prepared. Copies of previous reports are included as Appendix A, and are summarized below.

February 2005 Phase I Environmental Site Assessment (ESA), prepared by Singer Environmental Group and January 2007 Phase I ESA prepared by Don Carlo Environmental Services, Inc.

The 2005 and 2007 Phase I ESAs provide an evaluation of potential environmental concerns relating to hazardous materials and wastes at the site and surrounding properties. The Phase I ESAs were conducted in accordance with the American Society for Testing and Materials (ASTM) Standard (Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process). The 2005 and 2007 Phase I ESAs included a review of several historical sources, a site and vicinity reconnaissance, a review of available regulatory agency databases, and a review of local environmental records. Both Phase I ESAs identified Recognized Environmental Conditions (REC) as the former coal tar storage tanks and the two potential gasoline underground storage tanks (UST) on Block 493.

April 2005 Phase II Environmental Site Investigation (ESI), prepared by Fleming Lee Shue, Inc. (FLS)

The Phase II ESI was completed to evaluate potential impacts to soil and groundwater from the RECs identified in the 2005 and 2007 Phase I ESAs. The Phase II ESI included the advancement of six environmental soil borings (GP-1 through GP-3, GP-5, GP-6, and GP-8), installation of three temporary groundwater monitoring wells (GP-2, GP-3, and GP-6), and collection of soil and groundwater samples. Beneath the concrete surface cover of the former site warehouse, historic fill predominately consisting of light brown to tan sandy silt was observed to about 7 to 15 feet bgs. The historic fill was underlain by gray organic clay. Groundwater was encountered at depths ranging from approximately 4 to 10 feet bgs. A GPR survey did not identify subsurface anomalies indicative of USTs.

The following findings and conclusions were provided in the Phase II ESI:

- Coal tar spill – FLS reported a spill (Spill No. 05-00510) to NYSDEC on April 12, 2005 upon discovering free product in soil borings located in the southern part of Block 493 and the northern part of Block 495.
- Coal tar-impacted soil – Volatile organic compounds (VOC) and semivolatile organic compounds (SVOC) were reported at concentrations exceeding Technical and Administrative Guidance Memorandum 4046 (TAGM), the applicable standard at the time of the investigation, in the soil. VOC and SVOC concentrations were identified above the Title 6 New York Code, Rules, and Regulations Part 375 (6 NYCRR Part 375) Unrestricted Use Soil Cleanup Objectives (SCO). Notable contaminants of concern (COC) including benzene, toluene, ethylbenzene, and total xylenes (BTEX) and naphthalene, were reported in the area of the former tar tanks on the southern part of Block 493 and the northern part of Block 495. Total concentrations of BTEX in soil ranged from 12.8 milligrams per kilogram (mg/kg) to 1,032 mg/kg. Free product was observed in the soil. The report concluded that the main source of soil contamination is the former on-site coal tar storage tanks.
- Impacted groundwater – VOCs, including BTEX and SVOCs, were detected at concentrations exceeding NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS) and Guidance Values (SGV) for class GA water in all temporary groundwater monitoring wells. Total concentrations of BTEX ranged from 21 to 10,789 micrograms per liter (µg/L). In addition, methyl-tert-butyl-ether (MTBE) was detected at concentrations exceeding TOGS AWQS SGVs in three temporary groundwater monitoring wells. Total concentrations of MTBE ranged from 15 to 240 µg/L. Total naphthalene concentrations ranged from 260 µg/L to 33,000 µg/L. The estimated groundwater flow direction was reported as east toward the Gowanus Canal.

December 2006 Supplemental Phase II ESI, prepared by Don Carlo

The Supplemental Phase II ESI was completed to delineate the extent of contamination at the site. The Supplemental Phase II ESI included the advancement of six environmental soil borings (B4 through B9), installation of three groundwater monitoring wells (B5/WS2, B6/WS3, and B9/WS4), and the collection of soil and groundwater samples.

The following findings and conclusions were provided in the Supplemental Phase II ESI:

- Historic fill – The historic fill layer, observed from surface grade to about 12 feet bgs, exhibited SVOCs, including polycyclic aromatic hydrocarbons (PAH), and metal concentrations typical of New York City historic fill material.
- Impacted groundwater – One VOC (naphthalene) and multiple SVOCs exceeded their respective TOGS AWQS SGVs in groundwater samples collected from monitoring wells B5/WS2 and B6/WS3 on Block 493. Metals exceeded their respective TOGS AWQS SGVs in groundwater samples collected from all monitoring wells.

August 2010 Remedial Investigation Report, prepared by Langan

The reported spill Remedial Investigation (RI) was completed to: 1) investigate potential sources of contamination (i.e. release on site and/or at adjacent and surrounding properties that have affected subsurface conditions at the site); 2) identify the vertical and lateral extent of contamination resulting from historic site operations; and 3) initiate product recovery in the newly installed groundwater monitoring wells. Langan implemented the field investigation between June 2 and 11, 2010. The RI included advancement of 15 soil borings (SB-1 to SB-15), installation of six permanent groundwater monitoring wells (MW-1 through MW-6), and collection of soil and groundwater samples. One soil boring (SB-10) was advanced in the sidewalk immediately west of the site along Smith Street.

The following findings and conclusions were provided in the RIR:

- Grossly-contaminated[1] soil – Grossly-contaminated soil, primarily a coal tar/creosote material, was observed throughout the southern part of Block 493, the northern and western parts of Block 495, and beneath the sidewalk at up-gradient boring location, SB-10, immediately west of the site. Several VOCs and/or SVOCs exceeded Unrestricted Use SCOs in soil samples collected from all boring locations except SB-15 located in the southeast portion of the site. Several SVOCs exceeded Industrial Use SCOs at several boring locations.

[1] Per the NYSDEC 6 NYCRR Part 375-1.2 (u), the term "grossly-contaminated media" is defined as soil, sediment, surface water or groundwater which contains sources or substantial quantities of mobile contamination in the form of NAPL that is identifiable either visually, through strong odor, by elevated contaminant vapor levels or is otherwise readily detectable without laboratory analysis.

- Impacted groundwater – Several VOCs and/or SVOCs exceeded their respective TOGS AWQS SGVs in groundwater samples collected from all monitoring wells except MW-1. The investigation included four monitoring/gauging events. Groundwater measurements indicated flow is toward the Gowanus Canal. Free product was observed in and bailed from MW-2 and MW-3 during the first gauging and product recovery event. The second event found globules and sheen in MW-2 and MW-3, but no measurable free product thickness. No product was measured in the wells during the final two events.
- Off-site contamination – Adjacent and surrounding properties have been developed with numerous commercial and industrial tenants since at least the early 1900s. Coal tar contamination in SB-10 (Smith Street sidewalk) indicates that off-site sources may be contributing to the impacts observed on-site.

June 2011 Supplemental Investigation (SI) Update Letter, prepared by Langan

A Supplemental Investigation Update Letter was provided to NYSDEC in June 2011 that summarized SRI activities to date. SRI activities included a geophysical survey, advancement of additional on-site soil borings (SB-16 through SB-18), advancement of up-gradient and off-site delineation soil borings (MW-7 through MW-11), installation of groundwater monitoring wells (MW-7, MW-8, MW-9S, MW-9D, MW-10, and MW-11), and the collection of soil and groundwater samples. Investigative procedures and comprehensive reporting of the findings discussed in the SI Update Letter are presented the May 2012 SRI Report summarized below.

May 2012 Supplemental Remedial Investigation Report, prepared by Langan

The SRI was completed to further delineate site impacts and investigate potential off-site sources of contamination. Langan implemented the field portion of the SRI in two parts: between February 24 and April 1, 2011 and between January 9 and January 24, 2012. The first part of the SRI included advancement of eight soil borings (on-site borings SB-16 to SB-18 and MW-11 and off-site borings MW-7 through MW-10), installation of five off-site permanent groundwater monitoring wells (MW-7, MW-8, MW-9S, MW-9D and MW-10) and one on-site well (MW-11), and collection of soil and groundwater samples.

The second part of the SRI included advancement of five off-site soil borings (MW-14 through MW-17 and SB-19) and one on-site boring (SB-20), installation of seven off-site permanent groundwater monitoring wells (MW-14, MW-15A, MW-15B, MW-15C, MW-15D, MW-16 and MW-17), and collection of soil and groundwater samples.

The following findings and conclusions were provided in the SRI:

- Historic fill – The site surface cover consisted of concrete or asphalt sidewalk or concrete warehouse flooring underlain by historic fill consisting of sand, silt, clay, gravel, cobbles, wood and brick fragments, ash, and cinder up to 12 feet bgs. The presence of ash and cinders indicates a component of the fill may be waste from industrial processes. Analysis

of the fill from the SRI and previous reports found SVOC and metals exceedances of the 6 NYCRR Part 375 Unrestricted Use SCOs throughout the site.

- Grossly-contaminated soil – The southern part of Block 493 and the northern part of Block 495 have creosote/coal tar-like grossly-impacted soil ranging from about 1 to 17 feet bgs, with one location to 27 feet bgs. The impacts are concentrated near where the former coal tar tanks were located on Block 493 based on historic Sanborn fire insurance maps. The grossly-impacted material contains VOCs and SVOCs in exceedance of Part 375 Unrestricted Use SCOs. The primary COCs include naphthalene and BTEX.
- Groundwater Contamination - Groundwater elevations range from el. 0.61 to el. 3.81 NAVD88. Groundwater measurements indicate flow to the east/southeast toward the Gowanus Canal. Dissolved-phase naphthalene and BTEX were present in groundwater samples collected from Blocks 493 and 495. The highest groundwater concentrations were identified on Block 493 near the suspected source material. Elevated groundwater contaminants (VOCs and SVOCs) were also identified in the southern portion of Block 495.
- Off-Site Contamination – Block 492 (Up-Gradient Property) – A source of contamination from Block 492 appears to be migrating to the site and Block 494. Investigation on the sidewalks surrounding this property found creosote/coal tar-like grossly-impacted soil ranging from 7 to 25 feet bgs. Up-gradient soil and groundwater samples generally show higher levels of BTEX and naphthalene than found on the site.

August 2014 Draft SRIR, prepared by Langan

Following the Site's May 2013 admission into the BCP, Langan undertook a second supplemental Remedial Investigation (SRI) pursuant to a December 2013 Remedial Investigation Work Plan (SRIWP). Langan implemented the SRI between February 4 and 26, 2014. The objectives were to supplement existing environmental data obtained for the site during the 2010 RI and 2012 SRI and to further investigate the Areas of Concern (AOC) identified at the site. The 2014 SRI included soil, groundwater and soil vapor sampling and analysis. In August 2014 Langan prepared a Supplemental RI Report (SRIR) to present environmental data and findings from implementation of the 2013 SRIWP and incorporate previous environmental data obtained during the August 2010 RI and May 2012 SRI completed by Langan. Findings and conclusions of the 2014 SRI are as follows:

- Stratigraphy – The site surface cover primarily consisted of concrete or asphalt parking lot and concrete warehouse floor slab. Historic fill consisting of sand, with varying amounts of silt, clay, gravel, cobbles, wood and brick fragments, and ash was observed from about 1 to 15 feet bgs. The historic fill is underlain by fine sands and silts from about 2 to 55 feet bgs, and clays and silts (potential confining layers) with some organic materials in lenses were observed at varying depths (8 to 35 feet bgs).

- Groundwater – Groundwater elevations range from about el. 1.64 to el. 3.7 NAVD88. Groundwater generally flows to the east/southeast toward the Gowanus Canal.
- Site Contamination – Blocks 493 and 495
    - Soil/Fill - Historic fill contains elevated concentrations of VOCs, SVOCs, and metals. Grossly-contaminated coal tar/creosote soil and fill was identified in the central and western portion of the site ranging from about 1 to 18 feet bgs, with one location extending to about 27 feet bgs. The impacts are concentrated near the former coal tar tank locations based on historic Sanborn fire insurance maps, and along the up-gradient western site border. The grossly-impacted material contains VOCs, SVOCs, and metals. Grossly-impacted material migration appears minimal, evidenced by the absence of product accumulation in the groundwater monitoring wells. The grossly-impacted material is likely a source of dissolved phase naphthalene and BTEX in the groundwater.
    - Groundwater - Dissolved-phase naphthalene and BTEX were present in groundwater samples with the highest concentrations near the suspected source material. VOC and SVOC groundwater concentrations were lower in the 2014 sampling as compared with the 2012 sampling results; concentrations were an order of magnitude lower for multiple contaminants in the central and southern portion of the site.
    - Soil Vapor - Soil vapor contaminants, including BTEX compounds and tetrachloroethene (PCE), were detected above ambient air concentrations. Elevated levels of BTEX compounds may be from a combination of historic site activities, nearby off-site metal degreasing operations and other automotive and metalworking industry plants. Considering no PCE was found in the site soil or groundwater, PCE in soil vapor is potentially a result of off-site current and historic activities.
- Off-Site Contamination – Block 492 and 494 (Up-Gradient Properties) – Up-gradient properties represent a source of off-site contamination that appears to be migrating to the site. Investigation on the sidewalks up-gradient of the site found creosote/coal tar-like grossly-impacted soil ranging from about 7 to 25 feet bgs. Up-gradient soil and groundwater samples generally show higher concentrations of BTEX and roughly equivalent concentrations of naphthalene to that found on the site.

October 21, 2016 SRI Report – Addendum 1, prepared by Langan

Langan performed a third SRI in 2015 and prepared the 2015 SRI Report to address a data gap identified by the NYSDEC. This included the potential presence of grossly-impacted material at depths between 40 and 70 feet bgs along the Gowanus Canal waterfront. The 2015 SRI included advancement of four environmental/ geotechnical soil borings (GB01 through GB04) to

approximately 70 feet bgs, collection of one soil sample for laboratory analysis, installation of one monitoring well (GB04/OW01), and collection of one groundwater sample. The findings of the supplemental investigation are summarized below:

- Stratigraphy – The site surface cover primarily consisted of concrete or asphalt parking lot and concrete warehouse floor slab. Historic fill consisting of sand, with varying amounts of silt, clay, gravel, wood, brick, cinder, ash, concrete, ceramic, slag, coal, asphalt, and shell fragments were observed from surface grade to depths of 15 feet bgs. Sands and silty sands underlying the fill were observed to about 38 to 42 feet bgs with silt and clay lenses at varying depths. Sands were observed from about 38 to 64 feet bgs and a deep clay layer (potential confining layer) with a thickness of 4 to 13 or more feet thick was observed between about 58 and 71 feet bgs.
- Groundwater – Groundwater elevations ranged from el. 1.5 to el. 3.7 NAVD88. Groundwater generally flows to the east/southeast toward the Gowanus Canal.
- Site Contamination – Blocks 493 and 495
    - Soil/Fill - Historic fill was identified from surface grade to depths from 1 to 15 feet bgs and contains VOCs, SVOCs, and metals. Grossly-contaminated coal tar/creosote soil and fill was identified in the central and western portion of the site ranging from 1 to 18 feet bgs, with one location extending to 27 feet bgs and one location in the eastern portion of the site extending from 10 to 12 feet bgs, 30 to 32 feet bgs and 40 to 46 feet bgs. The impacts are generally concentrated near the former coal tar tank locations based on historic Sanborn fire insurance maps, along the up-gradient western site border, and near the Gowanus Canal. The grossly-impacted material contains VOCs, SVOCs, and metals. Grossly-impacted material migration appears minimal, evidenced by the absence of measurable product accumulation in the groundwater monitoring wells. The grossly-impacted material is likely a source of dissolved-phase naphthalene and BTEX in the groundwater.

      Grossly-impacted soil was observed in soil boring GB04 between 10 and 12 feet bgs, 30 and 32 feet bgs, and 40 to 46 feet bgs, with a maximum photoionization detector (PID) reading of 215 parts per million (ppm) VOCs recorded at 41 feet bgs. Staining and odors were observed in all four borings (GB01 to GB04) at depths ranging from 4 to 59.5 feet bgs. Elevated PID readings ranged from 9.8 ppm VOCs (GB03 at 47 feet bgs) to 215 ppm VOCs (GB04 at 41 feet bgs).

      Based on results from previous investigations and the 2015 SRI, the horizontal extent of the grossly-impacted soil is estimated to be an approximately 29,000-square-foot area in the central, central-eastern and western portions of the site. Data shows three discontinuous grossly-impacted layers; 1) one shallow layer

between approximately 1 to 18 feet bgs, with one location up to 27 feet bgs; 2) one deeper layer at one location on-site (GB04) between approximately 30 and 32 feet bgs; and 3) one deeper layer at one location on-site (GB04) ranging between 40 and 46 feet bgs.

- Groundwater - Coal tar-like odors and PID headspace readings at 22.0 ppm were identified at monitoring well GB04/OW01. Product was not detected in the monitoring well with the oil-water interface probe (i.e., no tone change for oil detection); however, globules of product were observed on the interface probe tape following well gauging.

  Dissolved-phase naphthalene and BTEX were present in the groundwater samples with the highest concentrations near suspected source material. Dissolved-phase contaminants are considered mobile in the subsurface; however, concentrations drop off significantly with increasing distance from the suspected source material, as observed in results from previous investigations. This concentration decrease is likely due to a combination of contaminant degradation, dilution and retardation. VOC and SVOC groundwater concentrations were lower in the 2015 sampling as compared with 2014 and 2012 sampling results; concentrations were an order of magnitude lower for multiple contaminants in the central and southern portion of the site.

  Fingerprint analysis showed that the product sample was composed of coal tar. The sample was collected from soil boring GB04 from 44 to 46 feet bgs, which was the depth interval exhibiting the greatest degree of impacts (as evidenced by grossly-impacted material, discoloration, odors or elevated PID readings).

August 17, 2018 Waterfront Geotechnical Engineering Study, prepared by Langan

Langan conducted a waterfront geotechnical engineering study for the proposed bulkhead cutoff wall at 627 and 659 Smith Street in Brooklyn, New York. The purpose of the study was to evaluate the subsurface site conditions and to provide recommendations for geotechnical design of the cutoff wall along the Gowanus Canal waterfront. The subsurface exploration consisted of seven borings (LB-1 through LB-7). The borings were drilled between April 5 and May 4, 2018. Borings LB-2 and LB-5 were drilled on land to about 102 feet bgs (corresponding to a completed elevation of el. -96 NAVD88). Borings LB-1, LB-3, LB-4, LB-6, and LB-7 were drilled from a barge within the Gowanus Canal to about 87 feet below the mudline (corresponding to a completed elevation of el. -103 to el. -111 NAVD88). The findings of the investigation are summarized below:

- An about 6-inch-thick layer of concrete pavement was encountered at the site surface with an about 21- to 28-foot-thick layer of historic fill underneath all land borings. The fill consisted of gray or brown sand with varying amounts of silt and clay.

- An about 4 to 18-foot-thick layer of soft sediment was encountered starting at the mudline in all water borings. The sediment consisted of brown or black silt or fine sand. Occasional pockets of gravel with varying amounts of sand or silt were observed.
- Estuarine deposits were encountered below the fill layer in the land borings and below the soft sediment layer in the water borings. Top of the estuarine deposit was about 21 to 41.5 feet below the top of the existing bulkhead (corresponding to about el. -15.5 to el. -35 NAVD88). Thickness of this layer ranges from about 51 to 66 feet in the land borings and about 32 to 52 feet in the water borings. The estuarine deposit consisted of grey/black silt or clay, with varying amounts of sand, and was occasionally underlain by or interbedded with sand with varying amounts of silt and clay.
- Glacial deposits were encountered below the estuarine deposits in all borings. Top of the glacial deposit was about 73 to 93 feet below the top of the existing bulkhead (corresponding to about el. -66.5 to el. -86.5). All borings were terminated in this layer. The glacial deposits primarily consisted of gray to brown medium to fine sand with varying amounts of silt, and occasional pockets of silt or gravel.
- Hydrocarbon-like odors, sheen, and staining were observed in three of the geotechnical borings advanced within the Gowanus Canal (LB-1, LB-3, and LB-7). Impacts were generally observed between el -21 and -44.

October 25, 2018 (Revised March 12, 2019) Pre-Design Supplemental Investigation Report, prepared by Langan

The Pre-Design Supplemental Investigation was implemented between August 31 and September 5, 2017 to provide information to aid in the design of an inland containment cutoff wall and to investigate former subsurface pipes and utilities identified on historic site drawings. Langan conducted the supplemental investigation in accordance with the NYSDEC-approved December 2013 RIWP and NYSDEC-approved April 6, 2017 Pre-Design Supplemental Investigation Work Plan. The supplemental investigation included advancement of one geotechnical soil boring (GB05) to approximately 50 feet bgs and excavation of four test pits to about 6 to 8 feet bgs to assess the presence of former subsurface pipes and historic utilities. The findings of the supplemental investigation are summarized below:

- Historic fill was identified from surface grade to depths from about 1 to 8 feet bgs. Hydrocarbon odors were identified in boring GB05 with PID readings up to 18.7 ppm VOCs at 12.5 feet bgs. Grossly-contaminated material was not identified in GB05.
- Grossly-contaminated hydrocarbon impacted historic fill was identified in test pits TP-3 and TP-4 between about 1 and 8 feet bgs.
- Tar-like material was observed within a 6-inch steel pipe observed in test pit TP-3 at about 4.5 feet bgs. Tar-like material migration appeared minimal, evidenced by the absence of

impacts observed in historic fill immediately surrounding the pipe. A maximum PID reading of 356 ppm was recorded in the 6-inch steel pipe observed within test pit TP-3.

1.7 Contaminant Conditions

This section presents a summary of contamination identified in soil and groundwater within the proposed excavation extent (IRM Area) associated with the steel sheet pile cutoff wall construction. The areas of environmental contamination are also summarized in Figures 3, 4 and 5. The following primary types of environmental contaminants have been identified within the IRM Area:

- Hydrocarbon-Contaminated Material
- Historic Fill

1.7.1 Hydrocarbon-Contaminated Material

Hydrocarbon-contaminated material, evidenced by grossly contaminated media, discoloration, odor or elevated PID readings, was identified at the site. Grossly contaminated media is defined in the May 2010 NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation to mean soil, sediment, surface water or groundwater which contains sources or substantial quantities of mobile contamination in the form of NAPL that is identifiable either visually, through strong odor, by elevated contaminant vapor levels or is otherwise readily detectable without laboratory analysis.

During the 2010 RI, 2012 SRI, 2014 SRI and 2018 geotechnical investigation, hydrocarbon-like odors and sheen were apparent in soil borings MW-4, MW-5, SB-15, SB-20, EB-10, GB01, GB02, GB03, GB04, LB-1, LB-3 and LB-7 at discreet intervals ranging from surface grade to 60 feet bgs. Total petroleum hydrocarbons (TPH) were detected in GB04 at a concentration of 798 mg/kg.

Creosote/coal tar-like grossly impacted soil was observed within the fill layer in the central and western portions of the site and extended to the fill/native interface. The grossly-impacted soil was limited to maximum depths of 15 to 18 feet bgs, except at MW-3 (central portion of site along western border) where impacted material was identified to approximately 27 feet bgs. During the 2015 SRI, grossly-impacted soils were observed in boring GB04 in the fill and native silty sand layers (10 to 12 feet bgs, 30 to 32 feet bgs and 40 to 46 feet bgs). Coal tar-like impacts were observed at depths ranging from about 10 to 12 feet bgs and from about 30 to 48 feet bgs. Soil samples collected from EB-10, GB04, SB-5, SB-8 and SB-20 indicated VOCs and SVOCs above Unrestricted Use (UU), Restricted Use Restricted-Residential (RURR) and/or Restricted Use Commercial (RUC) SCOs. Naphthalene, a common constituent in coal tar, was detected at a maximum concentration of 1,200 mg/kg in SB-08 from 10 to 13 feet bgs. Data shows three discontinuous grossly-impacted layers; 1) one shallow layer between approximately 1 to 18 feet bgs, with one location up to 27 feet bgs; 2) one deeper layer at one location on-site (GB04)

between approximately 30 and 32 feet bgs; and 3) one deeper layer at one location on-site (GB04) ranging between 40 and 46 feet bgs. Two groundwater samples within the IRM WP area were collected for VOC and SVOC analysis at MW-4 and MW-5. VOCs and SVOCs were detected at concentrations above TOGS Class GA AWQS. Naphthalene was detected at a concentration of 4,800 µg/L in MW-4.

1.7.2 Historic Fill

The IRM Area has a layer of historic fill that extends from below the asphalt and concrete cover to about 15 feet bgs and contains concentrations of VOCs, SVOCs and metals above applicable SCOs. SVOCs were detected in the majority of soil samples collected from historic fill at concentrations above 6 NYCRR Part 375 UU, RURR and/or RUC SCOs. Naphthalene was detected in the southwest and central portions of the site, with concentrations ranging from 520 to 5,500 mg/kg between depths of approximately 1 and 14.5 feet bgs. The highest naphthalene concentration within the IRM area was at boring SB-08 (1,200 mg/kg) from 10 to 13 feet bgs. SVOCs were detected in groundwater above NYSDEC TOGS AWQS for Class GA (drinking water) and may be attributable to historic fill material and/or known sources of coal tar in the vicinity of the site.

Several metals (arsenic, lead, mercury, zinc) were detected in fill material above 6 NYCRR Part 375 UU, RURR and/or RUC SCOs and are attributed to historic fill quality.

2.0 SUMMARY OF INTERIM REMEDIAL MEASURES

This IRM Work Plan addresses hydrocarbon-contaminated material and non-hazardous contaminated historic fill identified during previous investigations performed by Langan. The proposed IRM consists of the following tasks:

1. Installation of a new steel sheet pile cutoff wall to serve as a subsurface containment/cutoff wall for hydrocarbon free product migration – A hydrophilic sealant will be used at un-welded interlocking seams
2. Excavation, characterization and off-site disposal of excess soil/fill generated during construction of the new steel sheet pile cutoff wall
3. Continuous screening of excavated soil/fill for indications of residual contamination by visual means, odor, and monitoring with a PID
4. Documentation soil sampling and analysis, collected from the base of the IRM construction-related excavations (i.e., excavation areas), to document residual soil/fill
5. Collection and analysis of soil waste characterization samples as required for off-site disposal – This sampling is described in the Soil/ Materials Management Plan (SMMP) (Section 2.5) and the Quality Assurance Control Plan (QAPP), which is provided in Appendix B.
6. Dewatering and treatment or proper disposal of potential groundwater effluent generated during cutoff wall installation
7. Backfilling excavated areas, as necessary, to a site grade of about el 6 NAVD88 using fill meeting the more restrictive of the revised Part 360 regulations and RUC SCOs; virgin, native crushed stone or sand; or recycled concrete aggregate (RCA), in accordance with DER-10
8. Surveying excavations and components of the steel sheet pile cutoff wall by a New York State Professional Land Surveyor
9. Development and execution of a Construction Health and Safety Plan (CHASP) and Community Air Monitoring Program (CAMP) for the protection of on-site workers and the nearby community during remediation and construction activities
10. Collection of construction documentation (e.g., manifests, weight tickets, as-built drawings) to confirm satisfactory implementation of the IRM Work Plan
11. Installation of five, 6-inch diameter recovery wells inland of the new bulkhead cutoff wall following site-wide remediation. The wells will be installed to recover residual free product/ NAPL following implementation of the final site remedy.

It is anticipated that the IRM will be completed in advance of the final site remedy. As required, residual contamination not addressed by this IRM Work Plan will be addressed in a forthcoming RAWP. The IRM described herein will be performed in accordance with applicable federal, state, and local regulations. The estimated IRM implementation schedule is provided as Appendix C and the site-specific CHASP is provided as Appendix D. The NYSDEC will be promptly notified of any proposed changes, delays, and/or deviations from the IRM.

2.1 Objectives and Rationale

The objective of the IRM Work Plan is to prevent migration of hydrocarbon free product to the Gowanus Canal by installation of a new sheet pile bulkhead with relieving platform along the eastern and southern site perimeters. The seams will be fully sealed between all sheet pile pairs from tip elevation to top of the sheet. This will include the removal of contaminated historic fill that will be disturbed as part of construction-related earthwork.

The objective of installing the proposed steel sheet pile cutoff wall is to prevent migration of hydrocarbon-impacted media to the Gowanus Canal. Following installation of the sealed-seam sheet pile bulkhead with relieving platform, the area will be backfilled to about el. 6 NAVD88 with a minimum of one foot of soil cover that meets import soil requirements (See Sections 2.5.8 and 2.5.9). Backfilled soil will be placed above a demarcation barrier. These tasks will facilitate future construction and a comprehensive site remediation pursuant to a RAWP.

2.2 Remedial Activity Oversight

The Remediation Engineer (RE), Jason Hayes, P.E. of Langan, will oversee implementation of the IRM. The RE is responsible for documenting that the Contractor performs the work as specified in this IRM Work Plan and for providing required documentation to the NYSDEC as described below in Section 4.0. A field engineer/scientist/geologist, under the supervision of the RE, will provide full-time oversight during implementation of the IRM Work Plan. Work conducted in accordance with this IRM Work Plan will be properly documented in daily field reports, monthly BCP progress reports, and in the final closure report.

2.3 Site Preparation

Site preparation to be completed by the Contractor prior to implementation of the proposed IRM will include, but not be limited to, establishment of work zones, addition of support facilities, construction of decontamination facilities, implementation of erosion control measures, and implementation of site security measures (i.e. erection of security fencing around work zones and staging areas). The Contractor will ensure that all necessary permits are obtained prior to the start of any task described in this IRM Work Plan.

Dig Safely New York (811) will be contacted by the Contractor a minimum of three business days before ground-intrusive work begins. Dig Safely New York will be informed of the nature of the work and the intent to perform excavation of the site subsurface.

The Contractor will ensure that soil erosion and sediment control measures are in place, as necessary, prior to the start of and during work operations comprising this IRM.

2.4 Technical Description of Steel Sheet Pile Cutoff Wall

A new cutoff wall, about 750 feet in total length, will be installed along the eastern and southern side of the property, outboard of the existing relieving-platform bulkhead, within the Gowanus Canal. The new cutoff wall is a sealed-seam sheet pile bulkhead with relieving platform and is designed to stabilize the waterfront and serve as a containment/cutoff wall for coal tar free product. The relieving platform will be installed behind the bulkhead line to relieve the pressure of soil from behind the bulkhead. The top of the platform will be at el 6. The soil below the platform will slope from el 0, at the closure wall, to el -15 at the bulkhead. The closure wall is located approximately 30 feet behind the bulkhead and is designed to prevent soil loss from the site to the area below the relieving platform. The construction of the cutoff wall will consist of the following:

- Installation of a new continuous interlocking steel sheet pile cutoff wall – The steel sheet piles will be driven to about 66 feet bgs through the lower clay layer and into the lower sands. To prevent free product migration through seams, the interlocks between each sheet pile pair will be sealed by (1) welding the interlock between individual sheet piles for the full length of the sheet pile (forming a pair), and (2) by inserting a hydrophilic sealant (Adeka UltraSeal P-201) within the interlock seams from sheet pile tip (el -60) up to the top of the sheet pile.
    - During the 2015 SRI, grossly-impacted soils were observed in boring GB04 in the fill and native silty sand layers (10 to 12 feet bgs [about el -5 to -7], 30 to 32 feet bgs [about el -25 to -27] and 40 to 46 feet bgs [about el -35 to -41]). Coal tar-like impacts were observed in boring GB04 at depths ranging from about 10 to 12 feet bgs and from about 30 to 48 feet bgs (about el -25 to -43). Grossly-impacted soil was also observed in boring MW-3 in the fill and native silty sand layers (6 to 27 feet bgs [about el 0 to -21].
- Installation of a pile-supported platform behind the steel sheet pile cutoff wall – The platform will extend about 30 feet inland from the sheet pile face.
- Installation of a steel sheet pile closure wall directly inland of the platform – The closure sheet piles, about 12 feet long, will be driven to tip el -6.

- Excavation of about 3,000 cubic yards of soil to allow for installation of the relieving platform
- Backfilling to bring the excavated area to grade (about el 5) inland of the bulkhead.

Design plans for the cutoff wall are provided in Appendix E. The approximate excavation extent for this IRM Work Plan is shown on Figures 3, 4 and 5. Excavated historic fill and hydrocarbon-impacted material will be managed, transported, and disposed of as a regulated solid waste. Waste haulers will be 6 NYCRR Part 364-permitted and appropriately placarded per NYS Department of Transportation (NYSDOT) requirements. A cutoff wall design and construction work plan was provided to USEPA for their approval on December 8, 2018, as USEPA has jurisdiction over all construction within the Gowanus Canal. This IRM submission includes a revised cutoff wall design to address NYSDEC requirements along the northeast region of the Gowanus Canal waterfront. The revised drawings will be submitted to USEPA for review and approval.

2.5 Soil Management Plan

This section presents the approach to management, disposal, and reuse of soil, fill, and debris that is disturbed during implementation of the IRM based on the current knowledge of site conditions. A field engineer/scientist/geologist, under the supervision of the RE, will monitor and document handling and transport of historic fill and hydrocarbon-impacted material removed from the site and disposed of in accordance with applicable laws and regulations. The RE will assist the Contractor in identifying hydrocarbon-impacted material versus non-impacted historic fill and native soil during excavation, determining materials suitable for direct load-out versus temporary on-site stockpiling or reuse, and evaluating off-site disposal facilities. Hydrocarbon-contaminated and historic fill will be managed separately to avoid co-mingling.

2.5.1 Preliminary Waste Characterization

Waste characterization samples will be collected from the material generated during implementation of the IRM in accordance with disposal facility requirements, DER-10 Table 5.4(e)10 and Section 5.4. This activity will be coordinated and overseen by the RE. Samples will be collected to be representative of the material requiring disposal at a frequency consistent with disposal facility requirements and to determine if excavated material meets SCOs for potential on-site reuse. Samples may be collected from soil borings, test pits, or stockpiled material.

Laboratory tests for characterization of a waste stream typically include all or a subset of the following list. The actual testing will be determined by the facility's permit requirements.

- Total petroleum hydrocarbons (TPH) by gas chromatograph/ photoionization device (GC/PID);
- Total VOCs, USEPA Method 8260;

- Total SVOCs, USEPA Method 8270;
- Total Polychlorinated Biphenyls (PCB), USEPA Method 8082;
- Total metals, USEPA Method 6010B;
- Paint Filter;
- Resource Conservation and Recovery Act (RCRA) characteristics- Ignitability, corrosivity, and reactivity;
- Toxic Characteristics Leaching Procedure (TCLP) VOCs, SVOCs, metals and pesticides and herbicides; and
- Diesel Range Organics (DRO) and Gasoline Range Organics (GRO).

Waste characterization samples will be submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-approved laboratory for analysis in accordance with the QAPP provided in Appendix B. Analytical reports will be maintained and copies will be available for inspection in the field and will be included in the final report (Section 4.2). Analytical data will be compared to the SCOs listed in 6 NYCRR, Table 375-6.8.

2.5.2 Soil Erosion and Sediment Control Measures

Before starting any waterfront construction, the Contractor will install a turbidity curtain in the Gowanus Canal adjacent to the active work area of the site. An oil adsorbent boom will be installed inside the turbidity curtain. The Contractor will maintain the turbidity curtain and boom for the duration of the project.

Turbidity readings will be taken as described below:

- Readings will be taken prior to the start of any work and prior to the removal of the turbidity curtain.
- Turbidity readings will be taken with a portable turbidity meter meeting the requirements of USEPA 180.1 and the International Organization for Standardization (ISO) 7027. The meter will be capable of measuring turbidity in the range of 50 to 1,000 Nephelometric Turbidity Units (NTU). The unit will be calibrated in accordance with manufacturer's recommendations.
- Readings will be taken every 40 feet along the alignment of the turbidity curtain, both 2 feet inside and 5 feet outside the curtain. At each location, turbidity readings will be taken at depths of 6 and 18 inches below water.
- The turbidity curtain will remain in place until turbidity measurements demonstrate that post-construction conditions meet one of the following criteria:

i. Measurements inside the curtain are less than or equal to the measurements obtained prior to the start of construction; or

ii. Measurements inside the curtain are no more than 10% above measurements outside the curtain.

- The results of all turbidity readings will be recorded (by date, time and location) and included in the site observation reports.
- Following bulkhead completion and removal of the turbidity curtain, a representative sample of the curtain material will be collected. The sample will be collected to coordinate disposal of the spent curtain and will be submitted to a NYSDOH ELAP-approved laboratory for the following analyses:

iii. TCLP VOCs, SVOCs, pesticides, and metals

iv. Target Compound List (TCL) VOCs, SVOCs, Pesticides, Herbicides, PCBs, and Target Analyte List (TAL) metals and cyanide

Prior to on-site demolition or excavation, a silt fence will be installed around the outside of the limits of disturbance (areas of demolition and excavation) as required for erosion and sediment control. The silt fence placement may be modified throughout construction as needed to protect the areas being disturbed. The silt fence will be maintained for the duration of work and relocated as necessary to provide proper erosion protection and to keep soils from migrating off site.

A stabilized construction pad will be installed and maintained by the Contractor, if needed, at the construction entrance to the site. A stabilized construction pad is not needed unless construction-related vehicular traffic over site soil is anticipated.

Prior to the start of construction, and for the duration of construction, oil adsorbent booms will be used along the limits of the work zone to contain releases during bulkhead construction work. The oil adsorbent boom must remain in place until construction in the canal is completed and oil sheens have been removed from the surface of the water.

Soil erosion and sediment control measures will be inspected weekly and after major storm events by a Langan field engineer to confirm permit conditions are met (i.e. turbidity curtain is in place). The Contractor shall immediately correct any deficiencies noted by the inspector.

2.5.3 Soil Excavation

Historic fill within the proposed IRM Area is impacted with VOCs, SVOCs and metals above UU, RURR, and/ or RUC SCOs. Excavation will be conducted using conventional hydraulic excavation equipment. Specific excavation support requirements will be determined by the Construction Manager and Remediation Contractor. The Remediation Contractor is responsible for protection and support of excavation, and adjacent structures as required to complete this work in

accordance with New York City Building Code and other applicable regulations and guidance. Hot spots, if identified, will be located via survey by the Remediation Contractor. The survey and information pertaining to the final remedy will be shown on maps and be reported in the closure report.

About 3,000 cubic yards of non-hazardous contaminated soil/ fill is estimated to be excavated from within the steel sheet pile cutoff wall excavation area (about 40 to 50 feet in width). Soil/ fill that is not reused will be disposed of at an off-site permitted disposal facility capable of receiving this type of solid waste and transported by 6 NYCRR Part 364-permitted waste haulers. The approximate horizontal extents of excavation associated with the IRM are shown on Figures 3, 4 and 5.

If present, USTs will be exposed, the contents removed, rendered inert and cleaned, and the UST disposed of as metal scraps, in accordance with Section 5.5 of DER-10. The decommissioned UST registration will be updated with the NYSDEC Petroleum Bulk Storage (PBS) unit. NYSDEC will be notified at least 10 days in advance of any UST decommissioning associated with known tanks within the site. If previously unidentified USTs are encountered during implementation of the IRM Work Plan, NYSDEC will be notified prior to UST decommissioning.

2.5.4 Soil Screening Methods

During IRM excavation, visual, olfactory, and instrumental soil screening will be performed by a field engineer/scientist/geologist under the supervision of the RE. Instrumental screening will be performed using a PID equipped with a 10.6 electron Volt (eV) bulb that will be calibrated daily. Visibly impacted material will be segregated and placed on polyethylene sheeting pending off-site disposal.

2.5.5 Soil Stockpiles

Soil stockpile areas will be constructed for staging of non-hazardous soil and hydrocarbon-impacted soil that is not directly loaded into trucks for off-site disposal, in accordance with applicable federal and state laws and regulations, including regulations governing hazardous and solid waste. Separate stockpile areas will be constructed to avoid co-mingling materials of different soil types. All stockpile areas will meet the following minimum requirements:

- Excavated soil will be placed onto a minimum 8-mil low-permeability liner of sufficient strength and thickness to prevent puncture during use. Different material types will be segregated in separate stockpile areas;
- Equipment and procedures will be used to place and remove the soil that will minimize the potential to jeopardize the integrity of the liner;

- Stockpiles will be covered upon reaching capacity or, if active, at the end of each workday with minimum 8-mil plastic sheeting or tarps that will be securely anchored to the ground;
- Each stockpile area will be encircled with silt fences and hay bales, as needed, to contain and filter particulates from any rainwater that has drained off the soils and to mitigate the potential for surface water run-on;
- Stockpiles will be inspected at a minimum once each week and after every storm event and any deficiencies will be promptly addressed. Any damaged tarps or coverings will be promptly replaced; and
- Results of inspections will be recorded in a logbook to be maintained at the site and made available for inspection by NYSDEC upon request.

2.5.6 Material Load Out and Transport

Contaminated soil/fill excavated during implementation of the IRM Work Plan will be handled, transported, and disposed of by a licensed hauler in accordance with applicable 6 NYCRR Part 360 and Part 364 regulations and other applicable federal, state, and local regulations. The Remediation Contractor will provide appropriate permits, certifications, and written commitments from facilities to accept the material throughout the duration of the project. Waste manifests will be used to track the material that is transported off site. Haulers will be appropriately licensed and trucks will be properly placarded.

A field engineer/scientist/geologist, under the supervision of the RE, will oversee the load-out of excavated material. Once the loading of a container, dump truck, or trailer has been completed, the material will be transported to the NYSDEC-approved, off-site facility permitted to accept the material. Loaded vehicles leaving the site will be appropriately lined, securely covered, and manifested in accordance with applicable federal, state, local, and NYSDOT requirements and other applicable transportation requirements. Truck liners will be used for loads containing wet material capable of producing free liquid. A truck wash/cleaning area will be operated on-site. A field engineer/ scientist/geologist, under the supervision of the RE, will be responsible for documenting that outbound trucks are cleaned at the truck wash/cleaning area, as necessary, before leaving the site and IRM Area throughout the duration of the IRM. Locations where vehicles enter or exit the site will be inspected daily for evidence of off-site soil tracking. Proposed in-bound and out-bound truck routes to the site are shown on Figure 7.

2.5.7 Material Off-Site Disposal

The RE will review submittals for proposed disposal facilities before any materials leave the site to verify that the facility has the proper permits and to review their acceptance requirements. Waste characterization will be performed for material to be disposed of off-site in accordance with receiving facility requirements and in conformance with applicable permits. Sampling and

analytical methods, sampling frequency, analytical results and quality assurance/quality control (QA/QC) methods will be reported in the closure report. Waste characterization data available for soil/material to be disposed of at a given facility will be submitted to the disposal facility with suitable explanation prior to shipment and receipt. A letter from the disposal facility stating it is in receipt of the correspondence and is approved to accept the material shall be provided before any material is transported.

The waste removal contractor will provide the appropriate permits, certifications, and written commitments from disposal facilities to accept the material throughout the duration of the project. Contaminated material will be transported by a waste removal contactor who possesses a valid New York State Part 364 Waste Transporter Permit. Waste manifests will be used to track the material that is transported off-site. Haulers will be appropriately licensed and trucks will be properly placarded.

2.5.8 Material Reuse On-Site

Soil excavated during excavation activities associated with the proposed IRM may be reused if the requirements in this section are met. Stained, odorous or grossly-impacted soil will not be reused. Reused soil placed beneath the composite cover must meet the lower of Commercial SCOs or protection of groundwater SCOs for compounds identified above TOGS AWQS SGVs criteria in groundwater. Soil removed during implementation of the remedy or other purposes will not be reused within a cover soil layer or within landscaped areas. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site is prohibited for reuse on-site. Reuse of soil will be coordinated in advance with the NYSDEC case manager and will follow guidelines described in DER-10 Section 5.4(e) and 6 NYCRR Part 360.13.

2.5.9 Material Import to the Site

Imported material may be needed to backfill excavations to proposed grades following installation of the new bulkhead cutoff wall. If needed, backfill from off-site sources will consist of clean fill (as described in the following paragraph) or other applicable material such as virgin stone from a quarry or RCA with a site-specific Beneficial Use Determination (BUD) if required by NYSDEC.

Imported soil (i.e., clean fill) will meet the more restrictive of NYCRR Part 360 regulations and RUC SCOs. 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 onto 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 and for the constituents identified in DER-10 Table 5.4(e)10. The samples will be analyzed for VOCs, SVOCs, pesticides, PCBs, and metals by an NYSDOH ELAP-certified laboratory. Upon meeting these criteria and completion of NYSDEC

Request to Import/Reuse Fill or Soil documents, the clean fill will be transported to the site and segregated from impacted material on plastic sheeting until the clean fill is used as backfill.

If RCA is imported to the site, it will be from a NYSDEC-registered facility that has a valid 6 NYCRR Part 360 registration or permit for the period of acquisition of RCA. RCA imported to the site will be derived from recognizable and uncontaminated concrete. RCA and virgin stone imported from compliant facilities containing less than 10% by weight passing a No. 80 sieve will not require chemical testing, unless required by NYSDEC under the terms for operation of the facility. RCA import will be under a site-specific BUD, if required by NYSDEC.

Prior to material import, the RE will review documentation from each import facility, including the facility name, address, permit/registration, and site history, if necessary, in accordance with DER-10. Proposed import material will be approved by both the RE and the NYSDEC. Upon arrival, import material will be screened for evidence of contamination (visual, olfactory, and instrumental).

2.5.10 Waste Liquid Management

During previous environmental and geotechnical investigations, groundwater was observed at depths ranging from about 2.25 to 4 feet bgs. As needed, 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. Discharge of liquids into the New York City sewer system will be addressed through an approved NYCDEP permit and conform to pre-treatment stipulations of that permit. Dewatering fluids not suitable for discharge to the NYCDEP sewer system may be collected, characterized, and managed off-site.

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

2.5.11 Equipment Decontamination

Excavation equipment and trucks that come in contact with hydrocarbon-contaminated material will be decontaminated prior to removal from the site. The decontamination area will be constructed by the contractor to collect decontamination wastewater for off-site disposal or treatment and discharge. The design will consider adequate space to decontaminate site equipment and vehicles, and sloping and liners to facilitate collection of wastewater. In general, each decontamination pad will be constructed in an area about 12 feet wide by no less than 50 feet in length and a minimum of 6 inches deep with a 2% slope to one end of the pad. All surface water flowing or diverted toward the construction entrance will be piped beneath the entrance. If piping is impractical, the Contractor will establish berms with 5:1 slopes along the perimeter of the pad. A layer of non-woven geotextile fabric, a 30-mil polyethylene liner and another layer of

non-woven geotextile fabric will cover the base of the pad, extend past the ends and cover the berms (as necessary). Clean stone (1-4 inches in diameter) or RCA will be placed above the non-woven geotextile fabric. The Contractor will install a collection sump at the deeper end of the pad with a submersible pump to transfer decontamination fluids to on-site holding tanks. Collected decontamination wastewater shall be either discharged in accordance with the contractor's 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 decontamination area throughout the duration of hydrocarbon-contaminated and/or coal tar-contaminated soil excavation.

A stabilized area will be constructed to prevent decontaminated trucks from being re-contaminated prior to exiting. Areas not covered by the concrete slab will be covered with gravel and graded so that runoff water will be directed on site.

2.6 Documentation Soil Sampling

Where hydrocarbon-impacted material is identified and excavated for construction of the bulkhead cutoff, documentation soil samples will be collected in accordance with DER-10 guidance. Depending on the type of support of excavation system used, sidewall soil samples may not be collected because of inability to access sidewall soil.

Documentation soil samples, plus QA/QC samples, would be analyzed for Part 375 and TCL/TAL list of VOCs, SVOCs, PCBs, pesticides, and metals (including hexavalent and trivalent chromium and cyanide).

2.7 Recovery Well Installation

Following implementation of the final site remedy, five recovery wells inland of the new bulkhead cutoff wall will be installed to recover residual free product/ NAPL. The recovery wells will be placed in the northeast portion of the site to increase the likelihood of intercepting the NAPL plume identified between former boring/ monitoring well locations GB04/OW01 and SB-13. The recovery wells will be constructed with a 6-inch diameter stainless steel riser pipe with 10 to 15 feet of wire wrapped, 30-slot stainless steel screen and a solid 5-foot sump at the bottom of the well to facilitate the collection of NAPL. The recovery well screens will not cross confining layers, and will be placed at depth intervals exhibiting gross contamination. Recovery well sumps will be installed above or within the confining layer. Based on previous remedial investigations and a review of relevant boring logs along the eastern extent of the NAPL plume, a summary of the proposed recovery well construction is provided below:

- MW01 will be constructed using a 6-inch diameter stainless steel riser pipe with 15 feet of wire wrapped, 30-slot stainless steel screen, installed between 30 and 45 feet bgs (between about el. -25 and -40). A solid 5-foot sump will be installed between 45 and 50

feet bgs (between about el. -40 and -45) to facilitate the collection of NAPL. Based on a review of boring logs completed in the vicinity during previous remedial investigations, the sump will be located above a confining layer.

- MW02 will be constructed using a 6-inch diameter stainless steel riser pipe with 10 feet of wire wrapped, 30-slot stainless steel screen, installed between 5 and 15 feet bgs (between about el. 0 and -10). A solid 5-foot sump will be installed between 15 and 20 feet bgs (between about el. -10 and -15) to facilitate the collection of NAPL. Based on a review of boring logs completed in the vicinity during previous remedial investigations, the sump will be located above a confining layer.
- MW03 will be constructed using a 6-inch diameter stainless steel riser pipe with 15 feet of wire wrapped, 30-slot stainless steel screen, installed between 1 and 16 feet bgs (between about el. 4.9 and -10.1). A solid 5-foot sump will be installed between 16 and 21 feet bgs (between about el. -10.1 and -15.1) to facilitate the collection of NAPL. Based on a review of boring logs completed in the vicinity during previous remedial investigations, the sump will be located within a confining layer.
- MW04 and MW05 will be constructed using a 6-inch diameter stainless steel riser pipe with 15 feet of wire wrapped, 30-slot stainless steel screen, installed between 3 and 18 feet bgs (between about el. 3.3 and -11.7). A solid 5-foot sump will be installed between 18 and 23 feet bgs (between about el. -11.7 and -16.7) to facilitate the collection of NAPL. Based on a review of boring logs completed in the vicinity during previous remedial investigations, the sump will be located within a confining layer.

A Langan representative will be present full-time during recovery well installation to document the subsurface stratigraphy and to screen soil using a hand-held PID. The proposed recovery well construction details summarized above are subject to change based on real-time subsurface data (i.e. depth of gross impacts/ NAPL, presence and depth of confining layers) obtained during drilling activities.

To minimize the potential for drag-down of observed contamination to beneath the impermeable layer, recovery wells will be installed as double-cased wells using a sonic drill rig, or equivalent. An outer casing will be advanced and set within the top foot of the impermeable layer, and the inner casing will be advanced through the outer casing to the targeted depth. The annular space between the outer casing and borehole wall will be filled with clean, rounded quartz (i.e. #3 Morie or approved equivalent) and then sealed with hydrated bentonite pellets. The recovery wells will be finished with flush-mount metal manhole covers encased in concrete.

Following installation, each recovery well will be surged and developed with a submersible pump until the water becomes clear (having turbidity less than 50 Nephelometric Turbidity Units [NTU]).

Purged groundwater will be stored in labeled 55-gallon drums and staged on-site for future disposal to a permitted facility. The proposed recovery well locations are shown on Figure 6.

2.8 Dust, Odor, Vapor, and Nuisance Control Plan

This dust, odor, organic vapor, and nuisance control plan was developed in accordance with the NYSDOH Generic CAMP and Occupational Safety and Health Administration (OSHA) standards for construction (29 Code of Federal Regulations [CFR] 1926). IRM activities will be monitored for dust, odors, and VOCs by a field engineer/scientist/ geologist, under the supervision of the RE. Continuous monitoring at the perimeter of the work zones for odor, total VOCs, and dust will be required during ground-intrusive work such as soil excavation and handling. The work zone is defined as the general area in which machinery is operating in support of remediation. A portable PID will be used to monitor the work zone during hot spot excavation. The site perimeter will be monitored for fugitive dust emissions by visual observations and instrumental measurement. The CAMP will include real-time monitoring for total VOCs and particulates (i.e., dust) at the downwind perimeter of the site for protection of the off-site community (off-site receptors may include residences, businesses, and/or off-site workers). Particulate levels will be monitored continuously with real-time field instruments that will meet, at a minimum, the performance standards outlined in NYSDEC DER-10 Appendix 1B. Action levels for site worker respiratory use are set forth in the CHASP (Appendix D). Action levels for the protection of the community and visitors are detailed below.

Work practices to minimize odors and organic vapors include limiting the time that excavations remain open, wetting exposed soil, minimizing stockpiling of impacted soil, and/or minimizing the handling of impacted soil. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the source areas. Foam suppressants may include biodegradable foams that are applied over the source material for short-term control of the odor.

Total VOCs will be monitored with a handheld PID in accordance with the site-specific CHASP and CAMP. If the action level is exceeded and adequate ventilation cannot be provided, work will cease and the potential affected portion of the work area will be evacuated until adequate mechanical ventilation can be implemented to control the hazard. The following actions will be taken based on total VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the hot zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued.

After these steps, work will resume provided that the total VOC level 200 feet downwind of the hot 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 total VOC level is above 25 ppm at the perimeter of the hot zone, excavation will be shut down.

The following actions will be taken based on visual observations and measured dust levels using a quantitative meter following minimum performance standards in accordance with NYSDEC DER-10 Appendix 1B:

- If the downwind particulate level is 100 microgram per cubic meter (µg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind particulate levels do not exceed 150 µg/m^3 above the background level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind particulate levels are greater than 150 µg/m^3 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 particulate concentration to within 150 µg/m^3 of the upwind level and in preventing visible dust migration.

If nuisance odors or vapors exceeding action levels set forth in this IRM Work Plan are identified off-site, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors or vapors have been abated. NYSDEC and NYSDOH will be notified of all odor and vapor events and of all other complaints about the project. Implementation of odor and vapor controls, including halting work, will be the responsibility of the Contractor under the oversight of the RE who is responsible for certifying the closure report.

2.9 Construction Health and Safety Plan (CHASP)

The RE prepared a site-specific CHASP for this IRM Work Plan, which is provided in Appendix D. The CHASP provides a mechanism for establishing on-site safe working conditions, safety organization, procedures, and personal protective equipment 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, respectively). The CHASP includes, but is not limited to, the following components listed below:

- Organization and identification of key personnel

- Training requirements
- Medical surveillance requirements
- List of site hazards
- Excavation safety
- Work zone descriptions and monitoring procedures
- Personal safety equipment and protective clothing requirements
- Decontamination requirements
- Standard operating procedures
- Contingency plan
- Safety data sheets

2.10 Quality Assurance Project Plan

The RE prepared a QAPP, which includes proposed sampling procedures and analytical methods in the event that sample collection is required during implementation of the IRM. The QAPP is provided in Appendix B.

3.0 SCHEDULE

Mobilization for interim remedial measures is expected to take about 2 weeks. After mobilizing, remedial activities and construction will begin immediately, and is expected to take 4 to 6 months to complete. An interim remedial measure construction schedule is included in Appendix C. Following completion of the IRM, the remainder of the site will be remediated at a later time pursuant to an NYSDEC-approved RAWP.

3.1 Notification

The NYSDEC will be notified prior to commencement of work related to the IRM. A pre-construction meeting will be coordinated between the RE, the Remediation Contractor, and the NYSDEC. This meeting must take place prior to the implementation of this IRM Work Plan.

4.0 REPORTING

Upon completion of the IRM, construction documentation will be collected and compiled in a final report. Based on the anticipated construction schedule, we anticipate that work will continue from IRM implementation directly into RAWP implementation. As such, we anticipate that the IRM activities will be documented in the Final Engineering Report (FER). If there is a significant break between the IRM implementation and RAWP implementation, a Construction Completion Report (CCR) will be prepared and submitted to the NYSDEC. The RE responsible for certifying all reports 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 project reports will be submitted to the NYSDEC electronically as PDFs. Laboratory analytical data for documentation samples will be submitted in an electronic data deliverable (EDD) format that complies with the NYSDEC's electronic data warehouse standards.

4.1 Daily Reports

Daily reports will be prepared for the project file and for review by the NYSDEC Project Manager. The daily reports will include:

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

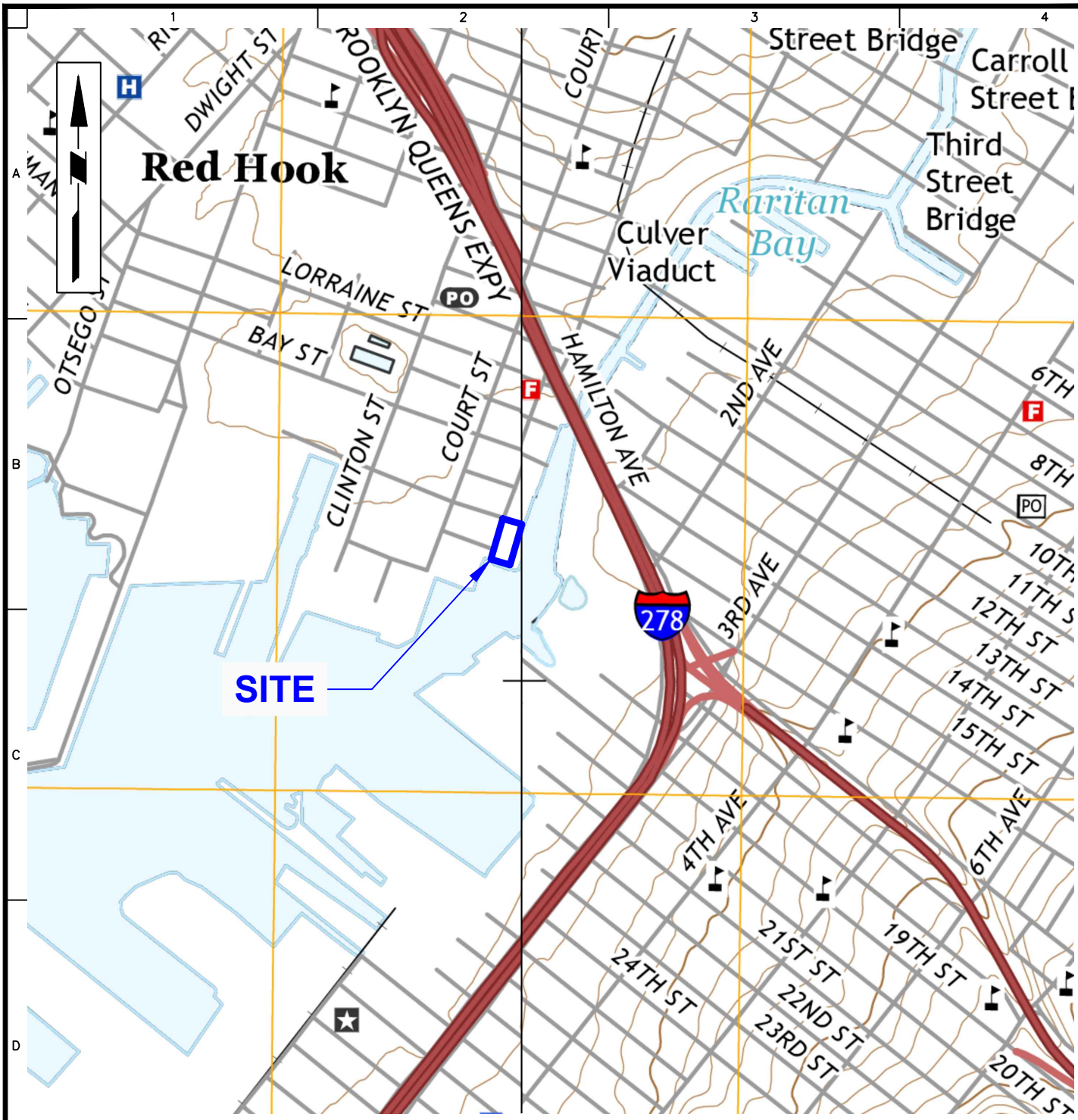
Daily reports are not intended to be the mode of communication for notifying the NYSDEC of emergencies (e.g., accidents, spills, etc.), requests for changes to this IRM Work Plan, and/or other sensitive or time critical information; however, such conditions will also be included in the daily reports. Emergency conditions, changes, and/or any deviations to this IRM Work Plan will be addressed directly to the NYSDEC Project Manager via telephone or email. If site conditions warrant, the RE may request to change from daily to weekly reports that include the above information.

4.2 Final Engineering Report/ Construction Completion Report

A CCR and/or FER will be submitted to the NYSDEC Project Managers following completion of the site remediation. The CCR and/or FER will document the implementation of the remedial action undertaken as an IRM. The CCR and/or FER will provide the following information:

1. The RE will certify that:
    i. Data generated was useable and met the remedial requirements;
    ii. The remedial work conformed to the IRM Work Plan;
    iii. Dust, odor, and vapor control measures were implemented during invasive work and conformed with the IRM Work Plan;
    iv. Remediation waste was transported and disposed in accordance with the IRM Work Plan; and
    v. Source approval and sampling of imported acceptable fill was completed in a manner consistent with the methodology of the IRM Work Plan;
2. Description of problems encountered and their resolutions;
3. Description of changes in the IRM from the elements provided in the IRM Work Plan and associated design documents and the reasons for them;
4. Description of the deviations from the approved IRM Work Plan;
5. "As-built" drawings including remediation areas and the bulkhead cutoff wall;
6. Listing of waste streams, quantity of materials disposed, and where they were disposed;
7. List of the remediation standards applied to the remedial actions;
8. Description of source and quality of fill;
9. A summary of all residual impacted material left on the site;
10. A tabular summary of all sampling results and all material characterization results and other sampling and chemical analysis performed as part of the IRM;
11. Written and photographic documentation of all remedial work performed under this remedy;
12. Copies of all the submitted progress reports;
13. Certifications, manifests, and bills of lading for excavated materials transported off-site;
14. An accounting of the destination of all material removed from the site, including excavated impacted soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids; and
15. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the site.

FIGURES



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SCALE IN FEET

NOTES:
1. BASEMAP REFERENCED FROM UNITED STATED GEOLOGICAL SURVEY 7.5-MINUTE SERIES JERSEY CITY AND BROOKLYN QUADRANGLES, DATED NOVEMBER 2016.
2. SITE BOUNDARY IS APPROXIMATE.

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Project
627-661 SMITH STREET
BLOCK No. 493, LOT No. 1
BLOCK No. 495, LOT No. 1
KINGS COUNTY NEW YORK

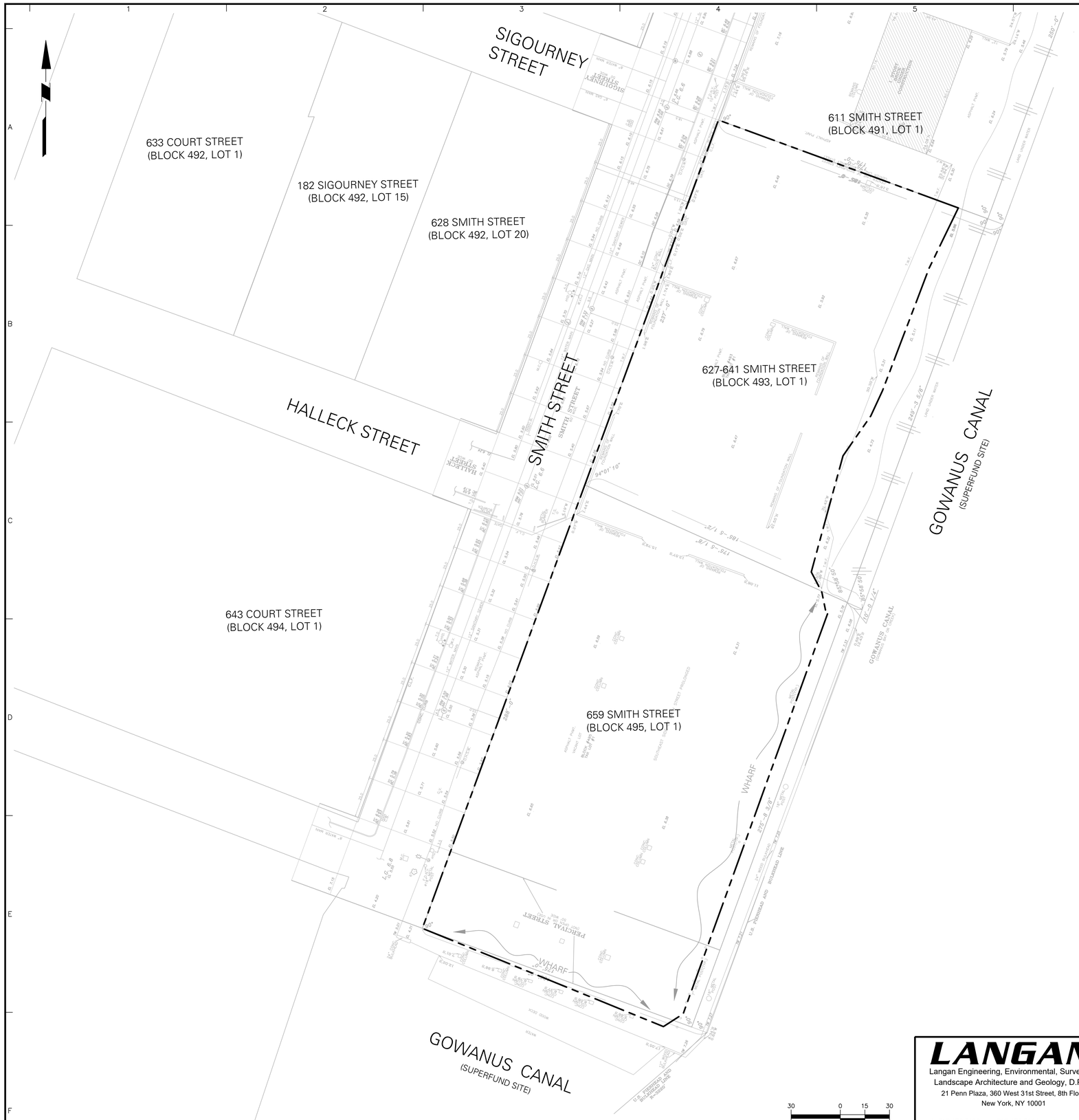
Figure Title
SITE LOCATION PLAN

Project No.	170063001
Date	10/22/2018
Drawn By	NEK
Checked By	ELS

Figure No. 1

Sheet 1 of 7

Filename: \\Langan.com\data\NYC\data0\170063001\Cadd Data - 170063001\Dwg\2018 - IRMWP\Figure 1 - Site Location Map.dwg Date: 12/11/2018 Time: 18:21 User: nkung Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

APPROXIMATE SITE BOUNDARY

NOTES:

1. BASEMAP IS MAPPLUTO, COPYRIGHTED BY THE NEW YORK CITY DEPARTMENT OF CITY PLANNING.
2. BASEMAP IS OVERLAID BY TOPOGRAPHIC SURVEY, PREPARED BY PRECISION SURVEYS, DATED MARCH 13, 2018, REVISED APRIL 6, 2018.
3. ELEVATIONS REFERENCE THE UNITED STATES GEOLOGICAL SURVEY (USGS) NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

LANGAN

PROJECT NO. 170063001

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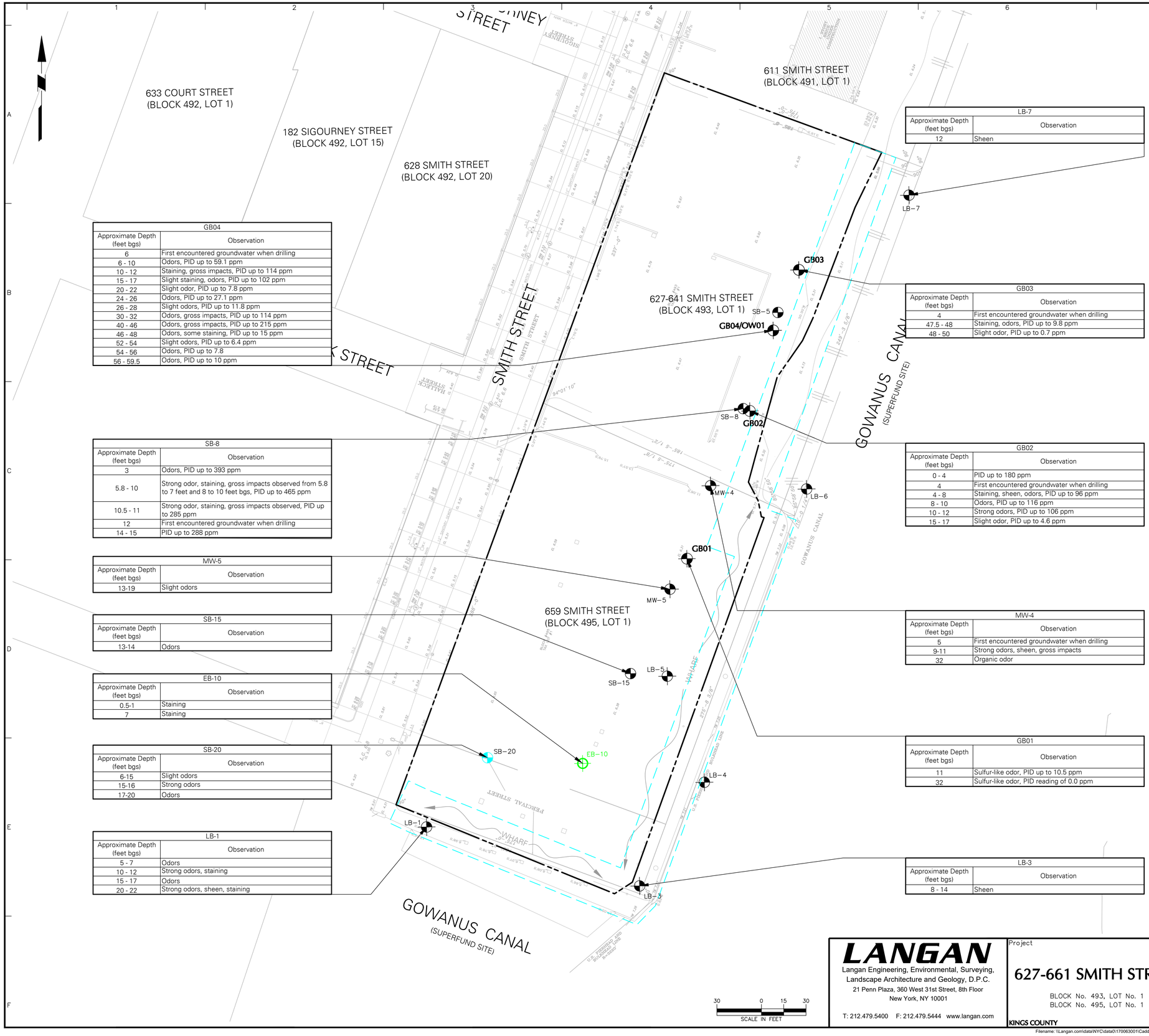
Project	627-661 SMITH STREET BLOCK No. 493, LOT No. 1 BLOCK No. 495, LOT No. 1 KINGS COUNTY NEW YORK
Figure Title	SITE PLAN
Project No.	170063001
Date	10/24/2018
Drawn By	NEK
Checked By	ELS
Figure No.	2
	Sheet 2 of 7

Filename: \\Langan.com\data\NYC\data01\170063001\Cadd Data - 170063001\Dwg\2018 - IRM\WP\Figure 2 - Site Plan_1.3.2018.dwg Date: 1/8/2020 Time: 13:56 User: nkung Style Table: Langan.stb Layout: FIGURE 2



GB04	
Approximate Depth (feet bgs)	Observation
6	First encountered groundwater when drilling
6 - 10	Odors, PID up to 59.1 ppm
10 - 12	Staining, gross impacts, PID up to 114 ppm
15 - 17	Slight staining, odors, PID up to 102 ppm
20 - 22	Slight odor, PID up to 7.8 ppm
24 - 26	Odors, PID up to 27.1 ppm
26 - 28	Slight odors, PID up to 11.8 ppm
30 - 32	Odors, gross impacts, PID up to 114 ppm
40 - 46	Odors, gross impacts, PID up to 215 ppm
46 - 48	Odors, some staining, PID up to 15 ppm
52 - 54	Slight odors, PID up to 6.4 ppm
54 - 56	Odors, PID up to 7.8
56 - 59.5	Odors, PID up to 10 ppm

SB-8	
Approximate Depth (feet bgs)	Observation
3	Odors, PID up to 393 ppm
5.8 - 10	Strong odor, staining, gross impacts observed from 5.8 to 7 feet and 8 to 10 feet bgs, PID up to 465 ppm
10.5 - 11	Strong odor, staining, gross impacts observed, PID up to 285 ppm
12	First encountered groundwater when drilling
14 - 15	PID up to 288 ppm

MW-5	
Approximate Depth (feet bgs)	Observation
13-19	Slight odors

SB-15	
Approximate Depth (feet bgs)	Observation
13-14	Odors

EB-10	
Approximate Depth (feet bgs)	Observation
0.5-1	Staining
7	Staining

SB-20	
Approximate Depth (feet bgs)	Observation
6-15	Slight odors
15-16	Strong odors
17-20	Odors

LB-1	
Approximate Depth (feet bgs)	Observation
5 - 7	Odors
10 - 12	Strong odors, staining
15 - 17	Odors
20 - 22	Strong odors, sheen, staining

LB-7	
Approximate Depth (feet bgs)	Observation
12	Sheen

GB03	
Approximate Depth (feet bgs)	Observation
4	First encountered groundwater when drilling
47.5 - 48	Staining, odors, PID up to 9.8 ppm
48 - 50	Slight odor, PID up to 0.7 ppm

GB02	
Approximate Depth (feet bgs)	Observation
0 - 4	PID up to 180 ppm
4	First encountered groundwater when drilling
4 - 8	Staining, sheen, odors, PID up to 96 ppm
8 - 10	Odors, PID up to 116 ppm
10 - 12	Strong odors, PID up to 106 ppm
15 - 17	Slight odor, PID up to 4.6 ppm

MW-4	
Approximate Depth (feet bgs)	Observation
5	First encountered groundwater when drilling
9-11	Strong odors, sheen, gross impacts
32	Organic odor

GB01	
Approximate Depth (feet bgs)	Observation
11	Sulfur-like odor, PID up to 10.5 ppm
32	Sulfur-like odor, PID reading of 0.0 ppm

LB-3	
Approximate Depth (feet bgs)	Observation
8 - 14	Sheen

LEGEND:

- APPROXIMATE SITE BOUNDARY
- GB01 — APPROXIMATE LOCATION OF GEOTECHNICAL BORING FROM AUGUST 2015 SUPPLEMENTAL REMEDIAL INVESTIGATION (SRI). RED COLOR DENOTES THAT GROSSLY- CONTAMINATED MATERIAL WAS OBSERVED
- GB04/OW01 — APPROXIMATE LOCATION OF MONITORING WELL INSTALLED 8/14/2015, AND SAMPLED 8/26/2015.
- MW–# — APPROXIMATE LOCATION OF MONITORING WELLS INSTALLED DURING THE JUNE-AUGUST 2010 REMEDIAL INVESTIGATION
- SB–# — APPROXIMATE LOCATION OF SOIL BORINGS INSTALLED DURING THE JUNE-AUGUST 2010 REMEDIAL INVESTIGATION.
- SB–# — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING THE JANUARY 2012 SUPPLEMENTAL REMEDIAL INVESTIGATION
- EB–# — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING THE FEBRUARY 2014 SUPPLEMENTAL REMEDIAL INVESTIGATION
- LB–7 — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING 2018 WATERFRONT INVESTIGATION
- APPROXIMATE INTERIM REMEDIAL MEASURES WORK AREA

NOTES:

1. "GROSSLY-CONTAMINATED MATERIAL" REFERS TO SOIL, SEDIMENT, SURFACE WATER OR GROUNDWATER WHICH CONTAINS SOURCES OR SUBSTANTIAL QUANTITIES OF MOBILE CONTAMINATION IN THE FORM OF NAPL THAT IS IDENTIFIABLE EITHER VISUALLY, THROUGH STRONG ODOR, BY ELEVATED CONTAMINANT VAPOR LEVELS OR IS OTHERWISE READILY DETECTABLE WITHOUT LABORATORY ANALYSIS. THIS DEFINITION IS PER THE NYSDEC 6 NYCRR PART 375-1.2 (u).
2. BASEMAP IS MAPPLUTO, COPYRIGHTED BY THE NEW YORK CITY DEPARTMENT OF CITY PLANNING.
3. BASEMAP IS OVERLAID BY TOPOGRAPHIC SURVEY, PREPARED BY PRECISION SURVEYS, DATED MARCH 13, 2018, REVISED APRIL 6, 2018.
4. ELEVATIONS REFERENCE THE UNITED STATES GEOLOGICAL SURVEY (USGS) NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. CRAIG GETOTECHNICAL DRILLING CO. INC. (CRAIG) COMPLETED THE INSTALLATION OF SOIL BORINGS GB01, GB02, GB03, AND GB04 AND MONITORING WELL GB/OW-04 BETWEEN AUGUST 13 AND 24, 2015 UNDER FULL-TIME LANGAN OVERSIGHT.
6. AQUIFER DRILLING AND TESTING (ADT) COMPLETED THE INSTALLATION OF SOIL BORING SB-8 IN JUNE 3, 2010 UNDER FULL-TIME LANGAN OVERSIGHT.
7. ENVIRONMENTAL PROTECTION AGENCY (EPA) SUBCONTRACTOR BOART LONGYEAR INSTALLED MONITORING WELL LOCATION MW-4 ON JUNE 16, 2010.
8. ft bgs = FEET BELOW GRADE SURFACE
9. PID = PHOTOIONIZATION DETECTOR READINGS
10. ppm = PARTS PER MILLION
11. NAPL = NON-AQUEOUS PHASE LIQUID. PER THE NYSDEC 6 NYCRR Part 375-1.2 (ac), NAPL: IS DEFINED AS A CONTAMINANT THAT IS A LIQUID WHICH MAY BE DENSER OR LIGHTER THAN WATER AND DOES NOT MIX EASILY OR DISSOLVE IN WATER, BUT REMAINS AS A SEPARATE PHASE.
12. CONTAMINATED MATERIAL WAS OBSERVED DURING INSTALLATION OF GEOTECHNICAL BORING GB-04 (BETWEEN APPROX. 6 AND 48 FEET BGS.), IMPACTED SOIL SAMPLES WERE COLLECTED AND ANALYZED, GROUNDWATER MONITORING WELL GB04/OW01 WAS INSTALLED ON 8/14/2015, AND GROUNDWATER SAMPLES WERE COLLECTED AND ANALYZED ON 8/26/2015.

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Project
627-661 SMITH STREET
BLOCK No. 493, LOT No. 1
BLOCK No. 495, LOT No. 1
KINGS COUNTY NEW YORK

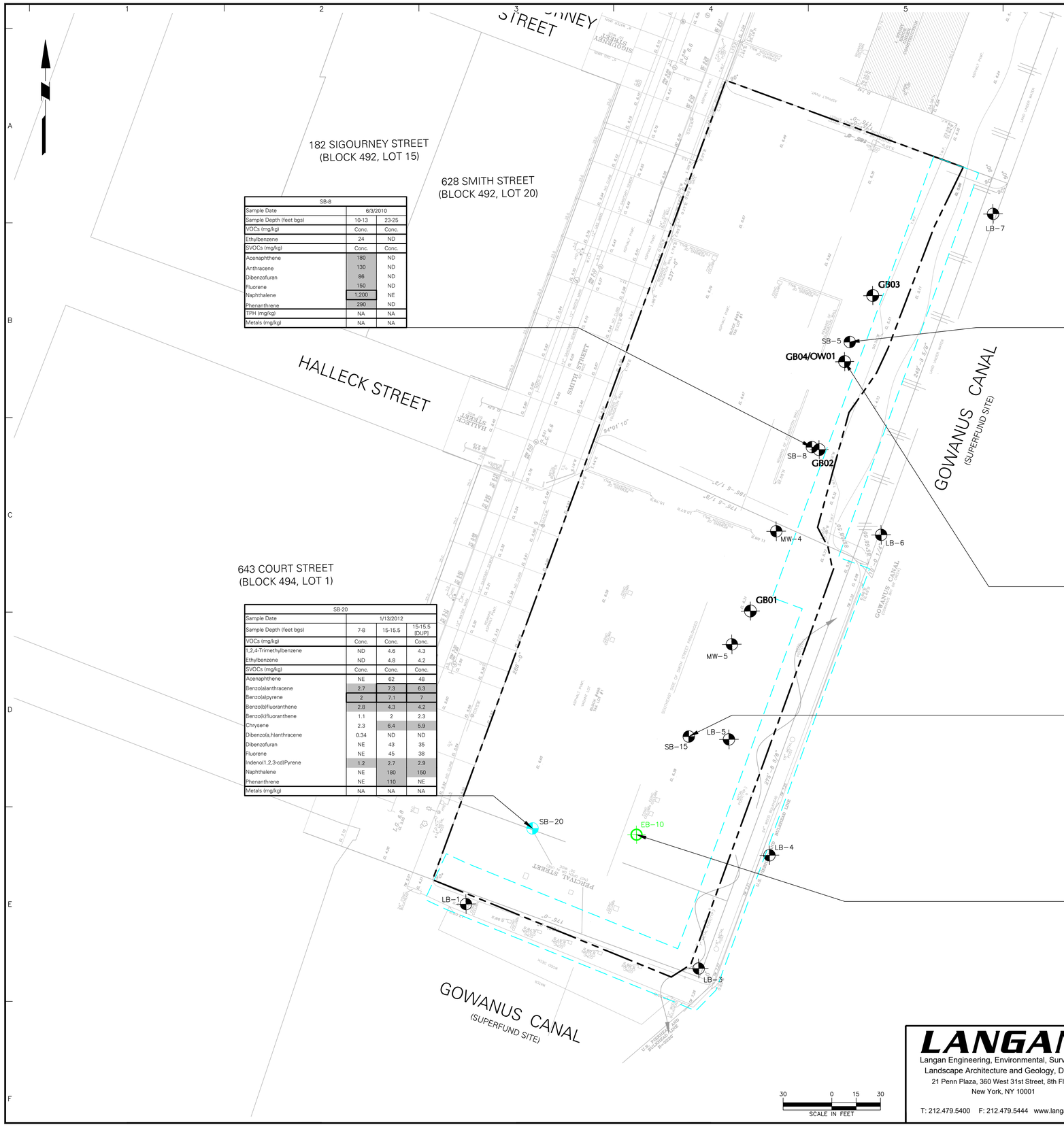
Figure Title
SAMPLE LOCATION PLAN AND FIELD OBSERVATIONS

Project No.	170063001
Date	09/06/2019
Drawn By	NEK
Checked By	ELS

Figure No. 3

Sheet 3 of 7

PROJECT NO. 170063001



SB-8		
Sample Date	6/3/2010	
Sample Depth (feet bgs)	10-13	23-25
VOCs (mg/kg)	Conc.	Conc.
Ethylbenzene	24	ND
SVOCs (mg/kg)	Conc.	Conc.
Acenaphthene	180	ND
Anthracene	130	ND
Dibenzofuran	86	ND
Fluorene	150	ND
Naphthalene	1,200	NE
Phenanthrene	290	ND
TPH (mg/kg)	NA	NA
Metals (mg/kg)	NA	NA

SB-20			
Sample Date	1/13/2012		
Sample Depth (feet bgs)	7-8	15-15.5	15-15.5 [DUP]
VOCs (mg/kg)	Conc.	Conc.	Conc.
1,2,4-Trimethylbenzene	ND	4.6	4.3
Ethylbenzene	ND	4.8	4.2
SVOCs (mg/kg)	Conc.	Conc.	Conc.
Acenaphthene	NE	62	48
Benzo(a)anthracene	2.7	7.3	6.3
Benzo(a)pyrene	2	7.1	7
Benzo(b)fluoranthene	2.8	4.3	4.2
Benzo(k)fluoranthene	1.1	2	2.3
Chrysene	2.3	6.4	5.9
Dibenzo(a,h)anthracene	0.34	ND	ND
Dibenzofuran	NE	43	35
Fluorene	NE	45	38
Indeno(1,2,3-cd)Pyrene	1.2	2.7	2.9
Naphthalene	NE	180	150
Phenanthrene	NE	110	NE
Metals (mg/kg)	NA	NA	NA

SB-5		
Sample Date	6/3/2010	
Sample Depth (feet bgs)	0-5	8-10
VOCs (mg/kg)	ND	ND
SVOCs (mg/kg)	Conc.	Conc.
Benzo(a)anthracene	2.4	7.9
Benzo(a)pyrene	2.7	6.2
Benzo(b)fluoranthene	2.6	9
Benzo(k)fluoranthene	ND	3.8
Chrysene	2.3	6.9
Dibenzo(a,h)anthracene	ND	1.1
Indeno(1,2,3-cd)Pyrene	ND	3.8
TPH (mg/kg)	NA	NA
Metals (mg/kg)	NA	NA

GB04	
Sample Date	6/3/2010
Sample Depth (feet bgs)	44-46
VOCs (mg/kg)	NE
SVOCs (mg/kg)	Conc.
Acenaphthene	340
Benzo(a)anthracene	4.8
Benzo(a)pyrene	3.2
Benzo(b)fluoranthene	3.2
Benzo(k)fluoranthene	1.2
Chrysene	4.4
Dibenzofuran	24
Fluoranthene	220
Indeno(1,2,3-cd)Pyrene	1.7
Naphthalene	420
TPH (mg/kg)	798
Metals (mg/kg)	NA

SB-15		
Sample Date	6/9/2010	
Sample Depth (feet bgs)	13-15	16-18
VOCs (mg/kg)	NE	NE
SVOCs (mg/kg)	NE	ND
Metals (mg/kg)	NA	NA

EB-10			
Sample Date	2/7/2014		
Sample Depth (feet bgs)	1-2	5-6	16-17
VOCs (mg/kg)	ND	NE	NE
SVOCs (mg/kg)	NE	NE	ND
Metals (mg/kg)	Conc.	Conc.	Conc.
Arsenic, Total	20	NE	NE
Lead, Total	140	170	NE
Mercury, Total	1	1.7	ND
Zinc, Total	250	NE	NE

LEGEND:

- APPROXIMATE SITE BOUNDARY
- GB01 — APPROXIMATE LOCATION OF GEOTECHNICAL BORING FROM AUGUST 2015 SUPPLEMENTAL REMEDIAL INVESTIGATION (SRI). RED COLOR DENOTES THAT GROSSLY- CONTAMINATED MATERIAL WAS OBSERVED
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- SB-# — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING THE JANUARY 2012 SUPPLEMENTAL REMEDIAL INVESTIGATION
- EB-# — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING THE FEBRUARY 2014 SUPPLEMENTAL REMEDIAL INVESTIGATION
- LB-7 — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING 2018 WATERFRONT INVESTIGATION
- APPROXIMATE INTERIM REMEDIAL MEASURES WORK AREA

NOTES:

1. "GROSSLY-CONTAMINATED MATERIAL" REFERS TO SOIL, SEDIMENT, SURFACE WATER OR GROUNDWATER WHICH CONTAINS SOURCES OR SUBSTANTIAL QUANTITIES OF MOBILE CONTAMINATION IN THE FORM OF NAPL THAT IS IDENTIFIABLE EITHER VISUALLY, THROUGH STRONG ODOR, BY ELEVATED CONTAMINANT VAPOR LEVELS OR IS OTHERWISE READILY DETECTABLE WITHOUT LABORATORY ANALYSIS. THIS DEFINITION IS PER THE NYSDEC 6 NYCRR PART 375-1.2 (u).
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4. ELEVATIONS REFERENCE THE UNITED STATES GEOLOGICAL SURVEY (USGS) NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
5. 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 UNRESTRICTED USE, RESTRICTED USE RESTRICTED-RESIDENTIAL USE, AND RESTRICTED USE - COMMERCIAL SOIL CLEANUP OBJECTIVES (SCO)
6. ONLY COMPOUNDS DETECTED AT CONCENTRATIONS ABOVE THEIR RESPECTIVE SCOs ARE SHOWN.
7. ANALYTES DETECTED WITH CONCENTRATIONS ABOVE NYSDEC PART 375 UNRESTRICTED USE SCOs ARE BOLDED.
8. ANALYTES DETECTED WITH CONCENTRATIONS ABOVE NYSDEC PART 375 RESTRICTED USE RESTRICTED RESIDENTIAL SCOs ARE BOLDED AND SHADED.
9. ANALYTES DETECTED WITH CONCENTRATIONS ABOVE NYSDEC PART 375 RESTRICTED USE COMMERCIAL SCOs ARE BOLDED, SHADED AND BORDERED.
10. VOC = VOLATILE ORGANIC COMPOUND
11. SVOC = SEMIVOLATILE ORGANIC COMPOUND
16. TPH = TOTAL PETROLEUM HYDROCARBON
17. mg/kg = MILLIGRAM PER KILOGRAM
18. Conc. = CONCENTRATION
19. feet bgs = FEET BELOW GRADE SURFACE
20. ND = NOT DETECTED
21. NE = CONCENTRATION WAS NOT DETECTED ABOVE THE RESPECTIVE SCOs
22. NA = NOT ANALYZED

Compound	NYSDEC Part 375 Unrestricted Use SCOs	NYSDEC Part 375 Restricted Use Restricted Residential SCOs	NYSDEC Part 375 Restricted Use Commercial SCOs
VOCs (mg/kg)			
1,2,4-Trimethylbenzene	3.6	52	190
Ethylbenzene	1	41	390
SVOCs (mg/kg)			
Acenaphthene	20	100	500
Anthracene	100	100	500
Benzo(a)anthracene	1	1	5.6
Benzo(a)pyrene	1	1	1
Benzo(b)fluoranthene	1	1	5.6
Benzo(k)fluoranthene	0.8	3.9	56
Chrysene	1	3.9	56
Dibenzo(a,h)anthracene	0.33	0.33	0.56
Dibenzofuran	7	59	350
Fluoranthene	100	100	500
Fluorene	30	100	500
Indeno(1,2,3-cd)Pyrene	0.5	0.5	5.6
Naphthalene	12	100	500
Phenanthrene	100	100	500
Metals (mg/kg)			
Arsenic, Total	13	16	16
Lead, Total	63	400	1,000
Mercury, Total	0.18	0.81	2.8
Zinc, Total	109	10,000	10,000

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Project
627-661 SMITH STREET
BLOCK No. 493, LOT No. 1
BLOCK No. 495, LOT No. 1
KINGS COUNTY NEW YORK

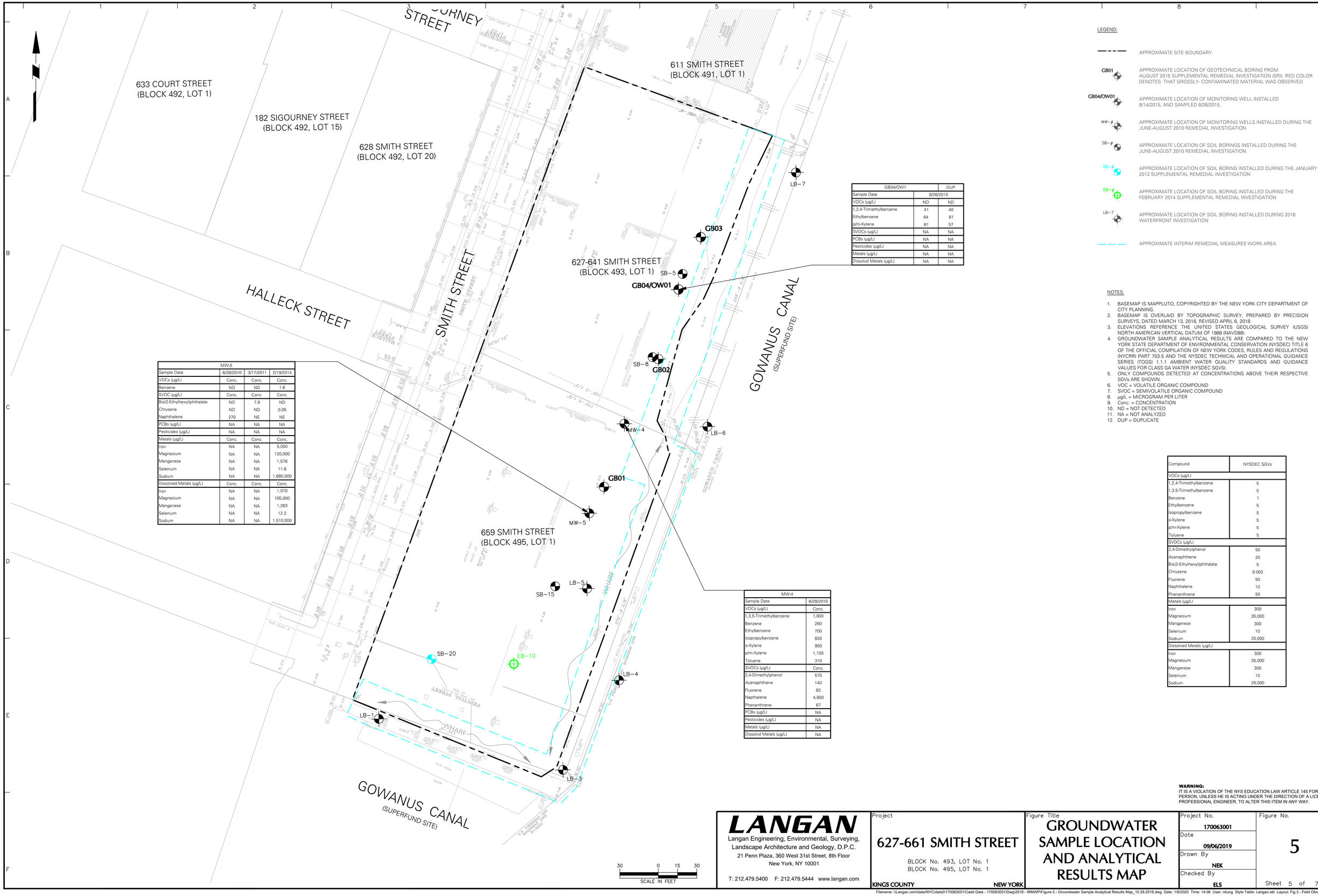
Figure Title
SOIL SAMPLE LOCATION AND ANALYTICAL RESULTS MAP

Project No. 170063001
Date 09/06/2019
Drawn By NEK
Checked By ELS

Figure No. 4
Sheet 4 of 7

LANGAN
PROJECT NO. 170063001

Filename: \\Langan.com\data\NYC\data01\170063001\Cadd Data - 170063001\Dwg\2018 - IRMWP\Figure 4 - Soil Sample Analytical Results Map_10.29.2018.dwg Date: 1/8/2020 Time: 14:03 User: nkung Style Table: Langan.stb Layout: Figure 4



MW-5			
Sample Date	6/28/2010	3/17/2011	2/19/2014
VOCs (µg/L)	Conc.	Conc.	Conc.
Benzene	ND	ND	1.6
SVOC (µg/L)	Conc.	Conc.	Conc.
Bis(2-Ethylhexyl)phthalate	ND	7.9	ND
Chrysene	ND	ND	0.05
Naphthalene	270	NE	NE
PCBs (µg/L)	NA	NA	NA
Pesticides (µg/L)	NA	NA	NA
Metals (µg/L)	Conc.	Conc.	Conc.
Iron	NA	NA	5,050
Magnesium	NA	NA	120,000
Manganese	NA	NA	1,576
Selenium	NA	NA	11.6
Sodium	NA	NA	1,680,000
Dissolved Metals (µg/L)	Conc.	Conc.	Conc.
Iron	NA	NA	1,070
Magnesium	NA	NA	105,000
Manganese	NA	NA	1,263
Selenium	NA	NA	12.2
Sodium	NA	NA	1,510,000

GB04/OW1		DUP
Sample Date	8/26/2015	
VOCs (µg/L)	ND	ND
1,2,4-Trimethylbenzene	41	40
Ethylbenzene	64	61
p/m-Xylene	61	57
SVOCs (µg/L)	NA	NA
PCBs (µg/L)	NA	NA
Pesticides (µg/L)	NA	NA
Metals (µg/L)	NA	NA
Dissolvd Metals (µg/L)	NA	NA

MW-4	
Sample Date	6/28/2010
VOCs (µg/L)	Conc.
1,3,5-Trimethylbenzene	1,000
Benzene	260
Ethylbenzene	700
Isopropylbenzene	820
o-Xylene	950
p/m-Xylene	1,100
Toluene	310
SVOCs (µg/L)	Conc.
2,4-Dimethylphenol	570
Acenaphthene	140
Fluorene	83
Napthalene	4,800
Phenanthrene	67
PCBs (µg/L)	NA
Pesticides (µg/L)	NA
Metals (µg/L)	NA
Dissolvd Metals (µg/L)	NA

LEGEND:

- APPROXIMATE SITE BOUNDARY
- GB01 — APPROXIMATE LOCATION OF GEOTECHNICAL BORING FROM AUGUST 2015 SUPPLEMENTAL REMEDIAL INVESTIGATION (SRI). RED COLOR DENOTES THAT GROSSLY- CONTAMINATED MATERIAL WAS OBSERVED
- GB04/OW01 — APPROXIMATE LOCATION OF MONITORING WELL INSTALLED 8/14/2015, AND SAMPLED 8/26/2015.
- MW-# — APPROXIMATE LOCATION OF MONITORING WELLS INSTALLED DURING THE JUNE-AUGUST 2010 REMEDIAL INVESTIGATION
- SB-# — APPROXIMATE LOCATION OF SOIL BORINGS INSTALLED DURING THE JUNE-AUGUST 2010 REMEDIAL INVESTIGATION.
- SB-# — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING THE JANUARY 2012 SUPPLEMENTAL REMEDIAL INVESTIGATION
- EB-# — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING THE FEBRUARY 2014 SUPPLEMENTAL REMEDIAL INVESTIGATION
- LB-7 — APPROXIMATE LOCATION OF SOIL BORING INSTALLED DURING 2018 WATERFRONT INVESTIGATION
- APPROXIMATE INTERIM REMEDIAL MEASURES WORK AREA

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3. ELEVATIONS REFERENCE THE UNITED STATES GEOLOGICAL SURVEY (USGS) NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. GROUNDWATER 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 703.5 AND THE NYSDEC TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES FOR CLASS GA WATER (NYSDEC SGVS).
5. ONLY COMPOUNDS DETECTED AT CONCENTRATIONS ABOVE THEIR RESPECTIVE SGVs ARE SHOWN.
6. VOC = VOLATILE ORGANIC COMPOUND
7. SVOC = SEMIVOLATILE ORGANIC COMPOUND
8. µg/L = MICROGRAM PER LITER
9. Conc. = CONCENTRATION
10. ND = NOT DETECTED
11. NA = NOT ANALYZED
12. DUP = DUPLICATE

Compound	NYSDEC SGVs
VOCs (µg/L)	
1,2,4-Trimethylbenzene	5
1,3,5-Trimethylbenzene	5
Benzene	1
Ethylbenzene	5
Isopropylbenzene	5
o-Xylene	5
p/m-Xylene	5
Toluene	5
SVOCs (µg/L)	
2,4-Dimethylphenol	50
Acenaphthene	20
Bis(2-Ethylhexyl)phthalate	5
Chrysene	0.002
Fluorene	50
Naphthalene	10
Phenanthrene	50
Metals (µg/L)	
Iron	300
Magnesium	35,000
Manganese	300
Selenium	10
Sodium	20,000
Dissolved Metals (µg/L)	
Iron	300
Magnesium	35,000
Manganese	300
Selenium	10
Sodium	20,000

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PROJECT NO. 170063001

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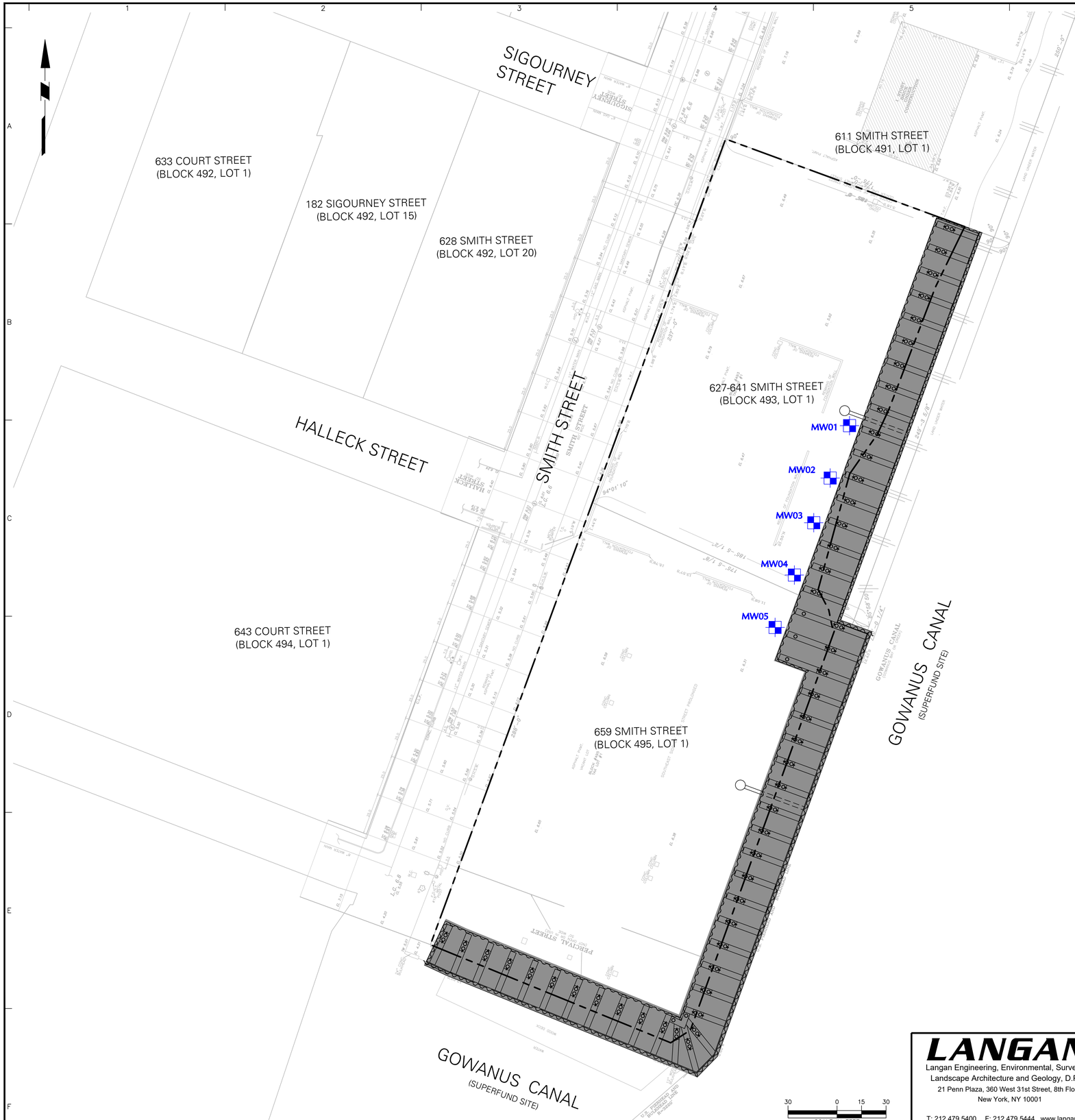
Project
627-661 SMITH STREET
BLOCK No. 493, LOT No. 1
BLOCK No. 495, LOT No. 1
KINGS COUNTY NEW YORK

Figure Title
GROUNDWATER SAMPLE LOCATION AND ANALYTICAL RESULTS MAP

Project No.	Figure No.
170063001	5
Date: 09/06/2019	
Drawn By: NEK	
Checked By: ELS	Sheet 5 of 7

Filename: \\Langan.com\data\NYC\data01\170063001\Cadd Data - 170063001\Dwg\2018 - IRM\WP\Figure 5 - Groundwater Sample Analytical Results Map_10.29.2018.dwg Date: 1/8/2020 Time: 14:06 User: nkung Style Table: Langan.stb Layout: Fig 3 - Field Observations



LEGEND:

- APPROXIMATE SITE BOUNDARY
- MW01 PROPOSED RECOVERY WELL LOCATION
- PROPOSED SEALED-SEAM STEEL SHEET PILE BULKHEAD CUTOFF WALL WITH RELIEVING PLATFORM
- APPROXIMATE LOCATION OF OUTFALL

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3. ELEVATIONS REFERENCE THE UNITED STATES GEOLOGICAL SURVEY (USGS) NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
4. PROPOSED BULKHEAD IS REFERENCED FROM THE 595-611 SMITH STREET BULKHEAD PLAN, FIGURE 1, PREPARED BY LANGAN, DATED , JANUARY 7, 2020.

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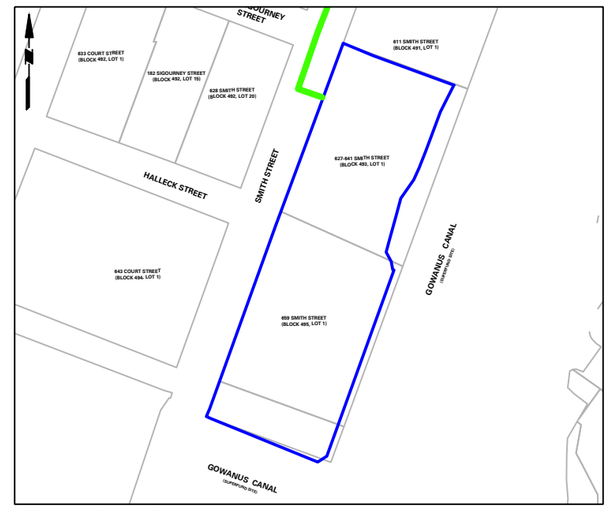
Project
627-661 SMITH STREET
BLOCK No. 493, LOT No. 1
BLOCK No. 495, LOT No. 1
KINGS COUNTY NEW YORK

Figure Title
PROPOSED RECOVERY WELL LOCATION PLAN

Project No.	Figure No.
170063001	6
Date: 09/06/2019	
Drawn By: NEK	
Checked By: ELS	Sheet 6 of 7

Filename: \\Langan.com\data\NYC\data01\170063001\Cadd Data - 170063001\Dwg\2018 - IRMWP\Figure 6 - Proposed Recovery Well Location Plan.dwg Date: 1/8/2020 Time: 14:23 User: nkung Style Table: Langan.stb Layout: FIGURE 6



AERIAL MAP - SCALE: 1" = 200'

200 0 100 200

SCALE IN FEET

LEGEND:

- APPROXIMATE BCP SITE BOUNDARY
- PROPOSED TRUCK ROUTE

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM NEW YORK CITY DEPARTMENT OF TRANSPORTATION (NYCDOT) 2015 NEW YORK CITY TRUCK ROUTE MAP

MAP KEY:

Local Truck Route
Trucks with an origin or destination for the purpose of delivery, loading or servicing within the respective Borough, shall only operate on designated local routes, except that an operator may operate on a non-designated street for the purpose of arriving at his/her destination. This shall be accomplished by leaving a designated truck route at the intersection that is nearest to their destination, proceeding by the most direct route, and then returning to the nearest designated truck route by the most direct route. If the operator has additional destinations in the same general area, he/she may proceed by the most direct route to his/her next destination without returning to a designated truck route, provided that the operator's next destination does not require that he/she cross a designated truck route.

Through Truck Route
Trucks having neither an origin nor a destination within the respective Borough shall restrict the operation of such vehicles to those street segments designated as Through Truck Routes.

Through Truck Route on Expressway

Through Truck Route on Tunnel

Exception 53' Trailers Allowed
For definition see information on reverse side.

Industrial Business Zones (IBZ)

Parks and Open Spaces

29A Highway Exit

Commercial Vehicles Prohibited

Low Vertical Clearance Area

3000 0 1500 3000

SCALE IN FEET

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Project	627-661 SMITH STREET BLOCK No. 493, Lot No. 1 BLOCK No. 495, Lot No. 1 KINGS COUNTY NEW YORK
Figure Title	TRUCK ROUTE MAP
Project No.	170063001
Date	10/17/2018
Drawn By	NEK
Checked By	ELS
Figure No.	7
Sheet	7 of 7

Filename: \\Langan.com\data\NYC\data0\170063001\Cadd Data - 170063001\Dwg\2018 - IRMWP\Figure 7 - Truck Route Map_1.4.2019.dwg Date: 1/4/2019 Time: 11:49 User: nkung Style Table: Langan.stb Layout: Figure 7 - Truck Route Map

APPENDIX A
PREVIOUS REPORTS

(SEPARATE ATTACHMENT)

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

LANGAN

QUALITY ASSURANCE PROJECT PLAN

for

RED HOOK SMITH STREET
627-661 SMITH STREET
BROOKLYN, NEW YORK

Prepared For:
Red Hook Developers Holdings, LLC
1400 Broadway, 15th Floor
New York, New York 10018

And

CF Smith LLC
404 Fifth Avenue, 5th Floor
New York, New York 10018

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

December 2013
Revised April 19, 2019

LANGAN

Langan Project No. 170063001

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is for the 85,400-square-foot site located at 627-661 Smith Street in the Red Hood neighborhood of Brooklyn, New York (the site). The Volunteer, Red Hook Developers Holdings, LLC and CF Smith LLC, was accepted into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) to investigate and, where necessary, remediate the site in conjunction with new development under a NYSDEC Brownfield Cleanup Agreement (BCA) for Site No. C224163, dated May 2013. Additional site information, including site maps, is provided in the NYSDEC-approved December 2013 Remedial Investigation Work Plan (RIWP) and April 2019 Remedial Action Work Plan (RAWP).

This QAPP specifies analytical methods to be used to ensure that data from the proposed Remedial Action (RA) at the Site are precise, accurate, representative, comparable, and complete.

1.2 PROJECT OBJECTIVES

The environmental objectives of this RAWP are to achieve a Track 4 cleanup under the New York State Brownfield Cleanup Program which includes the following:

- Excavation as described herein and off-site disposal of soil/fill to one foot below the observed water table in the central portion of the site.
- Prevent ingestion and direct contact with contaminated soil.
- Prevent contact with or inhalation of volatiles from contaminated groundwater.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminated soil.
- Prevent impacts to biota from ingestion and direct contact with the contaminated soil.

These objectives have been established in order to protect public health and the environment for the anticipated mixed-use development at the Site.

1.3 SCOPE OF WORK

Implementation of the Remedial Action (RA) is described in detail in the RAWP. All remedial work will be overseen by Langan on behalf of the Red Hook Developers Holdings, LLC and CF Smith LLC. The Proposed RA consists of the following:

- Removal of construction and demolition debris (C&D) currently onsite in accordance with federal, state, and local regulations to prepare the site for excavation and redevelopment
- Removal of all historic subsurface pipes and utilities currently onsite and disposal of tar-like material in accordance with federal, state, and local regulations to prepare the site for excavation and redevelopment
- Installation of a sealed-seam sheet-pile bulkhead cutoff wall with relieving platform along the eastern and southern boundary of the site in accordance with the April 11, 2019 Interim Remedial Measure (IRM) Work Plan. The seams will be fully sealed between all sheet pile pairs from tip elevation to top of the sheet.
- Excavation of grossly contaminated media, including hydrocarbon-contaminated material, to one foot below the observed water table in the central portion of the site
- Screening for indications of contamination, by visual means, odor and monitoring with a photoionization detector (PID), of all excavated soil during any intrusive site work
- Decommissioning and removal of underground storage tanks (UST) identified during remediation, including documentation of proper handling and disposal, if encountered
- Collection and analysis of documentation soil samples from the base of the grossly contaminated remedial excavation for NYSDEC Part 375 and TCL/TAL list of VOCs, SVOCs, metals, PCBs, pesticides, herbicides, and metals (including hexavalent and trivalent chromium and cyanide) analyses. Select samples (two base and two sidewall) will also be analyzed for 1,4-dioxane and Per- and Perfluoralkyl Substances (PFAS)
- Localized dewatering, if required, will be treated as necessary prior to discharge to the municipal sewer system or disposed of off-site
- Backfilling of excavated areas to development grade with site material (excluding the targeted grossly-contaminated media), clean imported/ reused material meeting the soil quality requirements in Part 375-6.7(d)(ii)(b) (i.e., lower of Protection of Groundwater [PG] Soil Cleanup Objectives [SCO] or Restricted-Use Restricted Residential [RURR] SCOs), recycled concrete aggregate (RCA) or virgin crushed stone
- Following implementation of the final site remedy, five recovery wells inland of the new bulkhead cutoff wall will be installed to recover residual free product/ NAPL, should it accumulate.
- Construction and maintenance of Engineering Controls, which will include capping all surfaces with impervious cover (e.g. concrete, asphalt), and the aforementioned bulkhead cut-off wall

- Development and implementation of 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 during the remediation phase of development
- Implementation of long-term Institutional Controls in the form of an Environmental Easement (EE) and Site Management Plan (SMP), which include "Notice of Use Restrictions" on the land and groundwater
- For future potential buildings, a soil vapor intrusion evaluation will be completed – The evaluation will include a provision for implementing actions recommended to address exposures related to soil vapor intrusion, as required.

2.0 DATA QUALITY OBJECTIVES AND PROCESS

Data Quality Objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. The sampling program will also provide for collection of soil, soil vapor, indoor air, or groundwater samples as part of a future need for sampling. DQOs for sampling activities are determined by evaluating five factors:

- Data needs and uses: The types of data required and how the data will be used after it is obtained.
- Parameters of Interest: The types of chemical or physical parameters required for the intended use.
- Level of Concern: Levels of constituents, which may require remedial actions or further investigations.
- Required Analytical Level: The level of data quality, data precision, and QA/QC documentation required for chemical analysis.
- Required Detection Limits: The detection limits necessary based on the above information.

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 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

Any future remedial activities and investigations will be overseen by Langan or another environmental consultant for the Volunteer or a future owner. The environmental consultant will also arrange data analysis and reporting tasks. The analytical services will be performed by an ELAP-certified laboratory. Data validation services will be performed by approved data validation contractor(s).

For the required sampling as stated in the RIWP, sampling will be conducted by Langan; the analytical services will be performed by Alpha Analytical Laboratories, Inc. of Westborough, Massachusetts (NYSDOH ELAP certification number 11148). Data validation services will be performed by Emily Strake. Project personnel resumes are provided in Attachment A.

Key contacts for this project are as follows:

Red Hook Developers Holdings, LLC	Mr. Emzon Shung Telephone: (212) 944-1330
Langan Technical Manager:	Ms. Emily Snead Telephone: (212) 479-5432
Langan Project Manager:	Mr. Joseph Good Telephone: (212) 479-5448
Langan Quality Assurance Officer (QAO):	Mr. Jason Hayes Telephone: (212) 479-5427
Data Validator:	Ms. Emily Strake Telephone: (215) 491-6526
Laboratory Representative:	Mr. Ben Rao Telephone: (201) 847-9100
Field Personnel:	TBD Telephone: TBD

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 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 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. 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.

Sample Field Blanks and Duplicates

Field blanks will be collected for quality assurance purposes at a rate of one per 20 soil investigations 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.

Duplicate soil 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.

Groundwater Samples

Groundwater sampling will be conducted using USEPA's Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples From Monitoring Wells, revised September 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.

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 samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

Soil Vapor 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 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.

Sample Field Blanks and Duplicates

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

a. Trip Blanks - A trip blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml VOA vial containing distilled, deionized water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for Part 375 volatiles analysis. The Trip Blank will be analyzed for volatile organic compounds to assess any contamination from sampling and transport, and internal laboratory procedures.

b. Field Blanks - Field blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix. Field blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. The field blank will consist of a sample of deionized, distilled water provided by the laboratory that has passed through a decontaminated bailer, tubing or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The field blank may be analyzed for all or some of the parameters of interest.

The duplicates will include:

c. Coded Field Duplicate - To determine the representativeness of the sampling methods, coded field duplicates will be collected at a minimum frequency of one per 20 field samples for each matrix (soil, groundwater, and soil vapor). The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.

d. Matrix Spike/Matrix Spike Duplicate (MS/MSD) - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field

samples (soil and groundwater). These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes.

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 and field blank sample containers and reagent preservatives. Sample bottle containers, including the field 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 samples collected in the field for laboratory analysis will be placed directly into the laboratory-supplied sample containers. Samples will then be placed and stored on-ice in laboratory provided coolers until shipment to the laboratory. The temperature in the coolers containing samples and associated field 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 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

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

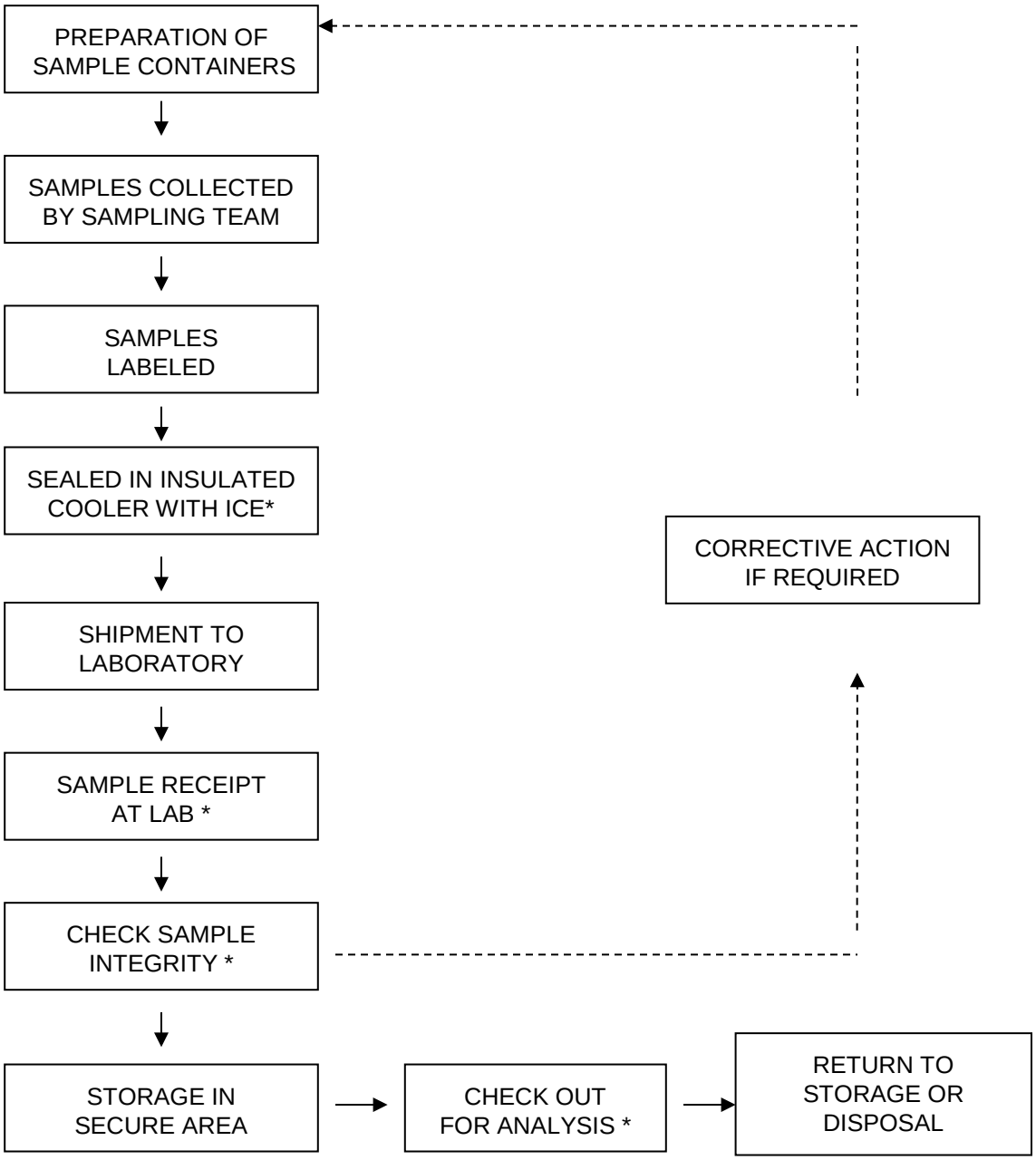
A chain-of-custody protocol has been established for collected samples that will be followed during sample handling activities in both field and laboratory operations. The primary purpose of the chain-of-custody procedures is to document the possession of the samples from collection through shipping, 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.

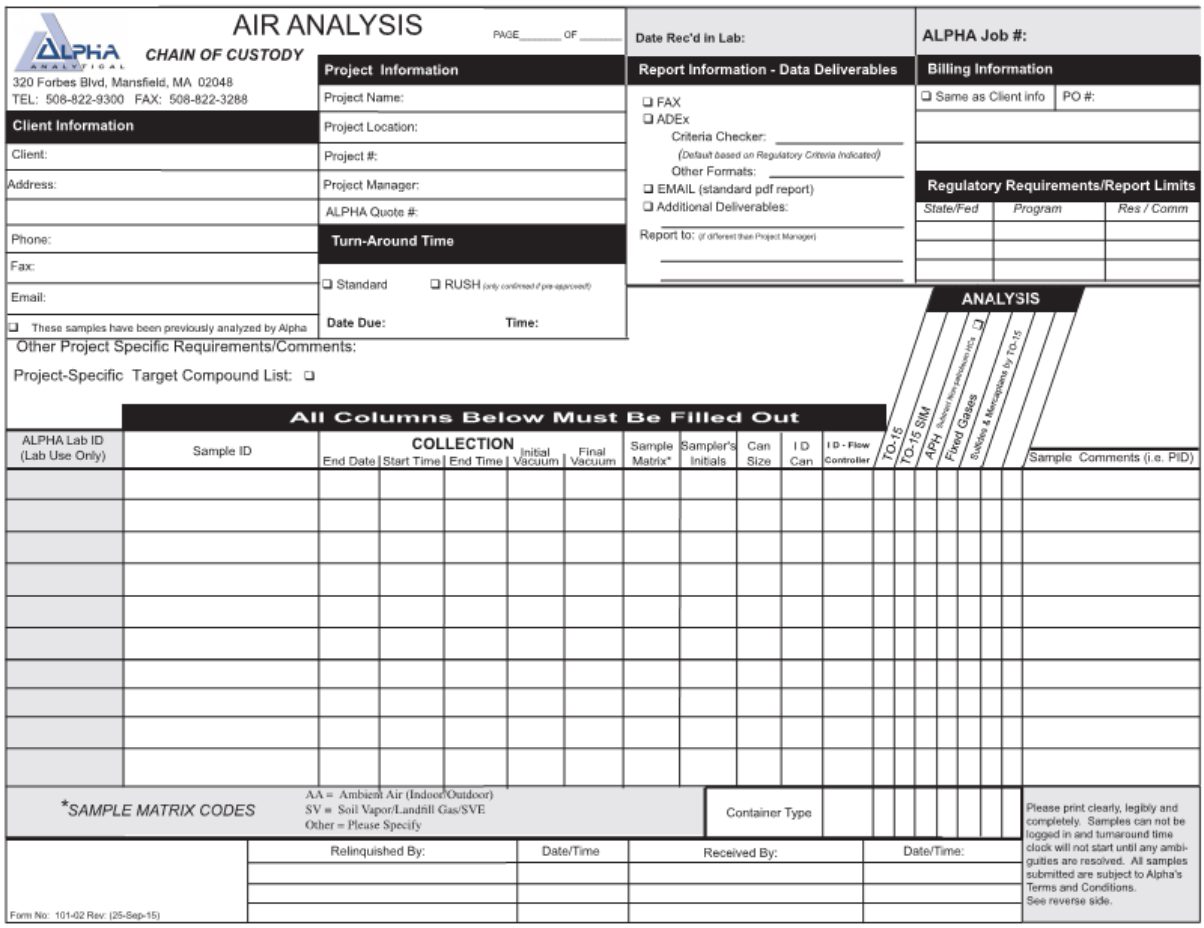
Samples will be packaged for shipment to the laboratory with the appropriate chain-of-custody form. A copy of the form will be retained by the sampling team for the project file and the original will be sent to the laboratory with the samples. Bills of lading will also be retained as part of the documentation 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 the laboratory 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



ALPHA ANALYTICAL

AIR ANALYSIS

CHAIN OF CUSTODY

PAGE_____ OF_____

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

TO-15 | TO-15 SIM | APH (Select Fractionation Info) ❑ | Fixed Gases | Sulfides & Mercaptans by TO-15

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	Sample Comments (i.e. PID)

*SAMPLE MATRIX CODES
AA = Ambient Air (Indoor/Outdoor)
SV = Soil Vapor/Landfill Gas/SVE
Other = Please Specify

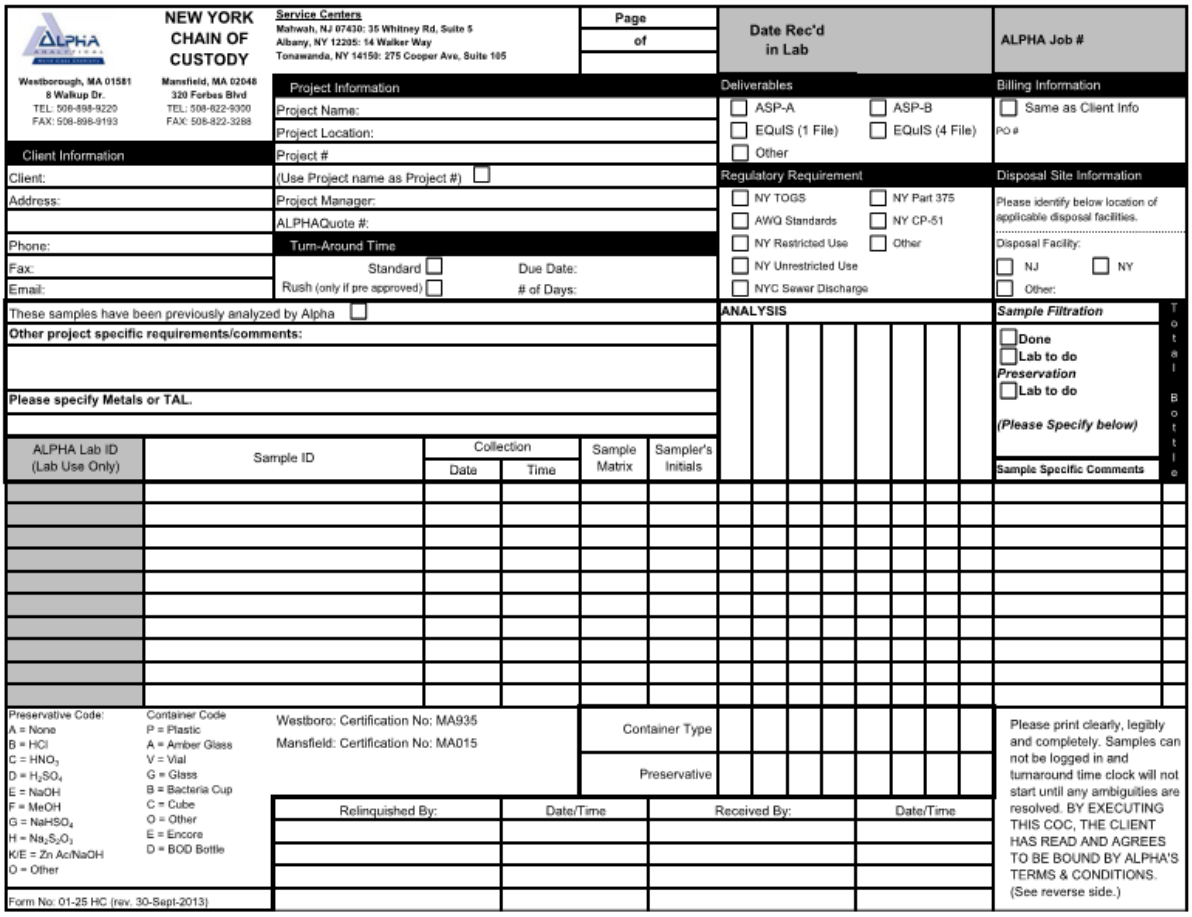
Container Type

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

ALPHA ANALYTICAL

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

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 #

Project Information
Project Name:
Project Location:
Project #
(Use Project name as Project #) ☐
Project Manager:
ALPHAQuote #:

Turn-Around Time
Standard ☐ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables
☐ ASP-A ☐ ASP-B
☐ EQuIS (1 File) ☐ EQuIS (4 File)
☐ Other

Billing Information
☐ Same as Client Info
PO #

Client Information
Client:
Address:
Phone:
Fax:
Email:

Regulatory Requirement
☐ NY TOGS ☐ NY Part 375
☐ AWQ Standards ☐ NY CP-51
☐ NY Restricted Use ☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Disposal Site Information
Please identify below location of applicable disposal facilities.
Disposal Facility:
☐ NJ ☐ NY
☐ Other:

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 Bottle

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

Data collected during the field investigation 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 or Task 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 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 Task 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

1. NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.

2. NYSDOH. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

3. USEPA, 2014. "Test Method for Evaluating Solid Waste," Update V dated July 2014 U.S. Environmental Protection Agency, Washington, D.C.

4. USEPA, 2016. Region II Standard Operating Procedure (SOP) #HW-34, "Trace Volatile Data Validation" (September 2016, Revision 1), USEPA Hazardous Waste Support Section. USEPA Region II

5. USEPA, 2016. Region II SOP #HW-35A, "Semivolatile Data Validation" (September 2016, Revision 1), USEPA Hazardous Waste Support Section. USEPA Region II

6. USEPA, 2016. Region II SOP #HW-36A, "Pesticide Data Validation" (October 2016, Revision 1), USEPA Hazardous Waste Support Section. USEPA Region II

7. USEPA, 2015. Region II SOP #HW-37A, "PCB Aroclor Data Validation" (June 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

8. USEPA 2016. Region II SOP #HW-3a, "ICP-AES Data Validation" (September 2016, Revision 1), USEPA Hazardous Waste Support Section. USEPA Region II

9. USEPA 2014. 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.

10. USEPA 2017. National Functional Guidelines for Superfund Organic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-2017-002, January 2017.

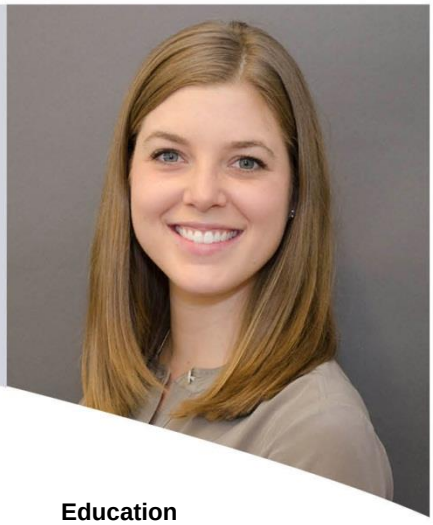
11. USEPA 2017b. National Functional Guidelines for Superfund Inorganic Methods Data Review, Office of Superfund Remediation and Technology Innovation, EPA-540-R-201 7-001, January 2017.

ATTACHMENT A

RESUMES

Emily L. Snead

Senior Staff Scientist
Environmental Engineering



5 years in the industry

Ms. Snead brings field experience and technical expertise to environmental investigations and remediation projects. She has independently performed Phase I and Phase II assessments and investigation, UST removals and closures, remedial excavations, vapor extractions, and ISCO injections. She excels at project research, environmental sampling, remedial oversight, proposal and report preparation. Her projects have included hospital centers, day care facilities, residential buildings, chemical plants, and commercial/industrial sites throughout New York City and the Tri-State area. Prior to her career in Environmental Consulting, Ms. Snead conducted research with NASA and performed construction oversight management in the Cayman Islands.

Selected Projects

Silvercup West, Long Island City, NY. Senior Staff Scientist - BCP site in Long Island City with remedial actions including installation of a new bulkhead cut-off wall along the East River and removal of hot-spot metals contaminated soil and grossly contaminated media. Provided field oversight for remedial investigations and lead delineations including collection of soil and groundwater samples. Prepared investigation reports, Remedial Action Work Plan and remedial cost estimates.

Highline 28-29 Development, New York, NY. Senior Staff Scientist - Provided field oversight during construction activities, hazardous PCE-contaminated soil delineation, and implementation of bioaugmentation to remediate the groundwater. Prepared the Remedial Closure Report, including text, tables, and figures.

295 Locust Avenue, Bronx, NY. Senior Staff Scientist - Provide field oversight of a BCP site including soil excavation and disposal, monitoring well decommissioning, groundwater sampling and annual SMP inspections. Prepared analytical table summaries.

620 Fulton Street, Brooklyn, NY. Senior Staff Scientist - Provided field oversight and material tracking for excavation of a new commercial care facility for the Hotel Trades Union. Hazardous lead soil removal and UST closure activities included in project scope. Prepared Soil Management Report, including text, tables and figures.

601 Washington Street, New York, NY. Senior Staff Scientist - BCP redevelopment site includes remedial excavation, groundwater ISCO treatment, and installation of an active SMD system. Collected groundwater samples and coordinates environmental field oversight.

Education

B.S., Environmental Science & Geology
Northeastern University

Professional Registration

40-Hour OSHA HAZWOPER

8-Hour OSHA HAZWOPER Refresher

10-Hour OSHA Construction Safety Training

DOT Hazardous Materials Shipping Training

First Aid/ CPR Training

LANGAN

50 Hudson Yards – 2 Hudson Blvd., New York, NY. Senior Staff Scientist - NYC OER E-Designated site as part of the Hudson Yards redevelopment area. Project includes remedial investigation, remedial excavation oversight, and closure reporting. Prepared OER Remedial Investigation Workplan, and Phase I ESA report for the property.

Riverside Center Parcel 1, New York, NY. Senior Staff Scientist - Project is enrolled in the VCP program, includes remedial excavation oversight to achieve Track 4 SCO clean-up, UST closure, spill investigation and closure, and reporting. Prepared waste characterization reports (tables, text, figures), Phase I ESA reports, coordinated with disposal facility approvals, provide engineering oversight management, draft closure reports.

Riverside Center Parcels 3 and 4, New York, NY. Senior Staff Scientist - Project is enrolled in the VCP program, includes remedial excavation oversight to achieve Track 1 SCO clean-up and closure reporting. Prepared waste characterization reports (tables, text, figures), Phase I ESA reports, coordinated with disposal facility approvals, provide engineering oversight management, draft closure reports.

335 Bond Street, Brooklyn, NY. Senior Staff Scientist - Conducted a Phase II and enrolled the site in the BCP program. Prepared BCP application, Phase II investigation report (text, tables, and figures).

1228-1234 Madison Avenue, New York, NY. Senior Staff Scientist – Conducted and prepared a Phase I ESA at an existing multi-use commercial/ residential development.

Columbia University Medical Center, Nursing School, New York, NY – Staff Scientist. Conducted a Phase I and II Environmental Site Investigation on an operating medical/ research facility. Prepared a Phase I ESA proposal and report using ASTM E1527-13 guidelines. Assisted with executing a Phase II Site Investigation that involved a complex bedrock subsurface investigation, soil sampling, groundwater sampling, and soil vapor sampling. Prepared boring logs, analytical tables, and drafted the Phase II Investigation Report.

Columbia University Medical Center, New York, NY – Staff Scientist. Provided subcontractor oversight for the removal of one, 1,000-gal UST and preparation of a final UST Closure Report for submittal to NYSDEC. Collected sidewall and bottom soil endpoint samples.

New York City Housing Authority, Bronx, NY – Staff Scientist. Implemented a community air monitoring program and conducted environmental oversight of all ground intrusive activities including test pit excavations, geotechnical investigations, and pile installation. Responsible for training new field staff on proper air monitoring and PPE field safety protocols.

Fordham University Real Estate Acquisition, New York, NY – Staff Scientist. Conducted a Phase I ESA of a 27-story Landmark building as part of a real estate transaction with Fordham University. Interviewed pertinent site users, and photographed site features. Drafted the Phase I ESA report using ASTM E1527-13 guidelines.

Consolidated Edison Substation Site Investigation, New York, NY – Staff Scientist. Provided oversight and field implementation of a site investigation including geophysical surveying, hand-clearing of boring locations, GeoProbe and Sonic drilling, installation of monitoring wells,

surveying of noise and vibration impacts, collection of soil and soil vapor samples. Prepared Site Remedial Investigation Report including drafting of document text, data tables, figures, and appendices.

11-09 Borden Avenue, Metropolitan Transit Agency Bridges and Tunnels/Borden Avenue ISCO Remediation, Long Island City, NY – Staff Scientist. Co-manage field operations, including oversight of subcontractors and coordination of excavation and disposal activities for 1,000 cubic yards of petroleum-impacted soil. Oversee implementation of in situ chemical oxidation to remediate petroleum-impacted soil and groundwater. Collection of soil and groundwater samples, preparation of quarterly monitoring reports including text, tables and figures.

Children's Aid Society (910 East 172nd Street), New York, NY – Staff Scientist. Participated in multiple phases of the remediation program at this Site. Oversight of the VEFR and assistance in the collection of groundwater samples using the low-flow sampling methods. Provided oversight for the installation of an angled recovery well set at a 45-degree angle into bedrock. Children's Aid Society was constructed on the former site of a gas station and requires periodic groundwater monitoring to mitigate potential vapor intrusions from an existing petroleum spill. Prepared quarterly monitoring reports including text, tables, and figures.

YRC Freight Newtown Creek EPA RFI, Brooklyn, NY – Staff Scientist. Researched and identified essential documents for an EPA RFI with regards to two Site properties. Conducted literature review and created a database of documentation for each property under the RFI. Prepared electronic and hard copies of each cumulative RFI deliverable.

154 Elizabeth Street Real Estate Acquisition, New York, NY – Staff Scientist. Conducted a Phase I ESA of an operating vehicular garage building as part of a real estate transaction. Prepared the Phase I ESA report.

522-532 W 29th Street Redevelopment, New York, NY – Staff Scientist. Developed and conducted a Phase II Site Investigation including soil, soil vapor, and groundwater sampling. Managed and coordinated field events with subcontractors and clients. Reviewed and interpreted laboratory data and prepared Remedial Action Workplan for submittal to New York City Office of Environmental Remediation.

534 W 29th Street Redevelopment, New York, NY – Staff Scientist. Developed a Phase II Site Investigation work-plan. Reviewed and interpreted laboratory data and prepared Remedial Investigation Report and Remedial Action Workplan for submittal to NYC OER.

Memorial Sloan-Kettering Cancer Center, Ambulatory Surgery Building, New York, NY – Staff Scientist. Implemented a community air monitoring program and conducted environmental oversight of all ground intrusive activities including soil excavations, pile installation, and demolition of existing structures. This site was part of NYSDEC's Voluntary Cleanup Program, enrolled by Consolidated Edison, and was a former gas holder and automotive fueling operation.

Joseph Good, PE, LEED AP

Senior Project Manager
Environmental Engineering

9 years in the industry

Mr. Good is an environmental engineer with experience working on both national and international projects. He has conducted environmental research on water treatment technology designed to remedy nutrient leaching from agricultural fields and to remove metals from urban stormwater. His consulting experience includes New York State Brownfield investigations and remediation, New York City Department of Environmental Protection (NYCDEP) E-designated site application, investigation, and remediations. Additional services include Phase I and II Environmental Site Assessments, remedial engineering and system design, Underground Storage Tank (UST) permitting, removal specifications, closure reporting, and soil vapor intrusion investigations. Mr. Good's field experience includes subsurface investigations, groundwater, soil, and air sampling programs, monitoring well installations, driller supervisions, subcontractor oversights, and waste characterizations.

Selected Projects

55 Hudson Yards, New York, NY – Sr. Staff Engineer and Project Engineer. Prepared a Phase I Environmental Site Assessment and Hazmat and Noise Remedial Action Plans for the new 50+-story commercial office building with approximately 1.3 million square feet gross floor area. Coordinated E-designation work plan approvals with the New York City Office of Environmental Remediation.

State University of New York (SUNY) Downstate Medical Center, Brooklyn, NY – Sr. Staff Engineer during the Phase I ESA for a new 10-story academic building with an approximate 19,000 SF footprint and a basement level.

504-520 West 34th Street, New York, NY – Sr. Staff Engineer. Provided services including a Phase II Environmental Site Investigation (ESI) for the properties on this NYC Planning Department "E" Designated site.

19 West 20th Street, New York, NY – Sr. Staff Engineer for sub-slab depressurization and vapor barrier system for a new 15-story residential development with a frootprint of approximately 10,000 SF. The system was required to address soil vapor issues and satisfy the E-Designation requirements of the New York City Department of Environmental Protection.

New York Aquarium Shark Tank and Animal Care Facility, Brooklyn, NY – Sr. Staff Engineer. Provided services for characterization and delineation of soil, preparation of a contaminated soil management and Construction Health and Safety Plan to guide earthwork within impacted materials.

Education

M.E., Civil and
Natural Resource Engineering
University of Canterbury

B.S., Civil Engineering
University of Illinois

Professional Registration

Professional Engineer (PE) in NY, IL

LEED Accredited Professional
(LEED AP)

40-Hour HAZWOPER

10-Hour OSHA

Affiliations

American Chemical Society (ACS)

United States Green Building Council (USGBC)

American Society of Civil Engineers (ASCE)

LANGAN

28-29 High Line, New York, NY- Project manager for mixed-use residential and commercial development adjacent to Manhattan's High Line park. Conducted Phase I Environmental Site Assessment and Phase II Environmental Site Investigations.

Hunters Point Library, Queens, NY – Sr. Project Engineer for 21,000 SF public Library on the Queens West waterfront.

627-641 Smith Street, Brooklyn, NY – Project manager for remedial and supplemental remedial investigations for contaminated soils containing VOCs, SVOCs and groundwater contaminants at this location adjoining the Gowanus Canal. Mr. Hayes coordinated with New York City Department of Environmental Conservation (NYCDEC) and United States Environmental Protection Agency requirements, performed a Remedial Investigation (RI) and prepared a Remedial Investigation Report (RIR).

Silvercup West, Long Island City, NY – Engineering services for proposed New York State Brownfield Cleanup Program (BCP) of a 7-acre former petroleum storage facility. Proposed development consists of 40- to 50-story residential towers, production studios and public cultural. Mr. Good's responsibilities included river sediment sampling, drilling and GPR oversight, soil boring characterization, and CAD and office support.

Gateway at Bronx Terminal Market, Bronx, NY – Field and office engineering for this BCP project that included approximately 55,000 tons of contaminated soil 17 USTs, Groundwater VOC plume and Lead, Arsenic and mercury impacts. Responsibilities included field and office support for air sampling and reporting for determining soil vapor mitigation system implementation.

Bronx Terminal Market Waterfront Park Development (Yankee Stadium Development), Bronx, NY – Field and office engineering for two NYSDEC Spill Sites on Piers 2-3, and 4. Duties included preparation of construction documents, remediation bid support, oversight, closure report preparation and coordination with NYSDEC and NYSEDC.

Bushwick Inlet Park, Brooklyn, NY – Engineering services for environmental services associated with the revitalization of 5-acres on the Greenpoint Willamsburg waterfront in Brooklyn, NY. The project includes a proposed 2 story building structure with a sloped roof with green spaces. Duties included preparation of specifications, cut/fill analysis and NYCDEP "E" designation submittals.

Abraham Joshua Heschel School, New York, NY – Performed Phase I and planned a Phase II investigation for the planned expansion of the Abraham Heschel School on the West Side of Manhattan. Also coordinated with NYCDEP for "E" designation submittals.

The Shops at Atlas Park, Glendale, NY – Field and office engineering services for BCP site in a densely populated former industrial area which has been developed into an open air commercial shopping center. Duties included field inspection and monitoring of remedial systems including air sparge/soil vapor extraction, and sub-slab depressurization systems.

New Meadowlands Stadium Redevelopment, East Rutherford, NJ – Planning and traffic engineering services for the development of a new Stadium in the Meadowlands. He assisted in developing off-site parking plan, bus stop design and future off and on site sign plans. He also

participated in traffic observation to identify bottlenecks in current traffic network to efficiently design future traffic patterns.

Selected Publications, Reports, and Presentations

Good, J.F., Hayes, J., Zeng, L., and Abrams, S. (2015). "Bioremediation via Soil Mixing to Address Chlorinated Ethenes and Ethanes at a Brownfield Site with High Organic and Metal Soils." Battelle- Third International Symposium on Bioremediation and Sustainable Environmental Technologies, Miami, Florida, May 18-21, 2015.

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2013). "pH Buffering in Stormwater Infiltration Systems – Sustainable Contaminant Removal with Waste Mussel Shells." DOI: 10.1007/s11270-014-1885-1

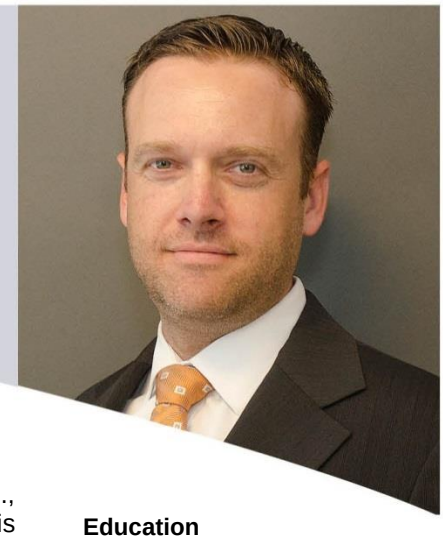
Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2012). "Contaminant Removal and Hydraulic Conductivity of Laboratory Rain Garden Systems for Stormwater Treatment. Water Science and Technology." DOI: 10.2166/wst.2012.135. 65(12):2154-2161

Good, J.F. (2011) "Water Quality Treatment and Hydraulic Efficacy of Rain Gardens. Civil and Natural Resources Engineering," University of Canterbury, Christchurch, New Zealand. Master of Engineering in Civil Engineering.

Good, J.F., O'Sullivan, A.D., Wicke, D., and Cochrane, T.A, (2011). "Appreciating Drainage Assets in New Zealand Cities: Rain Garden Treatment and Hydraulic Performance." International Water Association-Cities of the Future Conference, 22-25 May 2011, Stockholm, Sweden.

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, Indiana and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfield's application, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site application, investigation, and remediation. He is recognized as a national expert on the topic of soil vapor intrusion and mitigation in urban settings and has presented on the topic at several conferences, including the Battelle Conference of Chlorinated and Recalcitrant Compounds and the NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Conference. 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; 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

28-29 High Line Residential, New York, NY – Project Manager. Professional Engineer for investigation and remediation of an approximately 40,000-square-foot site adjacent to Manhattan's High Line Park. The site is in the NYC Voluntary Cleanup Program (VCP) and investigation and remediation is under the oversight of the NYCOER and the NYSDEC. Services includes implementation of a Remedial Investigation (RI), preparation of a RI Work Plan (RIWP), RI Report (RIR) and Remedial Action Work Plan (RAWP), completion of a treatability study to address chlorinated solvents in groundwater, groundwater treatment design, soil vapor mitigation system design (sub-slab depressurization [SSD] systems) and remedial oversight. Contaminants included petroleum, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), polychlorinated biphenyls (PCB), and metals. The site was being developed with three mixed-use residential and commercial towers.

Hudson Yards Redevelopment, New York, NY – Project Manager. Professional Engineer for the Hudson Yards redevelopment remediation, which includes the approximately 12-acre East Side Yards (ERY) and the about 12-acre West Side Yards (WRY) on the west side of Manhattan near the Hudson River. The project includes remediation of a former rail yard and associated structures, and construction of about 14 residential and commercial towers, open space, cultural space, educational space and a platform over active rail lines. Investigation and remediation is under the

Education

M.S., Environmental Engineering
Columbia University

B.Sc., 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

oversight of the NYCOER and the NYSDEC. Contaminants included petroleum, VOCs, metals (including hazardous lead) and SVOCs.

Gateway at Bronx Terminal Market, Bronx, NY – Project Manager.
NYS BCP project that included approximately 55,000 tons of contaminated soil, 17 USTs, groundwater VOC plume, and lead, arsenic and mercury impacts. The development included the construction of approximately 1 million gross square feet of retail and 2,600 parking spaces on a 16.5-acre former industrial and commercial use area. The due diligence investigations were completed for a larger 34-acre area inclusive of the area developed. Responsibilities included completion of a Phase I/II Environmental Site Assessment Due Diligence Study; preparation of the BCP application, RIWP, RIR, RAWP, RAA, and hazardous materials chapter of the EIS; design of five soil vapor mitigation systems including SSD and vapor barrier systems; implementation of the remedial investigation and oversight of the remedial action; preparation of the Final Engineering Report (FER) and Site Management Plan (SMP) in coordination with the NYSDEC and NYSDOH; and implementation of the SMP.

Silvercup West, Long Island City, NY – Project Manager. Professional Engineer for the remedial investigation and action for an East River waterfront NYSDEC Brownfield Cleanup Program (BCP) site on a 7-acre parcel that included a former bulk petroleum storage facility. The project is strategically divided into five separate BCP sites. Contaminants impacting soil, sediment, groundwater and soil vapor include petroleum product, VOCs, SVOCs and metals. Duties included preparation of BCP applications, RIWPs, RIRs, RAWPs, Remedial Alternatives Analyses (RAA), hazardous materials assessment for the Environmental Impact Statement (EIS); implementation of remedial investigation, waste characterization studies and remedial design (inclusive of source removal, soil vapor mitigation and a waterfront bulkhead/cutoff wall); and coordination with the NYSDEC and NYSDOH.

627 Smith Street, Brooklyn, NY – Project Manager. Professional Engineer for an 85,000-square-foot NYS BCP site on the Gowanus Canal. Responsible for remedial investigations and assessment of remedial alternatives concerning coal tar product, VOC, SVOC and metal impacts to soil, groundwater, sediment and soil vapor. Services included preparation of a BCP Application, RIWP and RIR, implementation of remedial investigations and subsurface contaminant modeling, and evaluation of remedial alternatives to include source removal, a barrier wall, in-situ stabilization and bulkhead/cutoff walls. Next steps include completion of a RAWP and formal RAA.

West & Watts (460 Washington Street), New York, NY – Project Manager. Professional Engineer for a completed 26,000-square-foot NYS BCP site near Manhattan's west shoreline. Investigation and remediation was completed under NYSDEC and NYSDOH oversight and included implementation of a remedial investigation, preparation of a RIWP, RIR, RAWP, FER and SMP, groundwater treatment design, soil vapor mitigations system design, remedial oversight and post-remediation groundwater monitoring. Site Work included RAWP implementation, report preparation and activities related to addressing resident and business concerns.

Gateway Center II Retail, Brooklyn, NY – Project Manager. Langan provided design, permitting and construction phase services for the development of this 40-acre, 638,000 SF, retail site. Environmental services included Phase I ESA and Phase II ESI, regulatory review, geophysical survey, preparation of

Remedial Action Plan (approved by the NYCDEP), and design of a sub-slab methane venting systems for the retail center buildings.

Riverside Center, Building Two, New York, NY – Project Manager. Langan provided geotechnical and environmental engineering services for the development of a new 42-story mixed-use building. This is a Restrictive Declaration site that required remedial investigation and action under the oversight of the NYCOER and NYSDEC. Services included preparation of a Phase I ESA, RIWP, RIR, RAWP and FER, design of a soil vapor mitigation remedy, and implementation of remedial investigation and oversight activities. Contaminants included petroleum, VOCs, SVOCs and metals.

NYC School Construction Authority (SCA) PCB Remediation – Project Manager. Responsible for PCB-impacted soil investigation and remediation for a multitude of schools during a 3-year on-call contract. Work was performed in accordance with USEPA and NYSDEC requirements, and the New York State Education Department protocol for addressing PCBs in caulking material in school buildings that were constructed or renovated between 1950 and 1977 and that are currently undergoing renovation and demolition.

Gowanus Village I, Brooklyn, NY – Project Manager. Responsible for historical review, investigation and remedial design consultation on a NYS BCP project on a 3.5-acre former coal-fired power plant and sulfur works along the Gowanus Canal. Project included PCBs, metals and VOC in soil and groundwater, USTs, and abandoned drums. Responsibilities included preparation of a NYS BCP application, RIWP and RIR; implementation of the remedial investigation; coordination with the NYSDEC and NYSDOH; remedial design evaluation; and preparation of a Waste Management Specification to comply with United States Green Building Council (USGBC) Leadership in Environment and Energy Design (LEED) credits.

Bronx Terminal Market Waterfront Park Development (Yankee Stadium Development), Bronx, NY – Project Manager. Responsible for three NYSDEC Spill Sites on Piers 2, 3, 4 and 5 along the Harlem River. Petroleum remediation included the removal of petroleum free product, and removal, registration and closure of nine USTs, treatment of residual VOCs in the groundwater with chemical oxidant, and disposal of approximately 20,000 tons of contaminated soil. Duties included remediation design, preparation of construction documents, remediation bid support, oversight, closure report preparation and coordination with NYCDEP, NYSDEC, NYC Economic Development Corp. (NYCEDC) and NYC Department of Parks and Recreation (NYCDPR).

New York Police Academy, College Point, NY – Design Engineer. Responsible for a sub-slab depressurization and vapor barrier system to mitigate methane contamination in the subsurface as part of development of a new approximately 235,000 SF New York Police Academy Training Facility.

Bushwick Inlet Park, Brooklyn, NY – Project Manager. Provided environmental services associated with the revitalization of five-acres on the Greenpoint-Williamsburg waterfront. The multifaceted public park project includes a two-story building structure with a sloped roof with green spaces. The site contains a soccer field, landscaped and waterfront walkways, administrative and parks department offices, maintenance facilities, comfort station, public meeting rooms, and café. Responsibilities included a Phase I ESA and coordination with NYCDEP for approvals under the NYC E-

designation program. Tasks included preparation of remediation specifications, bid support, remediation oversight, and preparation of a Remedial Action Report (RAR).

Residential Site at 29 Flatbush, Brooklyn, NY – Project Manager. Responsible for a BCP site on an 18,000-square-foot urban site. Activities were planned in coordination with development of a high-rise residential tower. Duties included site investigation, preparation of groundwater studies, remedial oversight and preparation of a RIR, RAWP and FER. Contaminants included VOCs, SVOCs and metals (including hazardous lead).

711 Stewart Avenue, Garden City, NY – Project Manager. Responsible for remedial investigation and alternatives analysis. The Site was impacted with a No. 6 fuel oil spill that originated from a 20,000-gallon and 10,000-gallon USTs that was under remediation since circa 1990. The spill was within the saturated zone and a depth that makes excavation of the source area infeasible. A Remedial Investigation was performed at the Site consisting of the advancement of soil borings, installation of groundwater monitoring wells, and collection of soil, groundwater, and free product samples. An alternative analysis and feasibility study were completed and an alternative was selected, approved by NYSDEC and implemented. The alternatives analysis evaluated several potential remedies including steam injection, in-situ chemical oxidation, vitrification, dual-phase extraction, single-phase extraction and surfactants.

140 6th Avenue, New York, NY – Project Manager. Responsible for investigation and remediation of a former gasoline station site with petroleum and VOC-impacts to soil, groundwater and soil vapor. Services included owner representation in cost sharing agreement with the responsible party, investigation, design of a chemical injection and groundwater monitoring system under the proposed building, design of several soil vapor mitigation systems, remedial oversight, and remedial reporting.

Riker's Island, Co-Generation Plant, Bronx, NY – Project Manager. Responsible for several environmental soil and soil vapor quality investigations to support the Co-Generation Plant project. Soil was sampled to determine appropriate handling, reuse, transport and disposal protocols. Soil vapor was sampled to determine the potential for contaminated soil vapor intrusion into the proposed structures. Investigations included the completion of 66 borings and 6 soil vapor probes, and collection of 135 soil samples and 6 soil vapor samples. Based on the investigation findings, we prepared a contaminated soil management specification and designed a soil vapor mitigation system consisting of a passive sub-slab depressurization system and a vapor barrier. Investigation findings and conclusions were presented to the client in several reports and a presentation.

The Shops at Atlas Park, Glendale, NY – Design Engineer. Responsible for the design of four sub-slab depressurization and vapor barrier systems for new and existing retail structures at a 12-acre property. This property consisted of a 90-year-old industrial park with a central boiler house, railroad unloading facilities and extensive underground fuel oil and gasoline storage tanks. Langan conducted extensive, coordinated geotechnical and environmental investigations and guided the project through the NYS BCP. Atlas Park became one of the first projects to enter into the BCP and be granted a Certificate of Completion. Langan implemented remediation programs that included environmental due diligence, oversight of abatement

and building demolition, preparation and implementation of remedial action plans and remediation construction documents, design and construction of six sub slab depressurization and vapor barrier systems for new and existing retail structures, and design and construction of two air sparging/vacuum extraction groundwater remediation systems. The former industrial park was transformed into an outdoor shopping and entertainment center and received an ACEC New York Gold Award for Engineering Excellence and an EPA Phoenix Award for Best Brownfield Project in USEPA Region 2.

Memorial Sloan-Kettering Cancer Center, New York, NY – Project Manager. Responsible for the subsurface and soil vapor intrusion investigations. The site is a 450,000 SF health care facility in New York City. Investigation included petroleum tank evaluations, and soil, groundwater, soil vapor and indoor air sampling.

Element West 59th Street Residential, New York, NY – Design Engineer. Responsible for the design, oversight and performance monitoring of a sub-slab depressurization and vapor barrier system for a 33-story residential tower (approximately 43,000 SF). The system design took advantage of the planned waterproofing membrane and sub-slab drainage system piping and sump in order to maximize design efficiency and save on project installation costs.

500 West 23rd Street, New York, NY – Project Manager representing the developer at a NYSDEC Spill Site and a NYC E-Designated Site under NYCDEP and NYCOER oversight. The site was a former gasoline filling station with an identified Responsible Party. Duties included assisting the developer in negotiating a remediation/development cost and work allocation agreement with the Responsible Party; coordinating with the NYCDEP and completing E-Designation submissions; completing additional remedial investigation work required by the NYCDEP and NYSDEC; designing and implementing a waste characterization study; designing and implementing a soil vapor intrusion assessment; designing a sub-slab depressurization and vapor barrier system; and oversight of the remedial action.

80 Metropolitan Avenue, Brooklyn, NY – Design Engineer. Responsible for a sub-slab depressurization and vapor barrier system for a proposed (42,000 SF) six-story townhouse. The system was required to address soil vapor issues and satisfy the E-Designation requirements of the NYCDEP.

Jacob Javits Convention Center, New York, NY – Project Manager. Performed a Phase I assessment and supervised a preliminary Phase II investigation for the planned expansion of the Javits Center; an approximate area of 1.75 million GSF. The ESA included a site inspection of seven parcels over a ten-block area, interviews with owner representatives and a review of environmental agencies databases, city, state and federal agencies inquiries, historical aerial and topographic photographs, Sanborn maps, city directories, building department files and zoning department records. The preliminary Phase II study involved a boring, monitoring well and soil vapor program.

261 Hudson Street, New York, NY – Project Manager. Responsible for investigation and remediation of the approximately 27,000-square-foot site. Services included Phase I ESA and Phase II ESI, BCP application, RIR, remedial oversight and RAWP.

Confidential Location, New York, NY – Project Manager. Performed an environmental site investigation of a five-story condominium with elevated

levels of airborne mercury vapor and elemental liquid mercury deposits in select locations. It is believed that the mercury came from historic use of the building as a shoe factory. The objectives were to provide a safe, healthy place to live, satisfy the requirements of the NYCDOH and maintain property values. The investigation involved review of historical documentation and previous site investigations; conversion of all monitoring and sampling data into intensity color coded drawings in an attempt to see contamination patterns and hot spots; coordination with the building cooperative to ensure that the solutions provided matched occupants long-term uses and expectations for the building; and investigation of remedial technologies to include abatement, cleaning and encapsulation.

Columbia University, Real Estate Group, Confidential Site, Bronx, NY – Project Manager. Responsible for environmental remediation and vapor mitigation for this partially occupied two-story warehouse building and an adjacent parking area. The 37,500 SF vacant space is the proposed new location of the New York City Transit Department of Buses Facility Operations, North Division's bus depot maintenance facility. Langan conducted an inspection of the site, documented the physical conditions of the structure, and designed a sealed slab remedy for the building.

Proposed JETS Stadium, New York, NY – Performed a Phase I environmental site assessment for the proposed, $1.2 billion Jets/Olympic Stadium on the west side of Manhattan.

7 World Trade Center, New York, NY – Provided environmental inspection and management services for contaminated soil excavated (approximately 40,000 tons) during the demolition and foundation construction. Conducted endpoint soil sampling to confirm the absence of significant levels of contamination indicative of a chemical or petroleum release. Generated a final closure report for submission to the NYSDEC.

Selected Publications, Reports, and Presentations

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Conference – 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

Bioremediation via Soil Mixing to Address Chlorinated Ethenes and Ethanes at a Brownfiedl Site with High Organic and Metal Soils - Battelle 2015

Trends in Vapor Intrusion Regulation and Urban Investigation and Assessment – Battelle 2016

Soil Vapor Mitigation - Urban Complexities for Depressurization System Design – Battelle 2017

Hydrogeology Complications in Urban Environments and the Impact on Remedy Selection – Battelle 2017

Combined Treatment Train to Address Mixed Plume at Urban Brownfield - Battelle 2018

Emerging Contaminant Considerations while Performing Due Diligence for Property Transactions – Battelle 2018

Emily G. Strake, CEP
Senior Project Chemist/ Risk Assessor

Human Health Risk Assessment
Chemical Data Validation

17 years in the industry ~ 4 years with Langan

Ms. Strake has seventeen years of environmental chemistry, risk assessment, auditing, and quality assurance experience. Most recently, she has focused her efforts on human health risk assessment, and has been the primary author or key contributor of risk assessment reports and screening evaluations for projects governed under RCRA, CERCLA, PADEP, DNREC, SWRCB, DTSC, NJDEP, CTDEEP, ODEQ, NYSDEC and MDE. She has experience in site-specific strategy development, which has enabled her to perform assessments to focus areas of investigation and identify risk-based alternatives for reducing remediation costs. Ms. Strake is a member of the Interstate Technology and Regulatory Council Risk Assessment Team responsible for the development and review of organizational risk assessment guidance documents and serves as a National Trainer in risk assessment for the organization.

Ms. Strake has extensive experience assessing potential adverse health effect to humans from exposure to hazardous contaminants in soil, sediment, groundwater, surface water, ambient and indoor air, and various types of animal, fish, and plant materials. She understands and applies environmental cleanup guidance and policies associated with multiple federal and state agencies. Additionally, she has broad experience in the development of preliminary remediation goals and site-specific action levels. She is proficient with the USEPA and Cal/EPA Johnson and Ettinger Model for Subsurface Vapor Intrusion into Buildings, USEPA's Adult Lead Methodology, DTSC's Leadspread 7 and 8, evaluation of aerobic biodegradation potential using API's BioVapor, and statistical evaluation of data using USEPA's ProUCL software. In addition, Ms. Strake is experienced in presentation of risk information at public meetings.

Ms. Strake has extensive experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. In addition, she has experience in EQuIS chemical database management. She also has a broad range of environmental field experience and maintains current OSHA HAZWOPER certification.

Ms. Strake is experienced in auditing laboratory and field-sampling activities for compliance with Quality Assurance Project Plans (QAPPs), the National Environmental Laboratory Accreditation Conference Standards Quality Systems manual, and applicable USEPA Guidance. Ms. Strake has also audited on-site laboratories in support of groundwater treatment operations and implemented corrective actions. Her responsibilities include writing reports on the value of laboratory work, writing/editing QAPPs for clients and project-specific sites, peer reviewing colleague's work, and mentoring staff within the office. She has also served as the Quality Assurance officer for several long-term projects, responsible for the achievement of all forms of Quality Control/Quality Assurance by onsite personnel relating to sampling, analysis, and data evaluation.

Education

M.B.A., Business Administration
The University of Scranton

B.S., Chemistry
Cedar Crest College

Certification

Board Certified Environmental Professional (CEP)

Memberships

Interstate Technology and Regulatory Council

Montgomery Township Environmental Advisory Committee Member, Term ending 1/1/2019.

Society for Risk Analysis

Training

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/Oct 2012

Publications/Presentations

Decision Making at Contaminated Sites: Issues and Options in Human Health Risk Assessment. Interstate Technology and Regulatory Council

Alternate Approaches for Act 2 Risk Assessments Using Site-Specific Information. Pennsylvania Brownfields Conference

EPA Region IX Vapor Intrusion Policy for Silicon Valley
2014 Environmental Workshop

LANGAN

Ms. Strake has several years' experience analyzing investigative samples, writing laboratory Standard Operating Procedures (SOPs), and managing all aspects of procedures and analyses for Optical Emission Spectrometry, X-Ray Fluorescence, Ignition analysis, and Atomic Absorption. Her experience also includes operating and performing routine instrument maintenance for GC/MS and IR. Ms. Strake has worked extensively on developing rapid soil characterization programs for PCB and pesticide analyses utilizing enzyme-linked immunosorbent assays, and was also involved in efforts to develop new instrumentation to quantify microbial nitrification of ammonium.

Selected Project Experience

Human Health Risk Assessment

- Performed a baseline risk assessment for hypothetical future residents at a CERCLA site in Hagerstown, Maryland. The evaluation included evaluation of ingestion, dermal contact, and inhalation of chemicals in groundwater. Linear low dose cancer risk was assessed as well as one-hit cancer risk.
- Delaware City Refinery - Performed comprehensive human health risk assessment for a petroleum refinery in Delaware City, Delaware. The risk assessment was the basis for a thorough characterization and assessment of potential risks posed by site-specific conditions. Developed various human exposure scenarios by using both Federal and State-Specific guidance for soil, groundwater, and surface water exposure.
- Major League Soccer's San Jose Earthquakes Stadium – Utilized heuristic soil gas model to calculate risk and hazard associated with inhalation of chlorinated solvents for the redevelopment of a public soccer stadium. Soil gas data was modeled assuming three soil stratum and site-specific soil, building, and exposure parameters. The Earthquakes' stadium is set to open in 2015.
- Texas Instruments – Participated in a collaboration with Robert Ettinger and Geosyntec Consulting to develop comments to USEPA Region IX and the San Francisco Regional Water Quality Control Board regarding vapor intrusion at South Bay Superfund Sites. The focus of the response was to outline scientific and policy objections to EPA's recommended TCE interim short-term indoor air response action levels and guidelines, and to clarify the use of California-modified indoor air screening levels for assessing and responding to TCE and PCE subsurface vapor intrusion into indoor air.
- DuPont - Worked as a key participant in the human health risk evaluation of mercury associated with legacy contamination of the South River located in Waynesboro, Virginia.
- Veteran's Affairs - Completed a human health risk evaluation of the potential future risk associated with inhalation of indoor air for the Veteran's Administration. Soil, soil gas, and groundwater samples were collected as part of the site characterization. Achieved DTSC approval of the risk assessment approach and conclusions.
- Santa Clara Landfill – Developed a human health risk assessment to characterize risk associated with exposure to landfill gas at the Santa Clara All Purpose Landfill. The risk assessment evaluated specific compounds in landfill gas, their concentrations, spatial patterns, and extent throughout the site, and assessed the

potential for vapor intrusion associated with a proposed future redevelopment.

- Occidental Chemical - Completed multiple AOC-specific risk assessments utilizing and applying the guidance set forth by the DTSC's Human Health Risk Assessment Note 1 (Default Exposure Factors for Use in Risk Assessment), Note 3 (Recommended Methodology for Use of USEPA Regional Screening Levels), and Note 4 (Screening Level Human Health Risk Assessments).
- Exelon - Developed a human health risk assessment for a utility-owned former Manufactured Gas Plant (MGP) site in Pennsylvania, under Pennsylvania's Act 2 Program. Used ProUCL statistical software to determine upper limits for full data sets and non-detect data. Conducted vapor intrusion modeling (via the Johnson & Ettinger model) and prepared vapor intrusion reports showing that risks to volatile organic compounds in soils and groundwater were not impacting indoor air quality.
- Avon - Completed a human health risk assessment for a redevelopment property located in Rye, New York. The objective of the evaluation was to characterize the risks associated with potential future human exposures to soil and groundwater affected by a release from the Site's former No. 2 fuel oil UST. The intended future use of the Site was a playground to be utilized by the general public for open play on commercial recreational equipment.
- Golden Gate National Parks Conservancy – Peer reviewed a Preliminary Endangerment Assessment Report for the Battery East Trail. The assessment included a human health risk evaluation that estimated carcinogenic risk from exposure to PAHs and dioxin/furans in soil using toxic equivalency to benzo(a)pyrene and 2,3,7,8-TCDD.
- Sunoco Refineries – Derived site-specific soil PRGs for lead using the EPA's adult lead model for two former Sunoco refineries. Achieved PADEP approval in May 2015. Completed receptor evaluations in accordance with USEPA risk assessment guidance to develop exposure parameters under current and reasonably anticipated future land use scenarios.
- Honeywell - Completed a focused human health risk evaluation of PAH contaminants for under NJDEP's Site Remediation Program. Applied a blended approach of qualitative risk characterization and quantitative risk calculation to propose closure of AOCs following the remedial investigation.
- Floreffe Terminal - Performed human health risk assessment for contamination resulting from a 3.9 million gallon diesel oil tank collapse along the Monongahela River. Evaluated potential impacts to human health via exposure to soil, groundwater, and surface water. Calculated site-specific standards for soil remediation.
- DOW Chemical - Calculated Medium Specific Concentrations for unregulated contaminants using the PADEP protocols to assist in the clean-up of a monomer tank explosion in Bristol, Pennsylvania. Selected appropriate surrogate toxicity data and evaluated novel on-site constituents by analogy.
- Ryder – Developed Alternative Direct Exposure Criteria for PAH-impacted fill material at a commercial facility. Site-specific soil

screening levels for incidental ingestion of soil were calculated following a forward risk evaluation for current on-site receptors.

- Rohm and Haas - Prepared an Act 2 site-specific human health risk assessment for the oldest industrial facility in the United States, located in southeast Philadelphia. The objective of the risk assessment was to determine achievable possible future land-use options under Pennsylvania's Land Recycling Program. The risk assessment included evolution of multiple site-COPCs and constituent suites: VOCs, SVOCs, PCBs, pesticides, and metals (including lead). Evaluated the potential for indoor air inhalation through J&E modeling of soil gas and groundwater.
- Regency - Conducted vapor intrusion modeling for a dry cleaning facility in the Philadelphia area. Predictive modeling using the Johnson and Ettinger approach indicated that estimated contaminant levels would not adversely affect human receptors.

Chemical Data Quality

- Participated in a CERCLA site investigation; assessed the usability of sample results for numerous matrices including dust, sediment, soils, and various aqueous matrices for a remedial investigation under the Contract Laboratory Program. Implemented an on-site pesticide immunoassay program to delineate soil contamination in real-time.
- Coordinated the collection of fish tissue samples and determined the validity of the analytical results associated with CERCLA and RCRA site characterizations. Assessed duck blood analytical results for the Connecticut Department of Energy and Environmental Protection Bureau of Natural Resources.
- Audited multiple accredited laboratories in New Jersey and Pennsylvania on behalf of clients using USEPA Guidance on Technical Audits and Related Assessments for Environmental Data Operations. The audits included full-suite USEPA and SW-846 methodology; and included reviewing staff experience and training records, equipment and facilities, policies, practices, procedures, and documentation for sample receipt, analysis, instrument maintenance, standard preparation, calibration and traceability, control charting, corrective actions, data reduction and review, report generation, and waste disposal.
- Reviewed and validated data packages for RCRA Facilities Investigation at a Philadelphia-area chemical site; issued data validation reports to project personnel and regulatory agencies. The reviews included evaluation of quarterly groundwater, soil, and soil vapor matrices. Participated in RCRA groundwater sampling, developed and executed the investigation's QAPP, and coordinated with the laboratory to schedule and perform field-sampling events.
- Completed Data Usability Summary Reports in accordance with NYSDEC DER-10 guidance for soil, groundwater, sediment surface water, soil gas, ambient air and indoor air analytical results.
- Acted as the Quality Assurance Officer for several long-term projects in Pennsylvania, Maryland, and New Jersey, Delaware, responsible for the achievement of all forms of QA/QC as it related to sampling, analysis, and data evaluation.

- EQuIS data manager for database migration of historical groundwater results associated with remediation activities; assisted with natural attenuation data evaluation and gained experience in geochemical trends associated with intrinsic biodegradation.

ATTACHMENT B

Laboratory Reporting and Method Detection Limits

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Page: 1

Langan Engineering & Environmental

TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - 1 Vial MeOH/2 Vial Water

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Methylene chloride	75-09-2	5	2.29	ug/kg	70-130	30	70-130	30	30			
1,1-Dichloroethane	75-34-3	1	0.145	ug/kg	70-130	30	70-130	30	30			
Chloroform	67-66-3	1.5	0.14	ug/kg	70-130	30	70-130	30	30			
Carbon tetrachloride	56-23-5	1	0.23	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloropropane	78-87-5	1	0.125	ug/kg	70-130	30	70-130	30	30			
Dibromochloromethane	124-48-1	1	0.14	ug/kg	70-130	30	70-130	30	30			
1,1,2-Trichloroethane	79-00-5	1	0.267	ug/kg	70-130	30	70-130	30	30			
Tetrachloroethene	127-18-4	0.5	0.196	ug/kg	70-130	30	70-130	30	30			
Chlorobenzene	108-90-7	0.5	0.127	ug/kg	70-130	30	70-130	30	30			
Trichlorofluoromethane	75-69-4	4	0.695	ug/kg	70-139	30	70-139	30	30			
1,2-Dichloroethane	107-06-2	1	0.257	ug/kg	70-130	30	70-130	30	30			
1,1,1-Trichloroethane	71-55-6	0.5	0.167	ug/kg	70-130	30	70-130	30	30			
Bromodichloromethane	75-27-4	0.5	0.109	ug/kg	70-130	30	70-130	30	30			
trans-1,3-Dichloropropene	10061-02-6	1	0.273	ug/kg	70-130	30	70-130	30	30			
cis-1,3-Dichloropropene	10061-01-5	0.5	0.158	ug/kg	70-130	30	70-130	30	30			
1,3-Dichloropropene, Total	542-75-6	0.5	0.158	ug/kg				30	30			
1,3-Dichloropropene, Total	542-75-6	0.5	0.158	ug/kg				30	30			
1,1-Dichloropropene	563-58-6	0.5	0.159	ug/kg	70-130	30	70-130	30	30			
Bromoform	75-25-2	4	0.246	ug/kg	70-130	30	70-130	30	30			
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.166	ug/kg	70-130	30	70-130	30	30			
Benzene	71-43-2	0.5	0.166	ug/kg	70-130	30	70-130	30	30			
Toluene	108-88-3	1	0.543	ug/kg	70-130	30	70-130	30	30			
Ethylbenzene	100-41-4	1	0.141	ug/kg	70-130	30	70-130	30	30			
Chloromethane	74-87-3	4	0.932	ug/kg	52-130	30	52-130	30	30			
Bromomethane	74-83-9	2	0.581	ug/kg	57-147	30	57-147	30	30			
Vinyl chloride	75-01-4	1	0.335	ug/kg	67-130	30	67-130	30	30			
Chloroethane	75-00-3	2	0.452	ug/kg	50-151	30	50-151	30	30			
1,1-Dichloroethene	75-35-4	1	0.238	ug/kg	65-135	30	65-135	30	30			
trans-1,2-Dichloroethene	156-60-5	1.5	0.137	ug/kg	70-130	30	70-130	30	30			
Trichloroethene	79-01-6	0.5	0.137	ug/kg	70-130	30	70-130	30	30			
1,2-Dichlorobenzene	95-50-1	2	0.144	ug/kg	70-130	30	70-130	30	30			
1,3-Dichlorobenzene	541-73-1	2	0.148	ug/kg	70-130	30	70-130	30	30			
1,4-Dichlorobenzene	106-46-7	2	0.171	ug/kg	70-130	30	70-130	30	30			
Methyl tert butyl ether	1634-04-4	2	0.201	ug/kg	66-130	30	66-130	30	30			
p/m-Xylene	179601-23-1	2	0.56	ug/kg	70-130	30	70-130	30	30			
o-Xylene	95-47-6	1	0.291	ug/kg	70-130	30	70-130	30	30			
Xylene (Total)	1330-20-7	1	0.291	ug/kg				30	30			
Xylene (Total)	1330-20-7	1	0.291	ug/kg				30	30			
cis-1,2-Dichloroethene	156-59-2	1	0.175	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloroethene (total)	540-59-0	1	0.137	ug/kg				30	30			
1,2-Dichloroethene (total)	540-59-0	1	0.137	ug/kg				30	30			
Dibromomethane	74-95-3	2	0.238	ug/kg	70-130	30	70-130	30	30			

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, Inc.

Langan Engineering & Environmental

TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - 1 Vial MeOH/2 Vial Water

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Styrene	100-42-5	1	0.196	ug/kg	70-130	30	70-130	30	30			
Dichlorodifluoromethane	75-71-8	10	0.915	ug/kg	30-146	30	30-146	30	30			
Acetone	67-64-1	10	4.811	ug/kg	54-140	30	54-140	30	30			
Carbon disulfide	75-15-0	10	4.55	ug/kg	59-130	30	59-130	30	30			
2-Butanone	78-93-3	10	2.22	ug/kg	70-130	30	70-130	30	30			
Vinyl acetate	108-05-4	10	2.15	ug/kg	70-130	30	70-130	30	30			
4-Methyl-2-pentanone	108-10-1	10	1.28	ug/kg	70-130	30	70-130	30	30			
1,2,3-Trichloropropane	96-18-4	2	0.127	ug/kg	68-130	30	68-130	30	30			
2-Hexanone	591-78-6	10	1.18	ug/kg	70-130	30	70-130	30	30			
Bromochloromethane	74-97-5	2	0.205	ug/kg	70-130	30	70-130	30	30			
2,2-Dichloropropane	594-20-7	2	0.202	ug/kg	70-130	30	70-130	30	30			
1,2-Dibromoethane	106-93-4	1	0.279	ug/kg	70-130	30	70-130	30	30			
1,3-Dichloropropane	142-28-9	2	0.167	ug/kg	69-130	30	69-130	30	30			
1,1,1,2-Tetrachloroethane	630-20-6	0.5	0.132	ug/kg	70-130	30	70-130	30	30			
Bromobenzene	108-86-1	2	0.145	ug/kg	70-130	30	70-130	30	30			
n-Butylbenzene	104-51-8	1	0.167	ug/kg	70-130	30	70-130	30	30			
sec-Butylbenzene	135-98-8	1	0.146	ug/kg	70-130	30	70-130	30	30			
tert-Butylbenzene	98-06-6	2	0.118	ug/kg	70-130	30	70-130	30	30			
o-Chlorotoluene	95-49-8	2	0.191	ug/kg	70-130	30	70-130	30	30			
p-Chlorotoluene	106-43-4	2	0.108	ug/kg	70-130	30	70-130	30	30			
1,2-Dibromo-3-chloropropane	96-12-8	3	0.998	ug/kg	68-130	30	68-130	30	30			
Hexachlorobutadiene	87-68-3	4	0.169	ug/kg	67-130	30	67-130	30	30			
Isopropylbenzene	98-82-8	1	0.109	ug/kg	70-130	30	70-130	30	30			
p-Isopropyltoluene	99-87-6	1	0.109	ug/kg	70-130	30	70-130	30	30			
Naphthalene	91-20-3	4	0.65	ug/kg	70-130	30	70-130	30	30			
Acrylonitrile	107-13-1	4	1.15	ug/kg	70-130	30	70-130	30	30			
n-Propylbenzene	103-65-1	1	0.171	ug/kg	70-130	30	70-130	30	30			
1,2,3-Trichlorobenzene	87-61-6	2	0.322	ug/kg	70-130	30	70-130	30	30			
1,2,4-Trichlorobenzene	120-82-1	2	0.272	ug/kg	70-130	30	70-130	30	30			
1,3,5-Trimethylbenzene	108-67-8	2	0.193	ug/kg	70-130	30	70-130	30	30			
1,2,4-Trimethylbenzene	95-63-6	2	0.334	ug/kg	70-130	30	70-130	30	30			
1,4-Dioxane	123-91-1	100	35.1	ug/kg	65-136	30	65-136	30	30			
1,4-Diethylbenzene	105-05-5	2	0.177	ug/kg	70-130	30	70-130	30	30			
4-Ethyltoluene	622-96-8	2	0.384	ug/kg	70-130	30	70-130	30	30			
1,2,4,5-Tetramethylbenzene	95-93-2	2	0.191	ug/kg	70-130	30	70-130	30	30			
Ethyl ether	60-29-7	2	0.341	ug/kg	67-130	30	67-130	30	30			
trans-1,4-Dichloro-2-butene	110-57-6	5	1.42	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
2-Chloroethoxyethane												
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

NYTCL Semivolatiles - EPA 8270D (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		
Acenaphthene	83-32-9	133.6	17.3012	ug/kg	31-137	50	31-137	50	50			
1,2,4-Trichlorobenzene	120-82-1	167	19.1048	ug/kg	38-107	50	38-107	50	50			
Hexachlorobenzene	118-74-1	100.2	18.704	ug/kg	40-140	50	40-140	50	50			
Bis(2-chloroethyl)ether	111-44-4	150.3	22.6452	ug/kg	40-140	50	40-140	50	50			
2-Chloronaphthalene	91-58-7	167	16.5664	ug/kg	40-140	50	40-140	50	50			
1,2-Dichlorobenzene	95-50-1	167	29.9932	ug/kg	40-140	50	40-140	50	50			
1,3-Dichlorobenzene	541-73-1	167	28.724	ug/kg	40-140	50	40-140	50	50			
1,4-Dichlorobenzene	106-46-7	167	29.1582	ug/kg	28-104	50	28-104	50	50			
3,3'-Dichlorobenzidine	91-94-1	167	44.422	ug/kg	40-140	50	40-140	50	50			
2,4-Dinitrotoluene	121-14-2	167	33.4	ug/kg	40-132	50	40-132	50	50			
2,6-Dinitrotoluene	606-20-2	167	28.6572	ug/kg	40-140	50	40-140	50	50			
Fluoranthene	206-44-0	100.2	19.1716	ug/kg	40-140	50	40-140	50	50			
4-Chlorophenyl phenyl ether	7005-72-3	167	17.869	ug/kg	40-140	50	40-140	50	50			
4-Bromophenyl phenyl ether	101-55-3	167	25.4842	ug/kg	40-140	50	40-140	50	50			
Bis(2-chloroisopropyl)ether	108-60-1	200.4	28.5236	ug/kg	40-140	50	40-140	50	50			
Bis(2-chloroethoxy)methane	111-91-1	180.36	16.7334	ug/kg	40-117	50	40-117	50	50			
Hexachlorobutadiene	87-68-3	167	24.4488	ug/kg	40-140	50	40-140	50	50			
Hexachlorocyclopentadiene	77-47-4	477.62	151.302	ug/kg	40-140	50	40-140	50	50			
Hexachloroethane	67-72-1	133.6	27.0206	ug/kg	40-140	50	40-140	50	50			
Isophorone	78-59-1	150.3	21.6766	ug/kg	40-140	50	40-140	50	50			
Naphthalene	91-20-3	167	20.3406	ug/kg	40-140	50	40-140	50	50			
Nitrobenzene	98-95-3	150.3	24.716	ug/kg	40-140	50	40-140	50	50			
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	133.6	19.0046	ug/kg	36-157	50	36-157	50	50			
n-Nitrosodi-n-propylamine	621-64-7	167	25.7848	ug/kg	32-121	50	32-121	50	50			
Bis(2-Ethylhexyl)phthalate	117-81-7	167	57.782	ug/kg	40-140	50	40-140	50	50			
Butyl benzyl phthalate	85-68-7	167	42.084	ug/kg	40-140	50	40-140	50	50			
Di-n-butylphthalate	84-74-2	167	31.6632	ug/kg	40-140	50	40-140	50	50			
Di-n-octylphthalate	117-84-0	167	56.78	ug/kg	40-140	50	40-140	50	50			
Diethyl phthalate	84-66-2	167	15.4642	ug/kg	40-140	50	40-140	50	50			
Dimethyl phthalate	131-11-3	167	35.07	ug/kg	40-140	50	40-140	50	50			
Benzo(a)anthracene	56-55-3	100.2	18.8042	ug/kg	40-140	50	40-140	50	50			
Benzo(a)pyrene	50-32-8	133.6	40.748	ug/kg	40-140	50	40-140	50	50			
Benzo(b)fluoranthene	205-99-2	100.2	28.1228	ug/kg	40-140	50	40-140	50	50			
Benzo(k)fluoranthene	207-08-9	100.2	26.72	ug/kg	40-140	50	40-140	50	50			
Chrysene	218-01-9	100.2	17.368	ug/kg	40-140	50	40-140	50	50			
Acenaphthylene	208-96-8	133.6	25.7848	ug/kg	40-140	50	40-140	50	50			
Anthracene	120-12-7	100.2	32.565	ug/kg	40-140	50	40-140	50	50			
Benzo(ghi)perylene	191-24-2	133.6	19.6392	ug/kg	40-140	50	40-140	50	50			
Fluorene	86-73-7	167	16.2324	ug/kg	40-140	50	40-140	50	50			
Phenanthrene	85-01-8	100.2	20.3072	ug/kg	40-140	50	40-140	50	50			
Dibenzo(a,h)anthracene	53-70-3	100.2	19.3052	ug/kg	40-140	50	40-140	50	50			
Indeno(1,2,3-cd)Pyrene	193-39-5	133.6	23.2798	ug/kg	40-140	50	40-140	50	50			

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Date Created: 07/27/18

Langan Engineering & Environmental

NYTCL Semivolatiles - EPA 8270D (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		
Pyrene	129-00-0	100.2	16.5998	ug/kg	35-142	50	35-142	50	50			
Biphenyl	92-52-4	380.76	38.744	ug/kg	54-104	50	54-104	50	50			
4-Chloroaniline	106-47-8	167	30.394	ug/kg	40-140	50	40-140	50	50			
2-Nitroaniline	88-74-4	167	32.1976	ug/kg	47-134	50	47-134	50	50			
3-Nitroaniline	99-09-2	167	31.4962	ug/kg	26-129	50	26-129	50	50			
4-Nitroaniline	100-01-6	167	69.138	ug/kg	41-125	50	41-125	50	50			
Dibenzofuran	132-64-9	167	15.7982	ug/kg	40-140	50	40-140	50	50			
2-Methylnaphthalene	91-57-6	200.4	20.1736	ug/kg	40-140	50	40-140	50	50			
Acetophenone	98-86-2	167	20.6746	ug/kg	14-144	50	14-144	50	50			
2,4,6-Trichlorophenol	88-06-2	100.2	31.6632	ug/kg	30-130	50	30-130	50	50			
P-Chloro-M-Cresol	59-50-7	167	24.883	ug/kg	26-103	50	26-103	50	50			
2-Chlorophenol	95-57-8	167	19.7394	ug/kg	25-102	50	25-102	50	50			
2,4-Dichlorophenol	120-83-2	150.3	26.8536	ug/kg	30-130	50	30-130	50	50			
2,4-Dimethylphenol	105-67-9	167	55.11	ug/kg	30-130	50	30-130	50	50			
2-Nitrophenol	88-75-5	360.72	62.792	ug/kg	30-130	50	30-130	50	50			
4-Nitrophenol	100-02-7	233.8	68.136	ug/kg	11-114	50	11-114	50	50			
2,4-Dinitrophenol	51-28-5	801.6	77.822	ug/kg	4-130	50	4-130	50	50			
4,6-Dinitro-o-cresol	534-52-1	434.2	80.16	ug/kg	10-130	50	10-130	50	50			
Pentachlorophenol	87-86-5	133.6	36.74	ug/kg	17-109	50	17-109	50	50			
Phenol	108-95-2	167	25.217	ug/kg	26-90	50	26-90	50	50			
2-Methylphenol	95-48-7	167	25.885	ug/kg	30-130.	50	30-130.	50	50			
3-Methylphenol/4-Methylphenol	106-44-5	240.48	26.1522	ug/kg	30-130	50	30-130	50	50			
2,4,5-Trichlorophenol	95-95-4	167	31.9972	ug/kg	30-130	50	30-130	50	50			
Benzoic Acid	65-85-0	541.08	169.004	ug/kg	10-110	50	10-110	50	50			
Benzyl Alcohol	100-51-6	167	51.102	ug/kg	40-140	50	40-140	50	50			
Carbazole	86-74-8	167	16.2324	ug/kg	54-128	50	54-128	50	50			
2-Fluorophenol	*367-12-4*									*25-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*30-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-136*		
4-Terphenyl-d14	*1718-51-0*									*18-120*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TCL Pesticides - EPA 8081B (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		
Delta-BHC	319-86-8	7.992	1.5651	ug/kg	30-150	30	30-150	50	50			
Lindane	58-89-9	3.33	1.48851	ug/kg	30-150	30	30-150	50	50			
Alpha-BHC	319-84-6	3.33	0.94572	ug/kg	30-150	30	30-150	50	50			
Beta-BHC	319-85-7	7.992	3.0303	ug/kg	30-150	30	30-150	50	50			
Heptachlor	76-44-8	3.996	1.79154	ug/kg	30-150	30	30-150	50	50			
Aldrin	309-00-2	7.992	2.81385	ug/kg	30-150	30	30-150	50	50			
Heptachlor epoxide	1024-57-3	14.985	4.4955	ug/kg	30-150	30	30-150	50	50			
Endrin	72-20-8	3.33	1.3653	ug/kg	30-150	30	30-150	50	50			
Endrin aldehyde	7421-93-4	9.99	3.4965	ug/kg	30-150	30	30-150	50	50			
Endrin ketone	53494-70-5	7.992	2.05794	ug/kg	30-150	30	30-150	50	50			
Dieldrin	60-57-1	4.995	2.4975	ug/kg	30-150	30	30-150	50	50			
4,4'-DDE	72-55-9	7.992	1.84815	ug/kg	30-150	30	30-150	50	50			
4,4'-DDD	72-54-8	7.992	2.85048	ug/kg	30-150	30	30-150	50	50			
4,4'-DDT	50-29-3	14.985	6.4269	ug/kg	30-150	30	30-150	50	50			
Endosulfan I	959-98-8	7.992	1.88811	ug/kg	30-150	30	30-150	50	50			
Endosulfan II	33213-65-9	7.992	2.67066	ug/kg	30-150	30	30-150	50	50			
Endosulfan sulfate	1031-07-8	3.33	1.58508	ug/kg	30-150	30	30-150	50	50			
Methoxychlor	72-43-5	14.985	4.662	ug/kg	30-150	30	30-150	50	50			
Toxaphene	8001-35-2	149.85	41.958	ug/kg	30-150	30	30-150	50	50			
cis-Chlordane	5103-71-9	9.99	2.78388	ug/kg	30-150	30	30-150	50	50			
trans-Chlordane	5103-74-2	9.99	2.63736	ug/kg	30-150	30	30-150	50	50			
Chlordane	57-74-9	64.935	26.4735	ug/kg	30-150	30	30-150	50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

Herbicides -EPA 8151A (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		
2,4-D	94-75-7	0.1665	0.0104895	mg/kg	30-150	30	30-150	30	30			
2,4,5-T	93-76-5	0.1665	0.0051615	mg/kg	30-150	30	30-150	30	30			
2,4,5-TP (Silvex)	93-72-1	0.1665	0.0044289	mg/kg	30-150	30	30-150	30	30			
DCAA	*19719-28-9*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TCL PCBs - EPA 8082A (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		
Aroclor 1016	12674-11-2	33.5	3.7989	ug/kg	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	33.5	5.0987	ug/kg	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	33.5	3.2964	ug/kg	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	33.5	4.1004	ug/kg	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	33.5	3.7587	ug/kg	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	33.5	2.7336	ug/kg	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	33.5	3.4974	ug/kg	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	33.5	2.7537	ug/kg	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	33.5	2.3718	ug/kg	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	33.5	1.541	ug/kg				50	50			
PCBs, Total	1336-36-3	33.5	1.541	ug/kg				50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

METALS by 6010D (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Aluminum, Total	7429-90-5	4	1.08	mg/kg	48-151		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Antimony, Total	7440-36-0	2	0.152	mg/kg	1-208		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Arsenic, Total	7440-38-2	0.4	0.0832	mg/kg	79-121		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Barium, Total	7440-39-3	0.4	0.0696	mg/kg	83-117		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Beryllium, Total	7440-41-7	0.2	0.0132	mg/kg	83-117		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Cadmium, Total	7440-43-9	0.4	0.0392	mg/kg	83-117		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Calcium, Total	7440-70-2	4	1.4	mg/kg	81-119		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Chromium, Total	7440-47-3	0.4	0.0384	mg/kg	80-120		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Cobalt, Total	7440-48-4	0.8	0.0664	mg/kg	84-115		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Copper, Total	7440-50-8	0.4	0.1032	mg/kg	81-118		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Iron, Total	7439-89-6	2	0.3612	mg/kg	45-155		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Lead, Total	7439-92-1	2	0.1072	mg/kg	81-117		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Magnesium, Total	7439-95-4	4	0.616	mg/kg	76-124		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Manganese, Total	7439-96-5	0.4	0.0636	mg/kg	81-117		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Nickel, Total	7440-02-0	1	0.0968	mg/kg	83-117		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Potassium, Total	7440-09-7	100	5.76	mg/kg	71-129		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Selenium, Total	7782-49-2	0.8	0.1032	mg/kg	78-122		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Silver, Total	7440-22-4	0.4	0.1132	mg/kg	75-124		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Sodium, Total	7440-23-5	80	1.26	mg/kg	72-127		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Thallium, Total	7440-28-0	0.8	0.126	mg/kg	80-120		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Vanadium, Total	7440-62-2	0.4	0.0812	mg/kg	78-122		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved
Zinc, Total	7440-66-6	2	0.1172	mg/kg	82-118		75-125	20	20		180 days	1 - Metals Only-Glass 60mL/2oz unpreserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1

Langan Engineering & Environmental

METALS by 7471B (SOIL)

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	0.08	0.016896	mg/kg	72-128		80-120	20	20		28 days	1 - Metals Only-Glass 60mL/2oz unpreserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

WETCHEM (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Method	Holding Time	Container/Sample Preservation
Cyanide, Reactive	57-12-5	10	10	mg/kg	30-125	40		40	40	7.3	14 days	1 - Glass 250ml/8oz unpreserved
Sulfide, Reactive	NONE	10	10	mg/kg	60-125	40		40	40	7.3	14 days	1 - Glass 250ml/8oz unpreserved
Chromium, Hexavalent	18540-29-9	0.8	0.16	mg/kg	80-120	20	75-125	20	20	7196A	30 days	1 - Glass 120ml/4oz unpreserved
Cyanide, Total	57-12-5	1	0.212	mg/kg	80-120	35	75-125	35	35	9010C/9012B	14 days	1 - Glass 250ml/8oz unpreserved
pH	12408-02-5	0		SU	99-101			5	5	9045D	24 hours	1 - Glass 250ml/8oz unpreserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TPH by GC-FID Quantitation Only (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		
TPH	NONE	33350	3835.25	ug/kg	40-140	40	40-140	40	40			
Total Petroleum Hydrocarbons (C9-C44)	NONE	33350	3341.67	ug/kg	40-140	40	40-140	40	40			
o-Terphenyl	*84-15-1*									*40-140*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5251-1
Page: 1

Langan Engineering & Environmental

TPH - Gasoline Range Organics (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Vial MeOH preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Gasoline Range Organics	NONE	2500	48.15	ug/kg	80-120	20	80-120	20	20			
1,1,1-Trifluorotoluene	*98-08-8*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

TCL Volatiles - EPA 8260C (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Methylene chloride	75-09-2	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,1-Dichloroethane	75-34-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Chloroform	67-66-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Carbon tetrachloride	56-23-5	0.5	0.134	ug/l	63-132	20	63-132	20	20			
1,2-Dichloropropane	78-87-5	1	0.137	ug/l	70-130	20	70-130	20	20			
Dibromochloromethane	124-48-1	0.5	0.149	ug/l	63-130	20	63-130	20	20			
1,1,2-Trichloroethane	79-00-5	1.5	0.5	ug/l	70-130	20	70-130	20	20			
Tetrachloroethene	127-18-4	0.5	0.181	ug/l	70-130	20	70-130	20	20			
Chlorobenzene	108-90-7	2.5	0.7	ug/l	75-130	20	75-130	20	20			
Trichlorofluoromethane	75-69-4	2.5	0.7	ug/l	62-150	20	62-150	20	20			
1,2-Dichloroethane	107-06-2	0.5	0.132	ug/l	70-130	20	70-130	20	20			
1,1,1-Trichloroethane	71-55-6	2.5	0.7	ug/l	67-130	20	67-130	20	20			
Bromodichloromethane	75-27-4	0.5	0.192	ug/l	67-130	20	67-130	20	20			
trans-1,3-Dichloropropene	10061-02-6	0.5	0.164	ug/l	70-130	20	70-130	20	20			
cis-1,3-Dichloropropene	10061-01-5	0.5	0.144	ug/l	70-130	20	70-130	20	20			
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20			
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20			
1,1-Dichloropropene	563-58-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Bromoform	75-25-2	2	0.65	ug/l	54-136	20	54-136	20	20			
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.167	ug/l	67-130	20	67-130	20	20			
Benzene	71-43-2	0.5	0.159	ug/l	70-130	20	70-130	20	20			
Toluene	108-88-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Ethylbenzene	100-41-4	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Chloromethane	74-87-3	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Bromomethane	74-83-9	2.5	0.7	ug/l	39-139	20	39-139	20	20			
Vinyl chloride	75-01-4	1	0.0714	ug/l	55-140	20	55-140	20	20			
Chloroethane	75-00-3	2.5	0.7	ug/l	55-138	20	55-138	20	20			
1,1-Dichloroethene	75-35-4	0.5	0.169	ug/l	61-145	20	61-145	20	20			
trans-1,2-Dichloroethene	156-60-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Trichloroethene	79-01-6	0.5	0.175	ug/l	70-130	20	70-130	20	20			
1,2-Dichlorobenzene	95-50-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,3-Dichlorobenzene	541-73-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,4-Dichlorobenzene	106-46-7	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Methyl tert butyl ether	1634-04-4	2.5	0.7	ug/l	63-130	20	63-130	20	20			
p/m-Xylene	179601-23-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
o-Xylene	95-47-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20			
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20			
cis-1,2-Dichloroethene	156-59-2	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20			
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20			
Dibromomethane	74-95-3	5	1	ug/l	70-130	20	70-130	20	20			

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1

Langan Engineering & Environmental

TCL Volatiles - EPA 8260C (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
1,2,3-Trichloropropane	96-18-4	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Acrylonitrile	107-13-1	5	1.5	ug/l	70-130	20	70-130	20	20			
Styrene	100-42-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Dichlorodifluoromethane	75-71-8	5	1	ug/l	36-147	20	36-147	20	20			
Acetone	67-64-1	5	1.46	ug/l	58-148	20	58-148	20	20			
Carbon disulfide	75-15-0	5	1	ug/l	51-130	20	51-130	20	20			
2-Butanone	78-93-3	5	1.94	ug/l	63-138	20	63-138	20	20			
Vinyl acetate	108-05-4	5	1	ug/l	70-130	20	70-130	20	20			
4-Methyl-2-pentanone	108-10-1	5	1	ug/l	59-130	20	59-130	20	20			
2-Hexanone	591-78-6	5	1	ug/l	57-130	20	57-130	20	20			
Bromochloromethane	74-97-5	2.5	0.7	ug/l	70-130	20	70-130	20	20			
2,2-Dichloropropane	594-20-7	2.5	0.7	ug/l	63-133	20	63-133	20	20			
1,2-Dibromoethane	106-93-4	2	0.65	ug/l	70-130	20	70-130	20	20			
1,3-Dichloropropane	142-28-9	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,1,1,2-Tetrachloroethane	630-20-6	2.5	0.7	ug/l	64-130	20	64-130	20	20			
Bromobenzene	108-86-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
n-Butylbenzene	104-51-8	2.5	0.7	ug/l	53-136	20	53-136	20	20			
sec-Butylbenzene	135-98-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
tert-Butylbenzene	98-06-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
o-Chlorotoluene	95-49-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
p-Chlorotoluene	106-43-4	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dibromo-3-chloropropane	96-12-8	2.5	0.7	ug/l	41-144	20	41-144	20	20			
Hexachlorobutadiene	87-68-3	2.5	0.7	ug/l	63-130	20	63-130	20	20			
Isopropylbenzene	98-82-8	2.5	0.7	ug/l	70-130	20	70-130	20	20			
p-Isopropyltoluene	99-87-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
Naphthalene	91-20-3	2.5	0.7	ug/l	70-130	20	70-130	20	20			
n-Propylbenzene	103-65-1	2.5	0.7	ug/l	69-130	20	69-130	20	20			
1,2,3-Trichlorobenzene	87-61-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2,4-Trichlorobenzene	120-82-1	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,3,5-Trimethylbenzene	108-67-8	2.5	0.7	ug/l	64-130	20	64-130	20	20			
1,2,4-Trimethylbenzene	95-63-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,4-Dioxane	123-91-1	250	60.8	ug/l	56-162	20	56-162	20	20			
1,4-Diethylbenzene	105-05-5	2	0.7	ug/l	70-130	20	70-130	20	20			
4-Ethyltoluene	622-96-8	2	0.7	ug/l	70-130	20	70-130	20	20			
1,2,4,5-Tetramethylbenzene	95-93-2	2	0.542	ug/l	70-130	20	70-130	20	20			
Ethyl ether	60-29-7	2.5	0.7	ug/l	59-134	20	59-134	20	20			
trans-1,4-Dichloro-2-butene	110-57-6	2.5	0.7	ug/l	70-130	20	70-130	20	20			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

NYTCL Semivolatiles - EPA 8270D (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	2	0.591	ug/l	37-111	30	37-111	30	30			
1,2,4-Trichlorobenzene	120-82-1	5	0.661	ug/l	39-98	30	39-98	30	30			
Hexachlorobenzene	118-74-1	2	0.579	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroethyl)ether	111-44-4	2	0.669	ug/l	40-140	30	40-140	30	30			
2-Chloronaphthalene	91-58-7	2	0.64	ug/l	40-140	30	40-140	30	30			
1,2-Dichlorobenzene	95-50-1	2	0.732	ug/l	40-140	30	40-140	30	30			
1,3-Dichlorobenzene	541-73-1	2	0.688	ug/l	40-140	30	40-140	30	30			
1,4-Dichlorobenzene	106-46-7	2	0.708	ug/l	36-97	30	36-97	30	30			
3,3'-Dichlorobenzidine	91-94-1	5	1.39	ug/l	40-140	30	40-140	30	30			
2,4-Dinitrotoluene	121-14-2	5	0.845	ug/l	48-143	30	48-143	30	30			
2,6-Dinitrotoluene	606-20-2	5	1.12	ug/l	40-140	30	40-140	30	30			
Fluoranthene	206-44-0	2	0.568	ug/l	40-140	30	40-140	30	30			
4-Chlorophenyl phenyl ether	7005-72-3	2	0.625	ug/l	40-140	30	40-140	30	30			
4-Bromophenyl phenyl ether	101-55-3	2	0.731	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroisopropyl)ether	108-60-1	2	0.696	ug/l	40-140	30	40-140	30	30			
Bis(2-chloroethoxy)methane	111-91-1	5	0.626	ug/l	40-140	30	40-140	30	30			
Hexachlorobutadiene	87-68-3	2	0.717	ug/l	40-140	30	40-140	30	30			
Hexachlorocyclopentadiene	77-47-4	20	7.84	ug/l	40-140	30	40-140	30	30			
Hexachloroethane	67-72-1	2	0.682	ug/l	40-140	30	40-140	30	30			
Isophorone	78-59-1	5	0.601	ug/l	40-140	30	40-140	30	30			
Naphthalene	91-20-3	2	0.68	ug/l	40-140	30	40-140	30	30			
Nitrobenzene	98-95-3	2	0.753	ug/l	40-140	30	40-140	30	30			
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	2	0.644	ug/l	40-140	30	40-140	30	30			
n-Nitrosodi-n-propylamine	621-64-7	5	0.7	ug/l	29-132	30	29-132	30	30			
Bis(2-Ethylhexyl)phthalate	117-81-7	3	0.91	ug/l	40-140	30	40-140	30	30			
Butyl benzyl phthalate	85-68-7	5	1.26	ug/l	40-140	30	40-140	30	30			
Di-n-butylphthalate	84-74-2	5	0.689	ug/l	40-140	30	40-140	30	30			
Di-n-octylphthalate	117-84-0	5	1.14	ug/l	40-140	30	40-140	30	30			
Diethyl phthalate	84-66-2	5	0.628	ug/l	40-140	30	40-140	30	30			
Dimethyl phthalate	131-11-3	5	0.65	ug/l	40-140	30	40-140	30	30			
Benzo(a)anthracene	56-55-3	2	0.61	ug/l	40-140	30	40-140	30	30			
Benzo(a)pyrene	50-32-8	2	0.539	ug/l	40-140	30	40-140	30	30			
Benzo(b)fluoranthene	205-99-2	2	0.635	ug/l	40-140	30	40-140	30	30			
Benzo(k)fluoranthene	207-08-9	2	0.597	ug/l	40-140	30	40-140	30	30			
Chrysene	218-01-9	2	0.543	ug/l	40-140	30	40-140	30	30			
Acenaphthylene	208-96-8	2	0.658	ug/l	45-123	30	45-123	30	30			
Anthracene	120-12-7	2	0.645	ug/l	40-140	30	40-140	30	30			
Benzo(ghi)perylene	191-24-2	2	0.611	ug/l	40-140	30	40-140	30	30			
Fluorene	86-73-7	2	0.619	ug/l	40-140	30	40-140	30	30			
Phenanthrene	85-01-8	2	0.613	ug/l	40-140	30	40-140	30	30			
Dibenzo(a,h)anthracene	53-70-3	2	0.548	ug/l	40-140	30	40-140	30	30			
Indeno(1,2,3-cd)Pyrene	193-39-5	2	0.707	ug/l	40-140	30	40-140	30	30			

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 2

Langan Engineering & Environmental

NYTCL Semivolatiles - EPA 8270D (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Pyrene	129-00-0	2	0.569	ug/l	26-127	30	26-127	30	30			
Biphenyl	92-52-4	2	0.757	ug/l	40-140	30	40-140	30	30			
4-Chloroaniline	106-47-8	5	0.632	ug/l	40-140	30	40-140	30	30			
2-Nitroaniline	88-74-4	5	1.14	ug/l	52-143	30	52-143	30	30			
3-Nitroaniline	99-09-2	5	1.22	ug/l	25-145	30	25-145	30	30			
4-Nitroaniline	100-01-6	5	1.3	ug/l	51-143	30	51-143	30	30			
Dibenzofuran	132-64-9	2	0.656	ug/l	40-140	30	40-140	30	30			
2-Methylnaphthalene	91-57-6	2	0.72	ug/l	40-140	30	40-140	30	30			
Acetophenone	98-86-2	5	0.847	ug/l	39-129	30	39-129	30	30			
2,4,6-Trichlorophenol	88-06-2	5	0.681	ug/l	30-130	30	30-130	30	30			
P-Chloro-M-Cresol	59-50-7	2	0.617	ug/l	23-97	30	23-97	30	30			
2-Chlorophenol	95-57-8	2	0.631	ug/l	27-123	30	27-123	30	30			
2,4-Dichlorophenol	120-83-2	5	0.769	ug/l	30-130	30	30-130	30	30			
2,4-Dimethylphenol	105-67-9	5	1.64	ug/l	30-130	30	30-130	30	30			
2-Nitrophenol	88-75-5	10	1.52	ug/l	30-130	30	30-130	30	30			
4-Nitrophenol	100-02-7	10	1.77	ug/l	10-80	30	10-80	30	30			
2,4-Dinitrophenol	51-28-5	20	5.47	ug/l	20-130	30	20-130	30	30			
4,6-Dinitro-o-cresol	534-52-1	10	2.1	ug/l	20-164	30	20-164	30	30			
Pentachlorophenol	87-86-5	10	3.43	ug/l	9-103	30	9-103	30	30			
Phenol	108-95-2	5	1.89	ug/l	12-110	30	12-110	30	30			
2-Methylphenol	95-48-7	5	1.02	ug/l	30-130	30	30-130	30	30			
3-Methylphenol/4-Methylphenol	106-44-5	5	1.11	ug/l	30-130	30	30-130	30	30			
2,4,5-Trichlorophenol	95-95-4	5	0.715	ug/l	30-130	30	30-130	30	30			
Benzoic Acid	65-85-0	50	12.9	ug/l	10-164	30	10-164	30	30			
Benzyl Alcohol	100-51-6	2	0.725	ug/l	26-116	30	26-116	30	30			
Carbazole	86-74-8	2	0.627	ug/l	55-144	30	55-144	30	30			
2-Fluorophenol	*367-12-4*									*21-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*15-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-120*		
4-Terphenyl-d14	*1718-51-0*									*41-149*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

NYTCL Semivolatiles -EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Acenaphthene	83-32-9	0.1	0.035	ug/l	40-140	40	40-140	40	40			
2-Chloronaphthalene	91-58-7	0.2	0.035	ug/l	40-140	40	40-140	40	40			
Fluoranthene	206-44-0	0.1	0.038	ug/l	40-140	40	40-140	40	40			
Hexachlorobutadiene	87-68-3	0.5	0.036	ug/l	40-140	40	40-140	40	40			
Naphthalene	91-20-3	0.1	0.043	ug/l	40-140	40	40-140	40	40			
Benzo(a)anthracene	56-55-3	0.1	0.018	ug/l	40-140	40	40-140	40	40			
Benzo(a)pyrene	50-32-8	0.1	0.039	ug/l	40-140	40	40-140	40	40			
Benzo(b)fluoranthene	205-99-2	0.1	0.016	ug/l	40-140	40	40-140	40	40			
Benzo(k)fluoranthene	207-08-9	0.1	0.042	ug/l	40-140	40	40-140	40	40			
Chrysene	218-01-9	0.1	0.038	ug/l	40-140	40	40-140	40	40			
Acenaphthylene	208-96-8	0.1	0.035	ug/l	40-140	40	40-140	40	40			
Anthracene	120-12-7	0.1	0.035	ug/l	40-140	40	40-140	40	40			
Benzo(ghi)perylene	191-24-2	0.1	0.042	ug/l	40-140	40	40-140	40	40			
Fluorene	86-73-7	0.1	0.037	ug/l	40-140	40	40-140	40	40			
Phenanthrene	85-01-8	0.1	0.015	ug/l	40-140	40	40-140	40	40			
Dibenzo(a,h)anthracene	53-70-3	0.1	0.039	ug/l	40-140	40	40-140	40	40			
Indeno(1,2,3-cd)Pyrene	193-39-5	0.1	0.04	ug/l	40-140	40	40-140	40	40			
Pyrene	129-00-0	0.1	0.04	ug/l	40-140	40	40-140	40	40			
2-Methylnaphthalene	91-57-6	0.1	0.045	ug/l	40-140	40	40-140	40	40			
Pentachlorophenol	87-86-5	0.8	0.22	ug/l	40-140	40	40-140	40	40			
Hexachlorobenzene	118-74-1	0.8	0.032	ug/l	40-140	40	40-140	40	40			
Hexachloroethane	67-72-1	0.8	0.03	ug/l	40-140	40	40-140	40	40			
2-Fluorophenol	*367-12-4*									*21-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*15-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-120*		
4-Terphenyl-d14	*1718-51-0*									*41-149*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

TCL Pesticides - EPA 8081B (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 120ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Delta-BHC	319-86-8	0.02	0.00467	ug/l	30-150	20	30-150	30	30			
Lindane	58-89-9	0.02	0.00434	ug/l	30-150	20	30-150	30	30			
Alpha-BHC	319-84-6	0.02	0.00439	ug/l	30-150	20	30-150	30	30			
Beta-BHC	319-85-7	0.02	0.0056	ug/l	30-150	20	30-150	30	30			
Heptachlor	76-44-8	0.02	0.0031	ug/l	30-150	20	30-150	30	30			
Aldrin	309-00-2	0.02	0.00216	ug/l	30-150	20	30-150	30	30			
Heptachlor epoxide	1024-57-3	0.02	0.00415	ug/l	30-150	20	30-150	30	30			
Endrin	72-20-8	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
Endrin aldehyde	7421-93-4	0.04	0.0081	ug/l	30-150	20	30-150	30	30			
Endrin ketone	53494-70-5	0.04	0.00477	ug/l	30-150	20	30-150	30	30			
Dieldrin	60-57-1	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
4,4'-DDE	72-55-9	0.04	0.00381	ug/l	30-150	20	30-150	30	30			
4,4'-DDD	72-54-8	0.04	0.00464	ug/l	30-150	20	30-150	30	30			
4,4'-DDT	50-29-3	0.04	0.00432	ug/l	30-150	20	30-150	30	30			
Endosulfan I	959-98-8	0.02	0.00345	ug/l	30-150	20	30-150	30	30			
Endosulfan II	33213-65-9	0.04	0.00519	ug/l	30-150	20	30-150	30	30			
Endosulfan sulfate	1031-07-8	0.04	0.00481	ug/l	30-150	20	30-150	30	30			
Methoxychlor	72-43-5	0.2	0.00684	ug/l	30-150	20	30-150	30	30			
Toxaphene	8001-35-2	0.2	0.0627	ug/l	30-150	20	30-150	30	30			
cis-Chlordane	5103-71-9	0.02	0.00666	ug/l	30-150	20	30-150	30	30			
trans-Chlordane	5103-74-2	0.02	0.00627	ug/l	30-150	20	30-150	30	30			
Chlordane	57-74-9	0.2	0.0463	ug/l	30-150	20	30-150	30	30			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

Herbicides -EPA 8151A (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
2,4-D	94-75-7	10	0.498	ug/l	30-150	25	30-150	25	25			
2,4,5-T	93-76-5	2	0.531	ug/l	30-150	25	30-150	25	25			
2,4,5-TP (Silvex)	93-72-1	2	0.539	ug/l	30-150	25	30-150	25	25			
DCAA	*19719-28-9*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

TCL PCBs - EPA 8082A (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Aroclor 1016	12674-11-2	0.083	0.019588	ug/l	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	0.083	0.031872	ug/l	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	0.083	0.027058	ug/l	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	0.083	0.029548	ug/l	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	0.083	0.022576	ug/l	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	0.083	0.034611	ug/l	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	0.083	0.01992	ug/l	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	0.083	0.017098	ug/l	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	0.083	0.027058	ug/l	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50			
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

METALS by 6020B (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Aluminum, Total	7429-90-5	0.01	0.00327	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Antimony, Total	7440-36-0	0.004	0.000429	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Arsenic, Total	7440-38-2	0.0005	0.000165	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Barium, Total	7440-39-3	0.0005	0.000173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Beryllium, Total	7440-41-7	0.0005	0.000107	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cadmium, Total	7440-43-9	0.0002	0.0000599	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Calcium, Total	7440-70-2	0.1	0.0394	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Chromium, Total	7440-47-3	0.001	0.000178	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Cobalt, Total	7440-48-4	0.0005	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Copper, Total	7440-50-8	0.001	0.000384	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Iron, Total	7439-89-6	0.05	0.0191	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Lead, Total	7439-92-1	0.001	0.000343	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Magnesium, Total	7439-95-4	0.07	0.0242	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Manganese, Total	7439-96-5	0.001	0.00044	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Nickel, Total	7440-02-0	0.002	0.000556	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Potassium, Total	7440-09-7	0.1	0.0309	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Selenium, Total	7782-49-2	0.005	0.00173	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Silver, Total	7440-22-4	0.0004	0.000163	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Sodium, Total	7440-23-5	0.1	0.0293	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Thallium, Total	7440-28-0	0.0005	0.000143	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Vanadium, Total	7440-62-2	0.005	0.00157	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved
Zinc, Total	7440-66-6	0.01	0.00341	mg/l	80-120		75-125	20	20		180 days	1 - Plastic 500ml HNO3 preserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

METALS by 7470A (WATER)

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	0.0002	0.000066	mg/l	80-120		75-125	20	20		28 days	1 - Plastic 500ml HNO3 preserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

WETCHEM (WATER)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Method	Holding Time	Container/Sample Preservation
Chromium, Hexavalent	18540-29-9	0.01	0.003	mg/l	85-115	20	85-115	20	20	7196A	24 hours	1 - Plastic 500ml unpreserved
Cyanide, Total	57-12-5	0.005	0.0018	mg/l	85-115	20	80-120	20	20	9010C/9012B	14 days	1 - Plastic 250ml NaOH preserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

TPH by GC-FID Quantitation Only (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 1000ml unpreserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
TPH	NONE	200	42	ug/l	40-140	40	40-140	40	40			
Total Petroleum Hydrocarbons (C9-C44)	NONE	500	43.1	ug/l	40-140	40	40-140	40	40			
o-Terphenyl	*84-15-1*									*40-140*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5253-1
Page: 1

Langan Engineering & Environmental

TPH - Gasoline Range Organics (WATER)

Holding Time: 14 days
Container/Sample Preservation: 3 - Vial HCl preserved

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Gasoline Range Organics	NONE	50	3.048	ug/l	80-120	20	80-120	20	20			
1,1,1-Trifluorotoluene	*98-08-8*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		

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Method	Analyte	Units	Reporting Limit		Method	Analyte	Units	Reporting Limit
TO15	Dichlorodifluoromethane	ug/m3	0.989		TO15	Dichlorodifluoromethane	ppbV	0.2
TO15	Chloromethane	ug/m3	0.413		TO15	Chloromethane	ppbV	0.2
TO15	Freon-114	ug/m3	1.4		TO15	Freon-114	ppbV	0.2
TO15	1,3-Butadiene	ug/m3	0.442		TO15	1,3-Butadiene	ppbV	0.2
TO15	Bromomethane	ug/m3	0.777		TO15	Bromomethane	ppbV	0.2
TO15	Chloroethane	ug/m3	0.528		TO15	Chloroethane	ppbV	0.2
TO15	Ethanol	ug/m3	9.42		TO15	Ethanol	ppbV	5
TO15	Vinyl bromide	ug/m3	0.874		TO15	Vinyl bromide	ppbV	0.2
TO15	Acetone	ug/m3	2.38		TO15	Acetone	ppbV	1
TO15	Trichlorofluoromethane	ug/m3	1.12		TO15	Trichlorofluoromethane	ppbV	0.2
TO15	Isopropanol	ug/m3	1.23		TO15	Isopropanol	ppbV	0.5
TO15	Tertiary butyl Alcohol	ug/m3	1.52		TO15	Tertiary butyl Alcohol	ppbV	0.5
TO15	Methylene chloride	ug/m3	1.74		TO15	Methylene chloride	ppbV	0.5
TO15	3-Chloropropene	ug/m3	0.626		TO15	3-Chloropropene	ppbV	0.2
TO15	Carbon disulfide	ug/m3	0.623		TO15	Carbon disulfide	ppbV	0.2
TO15	Freon-113	ug/m3	1.53		TO15	Freon-113	ppbV	0.2
TO15	trans-1,2-Dichloroethene	ug/m3	0.793		TO15	trans-1,2-Dichloroethene	ppbV	0.2
TO15	1,1-Dichloroethane	ug/m3	0.809		TO15	1,1-Dichloroethane	ppbV	0.2
TO15	Methyl tert butyl ether	ug/m3	0.721		TO15	Methyl tert butyl ether	ppbV	0.2
TO15	2-Butanone	ug/m3	1.47		TO15	2-Butanone	ppbV	0.5
TO15	Ethyl Acetate	ug/m3	1.8		TO15	Ethyl Acetate	ppbV	0.5
TO15	Chloroform	ug/m3	0.977		TO15	Chloroform	ppbV	0.2
TO15	Tetrahydrofuran	ug/m3	1.47		TO15	Tetrahydrofuran	ppbV	0.5
TO15	1,2-Dichloroethane	ug/m3	0.809		TO15	1,2-Dichloroethane	ppbV	0.2
TO15	n-Hexane	ug/m3	0.705		TO15	n-Hexane	ppbV	0.2
TO15	Benzene	ug/m3	0.639		TO15	Benzene	ppbV	0.2
TO15	Cyclohexane	ug/m3	0.688		TO15	Cyclohexane	ppbV	0.2
TO15	1,2-Dichloropropane	ug/m3	0.924		TO15	1,2-Dichloropropane	ppbV	0.2
TO15	Bromodichloromethane	ug/m3	1.34		TO15	Bromodichloromethane	ppbV	0.2
TO15	1,4-Dioxane	ug/m3	0.721		TO15	1,4-Dioxane	ppbV	0.2
TO15	2,2,4-Trimethylpentane	ug/m3	0.934		TO15	2,2,4-Trimethylpentane	ppbV	0.2
TO15	Heptane	ug/m3	0.82		TO15	Heptane	ppbV	0.2
TO15	cis-1,3-Dichloropropene	ug/m3	0.908		TO15	cis-1,3-Dichloropropene	ppbV	0.2
TO15	4-Methyl-2-pentanone	ug/m3	2.05		TO15	4-Methyl-2-pentanone	ppbV	0.5
TO15	trans-1,3-Dichloropropene	ug/m3	0.908		TO15	trans-1,3-Dichloropropene	ppbV	0.2
TO15	1,1,2-Trichloroethane	ug/m3	1.09		TO15	1,1,2-Trichloroethane	ppbV	0.2
TO15	Toluene	ug/m3	0.754		TO15	Toluene	ppbV	0.2
TO15	2-Hexanone	ug/m3	0.82		TO15	2-Hexanone	ppbV	0.2
TO15	Dibromochloromethane	ug/m3	1.7		TO15	Dibromochloromethane	ppbV	0.2
TO15	1,2-Dibromoethane	ug/m3	1.54		TO15	1,2-Dibromoethane	ppbV	0.2
TO15	Chlorobenzene	ug/m3	0.921		TO15	Chlorobenzene	ppbV	0.2
TO15	Ethylbenzene	ug/m3	0.869		TO15	Ethylbenzene	ppbV	0.2
TO15	p/m-Xylene	ug/m3	1.74		TO15	p/m-Xylene	ppbV	0.4
TO15	Bromoform	ug/m3	2.07		TO15	Bromoform	ppbV	0.2
TO15	Styrene	ug/m3	0.852		TO15	Styrene	ppbV	0.2
TO15	1,1,2,2-Tetrachloroethane	ug/m3	1.37		TO15	1,1,2,2-Tetrachloroethane	ppbV	0.2
TO15	o-Xylene	ug/m3	0.869		TO15	o-Xylene	ppbV	0.2
TO15	4-Ethyltoluene	ug/m3	0.983		TO15	4-Ethyltoluene	ppbV	0.2
TO15	1,3,5-Trimethylbenzene	ug/m3	0.983		TO15	1,3,5-Trimethylbenzene	ppbV	0.2
TO15	1,2,4-Trimethylbenzene	ug/m3	0.983		TO15	1,2,4-Trimethylbenzene	ppbV	0.2
TO15	Benzyl chloride	ug/m3	1.04		TO15	Benzyl chloride	ppbV	0.2
TO15	1,3-Dichlorobenzene	ug/m3	1.2		TO15	1,3-Dichlorobenzene	ppbV	0.2
TO15	1,4-Dichlorobenzene	ug/m3	1.2		TO15	1,4-Dichlorobenzene	ppbV	0.2
TO15	1,2-Dichlorobenzene	ug/m3	1.2		TO15	1,2-Dichlorobenzene	ppbV	0.2
TO15	1,2,4-Trichlorobenzene	ug/m3	1.48		TO15	1,2,4-Trichlorobenzene	ppbV	0.2
TO15	Hexachlorobutadiene	ug/m3	2.13		TO15	Hexachlorobutadiene	ppbV	0.2
TO15-SIM	Vinyl chloride	ug/m3	0.051		TO15-SIM	Vinyl chloride	ppbV	0.02
TO15-SIM	1,1-Dichloroethene	ug/m3	0.079		TO15-SIM	1,1-Dichloroethene	ppbV	0.02
TO15-SIM	cis-1,2-Dichloroethene	ug/m3	0.079		TO15-SIM	cis-1,2-Dichloroethene	ppbV	0.02
TO15-SIM	1,1,1-Trichloroethane	ug/m3	0.109		TO15-SIM	1,1,1-Trichloroethane	ppbV	0.02
TO15-SIM	Carbon tetrachloride	ug/m3	0.126		TO15-SIM	Carbon tetrachloride	ppbV	0.02
TO15-SIM	Trichloroethene	ug/m3	0.107		TO15-SIM	Trichloroethene	ppbV	0.02
TO15-SIM	Tetrachloroethene	ug/m3	0.136		TO15-SIM	Tetrachloroethene	ppbV	0.02

Date Created: 07/27/18
Created By: Ben Rao
File: PM5252-1
Page: 1

Langan Engineering & Environmental

TCLP Volatile Organics - EPA 8260C (SOIL)

Holding Time: 14 days
Container/Sample Preservation: 1 - Vial Large Septa unpreserved (4oz)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Chloroform	67-66-3	7.5	2.22	ug/l	70-130	20	70-130	20	20			
Carbon tetrachloride	56-23-5	5	1.34	ug/l	63-132	20	63-132	20	20			
Tetrachloroethene	127-18-4	5	1.81	ug/l	70-130	20	70-130	20	20			
Chlorobenzene	108-90-7	5	1.78	ug/l	75-130	25	75-130	25	25			
1,2-Dichloroethane	107-06-2	5	1.32	ug/l	70-130	20	70-130	20	20			
Benzene	71-43-2	5	1.59	ug/l	70-130	25	70-130	25	25			
Vinyl chloride	75-01-4	10	0.714	ug/l	55-140	20	55-140	20	20			
1,1-Dichloroethene	75-35-4	5	1.69	ug/l	61-145	25	61-145	25	25			
Trichloroethene	79-01-6	5	1.75	ug/l	70-130	25	70-130	25	25			
1,4-Dichlorobenzene	106-46-7	25	1.87	ug/l	70-130	20	70-130	20	20			
2-Butanone	78-93-3	50	19.4	ug/l	63-138	20	63-138	20	20			
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*		
Toluene-d8	*2037-26-5*									*70-130*		
4-Bromofluorobenzene	*460-00-4*									*70-130*		
Dibromofluoromethane	*1868-53-7*									*70-130*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5252-1
Page: 1

Langan Engineering & Environmental

TCLP ABN Compounds - EPA 8270D/1311 (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		
Hexachlorobenzene	118-74-1	10	2.895	ug/l	40-140	30	40-140	30	30			
2,4-Dinitrotoluene	121-14-2	25	4.225	ug/l	40-132	30	40-132	30	30			
Hexachlorobutadiene	87-68-3	10	3.585	ug/l	28-111	30	28-111	30	30			
Hexachloroethane	67-72-1	10	3.41	ug/l	21-105	30	21-105	30	30			
Nitrobenzene	98-95-3	10	3.765	ug/l	40-140	30	40-140	30	30			
2,4,6-Trichlorophenol	88-06-2	25	3.405	ug/l	30-130	30	30-130	30	30			
Pentachlorophenol	87-86-5	50	17.15	ug/l	9-103	30	9-103	30	30			
2-Methylphenol	95-48-7	25	5.1	ug/l	30-130	30	30-130	30	30			
3-Methylphenol/4-Methylphenol	106-44-5	25	5.55	ug/l	30-130	30	30-130	30	30			
2,4,5-Trichlorophenol	95-95-4	25	3.575	ug/l	30-130	30	30-130	30	30			
Pyridine	110-86-1	17.5	9.35	ug/l	10-66	30	10-66	30	30			
2-Fluorophenol	*367-12-4*									*21-120*		
Phenol-d6	*13127-88-3*									*10-120*		
Nitrobenzene-d5	*4165-60-0*									*23-120*		
2-Fluorobiphenyl	*321-60-8*									*15-120*		
2,4,6-Tribromophenol	*118-79-6*									*10-120*		
4-Terphenyl-d14	*1718-51-0*									*33-120*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5252-1
Page: 1

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TCLP Pesticides - EPA 8081B (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		
Lindane	58-89-9	0.02	0.00434	ug/l	30-150	20	30-150	30	30			
Heptachlor	76-44-8	0.02	0.0031	ug/l	30-150	20	30-150	30	30			
Heptachlor epoxide	1024-57-3	0.02	0.00415	ug/l	30-150	20	30-150	30	30			
Endrin	72-20-8	0.04	0.00429	ug/l	30-150	20	30-150	30	30			
Methoxychlor	72-43-5	0.2	0.00684	ug/l	30-150	20	30-150	30	30			
Toxaphene	8001-35-2	0.2	0.0627	ug/l	30-150	20	30-150	30	30			
Chlordane	57-74-9	0.2	0.0463	ug/l	30-150	20	30-150	30	30			
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*		
Decachlorobiphenyl	*2051-24-3*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5252-1
Page: 1

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TCLP Herbicides - EPA 8151A (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		
2,4-D	94-75-7	0.025	0.001245	mg/l	30-150	25	30-150	25	25			
2,4,5-TP (Silvex)	93-72-1	0.005	0.0013475	mg/l	30-150	25	30-150	25	25			
DCAA	*19719-28-9*									*30-150*		

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5252-1
Page: 1

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METALS by 6010D (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Arsenic, TCLP	7440-38-2	1	0.019	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved
Barium, TCLP	7440-39-3	0.5	0.021	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved
Cadmium, TCLP	7440-43-9	0.1	0.01	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved
Chromium, TCLP	7440-47-3	0.2	0.021	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved
Lead, TCLP	7439-92-1	0.5	0.027	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved
Selenium, TCLP	7782-49-2	0.5	0.035	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved
Silver, TCLP	7440-22-4	0.1	0.028	mg/l	75-125	20	75-125	20	20		180 days	1 - Glass 250ml/8oz unpreserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5252-1
Page: 1

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METALS by 7470A (SOIL)

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria	Holding Time	Container/Sample Preservation
Mercury, TCLP	7439-97-6	0.001	0.00033	mg/l	80-120		80-120	20	20		28 days	1 - Glass 250ml/8oz unpreserved

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5254-1
Page: 1

Langan Engineering & Environmental

1,4 Dioxane via EPA 8270D-SIM (WATER)

Holding Time: 7 days
Container/Sample Preservation: 2 - Amber 500ml 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	75	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								

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Date Created: 07/27/18
Created By: Ben Rao
File: PM5254-1
Page: 1

Langan Engineering & Environmental

NY PFAAs via EPA 537(M)-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 3 Plastic Trizma/1 Plastic/1 H20+Trizma

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.1312	ng/l	50-150	30	50-150	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.0856	ng/l	50-150	30	50-150	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.11	ng/l	50-150	30	50-150	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.1264	ng/l	50-150	30	50-150	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.0924	ng/l	50-150	30	50-150	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.1076	ng/l	50-150	30	50-150	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.0504	ng/l	50-150	30	50-150	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	2	0.194	ng/l	50-150	30	50-150	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2	0.1552	ng/l	50-150	30	50-150	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.1008	ng/l	50-150	30	50-150	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.1116	ng/l	50-150	30	50-150	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.1904	ng/l	50-150	30	50-150	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	0.2908	ng/l	50-150	30	50-150	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	2	0.2504	ng/l	50-150	30	50-150	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.1912	ng/l	50-150	30	50-150	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.2224	ng/l	50-150	30	50-150	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.2268	ng/l	50-150	30	50-150	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.3728	ng/l	50-150	30	50-150	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.0916	ng/l	50-150	30	50-150	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.0904	ng/l	50-150	30	50-150	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.072	ng/l	50-150	30	50-150	30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*50-150*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*50-150*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*50-150*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*50-150*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*50-150*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*50-150*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*50-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*50-150*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*50-150*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*50-150*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*50-150*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*50-150*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*50-150*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*50-150*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*50-150*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*50-150*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*50-150*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*50-150*		

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ATTACHMENT C

ANALYTICAL METHODS / QUALITY ASSURANCE SUMMARY TABLES

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	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	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					
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)	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					
		1,4-Dioxane	EPA 8270 SIM	Cool to 4°C	Two 500 ml amber glass	7 days to extract, 40 days after extraction to analysis					
		Per- and poly- fluoroalkyl substances (PFAS)	Modified EPA 537	Cool to 4°C	Two 275 ml plastic	14 days to extract, 28 days after extraction to analysis					
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	1 per 10 samples (minimum 1)	NA
Ambient/Indoor Air	Total VOCs via PID				6-Liter Summa Canister		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

ATTACHMENT D

SAMPLE NOMENCLATURE

SOP #01 – Sample Nomenclature

INTRODUCTION

The Langan Environmental Group conducts an assortment of site investigations where samples (Vapor, Solids, and Aqueous) are collected and submitted to analytical laboratories for analysis. The results of which are then evaluated and entered into a data base allowing quick submittal to the state regulatory authority (New York State Division of Environmental Conservation [NYSDEC]). In addition, Langan is linking their data management system to graphic and analytical software to enable efficient evaluation of the data as well as creating client-ready presentational material.

SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) is applicable to the general framework for labeling vapor, solid (soil) and aqueous (groundwater) samples that will be submitted for laboratory analysis. The nomenclature being introduced is designed to meet the NYSDEC EQuIS standard and has been incorporated into Langan software scripts to assist project personnel in processing the data. While this SOP is applicable to all site investigation; unanticipated conditions may arise which may require considerable flexibility in complying with this SOP. Therefore, guidance provided in this SOP is presented in terms of general steps and strategies that should be applied; but deviation from this SOP must be reported to the Project Manager (PM) immediately.

GENERAL SAMPLE IDENTIFICATION CONSIDERATIONS

Sample Labels

All sample ware must have a label. Recall that when you are using the Encore™ samples (see below); they are delivered in plastic lined foil bags. You are to label the bags[1]:

All other samples containers including Terra Cores™ must be labeled with laboratory provided self-adhesive labels.

Quick Breakdown of Sample Format

The general format for sample nomenclature is:

[1]Both Alpha and York laboratories permit the combining of the three Encore™ into a single bag. This may not be appropriate for all laboratories so please confirm with the labs themselves

LLNN_ID

Where

LL is a grouping of two (2) to four (4) letters signifying the sample media source. In older nomenclature SOPs this portion of the sample identification is commonly referred to as the *Sample Investigation Code*

NN represents a two digit number identifying the specific sample location or sample sequence number

_ ***(underscore)*** is required between the sample lettering and numeric identification and additional modifying data that determines the date of sampling or the depth of the sample interval

ID is a modifier specific to the sample type media (depth of soil sample or date of groundwater sample)

LL – Sample Investigation Code

Langan has devised a list of two to four letters to insure a quick ability to identify the sample investigation.

Code	Investigation
AA	Ambient Air
DS	Drum
EPB	Endpoint Location - Bottom (Excavation)
EPSW	Endpoint Location - Sidewall (Excavation)
FP	Free Product
IA	Indoor Air
IDW	Investigation Derived Waste (Soil Pile)
MW	Monitoring Well (Permanent)
SB	Soil Boring
SG	Staff Gauge (Stream Gauging)
SL	Sludge
SV	Soil Vapor Point
SVE	Soil Vapor Extraction Well
SW	Surface Water
TMW	Temporary Monitoring Well
TP	Test Pit (Excavated Material from Test Pit Not Associated With Sidewall or Bottom Samples)
WC	Waste Characterization Boring
COMP	Composite Sample
TB	Trip Blank (QA/QC Sampling – All Investigations)
FB	Field Blank (QA/QC Sampling – All Investigations)
DUP	Duplicate (QA/QC Sampling – All Investigations)

NN – Numeric Identifier

The two digit number that follows the sample investigation code (LL) identifies the specific sample based on the soil boring, monitoring well, endpoint or other location identification. For a subset of samples

where there is no specific location identifier, the two digit number is the sequence number for the sample submitted. For example, an aqueous sample from a monitoring well identified as MW-1 would have the sample investigation code of MW and the numeric identifier as 01. Note there is no hyphen. The same can be done for soil borings, a soil sample collected from soil boring 9 (SB-9) would be have the LLNN identification of SB09 (again, no hyphen).

Note however that there is a subset of samples related to laboratory analytical quality assurance, among these includes TB, FB, and DUP. On many investigations, the Scope will require multiple collections of these types of samples, therefore the numerical number represents the sequence sample count where the first sample is 01, the second sample is 02, and the third sample is 03 and so on.

_ Underscore
The underscore is required. It separates the investigation code and numeric identifier from the modifier specific to the sample itself. Note that every effort should be made to insure that the underscore is clear on the sample label and chain of custody (COC).

ID – Modifier Specific to Type Media
Each sample investigation code and numeric identifier is further modified by an ID specific to the sample type media. In general, soil samples (soil borings or endpoint samples) use an ID that indicates the depth at which the sample was taken. Aqueous samples (groundwater or surface water samples) are identified by the date the sample was collected. Other types of samples including quality control (TB, FB, and DUP), Vapor samples (AA, IA, SV or SVE), other soil type samples (IDW, sludge, free product, drum, and others) are also identified by a date. The following rules apply to the ID when using sample depth or sample date.

Sample Depth
The sample depth must be whole numbers (no fractions) separated by a hyphen. Thus for a soil sample collected from the soil boring SB-1 from a depth of 6 feet to 8 feet, the sample would be identified as:

SB01_6-8

Unfortunately, the NYSDEC EQuIS system does not accept fractions. Therefore, if your sample interval is a fraction of a foot (6.5-7.5), round up to the larger interval (6-8).

Sample Date
The sample date is always in the format of MMDDYY. Note that the year is two digits. Thus for a groundwater sample collected on July 1, 2015 from the monitoring well MW-1, the sample would be identified as:

MW01_070115

Special Cases
There are a couple of specific sample types that require further explanation.

Endpoint Sampling
End point sidewall samples are sometimes modified by magnetic direction (N, S, E, and W). For example, the first sidewall endpoint sample from the north wall of an excavation at a depth of 5 feet would be written as:

EPSW01_N_5

Again, note that the N in the identification refers to north and is separated from the prefix investigation code/numeric identifier and ID modifier suffix by underscores.

Vapor Extraction Well Sample
As with the sidewall endpoint samples, the sample name is altered by inserting a middle modifier between the prefix and suffix of the sample name. The middle modifier is used to identify the source of the sample (inlet sample port, midpoint sample port or outlet sample port). For example the midpoint port of the vapor extraction well number 1 sampled on July 1, 2015 would be written as;

SVE01_MID_070115

Matrix Spike and Matrix Spike Duplicate
On occasion, a Langan investigation will collect a sample to be used to provide the lab with a site specific medium to spike to determine the quality of the analytical method. This special case of sampling requires additional information to be used in the sample name, specifically, a suffix specifying whether the sample is the matrix spike (MS) or the matrix spike duplicate (MSD). In the following example, the sample is collected from soil boring number 1 at a depth of 2-4 feet. For the matrix spike sample:

SB01_2-4_MS

and for the matrix spike duplicate sample:

SB01_2-4_MSD

Multiple Interval Groundwater Sampling
Although not currently a common practice, low flow sampling facilitates stratigraphic sampling of a monitoring well. If the scope requires stratigraphic sampling then groundwater samples will be labeled with a lower case letter following the well number. For example, placing the pump or sampling tube at 10 feet below surface in MW01 on July 1, 2015 would require the sample to be labeled as:

MW01a_070115

While a second sample where the pump or tubing intake is placed at 20 feet would be labeled as:

MW01b_070115

Note that it is important that you record what depth the intake for each sample represents in your field notes; as this information is going to be critical to interpreting the results.

APPENDIX C
IRM CONSTRUCTION SCHEDULE

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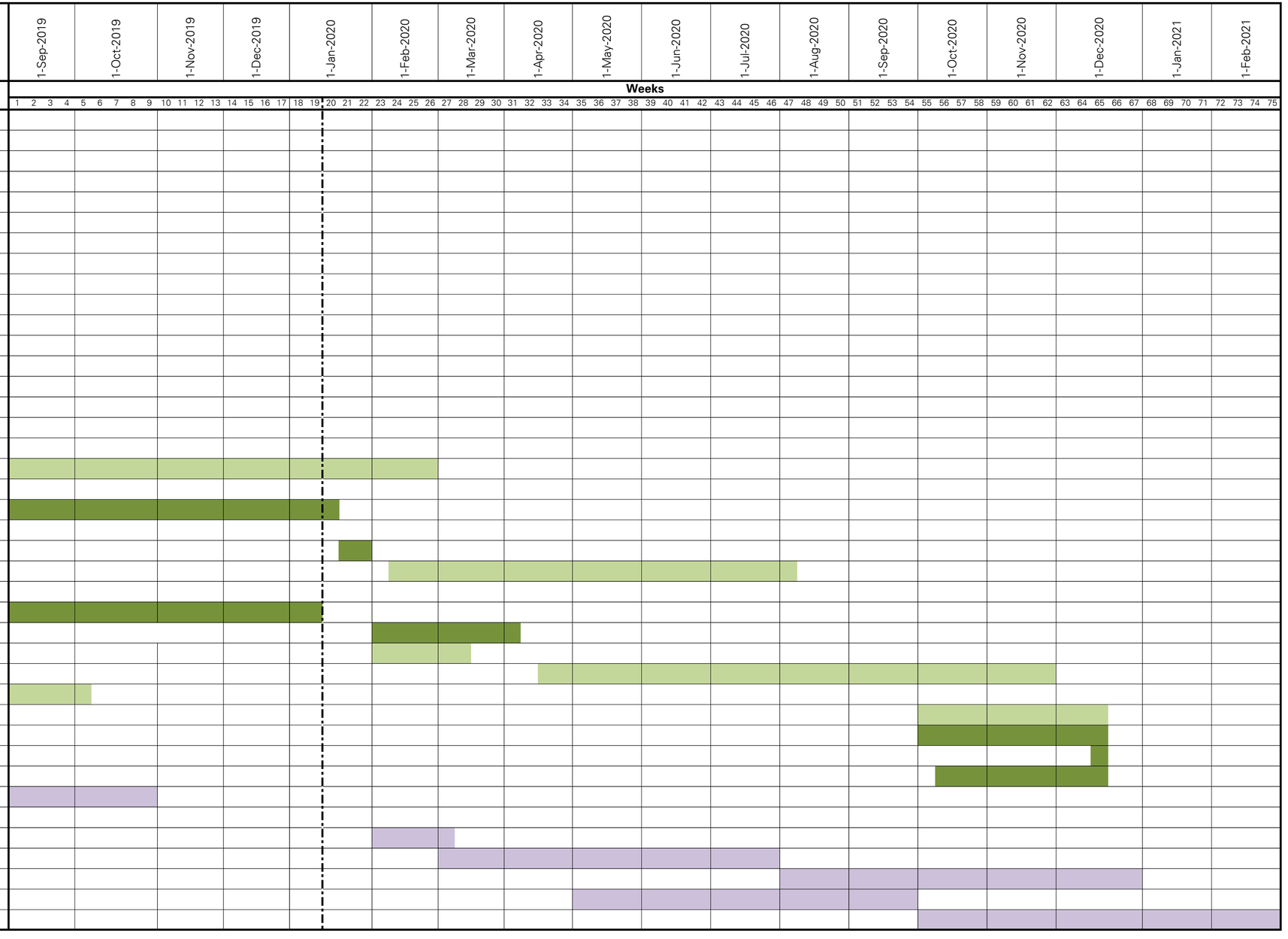
Draft - Smith Street Project Schedule

Brooklyn, New York
Project No. 170063001
Last Revised: January 16, 2020

No.	Task	Subtasks
A		**Subsurface Exploration**
A- 1		Prepare Exploration Work Plan (EWP) [Complete]
A- 2		USEPA Review & Approval of EWP [Complete]
A- 3		Subsurface Exploration [Complete]
A- 4		Geotechnical Report for Bulkhead (North) [Complete]
A- 5		Geotechnical Report for Bulkhead (South) [Complete]
B		**Bulkhead Design (North @ Collapse)**
B- 1		Design & Drawings [Complete]
B- 2		Bulkhead Construction Work Plan [Complete]
B- 3		USEPA Review & Approval for Construction [Complete]
C		**Bulkhead Design (South @ BCP Site)**
C- 1		Design & Drawings [Complete]
C- 2		Bulkhead Construction Work Plan [Complete]
C- 3		USEPA Review & Approval for Construction [Complete]
D		**Brownfield Cleanup Program (South)**
D- 1		Final Issuance of Pre-Design Investigation Report [Complete]
D- 2		Emerging Contaminant Work Plan, NYSDEC Review and Sampling [Complete]
D- 3		Emerging Contaminant Report Preparation and NYSDEC Approval
D- 4		Prepare an IRM Work Plan [Complete]
D- 5		NYSDEC IRM Work Plan Review, Revisions
D- 6		IRM Work Plan 45-Day Public Comment Period [Complete]
D- 7		IRM Work Plan Approval
D- 8		Implement IRM Work Plan (Includes Mobilization)
D- 9		Prepare a RAWP and Alternatives Analysis [Complete]
D- 10		NYSDEC RAWP Review, RAWP Revisions
D- 11		RAWP 45-Day Public Comment Period, Approval & DD Preparation
D- 12		Preliminary Waste Characterization and Reporting
D- 13		Implement RAWP
D- 14		Prepare and Submit EE and SMP (Revise per NYSDEC)
D- 15		Prepare and Submit FER (Revise per NYSDEC)
D- 16		NYSDEC FER and SMP Approval
D- 17		Obtain COC
D- 18		Record EE
E		**Bidding and Award**
F		**Bulkhead Construction**
F- 1		Mobilization & Site Prep
F- 2		Cut Off Wall & Foundations (South) - Blocks 493 & 495
F- 3		Cut Off Wall & Foundations (North) - Blocks 489 & 491
F- 4		Construction Platform (South) - Blocks 493 & 495
F- 5		Construction Platform (North) - Blocks 489 & 491



Notes and Assumptions:

1. Schedule assumes that the bulkhead cutoff wall will be constructed along the Gowanus Canal shoreline.
2. IRM = Interim Remedial Measure
3. AA = Alternatives Analysis
4. RAWP = Remedial Action Work Plan
5. DD = Decision Document
6. EE = Environmental Easement

APPENDIX D
CONSTRUCTION HEALTH AND SAFETY PLAN

LANGAN

CONSTRUCTION HEALTH AND SAFETY PLAN

FOR

RED HOOK SMITH STREET
627-661 SMITH STREET
BROOKLYN, NEW YORK

NYSDEC BCP NO.: C224163

Prepared For:

Red Hook Developers Holdings, LLC
1400 Broadway, 15th Floor
New York, New York 10018

And

CF Smith LLC
404 Fifth Avenue, 5th Floor
New York, New York 10018

Prepared By:

Langan Engineering, Environmental, Surveying,
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LANGAN

April 2019

Langan Project No. 170063005

TABLE OF CONTENTS

Page No.

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

***** Items to be posted prominently on site, or made readily available to personnel.

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 Parcel H3, which is located at 627-661 Smith Street in Brooklyn, New York (New York City Brooklyn Tax Block 493, Lot 1 and Block 495, Lot 1) ("the Site"). This CHASP provides the minimum requirements for implementing site operations during future possible 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 located at 627-661 Smith Street (Block 493, Lot 1, and Block 495, Lot 1) in the Red Hook neighborhood of Brooklyn, New York. The site is located along the Gowanus Canal at the mouth of the Gowanus Bay. The site is bounded by 595 Smith Street to the north, the Gowanus Canal to the east, the mouth of the Gowanus Canal to the south, and Smith Street to the west. The approximately 85,400-square-foot site was formerly developed with an approximately 63,500-square-foot one-story warehouse that was demolished in early 2018. Remaining site features include an asphalt-paved parking lot and concrete slabs and foundations associated with the former warehouse.

The site waterfront makes up about 750 linear feet of the Gowanus Canal. The waterfront consists of an about 500-foot-long timber-pile-supported relieving platform with a timber fender system that wraps around 659 Smith Street, and a 250-foot-long rubble embankment with remnant timber cribbing protruding from the embankment along 627 Smith Street. A Site Location Map is included as Figure 1.

The Volunteer was accepted into the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program (BCP) to investigate and, where necessary, remediate the site in conjunction with new development under a NYSDEC Brownfield Cleanup Agreement

(BCA) for Site No. C224163, dated May 2013. The northern portion of the site (NYC Tax Block 493, Lot 1) was previously subject to New York State Department of Environmental Conservation (NYSDEC) review under the Spills Program (Spill No. 05-00510, reported on April 12, 2005). The spill was closed by the NYSDEC on May 31, 2013. The site also previously had a NYSDEC Consent Order to remediate the spill. NYSDEC terminated the Consent Order on August 6, 2012 to allow the site to be admitted into the BCP.

1.3 Summary of Work Tasks

The general categories of work tasks that may be performed at the site include, but are not limited to:

1.3.1 Groundwater Investigation and Sampling

One or more groundwater monitoring wells may be sampled to evaluate groundwater quality. Groundwater samples will be collected in accordance with the work plan and where specified by the work plan, the Langan Low Flow Groundwater Sampling SOP (SOP #12). Groundwater samples will be submitted to an NYSDOH ELAP-certified laboratory and analyzed for constituents as specified in the work plan. Purged groundwater is to be stored in labeled drums in accordance with the work plan.

1.3.2 Excavation and Soil Screening

Langan personnel 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 calibrated photoionization detector (PID). Contractors will excavate for utilities, foundation components and potential grading using heavy equipment and hand tools. Contractors will notify Langan personnel if they identify indications suggestive of a potential chemical or petroleum release. Contaminated material shall be handled and property disposed in accordance with federal, state and city regulations, criteria and guidelines.

1.3.3 Excavation of Debris and Shoreline Stabilization

Langan will observe debris removal associated with shoreline stabilization. These activities include excavation and stockpiling of bulkhead debris, excavation and grading to site soil for shoreline stabilization, and backfilling with gravel. Details of the scopes of work to be completed are provided within the Removals and Temporary Shoreline Stabilization Work Plan.

The proposed work may include the excavation and removal of debris from the canal that was generated during a bulkhead collapse. Debris will be stockpiled on polyethylene sheeting and sampled for waste characterization. Site soils behind the damaged bulkhead will be excavated and graded in order to attain shoreline stabilization.

During construction, all soils and debris excavated or disturbed at the site will be either

transported off site for disposal at an approved facility or reused on the subject property. Langan personnel conducting activities that will contact the impacted historic fill, petroleum impacted material or impacted groundwater shall abide to the provisions of this CHASP.

1.3.4 Sheet Pile Installation

Interlocking steel sheet piles may installed via vibratory or impact hammer as shown on the Construction Drawings and specified in the work plan. Installation will be conducted from a barge in the canal or from a crane on land.

1.3.5 Excavation and Backfill Behind Sheet Piles

Soil excavation and backfilling will occur from the landward side of the newly installed sheet pile as specified in the work plan.

1.3.6 Removal of Existing Crib Wall

The existing crib wall will be excavated and removed as required for installation of sealed-seam sheet-pile bulkhead with relieving platform as shown on the Construction Drawings and as specified in the work plan.

1.3.7 Installation of Bulkhead

A new sealed-seam sheet-pile bulkhead with relieving platform will be constructed along the eastern and southern boundary of the site. The seams will be fully sealed with a hydrophilic sealant between all sheet pile pairs from tip elevation to top of the sheet and will serve as a subsurface containment/cutoff wall for hydrocarbon free product migration to the Gowanus Canal.

1.3.8 Soil Screening

As part of future 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 volatile organic vapors (VOCs) above background when using a properly calibrated hand held photoionization detector (PID, or equivalent).

1.3.9 Soil Sampling

Soil samples for excavation endpoint or delineation sampling (along with QA/QC samples) may be collected into laboratory-supplied batch-certified clean glassware and submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP).

1.3.10 Stockpiling

Potentially impacted soil may be stockpiled pending laboratory analysis and determining proper off-site disposal. Langan personnel will coordinate with the contractor in stockpiling soils (in accordance with the SMP, where applicable).

1.3.11 Characterization of Excavated Material

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

1.3.12 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 will consist of clean fill that meets the soil quality requirements in Part 375-6.7(d)(ii)(b) (i.e., lower of PG SCOs or RURR SCOs) or other acceptable fill material such as virgin stone from a quarry or RCA. If RCA is imported to the site, it will come from a NYSDEC-registered facility in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of RCA acquisition. RCA imported from compliant facilities will not require chemical testing, unless required by NYSDEC under its terms for operation of the facility. Imported RCA must be derived from recognizable and uncontaminated concrete and must conform to Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002). A Beneficial Use Determination (BUD) shall be obtained for prior to import of RCA to the site. RCA is not acceptable for, and will not be used as, site cover or drainage material.

1.3.13 Removal of Underground Storage Tanks

If encountered, the contractor shall 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. Langan personnel will monitor VOCs with a calibrated PID downwind from the UST excavation and record the PID readings.

1.3.14 Construction Dewatering

If construction dewatering is required, the dewatering contractor shall be responsible for handling contaminated dewatering fluids in accordance with federal, state and local regulations. Dewatering fluids are likely 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 ELAP-certified laboratory for analysis.

1.3.15 Construction Activity Inspections and Observations

Langan will observe construction activities including the composite cover performed by the contractor in accordance with the construction documents, RAWP, and 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.

1.3.16 Hot Spot Delineation

If required, Langan may retain a drilling contractor to advance soil borings to a depth below grade surface (bgs) as will be specified in the work plan. Borings locations will be based on the results of new analytical data, site inspection and document review. Hot spot soil delineation cannot commence until this CHASP is updated to define particulate monitoring action levels which are derived from the total and toxicity characteristic leaching procedure (TCLP) analytical data.

The drilling contractor will contact the appropriate utility mark-out authority and make available to their drilling staff the verification number and effective dates. The borings may be filled with clean soil cuttings after samples are collected.

Langan will screen soil for visual, olfactory, and instrumental indicators suggestive of a potential petroleum release. Instrument screening for the presence of volatile organic compounds (VOCs) may be performed with a calibrated photoionization detector (PID). Langan will collect soil samples as specified in the hot spot delineation portion of the work plan. Soil samples will be 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.

1.3.17 Hot Spot Soil Excavation and Disposal

If required, Langan will observe activities associated with the excavation and disposal of hot spot impacted soil discussed in the preceding task. Langan personnel will coordinate with the excavator contractor so that the boundaries of the hot spot excavation correspond to with the approved disposal facilities instructions. Langan personnel are not to sign the hazardous waste manifests unless instructed by the Project Manager.

Hot spot soil excavation and disposal cannot commence until this CHASP is updated to define particulate monitoring action levels which are derived from the total and toxicity characteristic leaching procedure (TCLP) analytical data.

1.3.18 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.

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 Project Manager (PM) is Emily Snead; the Langan Geotechnical PM is Kenneth Huber, their 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 CHASP, 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 site 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 prior to the start of the start of field activities. The Field Team Leader'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 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 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 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.

3.1.2 Soil Screening and Sampling

When conducting soil screening and collecting soil samples, Langan personnel will don chemical resistant gloves in addition to the standard personal protection equipment (PPE).

3.1.3 Stockpile Sampling

The 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).

3.1.4 Excavation of Debris and Shoreline Stabilization

Working near the water will pose potential drowning hazards due to slipping or falling into the Gowanus Canal. Potential adverse health effects are similar to slips, trips, and falls, and may also result in drowning. Good housekeeping at the site must be maintained at all times. Employees must be aware of the location of the water's edge and must either stay at least 25 feet away from the water, or wear a personal floatation device approved by the US Coast Guard.

3.1.5 Sheet Pile Installation

The sheet piles may be installed from the canal using a barge based construction platform. Only employees or direct hires of the sheet pile installation contractor and barge operator are permitted unfettered access to the barge based construction platform. Langan personnel are permitted on the barge during sheet pile installation and when consistent with their site duties and responsibilities. Persons working on or visiting the barge must don personal flotation devise (PFD) and be trained in its correct use. Langan and other contractor personnel must board the barge from secured platform. If using a ladder to board the barge from a floating dock or bulkhead wall, the ladder must be properly secured and inspected.

Regardless of whether the sheet piles are installed from a barge or from land, only those required for the sheet pile installation should be within the swing radius of the crane. Persons working near the crane must remain alert and aware of the crane's movements and stay away from the path of travel of the crane boom. No persons shall be allowed directly under the leads of the crane.

3.1.6 Hot Spot Delineation

Hot spot delineation sampling requires additional precautions to mitigate exposure. Langan will monitor indoor dust using air-dust monitoring equipment (DustTrak™ 2 or equivalent). The dust monitoring equipment should be equipped with an alarm. The primary alarm should be set for a specific value in milligrams per cubic meter (mg/m^3) above the 15 minute average background based on analytical data and the time weighted average exposure limits for the constituent of concern (COC). The secondary alarm may be set for a value based on the PEL for the specific COC.

If the primary alarm activates during work, the PM notified, and dust control measures should be implemented and all workers should don half face respirator with HEPA dust filters to continue to work. Dust control measures include applying a fine water spray wet all surfaces in the work area to dampen dust and activating ventilation. Workers can remove half respirators when air borne dust concentrations return to background. If dust mitigation does not lower dust concentrations and dust levels continue to climb, all work should cease when dust concentrations exceed secondary alarm level and the PM should be notified.

3.1.7 Construction Dewatering

If required, Langan may sample dewatering treatment system liquids from either the direct discharge standpipe or from a sample port or valve built into the storage tank, Langan will don the necessary PPE including nitrile gloves and if necessary, facial splash guard. 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 is wearing approved fall protection safety apparatus. The discharge samples will be submitted to an ELAP-certified laboratory for analysis in accordance with the work plan.

3.1.8 Removal of Underground Storage Tanks

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 Construction Activity Inspection

The contractor will operate equipment used to install the composite cover. Langan personnel will inspect in accordance with specification in the work plan and record the data the work plan requires. The installation of the composite cover is to be done exclusively by the contractor following their own health and safety specifications outlined in their HASPs. Other activities assigned to Langan as part of construction activities are limited to inspection and observations as specified in the work pan. 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.

3.1.10 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soils 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 employees 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^{O}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^{O}F (37.6^{O}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^{O}F. If oral temperature still exceeds 99.6^{O}F (37.6^{O}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^{O}F (38.1^{O}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^{O} to 60^{O}F (10^{O} to 16.6^{O}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^{O}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^{O}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^{O}F, or wind-chill less than 30^{O}F with precipitation).
- As a screening measure whenever anyone worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92^{O}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 (GFCIs) 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)

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. Potential adverse effects of electrical hazards include burns and electrocution, which could result in death.

3.4 Biological Hazards

3.4.1 Animals

No animals are expected to be encountered during site operations.

3.4.2 Insects

Insects are not expected to be encountered during site operations.

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 ft 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-piece, 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 ACTIONS LEVELS

7.1 Monitoring During Site Operations

Atmospheric air monitoring results may 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 may 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. Air monitoring will be the responsibility of the HSO or designee. Air monitoring may 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 may occur during intrusive work in the AOCs. Colormetric Indicator Tubes for benzene may be used as backup for the PID, if measurements remain above background monitor every 2 hours. The HSO will monitor the employee breathing zone at least every 30 minutes, or whenever there is any indication that concentrations may have changed (odors, visible gases, etc.) since the last measurement. If VOC levels are observed above 5 ppm for longer than 5 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for monitored gases are provided in Table 4.

7.1.2 Metals

Based upon the site historical fill, there is a potential for the soils to contain PAHs and metals. During invasive procedures which have the potential for creating airborne dust, such as excavation of dry soils, a real time airborne dust monitor such as a Mini-Ram may be used to monitor for air particulates. The HSO will monitor the employee breathing zone at least every 30 minutes, or whenever there is any indication that concentrations may have changed (appearance of visible dust) since the last measurement. If dust levels are observed to be greater than 0.100

mg/m^3 or visible dust is observed for longer than 15 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for dust monitoring 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 and dust will be established prior to intrusive activities within the AOC at an upwind location. 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 may be conducted in compliance with the NYSDOH Generic CAMP outlined below:

Monitoring for dust and odors will be conducted during all ground intrusive activities by the FTL. Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust may be required for all ground intrusive activities such as soil excavation and handling activities. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil and groundwater sampling and .soil excavation. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements (if required). When required, 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.

If VOC monitoring is required, the following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work

activities will resume with continued monitoring.

- If total VOC levels at the downwind perimeter of the hot zone 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 hot 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 total VOC level is above 25 ppm at the perimeter of the hot zone, activities will be shutdown.

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

- If the downwind particulate level is 100 micrograms per cubic meter (µg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 µg/m^3 above the background level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m^3 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/m^3 of the upwind level and in preventing visible dust migration.

8.1 Vapor Emission Response Plan

This section applies if VOC monitoring is required. If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the hot zone, boring and well installation, and excavation activities will be halted or odor controls will be employed, and monitoring continued. When work shut-down occurs, downwind air monitoring as directed by the HSO or FTL will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

If the organic vapor level decreases below 5 ppm above background, sampling and boring and well installation can resume, provided:

- The organic vapor level 200 feet downwind of the hot zone or half the distance to the nearest residential or commercial structure, whichever is less, is below 1 ppm over background, and

- More frequent intervals of monitoring, as directed by the HSO or FTL, are conducted.

8.2 Major Vapor Emission

This section applies if VOC monitoring is required. If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the hot zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If either of the following criteria is exceeded in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be implemented.

- Sustained organic vapor levels approaching 5 ppm above background for a period of more than 30 minutes, or
- Organic vapor levels greater than 5 ppm above background for any time period.

8.3 Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

- The local police authorities will immediately be contacted by the HSO or FTL and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the HSO or FTL; and
- All Emergency contacts will go into effect as appropriate.

8.4 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 (include 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:

SUNY Downstate Medical Center
450 Clarkson Avenue

Brooklyn, New York
718-245-4790

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 all of the time. 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, 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 the Langan Incident/Injury Hotline ***(800) 9-LANGAN*** (800-952-6426) extension 4699 should be called as soon as possible.

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 possible, the HSO will contact the Langan Incident/Injury Hotline (1-800-952-6426) or (973-560-4699) and Project Manager of identify any emergency situation.

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, it will be reported to the HSO immediately. First-aid equipment will be available on site at the following locations:

- First Aid Kit: Contractor Mobile Office or Vehicles
- Emergency Eye Wash: Contractor Mobile office or 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.

16.7 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.

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 CHASP, 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 RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

17.1 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.

17.2 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.

17.3 Onsite Log

A log of personnel on site each day will be kept by the HSO or designee.

17.4 Daily Safety Meetings ("Tailgate Talks")

Completed safety briefing forms will be maintained by the HSO.

17.5 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.

17.6 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 E). Langan's written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

17.7 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.

18.0 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 all applicable federal, state and local regulations. Confined spaces **will not** be entered by Langan personnel.

19.0 CHASP 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

TABLES

TABLE 1
TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	1,1′-Biphenyl Biphenyl Phenyl benzene Diphenyl	92-52-4	None	1 mg/m^3 100 mg/m^3	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Anthracene	120-12-7	PID	0.2 mg/m^3 80 mg/m^3 (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 – 1.3.18	Antimony	7440-36-0	None	0.5 mg/m^3 50 mg/m^3	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 – 1.3.18	Aroclor 1242	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Arsenic	NA	None	0.5 mg/m^3 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 – 1.3.18	Barium	10022-31-8	None	0.5 mg/m^3 50 mg/m^3	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 – 1.3.18	Benzene Benzol Phenyl hydride	71-43-2	PID	3.19 mg/m^3 1,595 mg/mg^3	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 – 1.3.18	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m^3 80 mg/m^3 (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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m^3 80 mg/m^3 (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 – 1.3.18	Benzo(b)fluoranthene	205-99-2	PID	0.2 mg/m^3 80 mg/m^3 (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 – 1.3.18	Benzo(g,h,i)perylene Benzo(ghi)perylene	191-24-2	PID	0.2 mg/m^3 80 mg/m^3 (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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid	
1.3.1 – 1.3.18	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m^3 80 mg/m^3 (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 – 1.3.18	Beryllium	7440-41-7	None	0.002 mg/m^3 4 mg/m^3	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Bis(2-ethylhexyl)phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl 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 – 1.3.18	Cadmium	7440-43-9	None	0.005 mg/m^3 9 mg/m^3	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	Chlordane Chlordan Chlordano 1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane	57-74-9	None	0.5 mg/m^3 100 mg/m^3	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 – 1.3.18	Chromium	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Cis-Chlordane a-Chlordane alpha Chlordane cis-Chlordan CIS-CHLORDANE Chlordane cis-;Chlordane cis;ALPHA-CHLORDAN Chlordan, cis-ALPHA-CHLORDANE alpha(cis)-chlordane α-chlordane solution	5102-71-9	None	0.5 mg/m^3 100 mg/m^3	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Cumene Cumol Isopropylbenzene 2-Phenyl propane	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 – 1.3.18	DDE 4,4-DDE 1,1-bis-(4-chlorophenyl)-2,2-dichloroethene Dichlorodiphenyldichloroethylene	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-40-4	PID	435 mg/m^3 3,472 mg/m^3	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 – 1.3.18	Fluoranthene Benzo(j, k)fluorene	206-44-0	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	Helium	7440-59-7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Heptachlor	76-44-8	None	0.5 mg/m^3 35 mg/m^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	In animals: tremor, convulsions; liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.18	Heptachlor epoxide 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene	1024-57-3	None	0.5 mg/m^3 35 mg/m^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	In animals: tremor, convulsions; liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Methyl Acetate	79-20-9	PID	200 ppm 3100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; headache, drowsiness; optic nerve atrophy; chest tightness; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.18	Methyl Bromide Bromomethane Monobromomethane	74-83-9	PID	20 ppm 250 ppm	Soil Groundwater Vapor	inhalation, skin absorption (liquid), skin and/or eye contact (liquid)	irritation to the eyes, skin, respiratory system; muscle weak, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.18	Methyl *tert*-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3	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 – 1.3.18	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 – 1.3.18	n-Butylbenzene	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	Selenium	7782-49-2	None	1 mg/m^3 0.2 mg/m^3	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 – 1.3.18	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	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 – 1.3.18	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 – 1.3.18	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 – 1.3.18	Trans-Chlordane gamma-Chlordane	5103-74-2	None	0.5 mg/m^3 100 mg/m^3	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.18	Trivalent Chromium Chromium III	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 – 1.3.18	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 – 1.3.18	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
500 mg/m3

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.
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.
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.

Instrument	Operation Parameters
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	No respirator; no further action required
> 1 ppm but < 5 ppm for > 5 minutes	1. Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated (i.e., by slowing drilling or excavation activities), contact HSO to review conditions and determine source and appropriate response action. 2. If PID readings remain above 1 ppm, temporarily discontinue work and upgrade to Level C protection. 3. If sustained PID readings fall below 1 ppm, downgrading to Level D protection may be permitted.
> 5 ppm but < 150 ppm for > 5 minutes	1. Discontinue all work; all workers shall move to an area upwind of the jobsite. 2. Evaluate potential causes of the excessive readings and allow work area to vent until VOC concentrations fall below 5 ppm. 3. Level C protection will continue to be used until PID readings fall below 1 ppm.
> 150 ppm	Evacuate the work area

Notes:
1. 1 ppm level based on OSHA Permissible Exposure Limit (PEL) for benzene.
2. 5 ppm level based on OSHA Short Term Exposure Limit (STEL) maximum exposure for benzene for any 15 minute period.
3. 150 ppm level based on NIOSH Immediately Dangerous to Life and Health (IDLH) for tetrachloroethylene.

TABLE 5
EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department	NYPD	911
Local Fire Department	NYFD	911
Ambulance/Rescue Squad	NYFD	911
Hospital	SUNY Downstate Medical Center	911 or (212) 746-7200
Langan Incident / Injury Hotline		800-952-6426 ex 4699
Langan Project Managers	Emily Sneed Kenneth Huber	508-918-8558 (cell) 631-525-6007 (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	Abe Gdansky	845-323-3091 (cell)
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 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).

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

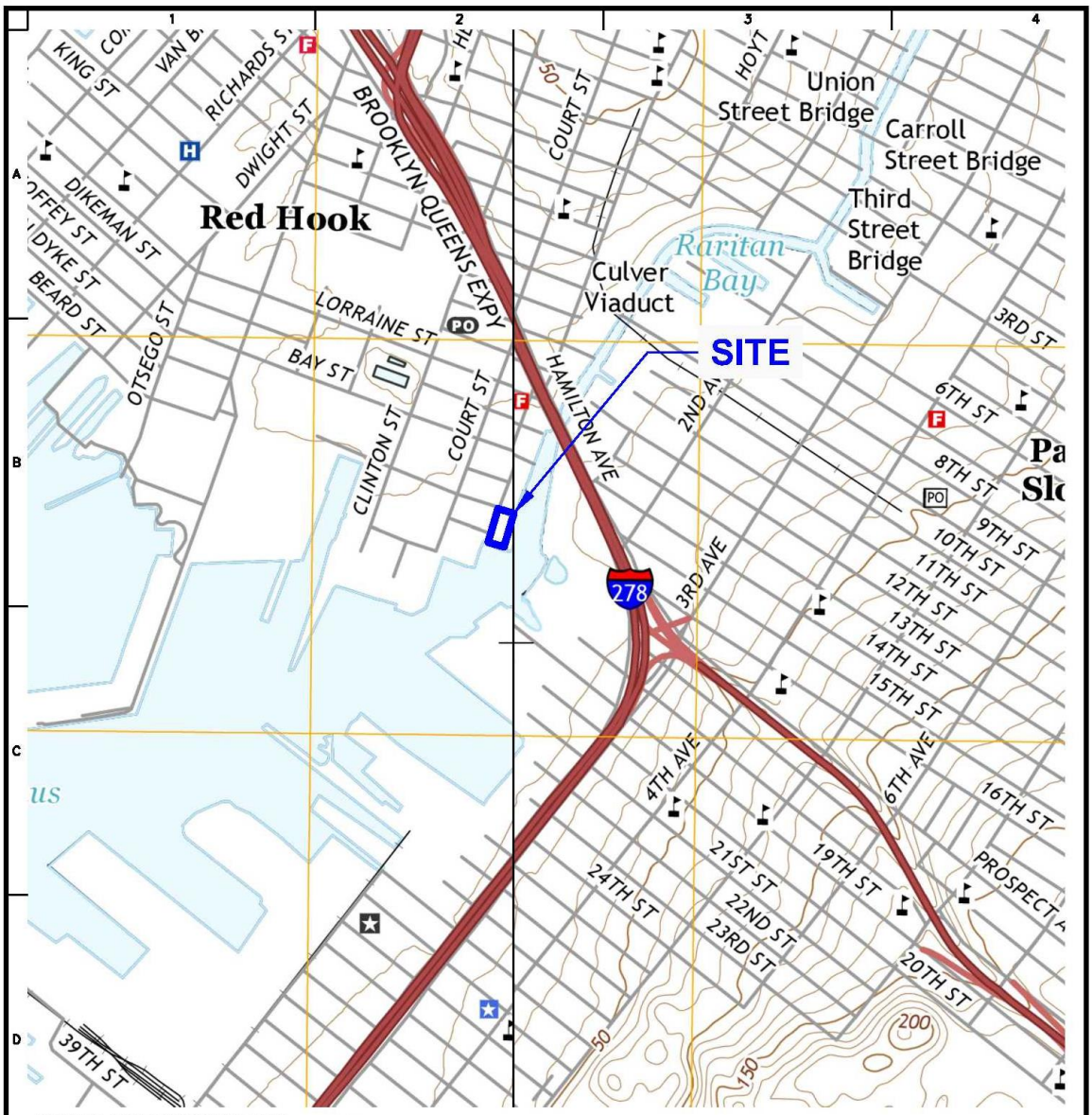
Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

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



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.

NOTES:
1. BASEMAP REFERENCED FROM UNITED STATED GEOLOGICAL SURVEY 7.5-MINUTE SERIES JERSEY CITY AND BROOKLYN QUADRANGLES, DATED NOVEMBER 2016.
2. SITE BOUNDARY IS APPROXIMATE.

LANGAN
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. S.A.
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	627-661 SMITH STREET BLOCK No. 493, LOT No.1 BLOCK No. 495, LOT No.1 BROOKLYN NEW YORK
Drawing Title	SITE LOCATION MAP
Project No.	170063001
Date	09/20/2017
Scale	N.T.S.
Drawn By / Checked By	NK / ELS
Submission Date	--
Drawing No.	1
Sheet	1 of 2

Filename: \\langan.com\data\NY\Cidata0\170063001\Cadd Data - 170063001\Dwg\2017 - Pre-Design Supplemental Investigation\Figure 1 - Site Location Map.dwg Date: 9/20/2017 Time: 08:10 User: nkung Style Table: Langan.stb Layout: ANSIA-BP

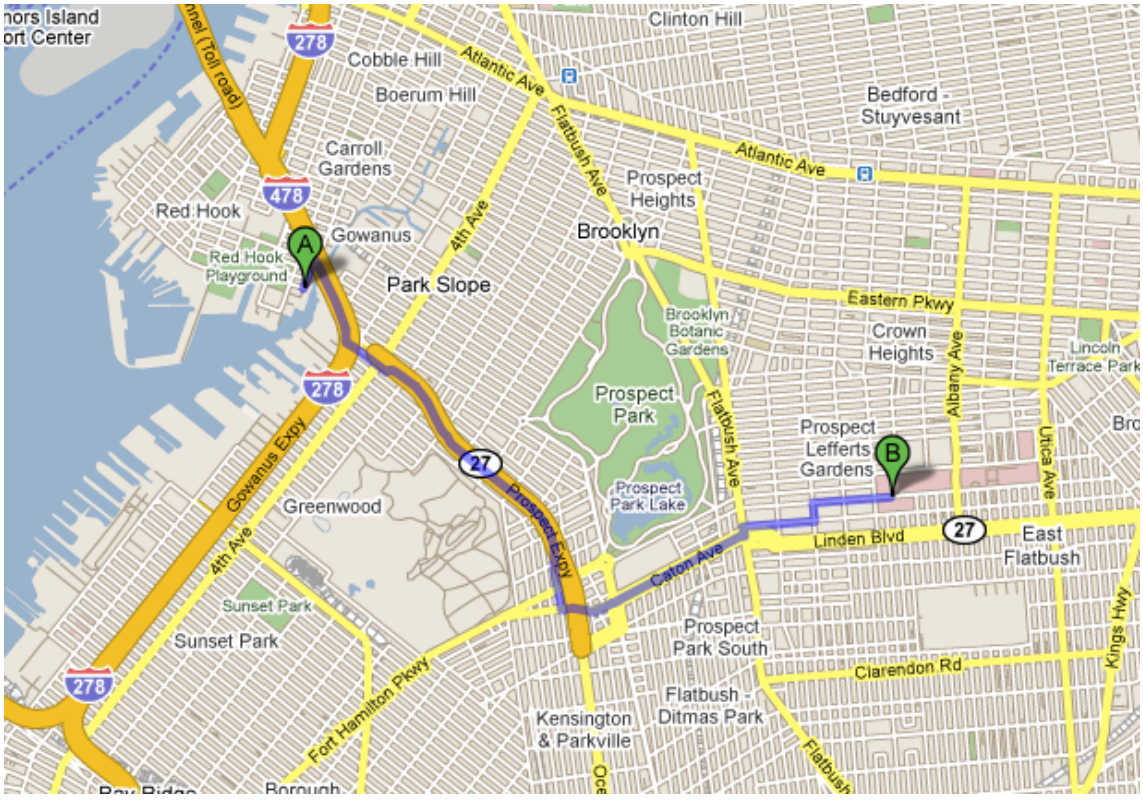
FIGURE 2
HOSPITAL ROUTE PLAN

Hospital Location: **SUNY Downstate Medical Center**
450 Clarkson Avenue
Brooklyn, New York
718-245-4790

START: 627-641 Smith Street, Brooklyn, New York

1. Start out on Smith Street going North toward Bay Street
2. Turn RIGHT on Lorraine Street.
3. Turn RIGHT on Hamilton Avenue.
4. Turn LEFT on 17th Street.
5. Merge onto NY-27 East/Prospect Express Parkway via the ramp on the LEFT.
6. Take EXIT 5 toward RT-27 East/Fort Hamilton Parkway.
7. Stay STRAIGHT to go onto E 5th Street/NY-27 East.
8. Turn LEFT on Caton Avenue/NY-27 East.
9. Turn LEFT on Flatbush Avenue.
10. Turn RIGHT on Lenox Road.
11. Turn LEFT on Rodgers Avenue.
12. Turn RIGHT on Clarkson Avenue

END: SUNY Downstate Medical Center, 450 Clarkson Avenue, Brooklyn, 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 personal protective equipment (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 Exclusion Zone 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 CONSTRUCTION CONSTRUCTION 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:

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 CHASP) 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 CHASP?				
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 powerlines?				
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: 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.

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
1. 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)
2. Installation of piping from vapor wells to skid connections and from discharge piping to effluent stack	1. Pinch fingers when connecting pipes 2. Slips/ Trips/ Falls 3. Machinery Hazards	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 3. Wear proper PPE (safety vest) / Maintain safe distance from operating machinery
3. Remediation equipment installation	1. Back strain when lifting heavy equipment 2. Slips/ Trips/ Falls 3. Traffic	1. Use proper lifting techniques / Use wheeled transport / Minimize distance to vehicle 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 pain 3. Wear proper PPE (safety vest)
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	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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	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: **Subsurface Investigation**

JSA Number: **JSA030-01**

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.

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
5. Transport equipment to work area	1. Back/strain 2. Slip/Trip/Falls 3. Traffic 4. Cuts/abrasions/contusions from equipment 5. Accidents due to vehicle operations	1. Use proper lifting techniques/Use wheeled transport 2. Minimize distance to work area/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, Langan approved safety shoes) 5. Observe posted speed limits/ Wear seat belts at all times
6. 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.
7. 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)	11. 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. 12. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block 13. Wear proper clothing/ dress in layers/ take regular breaks. 14. 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). 15. 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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		16. See AGI Sting R1 operating manual for specific concerns during operating instrument
8. 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 19. Heat Stress/ Cold Stress 20. Eye Injuries	17. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 18. 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 19. Wear Langan approved safety shoes 20. 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 21. Wear high visibility clothing & vest / Use cones or signs to designate work area 22. 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 23. Wear proper hearing protection 24. Wear hard hat / Avoid areas were overhead hazards exist. 25. 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 26. 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.

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
9. Unpack/Transport equipment to work area.	6. Back Strains 7. Slip/Trips/Falls 8. Cuts/Abrasions from equipment 9. Contusions from dropped equipment	6. Use proper lifting techniques/Use wheeled transport 7. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 8. Wear proper PPE (leather gloves, long sleeves). 9. Wear proper PPE (Langan approved safety shoes).
10. Initial Site Arrival-Site Assessment	1. Traffic	1. Situational awareness (be alert of your surroundings). Secure area from through traffic.
11. Surface Water Sampling	4. Contaminated media. Skin/eye contact with biological agents and/or chemicals.	1. Wear appropriate PPE (Safety glasses, appropriate gloves). Review (M)SDS for all chemicals being.
12. Sampling from bridges	1. Struck by vehicles	1. Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
13. 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.	27. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 28. Have unobstructed path from work area. Aware of surroundings. 29. Wear proper PPE (Leather gloves, long sleeves) 30. Wear proper PPE (Leather gloves, long sleeves)
14. 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.
15. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	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	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 31. Wear high visibility clothing & vest / Use cones or signs to designate work area 32. 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 33. Wear hearing protection 34. Wear hard hat / Avoid areas were overhead hazards exist. 35. 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 36. 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.

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
16. Transport equipment to work area	10. Back Strain 11. Slips/ Trips/ Falls 12. Traffic 13. Cuts/abrasions from equipment 14. 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)
17. Moving equipment to its planned location	2. Pinch Hazard 3. Slips/ Trips/ Falls	4. Wear proper PPE (leather gloves) 5. 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
18. Equipment Set-up	5. Pinch Hazard 6. Cuts/abrasions to knuckles/hands 7. Back Strain	4. Wear proper PPE (leather gloves) 5. Wear proper PPE (leather gloves) 6. Use proper lifting techniques / Use wheeled transport
19. All activities	31. Slips/ Trips/ Falls 32. Hand injuries, cuts or lacerations during manual handling of materials 33. Foot injuries 34. Back injuries 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	37. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 38. 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 39. Wear Langan approved safety shoes 40. 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 41. Wear high visibility clothing & vest / Use cones or signs to designate work area

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
7. All activities (cont'd)		42. 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 43. Wear hearing protection 44. Wear hard hat / Avoid areas were overhead hazards exist. 45. 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 46. 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.

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
20. Transport equipment to work area	15. Back Strain 16. Slips/Trips/Falls 17. Traffic 18. Cuts/abrasions/contusions from equipment	10. Use proper lifting techniques / Use wheeled transport 11. Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures 12. Wear proper PPE (high visibility vest or clothing) 13. Wear proper PPE (leather gloves, long sleeves, safety shoes)
21.Earth Moving Equipment	4. Equipment running over employee	2. Ensure you have direct line of sight with operator of equipment; don't walk behind equipment; maintain a safe distance away from equipment. 3. Wear proper PPE (high vis vest/clothing)
22.Excavation	8. Excavation collapse 9. Confined space 10. Soil	2. 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. 3. Langan employees are not authorized to enter a confined space; 4. Soil and equipment is kept at least 2 feet from edge of excavation
23.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
24. 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	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 proper PPE (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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	50. Eye Injuries	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 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: **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.

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
25. Unpack/Transport equipment to work area.	19. Back Strains 20. Slip/Trips/Falls 21. Cuts/Abrasions from equipment 4. Contusions from dropped equipment	14. Use proper lifting techniques/Use wheeled transport 15. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 16. Wear proper PPE (leather gloves, long sleeves). 4. Wear proper PPE (Langan approved safety shoes).
26. 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.
27. Collecting Soil/Fluid Sample	5. Irritation to eye from vapor, soil dust, or splashing 6. Irritation to exposed skin	4. 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) 5. Wear proper skin protection including nitrile gloves.
28. Closing Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.	5. 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.
29. Moving Drums	2. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid. 3. Back Strains	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. Use non-metallic mallet and non-sparking tools/wrenches. 3. Use proper lifting techniques/Use wheeled transport

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
30. All activities	51. Slips/ Trips/ Falls 52. Hand injuries, cuts or lacerations during manual handling of materials 53. Foot injuries 54. Back injuries 55. Traffic 56. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 57. High Noise levels 58. Overhead hazards 59. Heat Stress/ Cold Stress 60. Eye Injuries	57. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 58. 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 59. Wear Langan approved safety shoes 60. 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 61. Wear high visibility clothing & vest / Use cones or signs to designate work area 62. 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 63. Wear hearing protection 64. Wear hard hat / Avoid areas were overhead hazards exist. 65. 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 66. 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.

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	22. Back strain when lifting equipment 23. Slips/ Trips/ Falls while moving equipment 24. Traffic (if applicable) 25. Pinched fingers or running over toes during geoprobe set-up 26. 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	7. Skin or eye contact with calibration chemicals 8. Pinch fingers in monitoring equipment	6. Wear proper PPE (safety glasses/ goggles) 7. Wear proper PPE (leather gloves)
33. Set-up geoprobe rig	11. Geoprobe rig movement	6. 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	61. Pinched fingers while removing macrocore 62. Cuts/lacerations when cutting acetate liner open 63. Exposure to hazardous vapors	1. Wear proper PPE (nitrile gloves, cut-resistant or leather gloves 2. Wear proper PPE (cut-resistant or leather gloves) 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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Remove and open acetate liner (cont'd)	64. Skin contact with contaminated soil	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)
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	67. Use drum cart for moving drums / Use proper lifting techniques / Do not lift heavy loads without assistance 68. Wear proper PPE (cut-resistant or leather gloves) 69. Wear proper PPE (cut-resistant or leather gloves) 70. Wear proper PPE (nitrile gloves underneath work gloves) 71. Follow good housekeeping procedures / Ensure route to move drum and storage space is free from obstructions 72. Wear proper PPE (safety shoes) / Work in a safe manner to prevent dropped drum
9. 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	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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
9. All activities (cont'd)	10. Eye Injuries	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: 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.

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. Jobsite Pre-briefing	27. None	22. Review JSA, SOP's, and discuss hazards that may be present and control measures for present hazards while on-site.
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	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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	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	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.		
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.**)**

_____

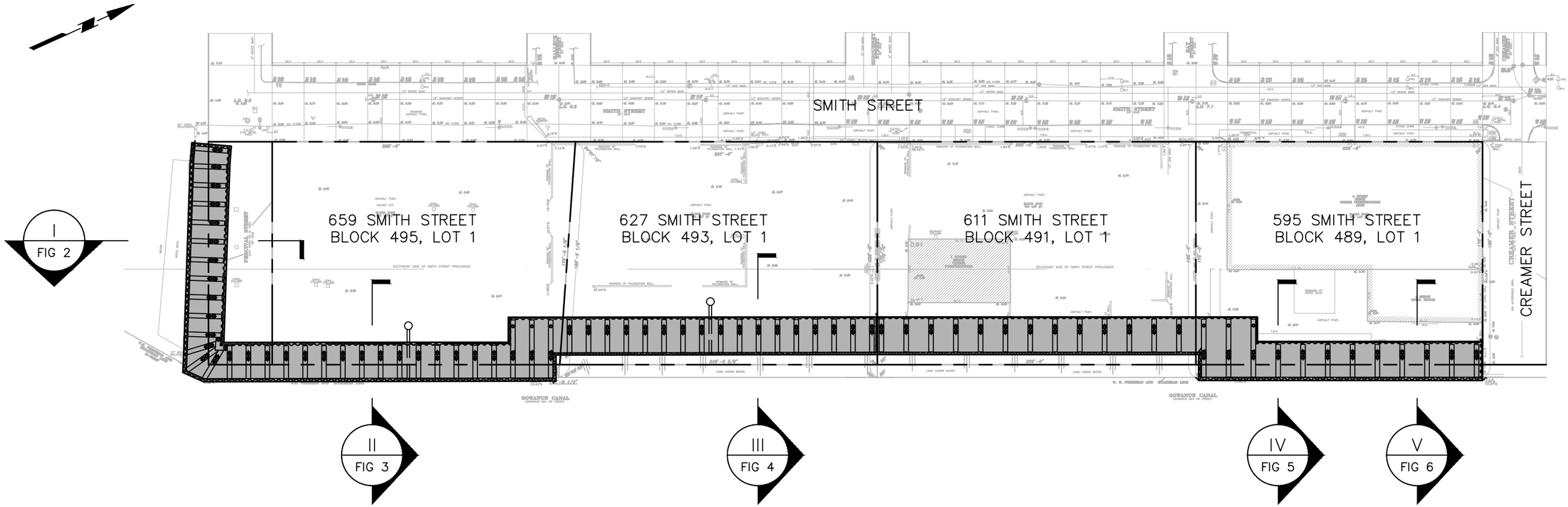
_____

_____

ATTENDEES

PRINT NAME	COMPANY	SIGNATURE

APPENDIX E
BULKHEAD PLANS



GOWANUS CANAL

FLOOD

EBB

80 0 40 80

SCALE: 1 INCH = 80 FEET

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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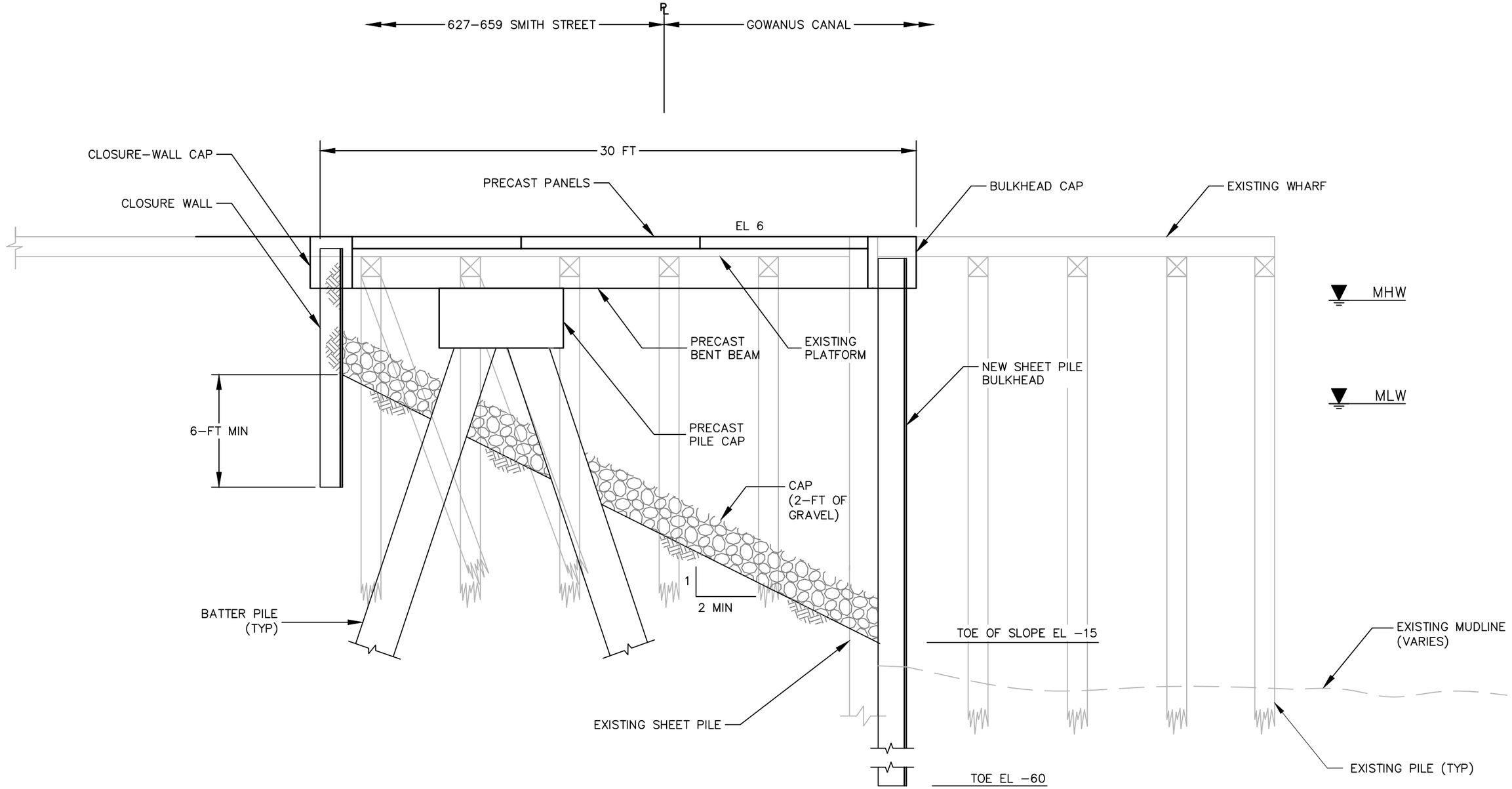
Project	595 - 611 SMITH STREET BULKHEAD BLOCK No. 489 & 491, LOT No.1 & 1 BROOKLYN KINGS NEW YORK
Figure Title	PLAN
Project No.	170488301
Date	01/07/2020
Drawn By	SOC
Checked By	KAH
Figure	1
Sheet	1 of 6

Filename: \\langan.com\data\NYC\data3\170488301\project data\CAD\01\sheetfiles\Existing Sections\170488301-GC101-0101.dwg Date: 1/7/2020 Time: 15:21 User: fdemelo Style Table: Langan.stb Layout: PLAN



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Project	595 - 611 SMITH STREET BULKHEAD BLOCK No. 489 & 491, LOT No.1 & 1 BROOKLYN KINGS NEW YORK
Figure Title	SECTION I
Project No.	170488301
Date	01/07/2020
Drawn By	SOC
Checked By	KAH
Figure	2
Sheet	2 of 6

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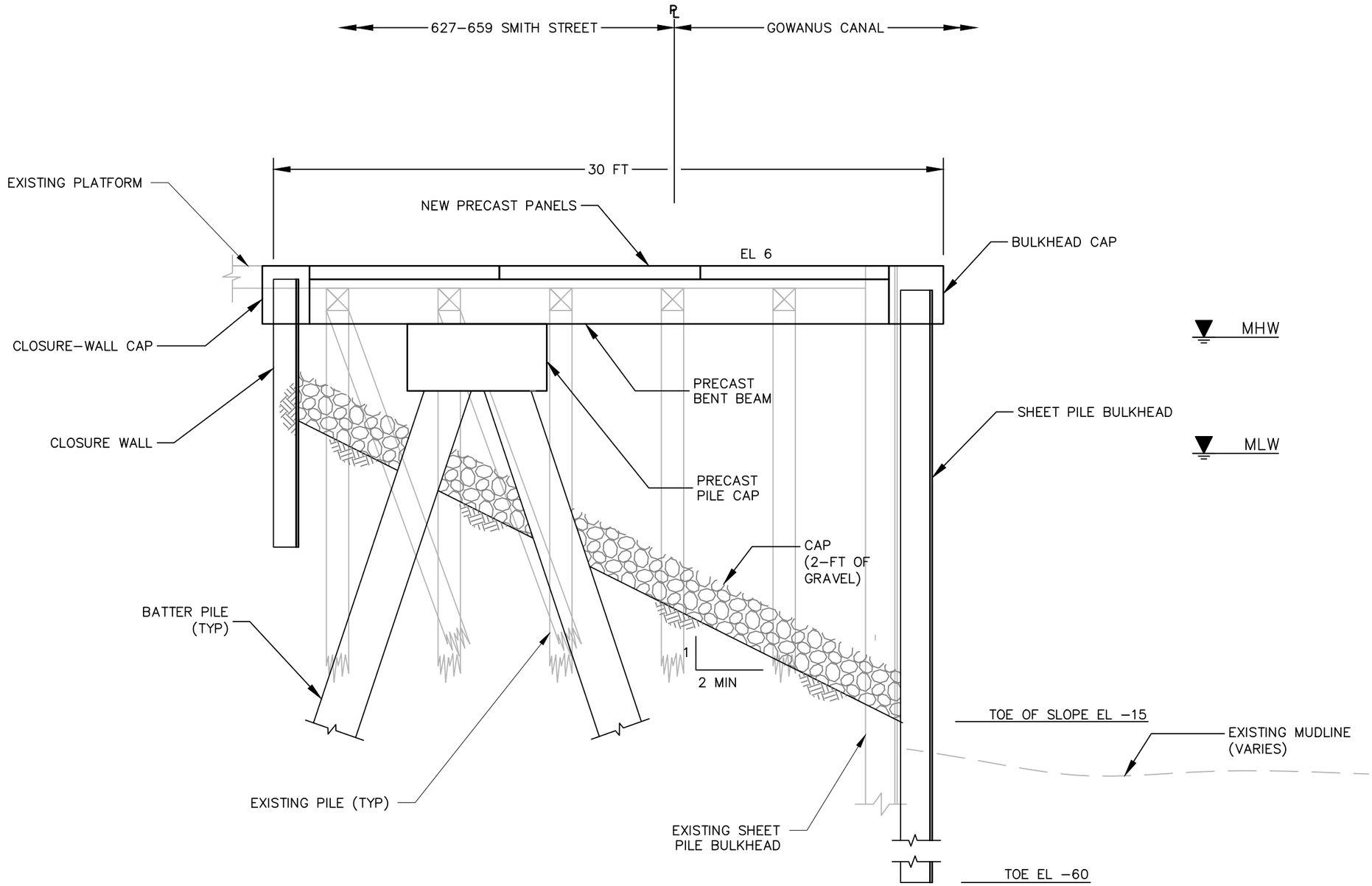

SCALE IN FEET

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Figure Title	SECTION II
Project No.	170488301
Date	01/07/2020
Drawn By	SOC
Checked By	KAH
Figure	3
Sheet	3 of 6

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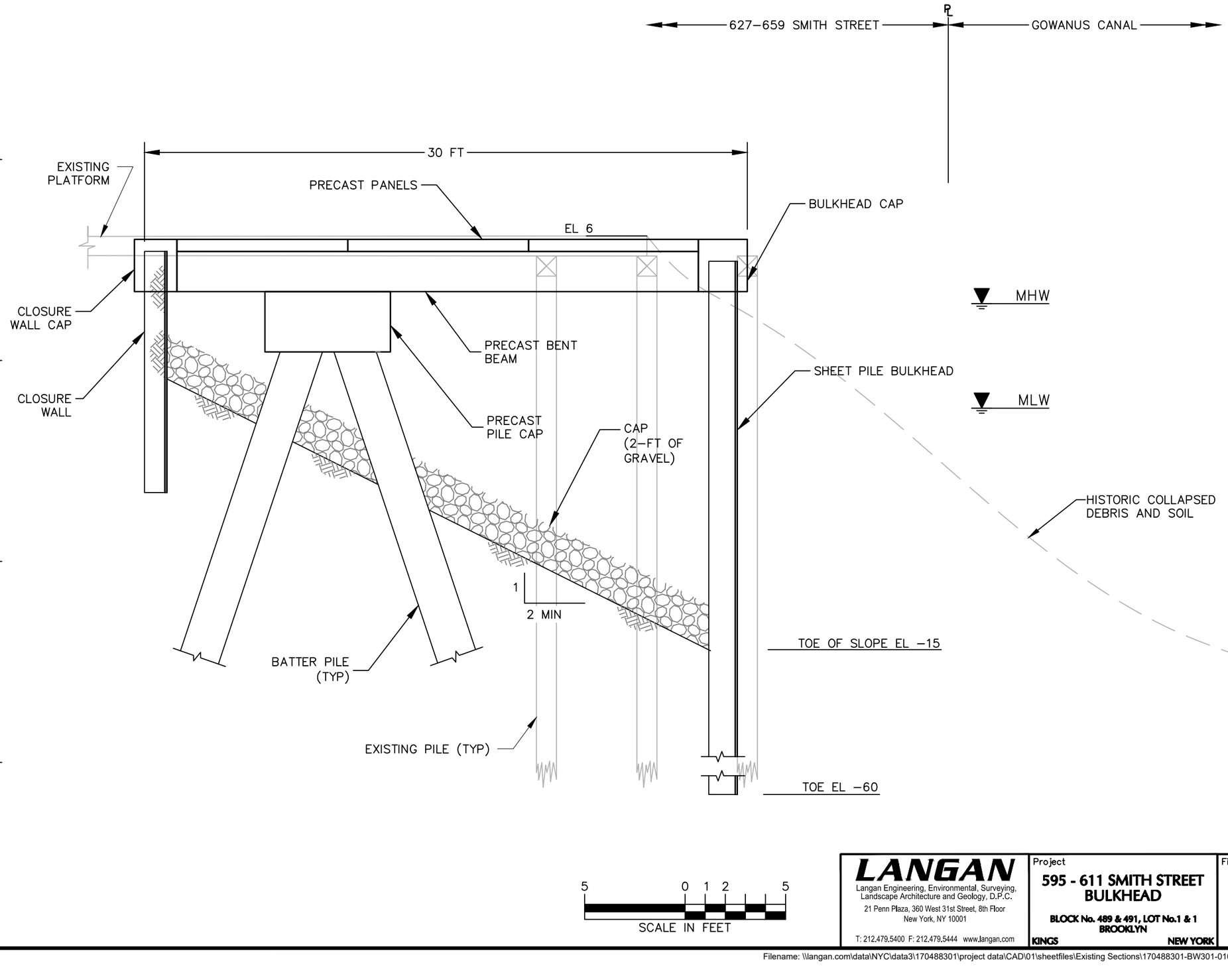

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Figure Title	SECTION III
Project No.	170488301
Date	01/07/2020
Drawn By	SOC
Checked By	KAH
Figure	4
Sheet	4 of 6

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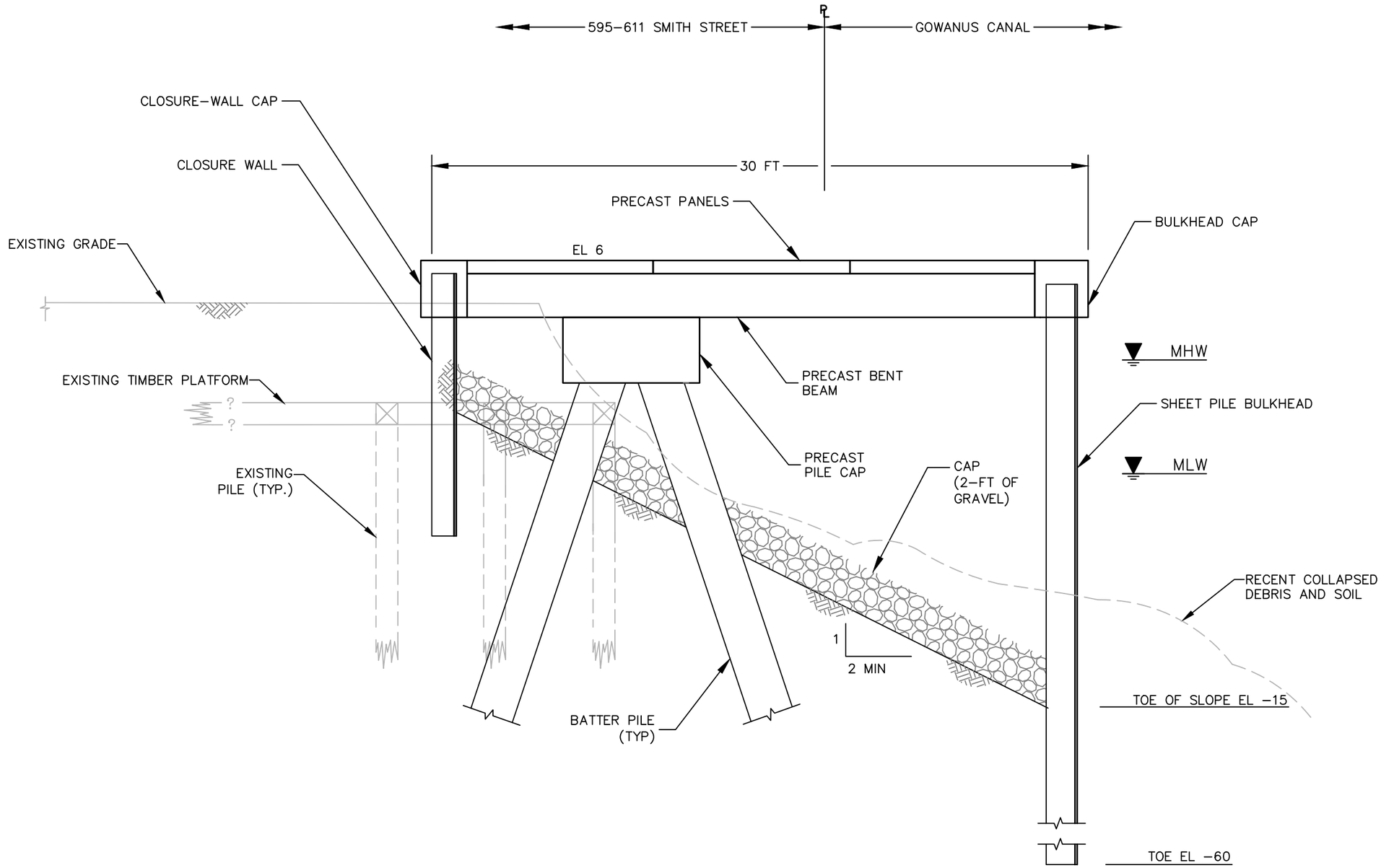

5 0 1 2 5

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Figure Title	SECTION IV
Project No.	170488301
Date	01/07/2020
Drawn By	SOC
Checked By	KAH
Figure	5
Sheet	5 of 6

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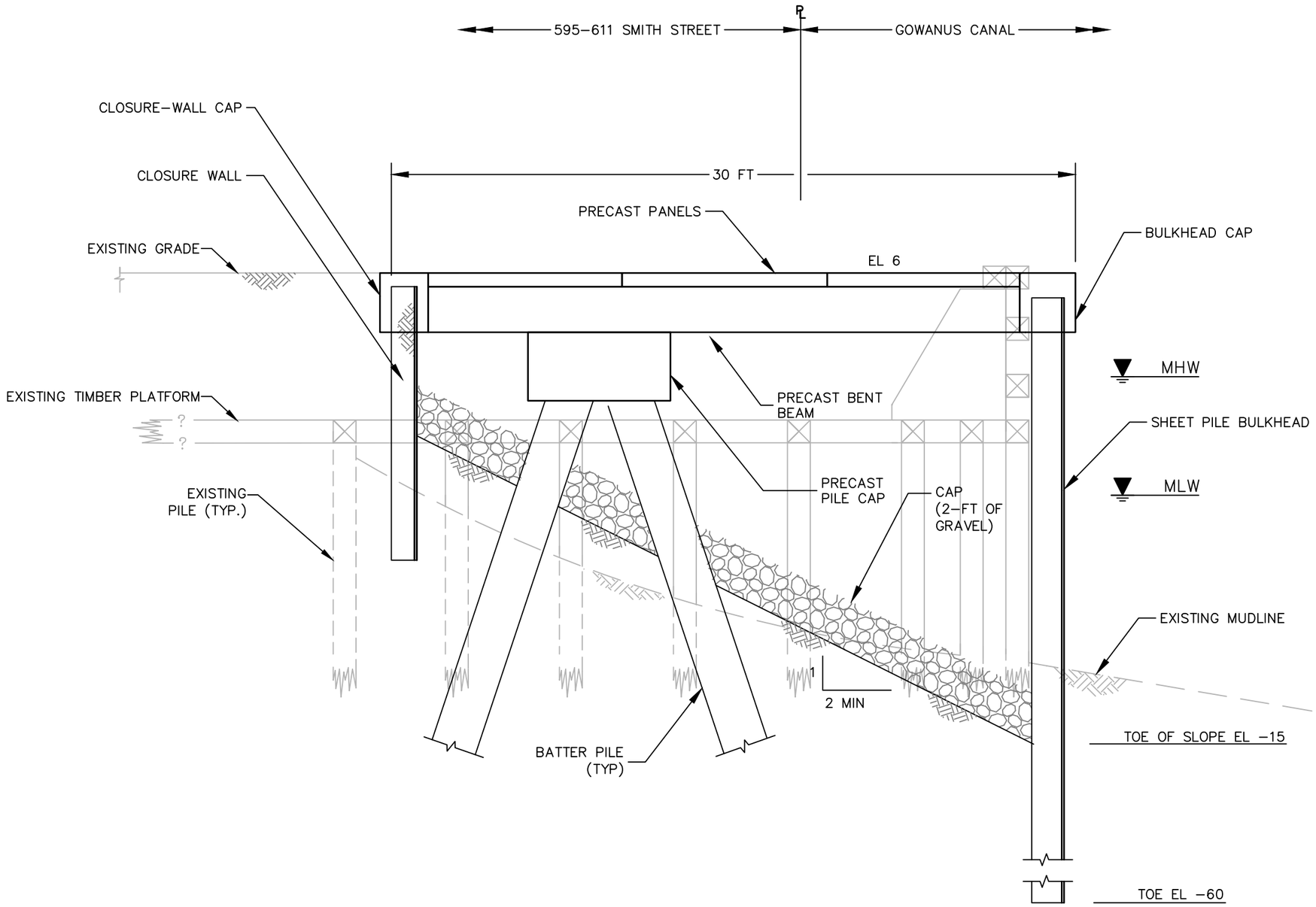

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Project

595 - 611 SMITH STREET BULKHEAD

BLOCK No. 489 & 491, LOT No.1 & 1
BROOKLYN

KINGS **NEW YORK**

Figure Title

SECTION V

Project No.	170488301
Date	01/07/2020
Drawn By	SOC
Checked By	KAH

Figure **6**

Sheet 6 of 6

Filename: \\langan.com\data\NYC\data3\170488301\project data\CAD\01\sheetfiles\Existing Sections\170488301-BW301-0101.dwg Date: 1/7/2020 Time: 15:21 User: fdemelo Style Table: Langan.stb Layout: SECTION V