INTERIM REMEDIAL MEASURES WORK PLAN No. 2

for

GOWANUS CANAL NORTHSIDE

Brooklyn, New York 11231
Block 424, Lots 1 and 20
Block 431, Lots 12 and 17
NYSDEC BCP Site No. C224080

Prepared For:

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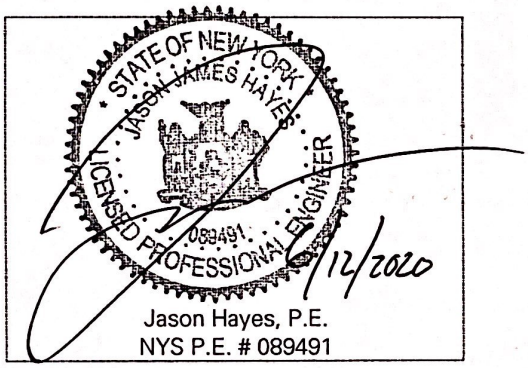
Langan Project No. 170295301

LANGAN

CERTIFICATION

I Jason Hayes, P.E., certify that I am currently a NYS-registered professional engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measures (IRM) Work Plan was prepared in accordance with applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).



Jason Hayes, P.E.
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1.0 INTRODUCTION

1.1 General

Gowanus Canal LLC (the Participant) entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) on April 16, 2015 to investigate and remediate a roughly 98,800-square-foot property identified as:

- Block 424, Lot 1: 479-493 Sackett Street, 267-285 Bond Street, and 484-508 Degraw Street, Brooklyn, New York
- Block 424, Lot 20: 495-505 Sackett Street, Brooklyn, New York
- Block 431, Lot 12: 498-502 Sackett Street, Brooklyn, New York
- Block 431, Lot 17: 508-520 Sackett Street and 505-517 Union Street, Brooklyn, New York

Each of these lots are collectively referred to herein as the "site". A site location map is provided as Figure 1.

This Interim Remedial Measures Work Plan (IRMWP) describes the following proposed interim remedial measures, which the Participant plans to complete in advance of the implementation of an NYSDEC-approved Remedial Action Work Plan (RAWP):

1. Partial demolition of the existing concrete seawall, steel sheet piles, timber bulkhead, and associated structures, as needed, to install a sheet pile cut-off wall
2. Installation of a sealed-seam, sheet pile cut-off wall outboard of the existing bulkhead to stabilize the shoreline, enable redevelopment, and reduce contaminant migration
3. Excavation, handling, transportation, and off-site disposal of material, as necessary, to complete construction of the cut-off wall and upland components (i.e., sheet pile deadman, tie rods, walers, and stormwater pretreatment units [PTUs])
4. Implementation of a Community Air Monitoring Plan (CAMP) for dust, odors, and volatile organic compounds (VOCs) during ground-intrusive activities
5. Dewatering and treatment as necessary to facilitate excavation necessary for cut-off wall construction
6. Collection and analysis of base of excavation endpoint and sidewall soil samples from the tie rod and waler excavation area
7. Surveying of cut-off wall, excavation, and backfilling extents by a surveyor licensed to practice in the state of New York

8. Preparation of a Construction Completion Report (CCR) to document construction of the steel sheet pile cut-off wall and satisfactory implementation of the IRMWP

This IRMWP has been prepared in accordance with requirements of the New York State Brownfield Cleanup Program (BCP) and NYSDEC's May 2010 Division of Environmental Remediation (DER)-10 - Technical Guidance for Site Investigation and Remediation. The IRM will be completed in advance of completing a remedial action (RA) for the site, which will be detailed in a forthcoming RAWP. This is in accordance with the definition of an IRM (May 2010 DER-10):

> ***"Interim remedial measures" or "IRM"*** *means activities to address both emergency and non-emergency site conditions, which can be undertaken without extensive investigation and evaluation, to prevent, mitigate or remedy environmental damage or the consequences of environmental damage attributable to a site, including, but not limited to, the following activities: construction of diversion ditches; collection systems; drum removal; leachate collection systems; construction of fences or other barriers; installation of water filters; provision of alternative water systems; the removal of source areas; or plume control.*

1.2 Site Description

The site was previously occupied by the Bayside Fuel Oil Depot Corporation and is a former Major Oil Storage Facility (MOSF). The site contains a vacant two-story office building (Block 431, Lot 17), vacant automobile maintenance garages formerly used to service the Bayside Fuel vehicle fleet (Block 431, Lot 12 and Block 424, Lot 1), and a vacant parking lot and equipment storage area (Block 424, Lots 1 and 20). Oil storage containers associated with the former MOSF on Lot 17 have been closed and removed.

According to a survey prepared by Control Point Associates Inc., P.C. and dated March 22, 2017, the site surface elevation ranges from about el. 11.5 feet (NAVD88[1]) in the northwestern portion of the site (Block 424, Lot 1) to about el. 3.5 feet in the northeastern portion of Lot 1 adjacent to the Gowanus Canal. A site plan is provided as Figure 2.

1.3 Site Geology and Hydrology

1.3.1 Geologic Conditions

Based on the findings of previous investigations, subsurface strata consist primarily of historic fill material underlain by sand, silt, and clay. The historic fill material predominately consists of silt, sand, gravel, demolition debris, wood, asphalt, coal, ash, and coal slag. The fill layer generally

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

extends to depths ranging from 6 to 10 feet below ground surface (bgs). Percent composition of clay within the native material increases in borings nearest to the Gowanus Canal, which borders the site to the east.

The United States Geological Survey (USGS) "Bedrock and Engineering Geologic Maps of New York County and Parts Kings and Queens Counties, New York, and Parts of Bergen and Hudson Counties, New Jersey" indicates that the bedrock underlying the site is part of the Hartland Formation. Based on a geotechnical investigation completed by Langan in the vicinity of the site, the minimum depth of bedrock is expected to be 100 feet bgs.

1.3.2 Hydrogeologic Conditions

Synoptic groundwater level measurements were collected from monitoring wells located on site and on the adjoining sidewalks during a remedial investigation (RI) on August 14, 2019. The water level measured in the shallow monitoring wells was between 1.37 feet bgs (el 4.87) in MW08, in the central portion of the site, and 8.27 feet bgs (el -1.87) in EPA-MW-3S near the eastern site boundary. Groundwater elevation data indicate that shallow groundwater in the southern and northeastern portions of the site generally flows to the east toward the Gowanus Canal. Shallow groundwater in the northwestern portion of the site on Lot 1 is inferred to flow towards the northwest.

The water level measured in the deep monitoring wells was between 2.69 feet bgs (el 2.35) in MW34D, near the eastern site boundary, and 4.66 feet bgs (el 1.08) in SB12D in the southeastern corner of the site. Deep groundwater is inferred to flow towards the south-southwest.

1.3.3 Waterfront

The eastern site boundary adjoins about 475 linear feet of the Gowanus Canal. The shoreline is protected by a series of bulkheads consisting from south to north of 225 linear feet of steel sheet pile bulkhead, 125 linear feet of concrete facing over timber crib bulkhead, and 125 linear feet of timber crib bulkhead. Existing grades along the top of bulkhead range from about el 3 to el 7.

1.4 Site History

The site is located in an area of historical industrial usage and has been used for industrial and manufacturing purposes from as early as 1886 until 2016. Past uses of the site include the following: a coal yard from 1886 to 1915; a fuel company from 1922 to 1928 and in 1938, an auto repair shop from 1938 to 1969, a wood box manufacturer in 1950, a fuel depot with filling stations and auto repair facility from 1950 to 2016, a private garage with two gasoline tanks from 1950 to 2016, a truck repair shop from 1969 to 2007, a telephone company in 1977, and a truck rental company from 1979 to 2007.

1.5 Previous Environmental Reports

The following previous environmental reports and work plans are listed for reference and were appended to the draft Remedial Investigation Report (RIR) submitted to the NYSDEC and New York State Department of Health (NYSDOH) on July 19, 2019:

1. Phase I Environmental Site Assessment (ESA) Report, prepared by Langan, dated June 4, 2014 (also summarized various reports and correspondence from 2002 to 2013);
2. IRMWP, prepared by Langan, dated June 30, 2015;
3. CCR, prepared by Langan, dated June 27, 2017;
4. Emerging Contaminants Sampling Work Plan, prepared by Langan, dated August 13, 2017;
5. Emerging Contaminants Sampling, October 2018;
6. Remedial Investigation Work Plan (RIWP), prepared by Langan, dated May 1, 2017; and
7. Draft RIR, prepared by Langan, dated July 19, 2019.

In general, previous environmental investigations have documented the presence of petroleum impacts to soil and groundwater across the site. In addition, historic fill and soil are subject to impacts from metals, semivolatile organic compounds (SVOCs), and pesticides, and groundwater is impacted by SVOCs, metals, and chlorinated solvent VOCs. Site soil and groundwater are also impacted by coal tar likely associated with the former Fulton Street manufactured gas plant (MGP), which was located about 400 feet east across the Gowanus Canal.

The most recent subsurface investigation was performed pursuant to the NYSDEC-approved RIWP. The RI findings are detailed in the July 19, 2019 draft RIR. AOCs defined based on the results of the RI and previous investigations are presented in the following sections.

1.5.1 AOC 1: Historical Petroleum Bulk Storage on Block 424

Potential impacts are associated with historical petroleum bulk storage on Block 424, including 17 former underground storage tanks (USTs):

- Fourteen 550-gallon diesel and kerosene USTs were located in the north-central portion of Lot 1 and were connected to two former pump islands in an exterior, partially paved parking lot. The USTs were removed in November 1998, and impacts were observed in soil and groundwater samples collected in the area.
- One 1,000-gallon gasoline UST and one 150-gallon gasoline UST were located in the northwestern portion of Lot 1 within a former vehicle maintenance garage. The USTs were removed during IRMWP implementation on January 20, 2017. Langan observed

petroleum-impacted soil in the tank grave at a depth of about 3 feet bgs with odors and total organic vapor (TOV) concentrations up to about 33 parts per million (ppm).

- One 550-gallon gasoline UST was previously located within an outdoor concrete-paved vacant parking lot in the western portion of Lot 20. The UST was removed during IRMWP implementation on January 18, 2017. Langan observed petroleum-impacted soil exhibiting odor and TOV concentrations up to about 65.9 ppm at a depth of about 3 feet bgs in the tank grave.

1.5.2 AOC 2: Historical Petroleum Bulk Storage on Block 431, Lot 17

Potential impacts are associated with multiple petroleum bulk storage (PBS) tanks formerly located on Block 431, Lot 17, as follows:

- Five bunkered aboveground storage tanks (ASTs), totaling 1.5 million gallons of fuel oil, diesel, and kerosene storage, were formerly located in the southern portion of Lot 17. The ASTs were removed during IRMWP implementation in April and May 2016. During excavation and disposal of the soil surrounding and overlying the ASTs, Langan observed odor, staining, and TOV concentrations up to about 15 ppm. Petroleum-impacted soil was also observed within each of the eight investigative test pits advanced beneath the former concrete base slab. The maximum observed TOV concentration was about 255 ppm, and globules of possible light non-aqueous-phase liquid (LNAPL) were observed in two of the test pits in the southwestern portion of Lot 17.
- One abandoned-in-place 1,080-gallon No. 2 fuel oil UST was formerly located immediately west of the two-story office building on Lot 17. The UST was removed during IRMWP implementation in May 2016. Langan observed petroleum-impacted soil exhibiting odor, staining, and TOV concentrations up to about 105 ppm at depths between 3 and 6 feet bgs in the tank grave, and identified possible LNAPL globules on standing groundwater within the grave.

1.5.3 AOC 3: Historical Petroleum Bulk Storage and Use of Block 431, Lot 12

Potential impacts are associated with historical use and PBS on Block 431, Lot 12. Lot 12 contained an automobile repair facility and garage between approximately 1950 and 2016. The lot contained one 4,000-gallon UST, two 275-gallon ASTs, and two unregistered 275-gallon ASTs. The 4,000-gallon gasoline UST, which was located in the northeastern corner of the lot within the automobile repair building, was closed and removed in December 2009. NYSDEC Spill No. 10-04835 was opened in July 2010 after petroleum product was observed in a utility trench excavation located on or adjacent to the site. The spill was closed in January 2011 with no remediation required. The four 275-gallon ASTs were removed during IRMWP implementation in 2016.

1.5.4 AOC 4: Historical Use of Block 424

Potential impacts are associated with historical use of Block 424, which included a coal yard (1886 to 1915 and 1938); a fuel company (1922 to 1928); an automobile repair facility (1938 and 1969); a commercial facility with gasoline tanks (1950 to 2016); and a commercial truck rental company (1979 to 2007). Previous investigations identified VOC and SVOC impacts to soil and groundwater that may be associated with these historical uses.

Historical PBS and chemical storage on Block 424 included seven ASTs and miscellaneous drums and storage containers with contents including waste oil, lube oil, and No. 2 fuel oil. The ASTs and miscellaneous containers were cleaned, dismantled, and removed from the site during IRMWP implementation in 2016. With the exception of incidental staining noted on the concrete slab near the ASTs inside the former maintenance garage, Langan did not observe field evidence of a potential release. The potential for releases of petroleum or other hazardous substances during filling of tanks or during other historical commercial activities at Block 424 was investigated.

1.5.5 AOC 5: Current and Historical Use, Historical Petroleum Bulk Storage and Petroleum Spills at Adjoining and Surrounding Properties

Potential and documented petroleum and chemical impacts on adjoining properties may have adversely impacted groundwater and/or soil vapor at the site. Current and historical use of up-gradient adjoining and surrounding properties included blacksmiths (1886 to 1969), coal yards (1886 to 1950), an electrical manufacturing facility (1950 to 2007), an oil burner warehouse (1969 to 2007), a plastic product manufacturer (1969 to 1987), an unspecified manufacturer (1988 to 2007), a brass foundry (1938 to 2007), and a machine shop (1950 to 2007).

A historical 2,500-gallon No. 2 fuel oil UST (Facility ID No. 2-604303) was listed at 259 Bond Street, which adjoins Lot 1 to the north, and two unregistered gasoline USTs were located within the former private garage at 501 Union Street, which adjoins Lot 17 to the west, between 1950 and 2007. NYSDEC Spill No. 06-03334 was reported in June 2006 after petroleum-impacted material was observed during excavation at a former electrical company at 198 Douglass Street, which adjoins Lot 1 to the north; a subsequent investigation revealed chlorinated solvents and petroleum-related VOCs in soil, groundwater, and indoor air at the property.

1.5.6 AOC 6: Impacts from the Former Fulton Street Manufactured Gas Plant and the Gowanus Canal Superfund Site:

Investigations of the Gowanus Canal Superfund Site and the Former Fulton Street MGP (formerly located about 400 feet east of the site, east of the Gowanus Canal) have revealed tar-related and other chemical impacts at depths greater than 20 feet bgs at sites along the Gowanus Canal.

Potential impacts associated with the Fulton Street MGP, including potential coal tar-related dense non-aqueous phase liquid (DNAPL), were investigated during the 2017 RI.

AOC extents are depicted on Figure 3. The following section presents the conclusions of the July 19, 2019 draft RIR.

1.6 Remedial Investigation Report Conclusions

The RI was implemented between July 31 and August 16, 2017. The findings summarized herein are based on both qualitative data (field observations and instrumental readings), and laboratory analytical results of soil, groundwater and soil vapor samples collected during the RI and during previous and supplemental investigations. The findings and conclusions presented in the draft RIR are as follows:

1. Stratigraphy: The subsurface profile generally consists of historic fill material directly overlying interbedded intermittent peat, sand, and clay horizons associated with marsh and flood deposits. Historic fill material is located throughout the site and generally extends to depths between about 6 feet and 10 feet bgs. Fill material extends to about 1 foot bgs within the former bunkered AST footprint in the southeastern portion of the site (Lot 17). The fill primarily consists of fine- to medium-grained sand, with varying amounts of silt, gravel, and anthropogenic and pyrogenic material including coal, brick, concrete, wood, and slag. The fill layer is generally underlain by fine- to medium-grained sand with varying amounts of silt and gravel. Intermittent clay units with thicknesses varying between about 6 inches and 22 feet were observed in all soil borings from as shallow as 1 foot bgs (SB11) through the maximum drilled depth of 60 feet bgs, with the exception of one boring in the northwestern portion of Lot 1 (SB01). Peat was encountered in three borings in Lot 17, including SB11 (1 to 9 feet bgs), SB23 (10 to 13 feet bgs), and SB25 (10 to 11 feet bgs). Bedrock was not encountered.
2. Hydrogeology: Groundwater was encountered between 8.27 feet bgs (el -1.87) in EPA-MW-3S in the eastern portion of the site (Lot 17) and 1.37 feet bgs (el 4.87) in MW08 in the central portion of the site (Lot 17). Groundwater elevation data indicate that shallow groundwater in the southern and northeastern portions of the site generally flows to the east towards the Gowanus Canal. Shallow groundwater in the northwestern portion of the site in Lot 1 is inferred to flow towards the northwest. The water level in deep monitoring wells was between 2.69 feet bgs (el 2.35) and 4.66 feet bgs (el 1.08) in the eastern portion (Lot 20) and southeastern portion (Lot 17) of the site, respectively. Deep groundwater is inferred to flow towards the southwest.

3. Petroleum-Impacted Soil, Groundwater, and Soil Vapor:

Soil: Field indications of petroleum impacts, including photoionization detector (PID) readings up to 9,150 ppm (SB26), were identified in soil samples collected throughout the site. The impacts were generally observed in Lot 17 near the former location of the bunkered AST and in the northern and northwestern portions of Lot 1 near the former 14 USTs and gasoline USTs. Petroleum-related VOCs were detected at concentrations above the Part 375 Restricted Use – Restricted Residential (RURR) Soil Cleanup Objectives (SCOs) in samples collected from the northern, western, and eastern portions of Lot 1. A maximum total VOC concentration of 1,318 milligrams per kilogram (mg/kg) was identified between 7 and 8 feet bgs in the north-central portion of Lot 1 (SB03). Most impacts were observed at depths shallower than 10 feet bgs, with the exception of a soil sample collected between 23 and 24 feet bgs from the western portion of Lot 1 (SB02). SVOCs were detected at concentrations up to 240 mg/kg and above those commonly associated with historic fill material in the northern and central portions of Lot 1 (SB15 and SB18), and in the southwestern portion of Lot 17 (SB10).

Groundwater Impacts: Petroleum-related VOCs and SVOCs were detected above the NYSDEC Technical & Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs) for Class GA Water in samples collected from 8 of 24 monitoring wells in the western, northern, and eastern portions of Lot 1, the southeastern portion of Lot 20, the southern portion of Lot 12, and the central and southeastern portions of Lot 17. LNAPL was also identified in monitoring well MW08 in the northwestern portion of Lot 17. The highest VOC concentrations were detected in the western and northern portions of Lot 1 (MW03 and MW02), which contained total benzene, toluene, ethylbenzene, and xylene (BTEX) concentrations of 465 micrograms per liter (µg/L) and 612 µg/L. The highest VOC concentrations in the southern portion of the site were detected in Lot 17 in MW11S, which contained total BTEX at 106 µg/L. One deep well (EPA-MW34D) in Lot 20 contained the gasoline additive methyl tert-butyl ether (MTBE) at 11 µg/L. The petroleum-related VOC and SVOC naphthalene was detected in multiple shallow wells, with a maximum concentration of 1,300 µg/L detected in well MW06S in the eastern portion of Lot 1 and in well MW11S in Lot 17. Coal tar may be a partial source of naphthalene detected in these wells.

Soil Vapor Impacts: Petroleum-related VOCs were detected at concentrations more than three orders of magnitude above those detected elsewhere at the site in the northern portion of Lot 1 (SV03). Ethanol, a gasoline additive, was also detected at

concentrations more than two orders of magnitude above those detected elsewhere at the site in samples collected from Lot 1 (SV02), Lot 12 (SV08), and Lot 17 (SV10).

Sources of Petroleum Impacts: Field and analytical evidence of petroleum contamination was observed throughout the site, with the greatest impacts observed in Lots 1 and 17. Potential sources of petroleum impacts include the 14 former diesel and kerosene USTs in the north-central portion of Lot 1, the former bunkered ASTs in Lot 17, historical petroleum bulk storage in Lot 12 (LNAPL in MW08), and historical vehicle maintenance and petroleum storage in Lot 1. Corresponding soil samples did not indicate an on-site source of the gasoline-related VOC 1,2,4,5-tetramethylbenzene that was detected in groundwater in the southwestern portion of Lot 12 (MW07).

4. Coal Tar-Impacted Soil and Groundwater: Coal tar-related impacts, including soil exhibiting smearing, odors, staining, and/or PID readings up to 15,000 ppm, were identified along the eastern perimeter of the site near the Gowanus Canal at depths between 15 and 54 feet bgs (SB06, SB11, SB12, and SB26). Coal tar contamination was most extensive in the southeastern portion of Lot 17 (SB26), in which impacts transected multiple clay layers between 15 and 54 feet bgs. The impacts were observed below the shallow clay layer in each boring, and appeared to terminate in a clay layer at 53 feet bgs in one boring in Lot 17 (SB11). Several coal tar-related VOCs and SVOCs were detected in corresponding soil and deep groundwater samples at concentrations above the Part 375 RURR SCOs and SGVs, respectively. Total VOC concentrations in coal tar-impacted wells were between 1,672 µg/L (MW12D) and 14,837 µg/L (MW26D). Naphthalene, a coal tar-related VOC and SVOC, was detected at a maximum soil concentration of 3,900 ppm in SB26 (42 to 43 feet bgs) and a maximum groundwater concentration of 8,300 mg/kg in MW06D. DNAPL was not observed. The occurrence of coal tar-related impacts along the western perimeter of the Gowanus Canal is consistent with the Environmental Protection Agency (EPA) Record of Decision for the Gowanus Superfund Site, which documented the presence of "bank-stored tar" along the canal at similar elevations to those identified at the site. The source of the coal tar is likely the Former Fulton Street MGP facility, which was located upland and east of the canal.

5. Arsenic- and Lead-Contaminated Soil: Arsenic and lead were detected at concentrations above those commonly associated with historic fill material in samples collected between 0 feet and 8 feet bgs in the western, northwestern, and southern portions of Lot 1 and in the central portion of Lot 17. Arsenic was detected in three borings in Lot 1 (SB02, SB15, and SB18) at concentrations between 48 mg/kg and 89.1 mg/kg, and in a boring in Lot 17 (SB24) at 38.6 mg/kg. Dissolved-phase arsenic was also detected in one well (MW02) at a concentration of 25.29 µg/L, which marginally exceeds the SGV of 25 µg/L. Lead was

detected between 7 and 8 feet bgs in a boring in the northern portion of Lot 1 (SB15) at a concentration of 2,860 mg/kg. Historical coal storage on Block 424 may be a source of elevated arsenic levels in shallow soil and groundwater. The elevated detection of lead in the northwestern portion of Lot 1 corresponds with VOC detections in the same sample and may therefore reflect a release of leaded gasoline associated with petroleum bulk storage or historical vehicle repair in that area.

6. Historic Fill Material: Historic fill material is present throughout the site and generally varies in thickness between about 6 feet and 10 feet. Samples of fill material contained PAHs, metals, and pesticides at concentrations that are generally consistent with those observed in historic fill material in New York City, with the exception of the arsenic and lead detections discussed above. PAHs were detected at concentrations above the Part 375 Unrestricted Use (UU) and/or RURR SCOs in 23 of 38 samples. Thirty samples of fill material contained up to six metals and eight samples contained pesticides (4,4'-DDD, 4,4'-DDE, and 4,4'-DDT) at concentrations above the Part 375 UU and/or RURR SCOs.

7. Regional Groundwater Quality: Groundwater across the site contained several SVOCs and metals at concentrations above the SGVs. With the exception of naphthalene (discussed above), the SVOCs were typically PAHs commonly associated with historic fill material. Historic fill is also the likely source of the pesticide dieldrin, which was detected above the SGV in two wells (MW06 and MW11S). With the exception of arsenic (discussed above), the dissolved-phase metals above the SGVs were limited to iron, magnesium, manganese, sodium, and antimony (MW11S and EPA-MW3S). Magnesium, manganese, and sodium are commonly associated with regional saline conditions attributable to encroachment of brackish groundwater near tidal sources (e.g., the Gowanus Canal) and/or seasonal application of road salt. Concentrations of the metals were typically higher in wells near the Gowanus Canal. The presence of dissolved-phase iron and antimony may reflect background conditions in historic fill and/or native soil.

8. Emerging Contaminant Analysis: Analytical results of emerging contaminant analysis of groundwater samples collected from monitoring wells MW05 and MW09 indicated perfluorooctanoic acid (PFOA) concentrations between 37 nanograms per liter (ng/L) and 56 ng/L and perfluorooctanesulfonic acid (PFOS) concentrations between 3 ng/L and 17 ng/L. 1,4-dioxane was not detected.

9. PCE-, TCE-, and Acetone-Impacted Soil Vapor: Soil vapor collected throughout Lot 1 and Lot 17 and in Lot 20 contained tetrachloroethene (PCE) (max 538 microgram per cubic meter [µg/m^3]), trichloroethene (TCE) (max 56.4 µg/m^3), and acetone (max 3,540 µg/m^3) at concentrations one to two orders of magnitude above those detective elsewhere at the site. Soil and groundwater sampling data did not indicate on-site sources of PCE and

TCE. The presence of TCE and the PCE breakdown product cis-1,2-dichloroethene in the off-site monitoring well located in the Sackett Street sidewalk south of Lot 1 (EPA-MW-4) at concentrations above the SGVs may indicate an off-site source for the chlorinated compounds. Acetone was detected in shallow soil samples throughout the site at concentrations above the Part 375 RURR SCO. Releases associated with historical on-site vehicle repair operations may therefore be the source of the acetone detections.

The NYSDEC issued comments to the draft RIR on October 11, 2019. Finalization of the draft RIR will occur after the comments are addressed, and after preparation and implementation of an NYSDEC-requested Off-Site Investigation Work Plan intended to determine the extent of possible off-site petroleum impacts to the northwest of the site. RI soil, groundwater, and soil vapor sample results are displayed on Figures 4A through 6B.

1.7 Proposed Development

The proposed redevelopment project is still in the planning phase and may include a multiple-story mixed-use development with a residential component. In the interim, a bulkhead will be constructed along the waterfront to stabilize the shoreline, enable redevelopment, reduce migration of coal tar-impacted soil and groundwater into and out of the Gowanus Canal, and facilitate dredging that is planned as part of the EPA's proposed remedy for the Gowanus Canal Superfund site.

2.0 SUMMARY OF INTERIM REMEDIAL MEASURES

This IRMWP includes the following tasks to support shoreline stabilization and reduce migration of coal tar-impacted soil and groundwater along the site's Gowanus Canal frontage:

1. Partial demolition of the existing concrete seawall, steel sheet piles, timber bulkhead, and associated structures as needed to install a sheet pile cut-off wall
2. Installation of a sealed-seam, sheet pile cut-off wall outboard of the existing bulkhead to stabilize the shoreline, enable redevelopment, and reduce contaminant migration
3. Excavation, handling, transportation, and off-site disposal of material generated during construction of the cut-off wall and upland components (i.e., sheet pile deadman, tie rods, walers, and stormwater PTUs)
4. Implementation of a CAMP for dust, odors, and VOCs during ground-intrusive activities
5. Dewatering and treatment as necessary to facilitate excavation necessary for cut-off wall construction
6. Collection and analysis of base of excavation endpoint and sidewall soil samples from the tie rod and waler excavation area
7. Surveying of cut-off wall, excavation, and backfilling extents by a surveyor licensed to practice in the state of New York
8. Preparation of a CCR to document construction of the steel sheet pile cut-off wall and satisfactory implementation of the IRMWP

The IRM described herein will be performed in accordance with applicable federal, state, and city regulations and a Health and Safety Plan (HASP), which is provided as Appendix A. A concept design for the cut-off wall is provided in Appendix B.

2.1 Interim Remedial Measures Objectives and Rationale

The objective of the IRMWP is to support shoreline stabilization and reduce migration of coal tar-impacted soil and groundwater along the site's Gowanus Canal frontage. Stabilizing the shoreline will facilitate future remedial excavation on site and dredging within the Gowanus Canal by preventing collapse of the existing bulkhead and associated upland soil and structures. Migration of coal tar-impacted soil and groundwater into and out of the Gowanus Canal will be substantially reduced by the construction of the sealed sheet pile cut-off wall. The toe depth of the cut-off wall will at a minimum extend to el -35± (current grade at existing bulkhead is el 6±).

The Remedial Action Objectives (RAOs) for this site are intended to be protective of public health and the environment and are developed based on contaminant-specific standards, criteria, and

guidance (SCGs). The RAOs were developed from information derived from previous environmental investigations, including known impacted media and potential public health and environmental exposure pathways.

The RAOs for this IRMWP are as follows:

RAOs	RAOs for Public Protection	RAOs for Environmental Protection
Soil	• Prevent ingestion/direct contact with contaminated soil and concrete • Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil	• Prevent migration of contaminants that would result in groundwater contamination
Groundwater	• Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards • Prevent contact with, or inhalation of, contaminants emanating from contaminated groundwater	• Prevent migration of contaminated groundwater onto or emanating from the site
Soil Vapor	• Reduce migration of contaminants from within and beneath the Gowanus Canal that could migrate on-site and transition into soil vapor	

2.2 Remedial Activity Oversight

Langan personnel will be on-site full-time during implementation of the IRMWP. Visual, olfactory, and PID soil screening and assessment will be performed for soil that is disturbed. The IRM activities will be documented in daily reports, monthly progress reports, and the CCR described in Section 4.0.

2.3 Site Preparation

Site preparation will be completed by the Contractor prior to the implementation of the IRMWP and will include, but not be limited to, the establishment of work zones, mobilization of support facilities, construction of decontamination facilities, and implementation of site security measures (i.e. erection of security fencing around work zones and staging areas). The Contractor will maintain soil erosion control and sediment control measures prior to and during work operations described in the IRMWP.

2.4 Technical Description of Sealed Sheet Pile Cut-off Wall

An about 475-foot-long, sealed sheet pile cut-off wall will be installed outboard of the existing Gowanus Canal bulkhead along the site's eastern perimeter. The cut-off wall is designed to stabilize the shoreline, substantially reduce coal tar migration into and out of the Gowanus Canal, and facilitate the dredging of the canal.

Construction of the cut-off wall will include:

- Installation of a continuous interlocking steel sheet pile (NZ26 or approved equivalent) cut-off wall with sealed seams. The sheet piles will be driven to a minimum toe depth of el -35±. The interlocks between each sheet pile will be sealed by either (1) welding the interlock for the full length of the sheet pile, or (2) by inserting a hydrophilic sealant (Adeka UltraSeal® P-201 or similar) within the interlock seams.
- Installation of a steel sheet pile deadman (NZ14 or approved equivalent) about 40 feet inland from the cut-off wall to serve as an anchor for the cut-off wall. The vertical deadman length is about 20 feet.
- Installation of about 33 horizontal tie rods from the cut-off wall to the deadman at about el 4±. Horizontal walers will be installed on the inland side of the cut-off wall and the deadman anchor to distribute the tie rod loads.
- Installation of two stormwater PTUs, associated piping, and outfall at about el. 0±. The stormwater PTUs will collect and pretreat future site runoff, which will then be discharged through the outfall. The PTUs will be located about 60 feet inland of the sheet pile cut-off wall.
- Excavation of about 4,700 cubic yards (CY) of soil and historic fill material to accommodate installation of the walers, tie rods, and PTUs within the proposed about 475-foot-long by 50-foot-wide work area. Soil will be sloped as necessary within the work area to support the excavation.
- Backfilling of the waler/tie rod trench excavations and any additional backfilling as needed to match the original site grade following construction of the cut-off wall.

Approximate excavation extents are shown on Figure 7. Excavated material will be handled, transported, and disposed of in accordance with Section 2.5. The current cut-off wall design is attached as Appendix B, and reflects comments received from the EPA.

2.5 Soil/Materials Management

This section describes the approach to handling, transportation, disposal, reuse, and import of materials (including soil, historic fill material, and liquid wastes) during implementation of the IRMWP. A Langan representative, under the supervision of the Remedial Engineer (RE), will monitor and document handling of soil and historic fill material exported from the site for disposal in accordance with applicable laws and regulations. Excavated material will be screened by visual and olfactory methods and with a PID to identify any evidence of environmental impacts. Impacted soil (if encountered), historic fill material, and native soil (if encountered) will be managed separately to avoid commingling.

2.5.1 Preliminary Waste Characterization

A waste characterization investigation will be conducted prior to Contractor mobilization. The investigation will include assessment and delineation of potential areas of characteristic hazardous soil (if necessary). Representative soil samples will be collected in accordance with general disposal facility requirements and DER-10 Section 5.4 (including Table 5.4[e]10) to characterize material subject to off-site disposal and/or reuse during installation of the cut-off wall components. Analytical soil sample results will be used to obtain pre-approval at select disposal facilities. Laboratory analysis for waste stream characterization will be determined by the facility's permit requirements. This activity will be coordinated and overseen by a Langan representative under the supervision of the RE. Samples may be collected from soil borings, test pits, or stockpiled material. If additional characterization is required during construction, it will be the responsibility of the Contractor and documented by a Langan representative.

Waste characterization samples will be submitted to an NYSDOH Environmental Laboratory Approval Program (ELAP) laboratory for analysis in accordance with the Quality Assurance Project Plan (QAPP) provided in Appendix C. Analytical reports will be included in the CCR.

2.5.2 Soil Erosion and Sediment Control Measures

Before starting construction, the Contractor shall install a turbidity curtain in the Gowanus Canal adjacent to the site. An oil absorbent 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 EPA Method 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) and will be calibrated in accordance with the manufacturer's recommendations.
- Two readings will be taken about every 40 feet along the alignment of the turbidity curtain, with one reading about 2 feet inside the curtain and the other about 5 feet outside the curtain. At each location, turbidity readings will be taken at depths of about 6 and 18 inches below the water surface.
- The turbidity curtain will remain in place until turbidity measurements demonstrate that post-construction measurements inside the curtain are:

  - less than or equal to the measurements obtained prior to the start of construction; or
  - 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 removal of the turbidity curtain, a representative waste characterization sample of the curtain material will be collected and submitted to an NYSDOH ELAP laboratory. Laboratory analyses will be determined by the requirements of the Contractor's chosen disposal facility.

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). 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 soil from migrating off site.

If construction-related vehicular traffic over exposed soil is anticipated, a stabilized construction pad will be installed and maintained by the Contractor at the construction entrance. Soil erosion and sediment control measures will be inspected weekly and after major storm events by a qualified Stormwater Pollution Prevention Plan (SWPPP) inspector. The Contractor shall immediately correct any deficiencies noted by the inspector.

Prior to the start of construction, and for the duration of construction, oil absorbent booms will be used along the limits of the work zone to contain potential releases during bulkhead construction work. The oil absorbent boom must remain in place until installation of the cut-off wall is completed and any oil sheen has been removed from the surface of the water.

2.5.3 Soil Excavation

Excavation will be conducted using conventional hydraulic excavation equipment. Specific excavation support requirements will be determined by the Construction Manager and Contractor. The 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 during waste characterization, will be located via survey or by measurement from a fixed reference point by the Contractor.

About 4,700 CY of soil and historic fill material will be excavated to accommodate installation of the cut-off wall and associated components. Excavation is anticipated to extend from surface grade to about el 1± within the proposed about 475-foot-long by 50-foot-wide work area. Additional excavation for two stormwater PTUs and associated outfall piping is anticipated to

extend from surface grade to about el. 0±. An about 60-foot-long and 50-foot-wide portion of the proposed excavation is within the Sackett Street right-of-way. Soil will be sloped around the work area to support the open excavation. Additional trench excavation may be required to remove obstructions; excavated spoils will be characterized in accordance with Section 2.5.1. Localized dewatering may be required during excavation (see Section 2.5.11). Excess soil and historic fill material not suitable for reuse (e.g., grossly-impacted material, soil exhibiting a nuisance odor, etc.) 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 extent of the excavation area is shown on Figure 7.

If uncovered during excavation, USTs will be decommissioned in accordance with DER-10 Section 5.5. The USTs will be exposed, rendered inert, and cleaned prior to disposal as scrap metal. The decommissioned UST registration will be updated with the NYSDEC PBS unit. If previously unidentified USTs are encountered during excavation, NYSDEC will be notified prior to UST decommissioning.

2.5.4 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by an engineer, geologist or scientist under the direct supervision of the Remedial Engineer (RE) during all soil-intrusive work performed under the IRMWP. Instrumental screening will be performed with a PID equipped with a 10.6 eV bulb and calibrated daily.

2.5.5 Stockpiles

Soil and concrete stockpiles will be constructed as necessary, pending off-site removal. Separate stockpiles will be constructed to avoid comingling different materials. Stockpiles will meet the following requirements:

- Individual stockpiles will not exceed 2,000 CY.
- Different material types will be segregated into separate stockpiles.
- Excavated soil, if stockpiled above soil of a different type, will be placed onto two layers of a minimum 6-mil low-permeability liner of sufficient strength and thickness to prevent puncture during use. Equipment and procedures will be used to place and remove the soil and 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 6-mil plastic sheeting or tarps which 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 runoff, and to mitigate the potential for surface water run-on.

- Stockpiles will be inspected once each week, at a minimum, and after every storm event. Any deficiencies will be promptly addressed. Any damaged tarps or coverings will be promptly replaced.
- Results of inspections will be recorded in a logbook and maintained at the site and made available for inspection by NYSDEC.

2.5.6 Material Load Out and Transport

Non-hazardous material will be handled, transported and disposed by a licensed hauler in accordance with applicable 6 NYCRR Part 360 Solid Waste Management Facilities requirements, 6 NYCRR Part 364 Waste Transporter Permit requirements, and other applicable federal, state and local regulations. Historic fill and contaminated soil will not be disposed of at Part 360.15 registered facilities (also known as Soil Recycling Facilities) unless the requirements of Part 360.13 - Special Requirements for Predetermined Beneficial Use of Fill Material - are met and approved by the NYSDEC.

The waste disposal contractor will provide appropriate permits, certifications, and written commitments from disposal facilities to accept the material throughout the duration of the project. Waste manifests will be used to track transported material off-site. Haulers will be appropriately licensed and trucks will be properly placarded.

A representative for the RE will oversee the load-out of excavated material. After the loading of a container, dump truck, or trailer has been completed, the material will be transported to a NYSDEC-approved off-site disposal facility. Loaded vehicles leaving the site will be appropriately lined, securely covered, and manifested in accordance with appropriate federal, state, local, and New York State Department of Transportation (NYSDOT) requirements (or other applicable transportation requirements). Truck liners and solid impermeable covers will be used, as needed, for loads containing wet material capable of producing free liquid. A truck wash/cleaning area will be operated on-site. All outbound trucks will be washed/cleaned at the truck wash before leaving the site until IRMWP implementation is complete. Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site sediment tracking. A truck route map is shown on Figure 8.

2.5.7 Materials Disposal Off-site

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 per Section 2.5.1. Sampling and analytical methods, sampling frequency, analytical results, and quality assurance/quality control (QA/QC) methods will be reported in the CCR. 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. Proposed disposal facility documentation will be presented to the NYSDEC prior to disposal activities.

2.5.8 Materials Reuse On-site

Non-hazardous historic fill or native soil may be reused at the discretion of the RE if it is not grossly impacted, does not exhibit nuisance odors (e.g. petroleum- or chemical-like odors), and meets the lower of the 6 NYCRR Part 375 PGW or RURR SCOs (see DER-10 Section 5.4[e]4). Fill material used as backfill for the excavation from which the fill material was taken, or as fill in areas of similar physical characteristics on the project property, will be reused without additional analytical testing assuming no grossly-impacted material or nuisance odors (e.g. petroleum- or chemical-like odors) are observed. Reused soil must be non-hazardous in accordance with the predetermined beneficial use listed in 6 NYCRR 360.13. Soil removed during implementation of the remedy or other purposes will not be reused within landscaped areas, unless approved by the NYSDEC. Reuse of soil will be coordinated in advance with the NYSDEC case manager. Material intended for reuse on-site will be stockpiled separately from waste material.

2.5.9 Material Import to the Site

Backfill from off-site sources will be sampled for emerging contaminants (PFAS and 1,4-dioxane), VOCs, SVOCs, polychlorinated biphenyls (PCBs), pesticides, and metals in accordance with DER-10, Table 5.4(e)10 (Recommended Number of Soil Samples for Soil Imported to a Site) and analytical results will meet the lower (more restrictive) of the 6 NYCRR Part 375 RURR and PGW SCOs. Documentation from each proposed import facility will be obtained, including the facility name, address, state department permits, and site history, if necessary, in accordance with NYSDEC DER-10 5.4(e)6. Representative samples of all imported material will be collected and analyzed on import volume at a frequency consistent with DER-10, Table 5.4(e)10. A Request to Import/Reuse Fill or Soil form will be submitted to the NYSDEC for each proposed source of backfill. Soil will not be imported without prior approval of the Request to Import/Reuse Fill or Soil form by the NYSDEC. Imported material will be screened for visual, olfactory, or instrumental evidence of contamination.

Backfill material will consist of soil meeting the lower (more restrictive) of the 6 NYCRR Part 375 RURR and PGW SCOs or other acceptable fill material such as virgin quarry sand or stone or recycled concrete aggregate (RCA). If RCA is imported to the site, it will be from NYSDEC-permitted or registered facilities in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported to the site must be derived from recognizable and uncontaminated concrete. RCA or virgin sand or stone aggregate may be

imported without analytical data if it contains less than 10 percent by weight passing a No. 80 sieve.

Material from industrial sites, spill sites, other environmental remediation sites or other potentially impacted sites will not be imported to the site. The imported fill will not include solid waste such as brick, concrete, glass, ash, wood, or other debris. Materials proposed for import onto the site will be sampled (if necessary), found to be in compliance with provisions in the IRMWP, and approved by the RE and NYSDEC prior to receipt.

2.5.10 Fluids Management

Based on the depth to groundwater observed during previous investigations, localized dewatering may be required during bulkhead installation. 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. Waste liquids may be discharged into the Gowanus Canal under an approved SPDES permit or into the New York City sewer system under an approved New York City Department of Environmental Protection (NYCDEP) permit and will conform to pre-treatment stipulations of the permit. Waste liquids not suitable for discharge to the Gowanus Canal or the NYCDEP sewer system may be collected, characterized, and managed off-site. Waste liquids will not be recharged back to the land surface or subsurface of the site.

2.5.11 Equipment Decontamination

Excavation equipment and trucks that come in contact with contaminated material will be decontaminated prior to removal from the site. The decontamination area will be constructed by the Contractor to collect rinsate for off-site disposal or treatment and discharge, as needed. The design will consider adequate space to decontaminate site equipment and vehicles, and sloping and liners to facilitate collection of wastewater. Collected rinsate shall be either discharged in accordance with the Contractor's NYCDEP or SPDES 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 contaminated soil excavation.

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

2.6 Documentation Sampling

About 14 documentation (i.e. endpoint) soil samples will be collected from the excavation base. Seven sidewall soil samples will be collected, from the following locations:

- the southern site boundary, adjacent to Union Street;
- the western sidewall of the excavation;
- the border of Block 424, Lot 20 and the Sackett Street right-of-way; and
- the border of Block 431, Lot 17 and the Sackett Street right-of-way.

Sidewall samples will not be collected from the northern or eastern excavation perimeters, because steel sheet pile return walls will preclude access to soil sidewalls. The proposed sampling locations are displayed on Figure 7.

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

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

The CCR will provide a tabular and map summary of all documentation sample results. Locations exhibiting clear signs of visual and/or olfactory petroleum-like contamination will be noted in daily field reports and the CCR.

2.7 Contingency Plan

If USTs or other previously unidentified contaminant sources are found during bulkhead installation, excavation, or other IRM activities, sampling will be performed on any product and surrounding subsurface material (e.g., soil, stone, etc.). Chemical analysis will include full scan parameters (Part 375 VOCs, SVOCs, PCBs, pesticides, and metals). Analyses will not be otherwise limited without NYSDEC approval.

If encountered, USTs will be decommissioned and closed in conformance with the criteria defined in 6 NYCRR Part 613-3.5, NYSDEC CP-51, and other applicable NYSDEC UST closure requirements including DER-10 Chapter 5.5.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC Project Manager. These findings will be also be detailed in daily reports and the CCR.

2.8 Dust, Odor, Vapor and Nuisance Control Plan

The 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). Ground-intrusive activities during IRWMP implementation will be monitored for dust, odors, and VOCs by a Langan representative, 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 hand-held PID will be used to monitor the work zone during hot spot excavations (if any). 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 HASP included as Appendix A. 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 hand-held PID in accordance with the site-specific HASP 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 stopped and a re-evaluation of activates initiated. The source of vapors will be identified, corrective actions will be taken to abate emissions, and monitoring will continue. 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.

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 µg/m³ 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/m³ 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/m³ above the background level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind particulate concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

If nuisance odors or vapors exceeding action levels set forth herein are identified off-site, work will be halted and the source of odors will be identified and corrected. Work will not resume until 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 control perimeter monitoring, including the temporary suspension of work, will be the

responsibility of the RE, who is responsible for certifying the CCR. The Contractor is responsibility for implementing all odor and vapor controls as required.

2.9 Contractor's Means and Methods

Appropriate management of structural stability of on- and/or off-site structures during bulkhead installation activities will be performed by the Contractor. The Contractor is solely responsible for safe execution of all invasive and other work performed under this IRMWP and will be responsible for obtaining any local, state or federal permits or approvals that may be required to perform work under this IRMWP.

2.10 Construction Health and Safety Plan

The RE prepared a site-specific HASP, which is provided as Appendix A. The HASP specifically addresses health and safety requirements pertaining to site contamination and will apply to all remedial and construction-related work on site. Contractors operating on the site are required to adhere to their own plans that, at a minimum, meet the requirements of the HASP. The HASP requires that all remedial work performed under this plan be in full compliance with governmental requirements, including site and worker safety requirements mandated by Federal OSHA. The HASP provides a mechanism for establishing on-site safe working conditions, safety organization, procedures, and personal protective equipment (PPE) requirements during the IRM. The HASP meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which include 29 CFR 1910.120 and 29 CFR 1926.65, respectively).

3.0 SCHEDULE

The Participant anticipates that the IRM implementation will take about three to four months from mobilization through completion. After completion of the IRM, the remainder of the site will be remediated under a forthcoming NYSDEC-approved RAWP.

The preliminary schedule shown below is based on the EPA Gowanus Canal dredging, which is anticipated to reach the west side of the canal, north of Union Street, in the summer of 2021. This schedule is subject to change based on changes in the EPA's schedule. Once a finalized schedule is available, it will be provided to the NYSDEC.

Task	Duration	Anticipated Date
Mobilization	2 weeks	February 15 to 26, 2021
Installation of Sheet Piles (including localized excavation to remove obstructions)	2 months	March 1 to May 3, 2021
Installation of Bulkhead Support Structures (incl. excavation throughout work area and collection of documentation soil samples)	1.5 months	April 5 to May 22, 2021
Backfill Installation	2 weeks	May 13 to May 27, 2021
Demobilization	1 week	May 30 to June 3, 2021

3.1 Notification

The NYSDEC will be notified at least seven calendar days prior to commencement of work related to the IRM to arrange a pre-construction meeting.

4.0 REPORTING

Following implementation of the NYSDEC-approved IRMWP, a CCR will be prepared and submitted. During the IRM, progress reports will be prepared and submitted as described below. The RE responsible for certifying the CCR will be an individual licensed to practice engineering in the State of New York. Jason Hayes, P.E. of Langan Engineering 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.

Daily reports and monthly progress reports will be provided in electronic format (e.g., PDF) to the NYSDEC's project manager during IRMWP implementation. Electronic copies of the daily reports and monthly progress reports will be included in the CCR.

4.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each week following the reporting period and will include:

- A progress update;
- A description of work locations;
- A site plan depicting relevant IRMWP site activities;
- A summary of complaints with relevant details (names, phone numbers);
- A summary of CAMP results;
- Deviations from the IRMWP (if applicable); and,
- Anticipated remedial activities.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the IRMWP or other sensitive or time critical information. However, such conditions will also be included in the daily reports. Emergency conditions and deviations to the IRMWP will be addressed directly to NYSDEC Project Manager via personal communication. If site conditions warrant, the RE may request to change from daily to weekly reports that include the above information.

4.2 Monthly Reports

Consistent with the BCA, monthly reports will be submitted to NYSDEC and NYSDOH Project Managers by the 10th of each month following the reporting period and will include:

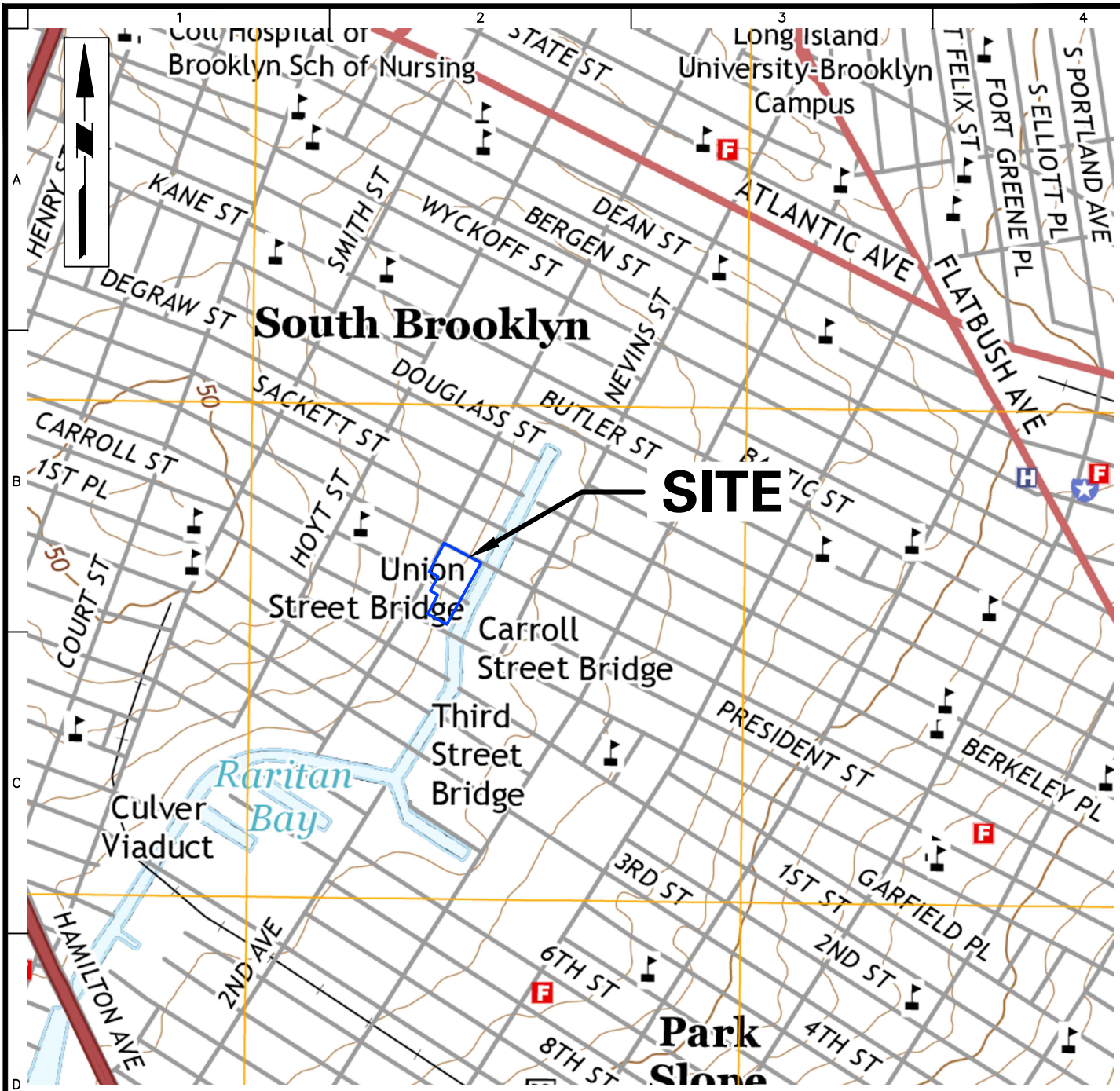
- Activities relative to the site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed;

- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

4.3 Construction Completion Report

A CCR, prepared in accordance with DER-10 Section 5.8, will be submitted to the NYSDEC following IRMWP implementation. The CCR will provide documentation that the remedial work required under the IRMWP was completed in substantial compliance with this plan.

FIGURES



MAP REFERENCE: USGS 7.5-MINUTE JERSEY CITY, N.J. (2011) AND BROOKLYN, N.Y. (2013) TOPOGRAPHIC QUADRANGLES

LEGEND:

SITE BOUNDARY

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.

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SCALE IN FEET

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Project

GOWANUS CANAL NORTHSIDE

BLOCK Nos. 424, LOT Nos. 1 & 20
BLOCK Nos. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title

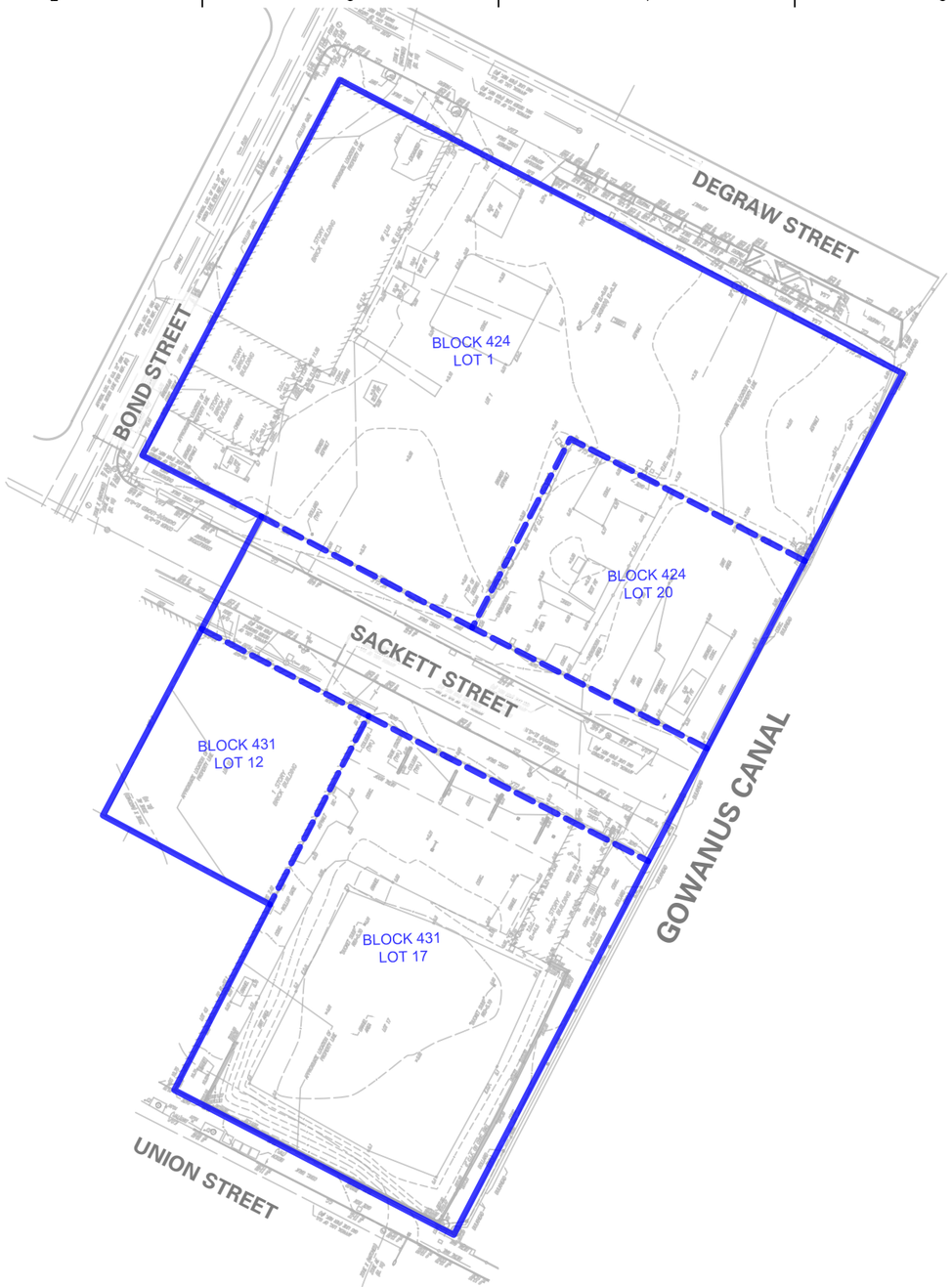
SITE LOCATION MAP

Figure No.	170295301
Date	9/23/2019
Drawn By	CMA
Checked By	PF

Drawing No. 1

Sheet 1 of 11

Filename: \\Langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\IRMWP (BH)\Figure x - Site Location.dwg Date: 10/3/2019 Time: 12:31 User: pstovall Style Table: Langan.stb Layout: ANSIA-BP



LEGEND:

SITE BOUNDARY

LOT BOUNDARY

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).

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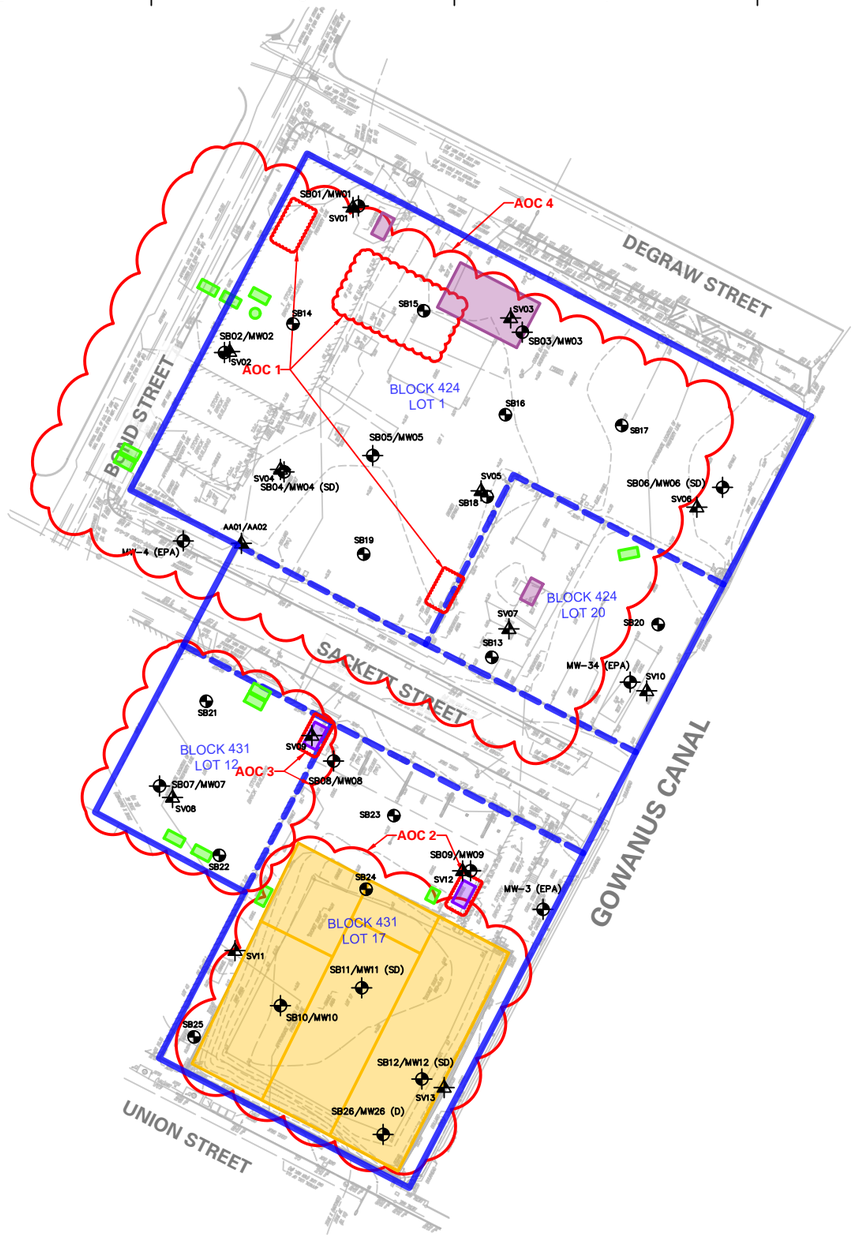
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
SITE PLAN

Project No. 170295301
Date 9/23/2019
Drawn By CMA
Checked By PF

Figure No. 2
Sheet 2 of 11

Filename: \\Langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\IRMWP (BH)\Figure X - TAG Maps.dwg Date: 10/3/2019 Time: 12:40 User: pstovall Style Table: Langan.stb Layout: SITE PLAN



LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING BUILDING EXTENTS
- APPROXIMATE AOC BOUNDARY
- APPROXIMATE LOCATION OF FORMER UNDERGROUND STORAGE TANKS (USTs)
- APPROXIMATE LOCATION OF FORMER ABOVEGROUND STORAGE TANKS (ASTs)
- APPROXIMATE LOCATION OF FORMER BUNKERED ASTs
- SB17 — 2017 RI SOIL BORING LOCATION
- SB02/MW02 — 2017 RI SOIL BORING AND MONITORING WELL LOCATION
- SB26/MW26 (D) — 2017 RI SOIL BORING AND DEEP MONITORING WELL LOCATION
- SB11/MW11 (SD) — 2017 RI SOIL BORING AND SHALLOW/DEEP MONITORING WELL COUPLET LOCATION
- MW-3 (EPA) — EXISTING UNITED STATES ENVIRONMENTAL PROTECTION AGENCY MONITORING WELL
- SV06 — 2017 RI SOIL VAPOR SAMPLE LOCATION
- AA01 — 2017 RI AMBIENT AIR SAMPLE LOCATION

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. AREA OF CONCERN (AOC) 1 - HISTORICAL PETROLEUM BULK STORAGE (PBS) ON BLOCK 424
4. AOC 2 - HISTORICAL PBS ON BLOCK 431, LOT 17
5. AOC 3 - HISTORICAL PBS AND USE OF BLOCK 431, LOT 12
6. AOC 4 - HISTORICAL USE OF BLOCK 424
7. AOC 5 - CURRENT AND HISTORICAL USE, HISTORICAL PBS AND CURRENT SPILL LISTINGS AT ADJOINING AND SURROUNDING PROPERTIES
8. AOC 6 - IMPACTS FROM THE FORMER FULTON STREET MANUFACTURED GAS PLANT (MGP) AND THE GOWANUS CANAL SUPERFUND SITE
9. RI = REMEDIAL INVESTIGATION

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.

80 0 40 80
SCALE IN FEET

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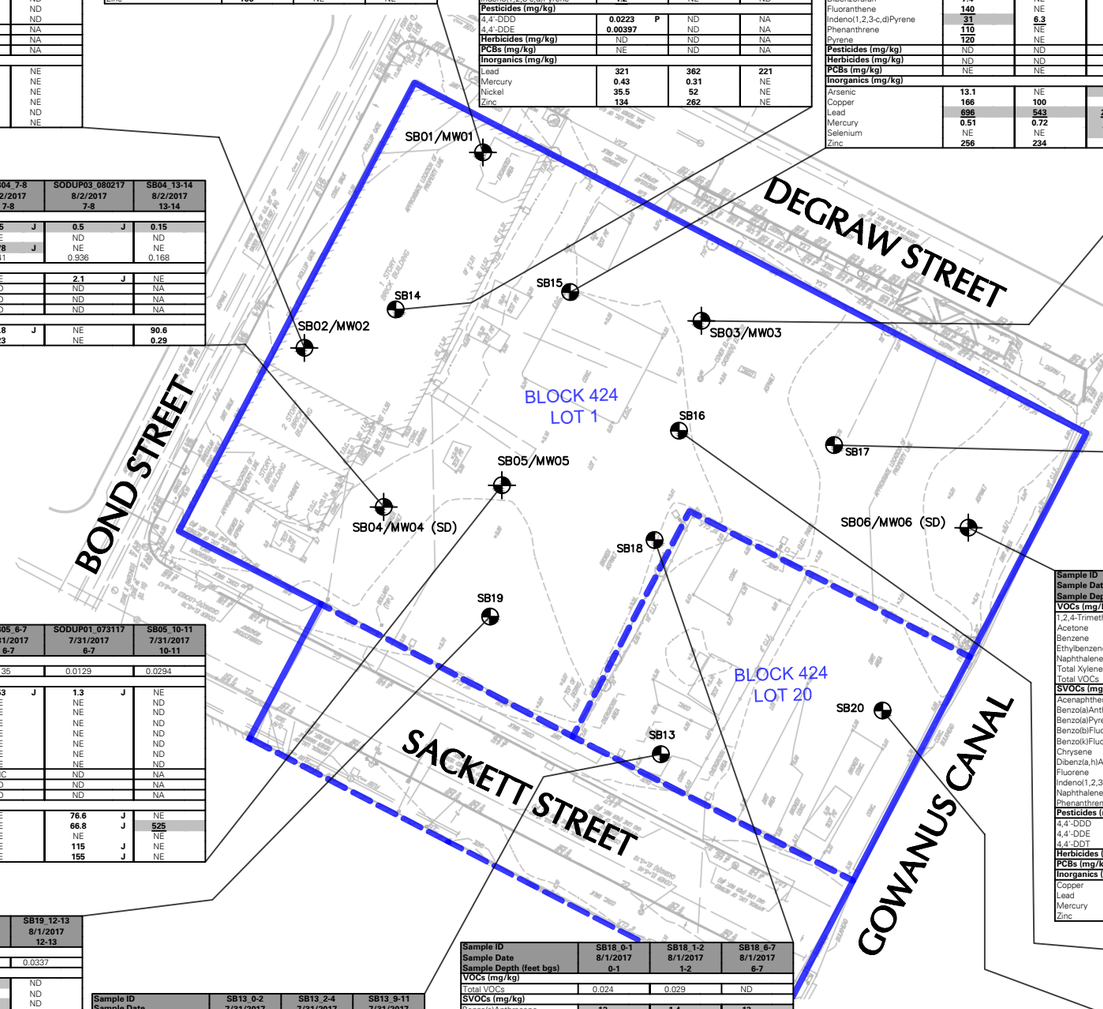
Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
AREAS OF CONCERN AND RI SAMPLE LOCATION MAP

Project No.	170295301
Date	9/23/2019
Drawn By	CMA
Checked By	PF

Figure No. 3
Sheet 3 of 11

Filename: \\Langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\IRMWP (BH)\Figure X - TAG Maps.dwg Date: 10/3/2019 Time: 12:53 User: pstovall Style Table: Langan.stb Layout: AOC LOCATION PLAN



Sample ID	SB02_1-2	SB02_10-11	SB02_23-24
Sample Date	8/2/2017	8/2/2017	8/2/2017
Sample Depth (feet bgs)	1-2	10-11	23-24
VOCs (mg/kg)			
1,2,4-Trimethylbenzene	NE	ND	**7.8**
Benzene	NE	ND	**0.1**
Ethylbenzene	NE	ND	**2.6**
Total Xylenes	NE	ND	**3.2**
Total VOCs	0.068	ND	37
SVOCs (mg/kg)			
Benzo(a)Anthracene	**2.2**	NE	ND
Benzo(a)Pyrene	**1.9**	NE	ND
Benzo(b)Fluoranthene	**2.8**	NE	ND
Benzo(k)Fluoranthene	**0.91**	NE	ND
Chrysene	**2.8**	NE	ND
Dibenz(a,h)Anthracene	**0.4** J	NE	ND
Indeno(1,2,3-c,d)Pyrene	**1.4**	NE	ND
Pesticides (mg/kg)	NE	ND	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	ND	ND	NA
Inorganics (mg/kg)			
Arsenic	**58.6**	NE	NE
Copper	**95**	NE	NE
Lead	**338**	**149**	NE
Mercury	**0.92**	NE	NE
Selenium	**5.34**	NE	ND
Zinc	**504**	NE	NE

Sample ID	SB01_0-1	SB01_10-11	SB01_11-12
Sample Date	8/2/2017	8/2/2017	8/2/2017
Sample Depth (feet bgs)	0-1	10-11	11-12
VOCs (mg/kg)			
Total VOCs	0.006	0.004	0.087
SVOCs (mg/kg)	NE	NE	NE
Pesticides (mg/kg)			
4,4'-DDT	**0.00682**	ND	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	ND	ND	NA
Inorganics (mg/kg)			
Copper	**57.2**	NE	NE
Lead	**196**	**88**	ND
Mercury	**1.1**	**0.26**	ND
Zinc	**166**	NE	NE

Sample ID	SB14_0-1	SB14_10-11	SB14_15-16
Sample Date	8/2/2017	8/2/2017	8/2/2017
Sample Depth (feet bgs)	0-1	10-11	15-16
VOCs (mg/kg)			
Acetone	**0.58** J	NE	NE
Benzene	**0.32**	ND	ND
Total Xylenes	**0.52** J	ND	ND
Total VOCs	3.31	0.0502	0.0303
SVOCs (mg/kg)			
Benzo(a)Anthracene	**2.2**	NE	ND
Benzo(a)Pyrene	**2**	NE	ND
Benzo(b)Fluoranthene	**2.8**	NE	ND
Benzo(k)Fluoranthene	**0.85**	NE	ND
Chrysene	**2.4**	NE	ND
Indeno(1,2,3-c,d)Pyrene	**1.2**	NE	ND
Pesticides (mg/kg)			
4,4'-DDD	**0.0223** P	ND	NA
4,4'-DDE	**0.00397**	ND	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	NE	ND	NA
Inorganics (mg/kg)			
Lead	**321**	**362**	**221**
Mercury	**0.43**	**0.31**	NE
Nickel	**35.5**	**52**	NE
Zinc	**134**	**262**	NE

Sample ID	SB15_0-2	SB15_5-7	SB15_7-8
Sample Date	7/31/2017	7/31/2017	7/31/2017
Sample Depth (feet bgs)	0-2	5-7	7-8
VOCs (mg/kg)			
Benzene	NE	ND	**0.16** J
Total Xylenes	NE	ND	**0.95** J
Total VOCs	2.05	ND	4.07
SVOCs (mg/kg)			
Benzo(a)Anthracene	**56**	**9.3**	NE
Benzo(a)Pyrene	**43**	**8.6**	ND
Benzo(b)Fluoranthene	**62**	**11**	ND
Benzo(k)Fluoranthene	**14**	**3.2**	ND
Chrysene	**49**	**9.6**	NE
Dibenz(a,h)Anthracene	**7.4**	**1.4**	ND
Dibenzofuran	**7.4**	NE	ND
Fluoranthene	**140**	NE	NE
Indeno(1,2,3-c,d)Pyrene	**31**	**6.3**	NE
Phenanthrene	**110**	NE	NE
Pyrene	**120**	NE	NE
Pesticides (mg/kg)	ND	ND	DNC
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	ND
Inorganics (mg/kg)			
Arsenic	**13.1**	NE	**48**
Copper	**166**	**100**	**188**
Lead	**696**	**543**	**2,880**
Mercury	**0.51**	**0.72**	**0.95**
Selenium	NE	NE	**5.61**
Zinc	**256**	**234**	**187**

Sample ID	SB03_0-2	SB03_7-8
Sample Date	8/1/2017	8/1/2017
Sample Depth (feet bgs)	0-2	7-8
VOCs (mg/kg)		
1,2,4-Trimethylbenzene	ND	**380**
1,3,5-Trimethylbenzene (Mesitylene)	ND	**110**
Benzene	NE	**1.1** J
Ethylbenzene	NE	**73**
Naphthalene	NE	**59**
n-Butylbenzene	ND	**21**
n-Propylbenzene	ND	**54**
Total Xylenes	ND	**210** J
Total VOCs	0.037	1,530
SVOCs (mg/kg)	NE	NE
Pesticides (mg/kg)		
4,4'-DDD	**0.00341**	ND
Herbicides (mg/kg)	ND	ND
PCBs (mg/kg)	ND	ND
Inorganics (mg/kg)		
Lead	**211**	NE
Mercury	**0.36** J	NE
Nickel	NE	**82.3**
Zinc	**132**	**110**

Sample ID	SB04_1-2	SB04_7-8	SODUP03_080217	SB04_13-14
Sample Date	8/2/2017	8/2/2017	8/2/2017	8/2/2017
Sample Depth (feet bgs)	1-2	7-8	7-8	13-14
VOCs (mg/kg)				
Acetone	ND	**0.5** J	**0.5** J	**0.15**
Benzene	**0.066** J	NE	ND	ND
Toluene	NE	**0.78** J	NE	NE
Total VOCs	0.728	1.41	0.936	0.168
SVOCs (mg/kg)				
3,5,4-Methylphenol (m&p Cresol)	**0.66**	NE	**2.1** J	NE
Pesticides (mg/kg)	NE	ND	ND	NA
Herbicides (mg/kg)	ND	ND	ND	NA
PCBs (mg/kg)	ND	ND	ND	NA
Inorganics (mg/kg)				
Lead	**122** J	**84.8** J	NE	**90.6**
Mercury	**0.8** J	**0.23**	NE	**0.29**

Sample ID	SB17_0-2	SB17_7-8	SB17_11-12
Sample Date	7/31/2017	7/31/2017	7/31/2017
Sample Depth (feet bgs)	0-2	7-8	11-12
VOCs (mg/kg)			
Benzene	NE	**0.091** J	ND
Total Xylenes	**0.71**	**0.29** J	ND
Total VOCs	2.91	2.25	0.214
SVOCs (mg/kg)			
Benzo(a)Anthracene	**1.4**	**1.7**	ND
Benzo(a)Pyrene	**1.7**	**1.2**	ND
Benzo(b)Fluoranthene	**2**	**1.4**	ND
Chrysene	**1.4**	**1.5**	ND
Indeno(1,2,3-c,d)Pyrene	**1.2**	**0.64**	ND
Pesticides (mg/kg)			
4,4'-DDD	**0.00736**	ND	NA
4,4'-DDE	**0.00845**	ND	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	NE	ND	NA
Inorganics (mg/kg)			
Copper	**227**	NE	NE
Lead	**486**	**152**	NE
Mercury	**1.8**	**3.8**	NE
Nickel	NE	**37.7**	NE
Zinc	NE	**177**	NE

Sample ID	SB05_0-2	SB05_6-7	SODUP01_073117	SB05_10-11
Sample Date	7/31/2017	7/31/2017	7/31/2017	7/31/2017
Sample Depth (feet bgs)	0-2	6-7	6-7	10-11
VOCs (mg/kg)				
Total VOCs	0.0012	0.0135	0.0129	0.0294
SVOCs (mg/kg)				
3 & 4 Methylphenol (m&p Cresol)	ND	**0.53** J	**1.3** J	NE
Benzo(a)Anthracene	**3.5**	NE	NE	ND
Benzo(a)Pyrene	**3.3**	NE	NE	ND
Benzo(b)Fluoranthene	**4.2**	NE	NE	ND
Benzo(k)Fluoranthene	**1.2**	NE	NE	ND
Chrysene	**3.7**	NE	NE	ND
Dibenz(a,h)Anthracene	**0.49**	NE	NE	ND
Indeno(1,2,3-c,d)Pyrene	**2.3**	NE	NE	ND
Pesticides (mg/kg)	DNC	DNC	ND	NA
Herbicides (mg/kg)	ND	ND	ND	NA
PCBs (mg/kg)	ND	ND	ND	NA
Inorganics (mg/kg)				
Copper	NE	NE	**76.6** J	NE
Lead	**260**	NE	**66.8** J	**525**
Mercury	**0.36**	NE	NE	NE
Nickel	NE	NE	**115** J	NE
Zinc	**267**	NE	**155** J	NE

Sample ID	SB06_0-2	SODUP02_080117	SB06_5-6	SB06_26-27
Sample Date	8/1/2017	8/1/2017	8/1/2017	8/1/2017
Sample Depth (feet bgs)	0-2	0-2	5-6	26-27
VOCs (mg/kg)				
1,2,4-Trimethylbenzene	NE	NE	ND	**21** J
Acetone	**0.63** J	NE	**0.075** J	**12** J
Benzene	**0.2** J	NE	NE	**1.4** J
Ethylbenzene	NE	NE	ND	**29**
Naphthalene	NE	NE	NE	**710**
Total Xylenes	**1** J	NE	ND	**9.3** J
Total VOCs	8.08	0.0424	0.0827	834
SVOCs (mg/kg)				
Acenaphthene	ND	ND	ND	**70**
Benzo(a)Anthracene	NE	NE	NE	**20**
Benzo(a)Pyrene	NE	NE	NE	**16**
Benzo(b)Fluoranthene	NE	NE	NE	**12**
Benzo(k)Fluoranthene	NE	NE	NE	**3.9**
Chrysene	NE	NE	NE	**16**
Dibenz(a,h)Anthracene	ND	ND	ND	**1.8** J
Fluorene	NE	ND	ND	**35**
Indeno(1,2,3-c,d)Pyrene	NE	NE	NE	**6.2**
Naphthalene	NE	NE	NE	**240**
Phenanthrene	NE	NE	NE	**120**
Pesticides (mg/kg)				
4,4'-DDD	NE	ND	**0.0126**	NA
4,4'-DDE	NE	NE	**0.004** J	NA
4,4'-DDT	**0.00513**	ND	**0.00684**	NA
Herbicides (mg/kg)	ND	ND	ND	NA
PCBs (mg/kg)	NE	NE	NE	NA
Inorganics (mg/kg)				
Copper	**69.9**	**65.7**	**58.6**	NE
Lead	**198** J	**80** J	**197**	NE
Mercury	**0.22** J	NE	NE	ND
Zinc	**129**	NE	**145**	NE

Sample ID	SB19_1-2	SB19_5-6	SB19_12-13
Sample Date	8/1/2017	8/1/2017	8/1/2017
Sample Depth (feet bgs)	1-2	5-6	12-13
VOCs (mg/kg)			
Total VOCs	ND	ND	0.0337
SVOCs (mg/kg)			
Benzo(a)Anthracene	**3.8**	**6.2**	ND
Benzo(a)Pyrene	**3.3**	**5.7**	ND
Benzo(b)Fluoranthene	**4.4**	**7.7**	ND
Benzo(k)Fluoranthene	**1.4**	**2.7**	ND
Chrysene	**3.9**	**7**	ND
Dibenz(a,h)Anthracene	**0.48**	**0.77**	ND
Indeno(1,2,3-c,d)Pyrene	**2.2**	**3.7**	ND
Pesticides (mg/kg)	DNC	ND	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	ND	ND	NA
Inorganics (mg/kg)			
Copper	**63.8**	**55.6**	NE
Lead	**239**	NE	**197**
Mercury	**0.33**	**0.22**	NE
Zinc	**178**	NE	NE

Sample ID	SB13_0-2	SB13_2-4	SB13_9-11
Sample Date	7/31/2017	7/31/2017	7/31/2017
Sample Depth (feet bgs)	0-2	2-4	9-11
VOCs (mg/kg)			
Total VOCs	0.0088	0.0427	0.0417
SVOCs (mg/kg)	NE	NE	NE
Pesticides (mg/kg)			
4,4'-DDD	ND	**0.0143** J	ND
4,4'-DDE	NE	**0.0147** J	ND
4,4'-DDT	**0.00439**	ND	ND
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	NE	ND
Inorganics (mg/kg)			
Cadmium	NE	**2.82**	NE
Chromium, Trivalent	NE	**51**	NE
Copper	NE	**58.7**	NE
Lead	**67.3**	**348**	NE
Nickel	NE	NE	**43.3**
Zinc	NE	**233**	NE

Sample ID	SB18_0-1	SB18_1-2	SB18_6-7
Sample Date	8/1/2017	8/1/2017	8/1/2017
Sample Depth (feet bgs)	0-1	1-2	6-7
VOCs (mg/kg)			
Total VOCs	0.024	0.029	ND
SVOCs (mg/kg)			
Benzo(a)Anthracene	**12**	**1.4**	**13**
Benzo(a)Pyrene	**12**	**1.2**	**9.1**
Benzo(b)Fluoranthene	**14**	**1.8**	**12**
Benzo(k)Fluoranthene	**5.5**	NE	**5.2**
Chrysene	**11**	**1.5**	**11**
Dibenz(a,h)Anthracene	**1.7**	NE	**1.7**
Indeno(1,2,3-c,d)Pyrene	**7.9**	**0.81**	**6**
Pesticides (mg/kg)			
4,4'-DDE	ND	ND	**0.00538**
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	ND
Inorganics (mg/kg)			
Arsenic	NE	**89.1**	NE
Copper	**52.8**	**136**	NE
Lead	**596**	**346**	NE
Mercury	**0.61**	NE	ND
Nickel	NE	NE	**47.7**
Zinc	**257**	**424**	NE

Sample ID	SB20_0-2	SB20_6-7	SB20_7-8
Sample Date	7/31/2017	7/31/2017	7/31/2017
Sample Depth (feet bgs)	0-2	6-7	7-8
VOCs (mg/kg)			
Total VOCs	0.0027	0.0188	0.0273
SVOCs (mg/kg)	NE	NE	NE
Pesticides (mg/kg)			
4,4'-DDT	**0.00335** J	ND	ND
Herbicides (mg/kg)	ND	ND	ND
PCBs (mg/kg)	NE	ND	ND
Inorganics (mg/kg)			
Copper	**309**	NE	NE
Lead	**122**	NE	NE
Mercury	**0.39**	NE	**0.19**
Nickel	**63.6**	NE	**38.1**
Zinc	**292**	NE	NE

Sample ID	SB16_0-2	SB16_7-8	SB16_14-15
Sample Date	7/31/2017	7/31/2017	7/31/2017
Sample Depth (feet bgs)	0-2	7-8	14-15
VOCs (mg/kg)			
Total VOCs	0.00024	0.0462	0.024
SVOCs (mg/kg)			
Benzo(a)Anthracene	**4.5**	ND	ND
Benzo(a)Pyrene	**4.2**	ND	ND
Benzo(b)Fluoranthene	**5.2**	ND	ND
Benzo(k)Fluoranthene	**2**	ND	ND
Chrysene	**4.6**	ND	ND
Dibenz(a,h)Anthracene	**0.76**	ND	ND
Indeno(1,2,3-c,d)Pyrene	**3**	ND	ND
Pesticides (mg/kg)	NE	DNC	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	NE	ND	NA
Inorganics (mg/kg)			
Arsenic	**15.7**	NE	NE
Copper	**112**	NE	NE
Lead	**522**	NE	NE
Mercury	**0.26**	NE	NE
Nickel	NE	**39.9** J	NE
Zinc	**250**	NE	NE

LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- SB17 — 2017 RI SOIL BORING LOCATION
- SB02/MW02 — 2017 RI SOIL BORING AND MONITORING WELL LOCATION
- SB26/MW26 (D) — 2017 RI SOIL BORING AND DEEP MONITORING WELL LOCATION
- SB11/MW11 (SD) — 2017 RI SOIL BORING AND SHALLOW/DEEP MONITORING WELL COUPLET LOCATION

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SEE FIGURE 4B FOR BLOCK NO. 431, LOT NOS. 12 AND 17 (SOUTHERN PORTION OF SITE).
4. CONCENTRATIONS DETECTED ABOVE PART 375 UNRESTRICTED USE (UU) SOIL CLEANUP OBJECTIVES (SCO) ARE BOLDED.
5. CONCENTRATIONS DETECTED ABOVE RESTRICTED USE PROTECTION OF GROUNDWATER (PGW) SCOs ARE SHADED.
6. CONCENTRATIONS DETECTED ABOVE NYSDEC RESTRICTED USE RESTRICTED-RESIDENTIAL (RURR) SCOs ARE UNDERLINED.
7. NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) PART 375 SCOs ARE PRESENTED IN THE TABLE BELOW.
8. RI = REMEDIAL INVESTIGATION
9. VOC = VOLATILE ORGANIC COMPOUND.
10. SVOC = SEMIVOLATILE ORGANIC COMPOUND.
11. PCB = POLYCHLORINATED BIPHENYL.
12. mg/kg = MILLIGRAMS PER KILOGRAM.
13. NA = NOT ANALYZED
14. ND = NO DETECTIONS
15. NE = NO DETECTIONS ABOVE THE RESPECTIVE CRITERION.
16. DNC = DETECTION BUT NO APPLICABLE CRITERION
17. J = THE COMPOUND WAS DETECTED ABOVE THE METHOD DETECTION LIMIT, BUT BELOW THE REPORTING LIMIT; THEREFORE THE RESULT IS AN ESTIMATED CONCENTRATION.

Analyte	NYSDE Part 375 Unrestricted Use SCOs	NYSDE Part 375 Restricted Use Protection of Groundwater SCOs	NYSDE Part 375 Restricted Use Restricted-Residential SCOs
VOCs (mg/kg)			
1,2,4-Trimethylbenzene	3.6	3.6	52
1,3,5-Trimethylbenzene (Mesitylene)	8.4	8.4	52
Acetone	0.05	0.05	100
Benzene	0.06	0.06	4.8
Ethylbenzene	1	1	41
Naphthalene	12	12	100
n-Butylbenzene	12	12	100
n-Propylbenzene	3.9	3.9	100
Toluene	0.7	0.7	100
Total Xylenes	0.26	1.6	100
SVOCs (mg/kg)			
3 & 4 Methylphenol (m&p Cresol)	0.33	--	100
Acenaphthene	20	98	100
Acenaphthylene	100	107	100
Anthracene	100	1,000	100
Benzo(a)Anthracene	1	1	1
Benzo(a)Pyrene	1	22	1
Benzo(b)Fluoranthene	1	1.7	1
Benzo(g,h,i)Perylene	100	1,000	100
Benzo(k)Fluoranthene	0.8	1.7	3.9
Chrysene	1	1	3.9
Dibenz(a,h)Anthracene	0.33	1,000	0.33
Dibenzofuran	7	210	59
Fluoranthene	100	1,000	100
Fluorene	30	386	100
Indeno(1,2,3-c,d)Pyrene	0.5	8.2	0.5
Naphthalene	12	12	100
Phenanthrene	100	1,000	100
Pyrene	100	1,000	100
Pesticides (mg/kg)			
4,4'-DDD	0.0033	14	13
4,4'-DDE	0.0033	17	8.9
4,4'-DDT	0.0033	136	7.9
PCBs (mg/kg)			
Total PCBs	0.1	3.2	1
Metals (mg/kg)			
Arsenic	13	16	16
Barium	350	820	400
Cadmium	2.5	7.5	4.3
Chromium, Hexavalent	1	19	110
Chromium, Trivalent	30	--	180
Copper	50	1720	270
Lead	63	450	400
Mercury	0.18	0.73	0.81
Nickel	30	130	310
Selenium	3.9	4	180
Zinc	109	2,480	10,000

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

60 0 20 40 60

SCALE: 1 INCH = 60 FEET

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Project

GOWANUS CANAL NORTHSIDE

BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17

BROOKLYN NEW YORK

Figure Title

SOIL SAMPLE LOCATION AND RESULTS MAP - LOT 1 AND LOT 20

Project No.	170295301
Date	7/23/2019
Drawn By	CMA
Checked By	PF

Figure No. 4A

Sheet 4 of 11

Sample ID	SB07_0-1	SB07_1-2	SB07_13-14
Sample Date	8/4/2017	8/4/2017	8/4/2017
Sample Depth (feet bgs)	0-1	1-2	13-14
VOCs (mg/kg)			
Total VOCs	0.00963	0.719	0.105
SVOCs (mg/kg)			
3 & 4 Methylphenol (m&p Cresol)	NE	**0.64**	ND
Benzo(a)Anthracene	**2.3**	**1.9**	NE
Benzo(a)Pyrene	**1.9**	**1.5**	NE
Benzo(b)Fluoranthene	**2.2**	**1.7**	NE
Benzo(k)Fluoranthene	**0.87**	NE	NE
Chrysene	**2.1**	**1.8**	NE
Indeno(1,2,3-c,d)Pyrene	**1.2**	**0.82**	NE
Pesticides (mg/kg)	ND	NE	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	ND	ND	NA
Inorganics (mg/kg)			
Copper	**55.1**	NE	NE
Lead	**203**	**164**	**121**
Mercury	NE	**0.62**	**0.24**
Nickel	NE	NE	**55.6**
Zinc	**120**	NE	NE

Sample ID	SB21_0-1	SB21_1-2	SB21_12-13
Sample Date	8/4/2017	8/4/2017	8/4/2017
Sample Depth (feet bgs)	0-1	1-2	12-13
VOCs (mg/kg)			
Total VOCs	ND	0.013	0.0178
SVOCs (mg/kg)	NE	ND	ND
Pesticides (mg/kg)	ND	ND	NA
Herbicides (mg/kg)	ND	ND	NA
PCBs (mg/kg)	NE	ND	NA
Inorganics (mg/kg)			
Copper	**112**	NE	NE
Lead	**117**	NE	NE
Zinc	**758**	NE	NE

Sample ID	SB08_0-1	SB08_1-2
Sample Date	8/3/2017	8/3/2017
Sample Depth (feet bgs)	0-1	1-2
VOCs (mg/kg)		
Total VOCs	17.07	11.2
SVOCs (mg/kg)	NE	NE
Pesticides (mg/kg)	ND	ND
Herbicides (mg/kg)	ND	ND
PCBs (mg/kg)	ND	ND
Inorganics (mg/kg)		
Nickel	**30.6**	**32.9**

Sample ID	SB23_0-1	SB23_1-2
Sample Date	8/3/2017	8/3/2017
Sample Depth (feet bgs)	0-1	1-2
VOCs (mg/kg)		
Total VOCs	5.43	0.104
SVOCs (mg/kg)		
Benzo(a)Anthracene	**3.6**	**2**
Benzo(a)Pyrene	**2.9**	**1.5**
Benzo(b)Fluoranthene	**3.6**	**1.8**
Benzo(k)Fluoranthene	**1.3**	NE
Chrysene	**3.4**	**1.8**
Dibenz(a,h)Anthracene	**0.44**	NE
Indeno(1,2,3-c,d)Pyrene	**1.7**	**0.82**
Pesticides (mg/kg)	ND	ND
Herbicides (mg/kg)	DNC	ND
PCBs (mg/kg)	NE	NE
Inorganics (mg/kg)		
Arsenic	**28.8**	NE
Lead	NE	**110**
Nickel	NE	**37.7**

Sample ID	SB09_1-2	SB09_9-10
Sample Date	8/3/2017	8/3/2017
Sample Depth (feet bgs)	1-2	9-10
VOCs (mg/kg)		
Total VOCs	0.004	1.83
SVOCs (mg/kg)	NE	NE
Pesticides (mg/kg)	DNC	NA
Herbicides (mg/kg)	ND	NA
PCBs (mg/kg)		
Total PCBs	**0.323**	NA
Inorganics (mg/kg)		
Lead	**338**	NE
Mercury	**0.93**	NE
Zinc	**157**	NE

Sample ID	SB22_0-1	SB22_1-2
Sample Date	8/4/2017	8/4/2017
Sample Depth (feet bgs)	0-1	1-2
VOCs (mg/kg)		
Total Xylenes	**0.63** J	NE
Total VOCs	8.25	22.4
SVOCs (mg/kg)		
Benzo(a)Anthracene	**14**	NE
Benzo(a)Pyrene	**14**	NE
Benzo(b)Fluoranthene	**24**	NE
Benzo(k)Fluoranthene	**4.9**	NE
Chrysene	**14**	NE
Dibenz(a,h)Anthracene	**2.2**	NE
Indeno(1,2,3-c,d)Pyrene	**8.8**	NE
Pesticides (mg/kg)	NE	NE
Herbicides (mg/kg)	DNC	NE
PCBs (mg/kg)	NE	NE
Inorganics (mg/kg)		
Arsenic	**30.2**	NE
Copper	**175**	NE
Lead	**79.7**	NE
Mercury	**0.53**	NE

Sample ID	SB12_1-2	SODUP04_080317	SB12_7-8	SB12_24-25
Sample Date	8/3/2017	8/3/2017	8/3/2017	8/3/2017
Sample Depth (feet bgs)	1-2	1-2	7-8	24-25
VOCs (mg/kg)				
1,2,4-Trimethylbenzene	NE	NE	NE	**5.1** J
Acetone	NE	**0.054**	NE	ND
Ethylbenzene	NE	NE	NE	**10**
Naphthalene	NE	NE	NE	**180**
Total Xylenes	NE	NE	NE	**9.2**
Total VOCs	0.0918	0.086	0.211	229
SVOCs (mg/kg)				
Acenaphthene	NE	NE	ND	**540**
Anthracene	ND	ND	ND	**140**
Benzo(a)Anthracene	ND	ND	ND	**88**
Benzo(a)Pyrene	ND	ND	ND	**72**
Benzo(b)Fluoranthene	ND	ND	ND	**56**
Benzo(k)Fluoranthene	ND	ND	ND	**16**
Chrysene	ND	ND	ND	**76**
Dibenz(a,h)Anthracene	ND	ND	ND	**7.7**
Dibenzofuran	ND	ND	ND	**13**
Fluoranthene	NE	NE	ND	**300**
Fluorene	NE	ND	ND	**140**
Indeno(1,2,3-c,d)Pyrene	ND	ND	ND	**26**
Naphthalene	NE	NE	ND	**1,800**
Phenanthrene	NE	NE	ND	**900**
Pyrene	NE	NE	NE	**430**
Pesticides (mg/kg)	ND	ND	NA	NA
Herbicides (mg/kg)	ND	ND	NA	NA
PCBs (mg/kg)	ND	ND	NA	NA
Inorganics (mg/kg)				
Arsenic	NE	NE	**20.2** J	NE
Chromium, Trivalent	**51**	NE	NE	NE

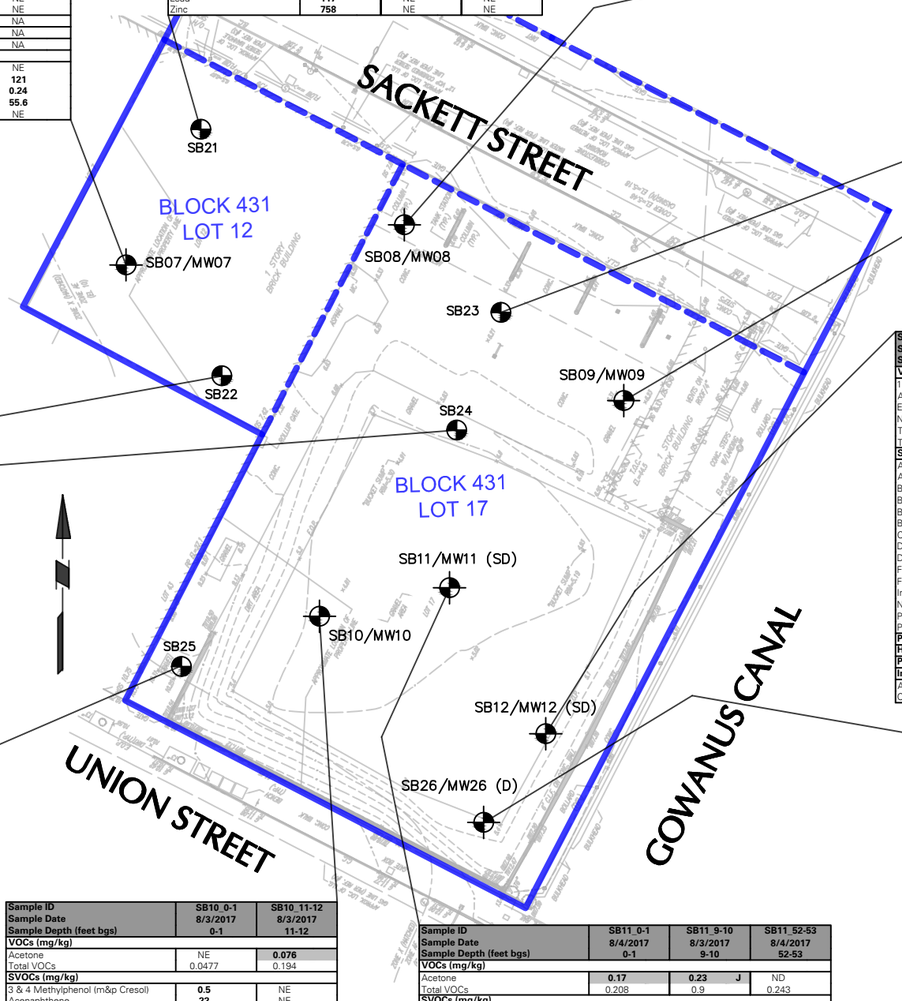
Sample ID	SB24_0-1	SB24_15-16
Sample Date	8/3/2017	8/3/2017
Sample Depth (feet bgs)	0-1	15-16
VOCs (mg/kg)		
Acetone	NE	**0.078**
Total VOCs	0.0588	0.159
SVOCs (mg/kg)		
Benzo(a)Anthracene	**2.6**	ND
Benzo(a)Pyrene	**2.3**	ND
Benzo(b)Fluoranthene	**2.9**	ND
Benzo(k)Fluoranthene	**1**	ND
Chrysene	**2.3**	ND
Dibenz(a,h)Anthracene	**0.34**	ND
Indeno(1,2,3-c,d)Pyrene	**1.4**	ND
Pesticides (mg/kg)	ND	NA
Herbicides (mg/kg)	ND	NA
PCBs (mg/kg)	ND	NA
Inorganics (mg/kg)		
Arsenic	**38.6**	NE
Lead	**96.3**	NE
Mercury	**0.34**	ND
Selenium	**8.48**	ND

Sample ID	SB26_2-3	SB26_24-25	SB26_42-43
Sample Date	8/4/2017	8/4/2017	8/4/2017
Sample Depth (feet bgs)	2-3	24-25	42-43
VOCs (mg/kg)			
1,2,4-Trimethylbenzene	NE	**85**	**19** J
1,3,5-Trimethylbenzene (Mesitylene)	NE	**22** J	NE
Benzene	NE	**2.5** J	**5.4**
Ethylbenzene	NE	**120**	**41**
Naphthalene	NE	**3,000**	**780**
n-Propylbenzene	NE	**7** J	NE
Toluene	NE	ND	**2.9** J
Total Xylenes	NE	**39**	**34**
Total VOCs	1.64	3,470	977
SVOCs (mg/kg)			
Acenaphthene	NE	**250**	**1,200**
Acenaphthylene	ND	NE	**260**
Anthracene	NE	**150**	**640**
Benzo(a)Anthracene	**7.4**	**110**	**410**
Benzo(a)Pyrene	**5.9**	**86**	**340**
Benzo(b)Fluoranthene	**7.1**	**67**	**260**
Benzo(g,h,i)Perylene	NE	NE	**140**
Benzo(k)Fluoranthene	**2.2**	**21**	**86**
Chrysene	**7**	**97**	**370**
Dibenz(a,h)Anthracene	**0.8**	**8.8**	**35** J-L
Dibenzofuran	NE	**24**	**77**
Fluoranthene	NE	**170**	**780**
Fluorene	NE	**180**	**710**
Indeno(1,2,3-c,d)Pyrene	**2.8**	**32**	**130**
Naphthalene	NE	**1,100**	**3,900**
Phenanthrene	NE	**530**	**2,200**
Pyrene	NE	**240**	**1,100**
Pesticides (mg/kg)	NE	NA	NA
Herbicides (mg/kg)	DNC	NA	NA
PCBs (mg/kg)	ND	NA	NA
Inorganics (mg/kg)			
Copper	**138**	NE	NE
Lead	**127**	NE	NE
Mercury	**0.52**	ND	ND
Nickel	**31.3**	NE	NE

Sample ID	SB25_0-1	SB25_6-7
Sample Date	8/4/2017	8/4/2017
Sample Depth (feet bgs)	0-1	6-7
VOCs (mg/kg)		
Total VOCs	ND	23.2
SVOCs (mg/kg)		
Benzo(a)Anthracene	NE	**2.1**
Benzo(a)Pyrene	NE	**1.6**
Benzo(b)Fluoranthene	NE	**2**
Chrysene	NE	**2**
Indeno(1,2,3-c,d)Pyrene	NE	**1**
Pesticides (mg/kg)	ND	NE
Herbicides (mg/kg)	ND	DNC
PCBs (mg/kg)	ND	ND
Inorganics (mg/kg)		
Arsenic	**15.2**	NE
Chromium, Hexavalent	**2.1**	ND
Copper	**76.3**	NE
Lead	**352**	**104**
Mercury	**7.2**	**0.38**

Sample ID	SB10_0-1	SB10_11-12
Sample Date	8/3/2017	8/3/2017
Sample Depth (feet bgs)	0-1	11-12
VOCs (mg/kg)		
Acetone	NE	**0.076**
Total VOCs	0.0477	0.194
SVOCs (mg/kg)		
3 & 4 Methylphenol (m&p Cresol)	**0.5**	NE
Acenaphthene	**22**	NE
Benzo(a)Anthracene	**87**	**3.5**
Benzo(a)Pyrene	**83**	**2.9**
Benzo(b)Fluoranthene	**95**	**3.6**
Benzo(k)Fluoranthene	**18**	**1.2**
Chrysene	**82**	**3.4**
Dibenz(a,h)Anthracene	**6**	**0.39**
Dibenzofuran	**9**	NE
Fluoranthene	**220**	NE
Indeno(1,2,3-c,d)Pyrene	**49**	**1.8**
Phenanthrene	**240**	NE
Pyrene	**190**	NE
Pesticides (mg/kg)	ND	NA
Herbicides (mg/kg)	ND	NA
PCBs (mg/kg)	ND	NA
Inorganics (mg/kg)		
Zinc	NE	**395**

Sample ID	SB11_0-1	SB11_9-10	SB11_52-53
Sample Date	8/4/2017	8/3/2017	8/4/2017
Sample Depth (feet bgs)	0-1	9-10	52-53
VOCs (mg/kg)			
Acetone	**0.17**	**0.23** J	ND
Total VOCs	0.208	0.9	0.243
SVOCs (mg/kg)			
3 & 4 Methylphenol (m&p Cresol)	**1.7**	NE	ND
Benzo(a)Anthracene	NE	NE	**3.3**
Benzo(a)Pyrene	NE	ND	**2.5**
Benzo(b)Fluoranthene	NE	NE	**1.9**
Chrysene	NE	NE	**2.9**
Indeno(1,2,3-c,d)Pyrene	NE	ND	**0.99**
Pesticides (mg/kg)	ND	NA	NA
Herbicides (mg/kg)	NDC	NA	NA
PCBs (mg/kg)	ND	NA	NA
Inorganics (mg/kg)			
Arsenic	**25.1**	NE	NE
Barium	**351**	NE	NE
Copper	**218**	NE	NE
Lead	**649**	**194**	NE
Mercury	**12**	**0.69**	ND
Zinc	**120**	NE	NE



LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- SB17 — 2017 RI SOIL BORING LOCATION
- SB02/MW02 — 2017 RI SOIL BORING AND MONITORING WELL LOCATION
- SB26/MW26 (D) — 2017 RI SOIL BORING AND DEEP MONITORING WELL LOCATION
- SB11/MW11 (SD) — 2017 RI SOIL BORING AND SHALLOW/DEEP MONITORING WELL COUPLET LOCATION

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SEE FIGURE 4A FOR BLOCK NO. 424, LOT NOS. 1 AND 20 (NORTHERN PORTION OF SITE).
4. CONCENTRATIONS DETECTED ABOVE PART 375 UNRESTRICTED USE (UU) SOIL CLEANUP OBJECTIVES (SCO) ARE BOLDED.
5. CONCENTRATIONS DETECTED ABOVE RESTRICTED USE PROTECTION OF GROUNDWATER (PGW) SCOs ARE SHADED.
6. CONCENTRATIONS DETECTED ABOVE NYSDEC RESTRICTED USE RESTRICTED-RESIDENTIAL (RURR) SCOs ARE UNDERLINED.
7. NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) PART 375 SCOs ARE PRESENTED IN THE TABLE BELOW.
8. RI = REMEDIAL INVESTIGATION
9. VOC = VOLATILE ORGANIC COMPOUND.
10. SVOC = SEMIVOLATILE ORGANIC COMPOUND.
11. PCB = POLYCHLORINATED BIPHENYL.
12. mg/kg = MILLIGRAMS PER KILOGRAM.
13. NA = NOT ANALYZED
14. ND = NO DETECTIONS
15. NE = NO DETECTIONS ABOVE THE RESPECTIVE CRITERION.
16. DNC = DETECTION BUT NO APPLICABLE CRITERION
17. J = THE COMPOUND WAS DETECTED ABOVE THE METHOD DETECTION LIMIT, BUT BELOW THE REPORTING LIMIT; THEREFORE THE RESULT IS AN ESTIMATED CONCENTRATION.

Analyte	NYSDE Part 375 Unrestricted Use SCOs	NYSDE Part 375 Restricted Use Protection of Groundwater SCOs	NYSDE Part 375 Restricted Use Restricted-Residential SCOs
VOCs (mg/kg)			
1,2,4-Trimethylbenzene	3.6	3.6	52
1,3,5-Trimethylbenzene (Mesitylene)	8.4	8.4	52
Acetone	0.05	0.05	100
Benzene	0.06	0.06	4.8
Ethylbenzene	1	1	41
Naphthalene	12	12	100
n-Butylbenzene	12	12	100
n-Propylbenzene	3.9	3.9	100
Toluene	0.7	0.7	100
Total Xylenes	0.26	1.6	100
SVOCs (mg/kg)			
3 & 4 Methylphenol (m&p Cresol)	0.33	~	100
Acenaphthene	20	98	100
Acenaphthylene	100	107	100
Anthracene	100	1,000	100
Benzo(a)Anthracene	1	1	1
Benzo(a)Pyrene	1	22	1
Benzo(b)Fluoranthene	1	1.7	1
Benzo(g,h,i)Perylene	100	1,000	100
Benzo(k)Fluoranthene	0.8	1.7	3.9
Chrysene	1	1	3.9
Dibenz(a,h)Anthracene	0.33	1,000	0.33
Dibenzofuran	7	210	59
Fluoranthene	100	1,000	100
Fluorene	30	386	100
Indeno(1,2,3-c,d)Pyrene	0.5	8.2	0.5
Naphthalene	12	12	100
Phenanthrene	100	1,000	100
Pyrene	100	1,000	100
Pesticides (mg/kg)			
4,4'-DDD	0.0033	14	13
4,4'-DDE	0.0033	17	8.9
4,4'-DDT	0.0033	136	7.9
PCBs (mg/kg)			
Total PCBs	0.1	3.2	1
Metals (mg/kg)			
Arsenic	13	16	16
Barium	350	820	400
Cadmium	2.5	7.5	4.3
Chromium, Hexavalent	1	19	110
Chromium, Trivalent	30	~	180
Copper	50	1720	270
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50 0 25 50

SCALE: 1 INCH = 50 FEET

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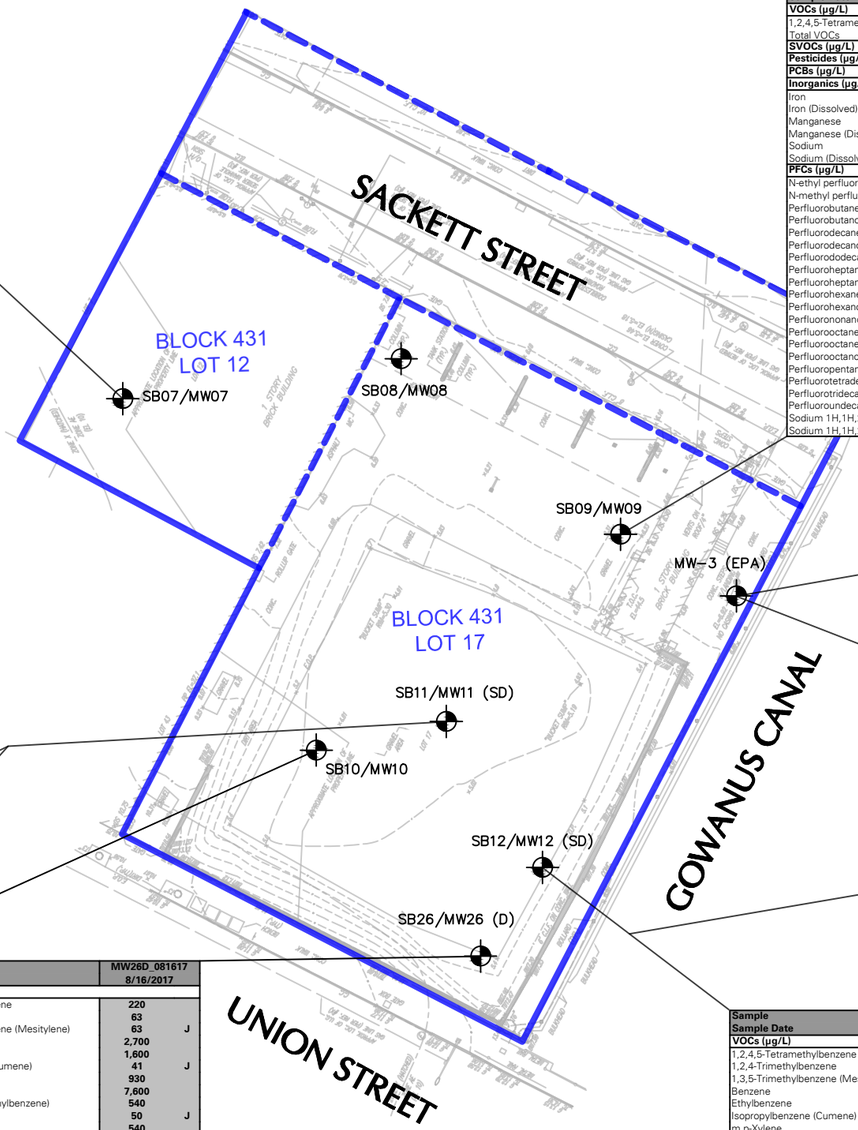
Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
SOIL SAMPLE LOCATION AND RESULTS MAP - LOT 12 AND LOT 17

Project No.	170295301
Date	9/23/2019
Drawn By	CMA
Checked By	PF
Figure No.	4B
Sheet	5 of 11



Sample ID Sample Date	MW07_081417 8/14/2017		GWDUP01_081417 8/14/2017	
VOCs (µg/L)				
1,2,4,5-Tetramethylbenzene	**8.2**		**9.6**	
Total VOCs	16.6		18.7	
SVOCs (µg/L)				
Benzo(a)Anthracene	**0.25**		**0.39**	
Benzo(a)Pyrene	**0.16**		**0.28**	
Benzo(b)Fluoranthene	**0.19**		**0.36**	
Benzo(k)Fluoranthene	**0.08**	J	**0.14**	
Chrysene	**0.22**		**0.34**	
Indeno(1,2,3-c,d)Pyrene	**0.12**		**0.2**	
Pesticides (µg/L)	ND		ND	
PCBs (µg/L)	ND		ND	
Inorganics (µg/L)				
Iron	**16,000**		**17,500**	
Iron (Dissolved)	**13,800**		**14,200**	
Manganese	**1,273**		**1,395**	
Manganese (Dissolved)	**1,316**		**1,382**	
Sodium	**160,000**		**177,000**	
Sodium (Dissolved)	**159,000**		**158,000**	

Sample Sample Date	MW11S_081417 8/14/2017	
VOCs (µg/L)		
1,2,4-Trimethylbenzene	**36**	
1,3,5-Trimethylbenzene (Mesitylene)	**11**	J
Benzene	**4.7**	J
Ethylbenzene	**54**	
Isopropylbenzene (Cumene)	**7.4**	J
m,p-Xylene	**29**	
Naphthalene	**1,300**	
o-Xylene (1,2-Dimethylbenzene)	**18**	J
Total Xylenes	**47**	J
Total VOCs	1,640	
SVOCs (µg/L)		
Acenaphthene	**26**	
Benzo(a)Anthracene	**0.6**	
Benzo(a)Pyrene	**0.35**	
Benzo(b)Fluoranthene	**0.3**	
Benzo(k)Fluoranthene	**0.11**	
Biphenyl (Diphenyl)	**22**	
Chrysene	**0.52**	
Indeno(1,2,3-c,d)Pyrene	**0.16**	
Naphthalene	**720**	
Phenanthrene	**61**	
Phenol	**6.8**	
Pesticides (µg/L)		
Dieldrin	**0.121**	J
PCBs (µg/L)	ND	
Inorganics (µg/L)		
Antimony (Dissolved)	**3.84**	J
Arsenic	**32.54**	
Chromium, Total	**109.3**	
Iron	**70,300**	
Iron (Dissolved)	**7,380**	
Lead	**365.2**	
Magnesium	**127,000**	
Magnesium (Dissolved)	**99,100**	
Manganese	**1,577**	
Manganese (Dissolved)	**484**	
Mercury	**0.9**	
Selenium	**11.2**	
Sodium	**654,000**	
Sodium (Dissolved)	**580,000**	

Sample Sample Date	MW11D_081617 8/16/2017	
VOCs (µg/L)		
Tert-Butyl Methyl Ether	**140**	
Total VOCs	145	
SVOCs (µg/L)		
Acenaphthene	**29**	
Benzo(a)Anthracene	**0.27**	
Benzo(b)Fluoranthene	**0.06**	J
Chrysene	**0.27**	

Sample Sample	MW10_081417 8/14/2017	
VOCs (µg/L)		
Total VOCs	3.56	
SVOCs (µg/L)		
Benzo(a)Anthracene	**0.16**	
Benzo(b)Fluoranthene	**0.05**	J
Chrysene	**0.14**	
Phenol	**2.8**	J
Pesticides (µg/L)	ND	
PCBs (µg/L)	ND	
Inorganics (µg/L)		
Iron	**1,310**	
Iron (Dissolved)	**1,140**	
Manganese	**480.6**	
Manganese (Dissolved)	**475.2**	
Sodium	**39,900**	
Sodium (Dissolved)	**39,600**	

Sample Sample Date	MW26D_081617 8/16/2017	
VOCs (µg/L)		
1,2,4-Trimethylbenzene	**220**	
1,2-Dichloroethane	**63**	
1,3,5-Trimethylbenzene (Mesitylene)	**63**	J
Benzene	**2,700**	
Ethylbenzene	**1,600**	
Isopropylbenzene (Cumene)	**41**	J
m,p-Xylene	**930**	
Naphthalene	**7,600**	
o-Xylene (1,2-Dimethylbenzene)	**540**	
Styrene	**50**	J
Toluene	**540**	
Total Xylenes	**1,500**	
Total VOCs	16,300	
SVOCs (µg/L)		
Acenaphthene	**160**	
Benzo(a)Anthracene	**6.8**	J
Biphenyl (Diphenyl)	**46**	
Bis(2-Ethylhexyl) Phthalate	**8.4**	
Fluorene	**56**	
Naphthalene	**3,600**	
Phenanthrene	**90**	
Phenol	**2.4**	J

Sample ID Sample Date	MW09_081417 8/14/2017		MW09_100118 10/1/2018	
VOCs (µg/L)				
1,2,4,5-Tetramethylbenzene	**12**		NA	
Total VOCs	13.5		NA	
SVOCs (µg/L)	NE		ND	
Pesticides (µg/L)	DNC		NA	
PCBs (µg/L)	ND		NA	
Inorganics (µg/L)				
Iron	**6,520**		NA	
Iron (Dissolved)	**6,330**		NA	
Manganese	**1,414**		NA	
Manganese (Dissolved)	**1,400**		NA	
Sodium	**94,000**		NA	
Sodium (Dissolved)	**94,300**		NA	
PFCs (µg/L)				
N-ethyl perfluorooctane- sulfonamidoacetic acid	NA		ND	
N-methyl perfluorooctane- sulfonamidoacetic acid	NA		ND	
Perfluorobutanesulfonic Acid	NA		ND	
Perfluorobutanoic acid	NA		0.0038	
Perfluorodecanesulfonic acid	NA		ND	
Perfluorodecanoic acid	NA		ND	
Perfluorododecanoic Acid	NA		ND	
Perfluoroheptanesulfonic acid	NA		ND	
Perfluoroheptanoic acid	NA		0.005	
Perfluorohexanesulfonic Acid	NA		0.0032	
Perfluorohexanoic Acid	NA		0.0072	
Perfluorononanoic Acid	NA		0.003	
Perfluorooctanesulfonamide	NA		ND	
Perfluorooctanesulfonic acid	NA		0.017	
Perfluorooctanoic Acid	NA		0.037	
Perfluoropentanoic Acid	NA		0.022	
Perfluorotetradecanoic Acid	NA		ND	
Perfluorotridecanoic Acid	NA		ND	
Perfluoroundecanoic Acid	NA		ND	
Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonate (8:2)	NA		0.0036	J
Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonate (6:2)	NA		ND	

Sample ID Sample Date	EPA-MW3S_081417 8/14/2017	
VOCs (µg/L)	ND	
SVOCs (µg/L)		
Benzo(a)Anthracene	**0.04**	J
Pesticides (µg/L)	ND	
PCBs (µg/L)	ND	
Inorganics (µg/L)		
Antimony (Dissolved)	**3.32**	J
Magnesium	**846,000**	
Magnesium (Dissolved)	**828,000**	
Sodium	**6,630,000**	
Sodium (Dissolved)	**6,640,000**	

Sample ID Sample Date	EPA-MW3D_081617 8/16/2017
VOCs (µg/L)	
Total VOCs	5.76
SVOCs (µg/L)	
Benzo(a)Anthracene	**0.19**
Benzo(b)Fluoranthene	**0.03** J
Chrysene	**0.19**

Sample Sample Date	MW12S_081417 8/14/2017	
VOCs (µg/L)		
1,2,4-Trimethylbenzene	**6.7**	
Benzene	**1.1**	
Ethylbenzene	**11**	
Naphthalene	**160**	
Total Xylenes	**7.4**	J
Total VOCs	210	
SVOCs (µg/L)		
Acenaphthene	**26**	
Benzo(a)Anthracene	**0.37**	
Benzo(b)Fluoranthene	**0.06**	J
Chrysene	**0.33**	
Naphthalene	**86**	
Phenol	**2.6**	J
Pesticides (µg/L)	ND	
PCBs (µg/L)	ND	
Inorganics (µg/L)		
Iron	**1,090**	
Iron (Dissolved)	**1,020**	
Magnesium	**48,500**	
Magnesium (Dissolved)	**48,800**	
Manganese	**335.5**	
Manganese (Dissolved)	**355.6**	
Sodium	**336,000**	
Sodium (Dissolved)	**336,000**	

Sample Sample Date	MW12D_081617 8/16/2017	
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	**8.3**	J
1,2,4-Trimethylbenzene	**54**	
1,3,5-Trimethylbenzene (Mesitylene)	**9.6**	J
Benzene	**2.7**	
Ethylbenzene	**63**	
Isopropylbenzene (Cumene)	**18**	
m,p-Xylene	**15**	
Naphthalene	**1,400**	
n-Propylbenzene	**7.1**	J
o-Xylene (1,2-Dimethylbenzene)	**17**	
Total Xylenes	**32**	
Total VOCs	1,700	
SVOCs (µg/L)		
Acenaphthene	**200**	
Benzo(a)Anthracene	**0.76**	J
Biphenyl (Diphenyl)	**38**	
Naphthalene	**670**	
Phenanthrene	**68**	

LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- SB02/MW02 — 2017 RI SOIL BORING AND MONITORING WELL LOCATION
- SB26/MW26 (D) — 2017 RI SOIL BORING AND DEEP MONITORING WELL LOCATION
- SB11/MW11 (SD) — 2017 RI SOIL BORING AND SHALLOW/DEEP MONITORING WELL COUPLET LOCATION
- MW-3 (EPA) — EXISTING UNITED STATES ENVIRONMENTAL PROTECTION AGENCY MONITORING WELL

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SEE FIGURE 5A FOR BLOCK NO. 424, LOT NOS. 1 AND 20 (NORTHERN PORTION OF SITE).
4. GROUNDWATER ANALYTICAL RESULTS ARE COMPARED TO NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT QUALITY STANDARDS AND GUIDANCE VALUES (SGVs) FOR CLASS GA DRINKING WATER.
5. ONLY CONCENTRATIONS FOR COMPOUNDS ABOVE CLASS GA SGVs ARE SHOWN.
6. CONCENTRATIONS DETECTED ABOVE TOGS SGVs ARE HIGHLIGHTED AND BOLDED.
7. TOGS CLASS GA SGVs ARE PRESENT IN THE TABLE BELOW.
8. RI = REMEDIAL INVESTIGATION
9. VOC = VOLATILE ORGANIC COMPOUND.
10. SVOC = SEMIVOLATILE ORGANIC COMPOUND.
11. PCB = POLYCHLORINATED BIPHENYL.
12. µg/L = MICROGRAMS PER LITER.
13. NA = NOT ANALYZED
14. ND = NO DETECTIONS
15. NE = NO DETECTIONS ABOVE THE RESPECTIVE CRITERION.
16. DNC = DETECTION BUT NO APPLICABLE CRITERION
17. J = THE COMPOUND WAS DETECTED ABOVE THE METHOD DETECTION LIMIT, BUT BELOW THE REPORTING LIMIT; THEREFORE THE RESULT IS AN ESTIMATED CONCENTRATION.

Analyte	NYSDEC SGVs
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	5
1,2,4-Trimethylbenzene	5
1,2-Dichloroethane	0.6
1,3,5-Trimethylbenzene (Mesitylene)	5
Acetone	50
Benzene	1
cis-1,2-Dichloroethene	5
Ethylbenzene	5
Isopropylbenzene (Cumene)	5
m,p-Xylene	5
Naphthalene	10
n-Butylbenzene	5
n-Propylbenzene	5
o-Xylene (1,2-Dimethylbenzene)	5
Sec-Butylbenzene	5
Styrene	5
Tert-Butyl Methyl Ether	10
Toluene	5
Total Xylenes	5
Trichloroethene (TCE)	5
SVOCs (µg/L)	
2,4-Dimethylphenol	1
Acenaphthene	20
Benzo(a)Anthracene	0.002
Benzo(a)Pyrene	0
Benzo(b)Fluoranthene	0.002
Benzo(k)Fluoranthene	0.002
Biphenyl (Diphenyl)	5
Bis(2-Ethylhexyl) Phthalate	5
Chrysene	0.002
Fluorene	50
Indeno(1,2,3-c,d)Pyrene	0.002
Naphthalene	10
Phenanthrene	50
Phenol	1
Pesticides (µg/L)	
Dieldrin	0.004
Inorganics (µg/L)	
Antimony	3
Arsenic	25
Chromium, Total	50
Iron	300
Lead	25
Magnesium	35,000
Manganese	300
Mercury	0.7
Selenium	10
Sodium	20,000

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.

50 0 25 50

SCALE: 1 INCH = 50 FEET

LANGAN

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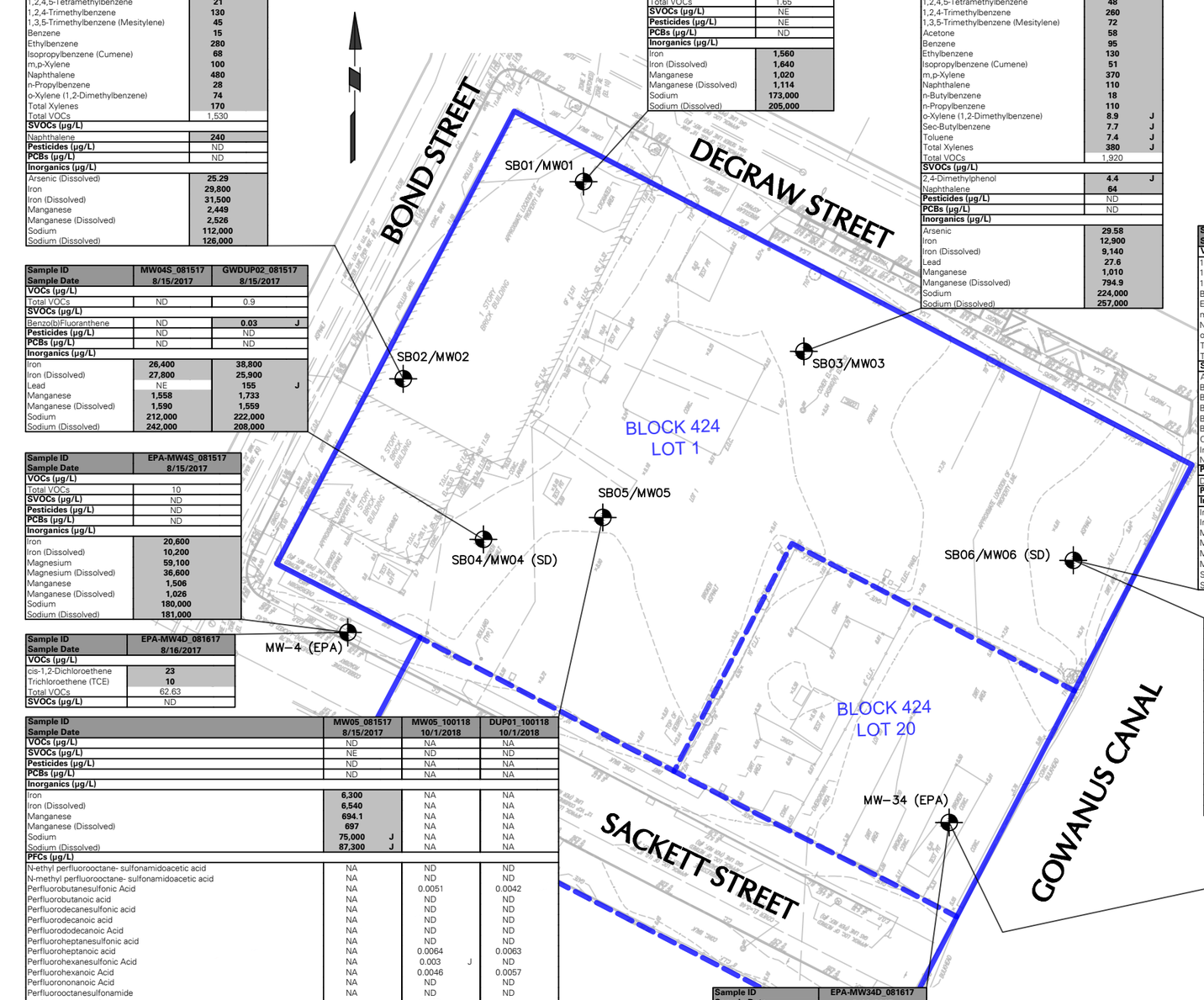
Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
GROUNDWATER SAMPLE LOCATION AND RESULTS MAP - LOT 12 AND LOT 17

Project No. 170295301
Date 9/23/2019
Drawn By CMA
Checked By PF

Figure No. 5B
Sheet 7 of 11

Filename: \\Langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\IRMWP (BH)\Figure X - TAG Maps.dwg Date: 10/6/2019 Time: 13:10 User: canderson Style Table: Langan.stb Layout: SOUTH-GW TAG TABLE



Sample ID Sample Date	MW02_081517 8/15/2017
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	**21**
1,2,4-Trimethylbenzene	**130**
1,3,5-Trimethylbenzene (Mesitylene)	**45**
Benzene	**15**
Ethylbenzene	**280**
Isopropylbenzene (Cumene)	**68**
m,p-Xylene	**100**
Naphthalene	**480**
n-Propylbenzene	**28**
o-Xylene (1,2-Dimethylbenzene)	**74**
Total Xylenes	**170**
Total VOCs	1,530
SVOCs (µg/L)	
Naphthalene	**240**
Pesticides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Arsenic (Dissolved)	**25.29**
Iron	**29,800**
Iron (Dissolved)	**31,500**
Manganese	**2,449**
Manganese (Dissolved)	**2,526**
Sodium	**112,000**
Sodium (Dissolved)	**126,000**

Sample ID Sample Date	MW01_081517 8/15/2017
VOCs (µg/L)	
Total VOCs	1.65
SVOCs (µg/L)	NE
Pesticides (µg/L)	NE
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	**1,560**
Iron (Dissolved)	**1,640**
Manganese	**1,020**
Manganese (Dissolved)	**1,114**
Sodium	**173,000**
Sodium (Dissolved)	**205,000**

Sample ID Sample Date	MW03_081517 8/15/2017	
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	**48**	
1,2,4-Trimethylbenzene	**260**	
1,3,5-Trimethylbenzene (Mesitylene)	**72**	
Acetone	**58**	
Benzene	**95**	
Ethylbenzene	**130**	
Isopropylbenzene (Cumene)	**51**	
m,p-Xylene	**370**	
Naphthalene	**110**	
n-Butylbenzene	**18**	
n-Propylbenzene	**110**	
o-Xylene (1,2-Dimethylbenzene)	**8.9**	J
Sec-Butylbenzene	**7.7**	J
Toluene	**7.4**	J
Total Xylenes	**380**	J
Total VOCs	1,920	
SVOCs (µg/L)		
2,4-Dimethylphenol	**4.4**	J
Naphthalene	**64**	
Pesticides (µg/L)	ND	
PCBs (µg/L)	ND	
Inorganics (µg/L)		
Arsenic	**29.58**	
Iron	**12,900**	
Iron (Dissolved)	**9,140**	
Lead	**27.6**	
Manganese	**1,010**	
Manganese (Dissolved)	**794.9**	
Sodium	**224,000**	
Sodium (Dissolved)	**257,000**	

Sample ID Sample Date	MW04S_081517 8/15/2017		GWDUP02_081517 8/15/2017	
VOCs (µg/L)				
Total VOCs	ND		0.9	
SVOCs (µg/L)				
Benzo(b)Fluoranthene	ND		**0.03**	J
Pesticides (µg/L)	ND		ND	
PCBs (µg/L)	ND		ND	
Inorganics (µg/L)				
Iron	**26,400**		**38,800**	
Iron (Dissolved)	**27,800**		**25,900**	
Lead	NE		**155**	J
Manganese	**1,558**		**1,733**	
Manganese (Dissolved)	**1,590**		**1,559**	
Sodium	**212,000**		**222,000**	
Sodium (Dissolved)	**242,000**		**208,000**	

Sample ID Sample Date	EPA-MW4S_081517 8/15/2017
VOCs (µg/L)	
Total VOCs	10
SVOCs (µg/L)	ND
Pesticides (µg/L)	ND
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	**20,600**
Iron (Dissolved)	**10,200**
Magnesium	**59,100**
Magnesium (Dissolved)	**36,600**
Manganese	**1,506**
Manganese (Dissolved)	**1,026**
Sodium	**180,000**
Sodium (Dissolved)	**181,000**

Sample ID Sample Date	EPA-MW4D_081617 8/16/2017
VOCs (µg/L)	
cis-1,2-Dichloroethene	**23**
Trichloroethene (TCE)	**10**
Total VOCs	62.63
SVOCs (µg/L)	ND

Sample ID Sample Date	MW05_081517 8/15/2017		MW05_100118 10/1/2018		DUP01_100118 10/1/2018	
VOCs (µg/L)	ND		NA		NA	
SVOCs (µg/L)	NE		ND		ND	
Pesticides (µg/L)	ND		NA		NA	
PCBs (µg/L)	ND		NA		NA	
Inorganics (µg/L)						
Iron	**6,300**		NA		NA	
Iron (Dissolved)	**6,540**		NA		NA	
Manganese	**694.1**		NA		NA	
Manganese (Dissolved)	**697**		NA		NA	
Sodium	**75,000**	J	NA		NA	
Sodium (Dissolved)	**87,300**	J	NA		NA	
PFCs (µg/L)						
N-ethyl perfluorooctane- sulfonamidoacetic acid	NA		ND		ND	
N-methyl perfluorooctane- sulfonamidoacetic acid	NA		ND		ND	
Perfluorobutanesulfonic Acid	NA		0.0051		0.0042	
Perfluorobutanoic acid	NA		ND		ND	
Perfluorodecanesulfonic acid	NA		ND		ND	
Perfluorodecanoic acid	NA		ND		ND	
Perfluorododecanoic Acid	NA		ND		ND	
Perfluoroheptanesulfonic acid	NA		ND		ND	
Perfluoroheptanoic acid	NA		0.0064		0.0063	
Perfluorohexanesulfonic Acid	NA		0.003	J	ND	
Perfluorohexanoic Acid	NA		0.0046		0.0057	
Perfluorononanoic Acid	NA		ND		ND	
Perfluorooctanesulfonamide	NA		ND		ND	
Perfluorooctanesulfonic acid	NA		0.003	J	ND	
Perfluorooctanoic Acid	NA		0.055		0.056	
Perfluoropentanoic Acid	NA		0.0038		0.0036	
Perfluorotetradecanoic Acid	NA		ND		ND	
Perfluorotridecanoic Acid	NA		ND		ND	
Perfluoroundecanoic Acid	NA		ND		ND	
Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-decane sulfonate (8:2)	NA		ND		ND	
Sodium 1H,1H,2H,2H-perfluoro-1-[1,2-13C2]-octane sulfonate (6:2)	NA		ND		ND	

Sample ID Sample Date	MW06S_081517 8/15/2017	
VOCs (µg/L)		
1,2,4,5-Tetramethylbenzene	**21**	
1,2,4-Trimethylbenzene	**33**	
1,3,5-Trimethylbenzene (Mesitylene)	**8**	J
Benzene	**51**	
Ethylbenzene	**93**	
m,p-Xylene	**8.1**	J
Naphthalene	**1,300**	
o-Xylene (1,2-Dimethylbenzene)	**29**	
Total Xylenes	**37**	J
Total VOCs	1,590	
SVOCs (µg/L)		
Acenaphthene	**70**	
Benzo(a)Anthracene	**0.49**	
Benzo(a)Pyrene	**0.27**	
Benzo(b)Fluoranthene	**0.21**	
Benzo(k)Fluoranthene	**0.09**	J
Biphenyl (Diphenyl)	**13**	
Chrysene	**0.54**	
Indeno(1,2,3-c,d)Pyrene	**0.09**	J
Naphthalene	**470**	
Pesticides (µg/L)		
Dieldrin	**0.045**	J
PCBs (µg/L)	ND	
Inorganics (µg/L)		
Iron	**11,400**	
Iron (Dissolved)	**7,170**	
Magnesium	**171,000**	
Magnesium (Dissolved)	**182,000**	
Manganese	**706**	
Manganese (Dissolved)	**544.4**	
Sodium	**1,410,000**	
Sodium (Dissolved)	**1,720,000**	

Sample ID Sample Date	MW06D_081617 8/16/2017	
VOCs (µg/L)		
1,2,4-Trimethylbenzene	**250**	
1,3,5-Trimethylbenzene (Mesitylene)	**52**	J
Benzene	**2,000**	
Ethylbenzene	**2,200**	
Isopropylbenzene (Cumene)	**62**	J
m,p-Xylene	**55**	J
Naphthalene	**8,300**	
o-Xylene (1,2-Dimethylbenzene)	**620**	
Total Xylenes	**680**	J
Total VOCs	14,300	
SVOCs (µg/L)		
Acenaphthene	**170**	
Benzo(a)Anthracene	**7.2**	J
Biphenyl (Diphenyl)	**37**	
Naphthalene	**4,600**	
Phenanthrene	**54**	

Sample ID Sample Date	EPA-MW34D_081617 8/16/2017
VOCs (µg/L)	
Tert-Butyl Methyl Ether	**11**
Total VOCs	82.2
SVOCs (µg/L)	
Acenaphthene	**270**
Benzo(a)Anthracene	**0.76** J
Biphenyl (Diphenyl)	**25**

Sample ID Sample Date	EPA-MW34S_081417 8/14/2017
VOCs (µg/L)	
Total VOCs	3.07
SVOCs (µg/L)	
Benzo(a)Anthracene	**0.21**
Benzo(b)Fluoranthene	**0.04** J
Chrysene	**0.19**
Pesticides (µg/L)	NE
PCBs (µg/L)	ND
Inorganics (µg/L)	
Iron	**4,650**
Iron (Dissolved)	**4,680**
Magnesium	**52,800**
Magnesium (Dissolved)	**51,800**
Manganese	**2,921**
Manganese (Dissolved)	**3,173**
Sodium	**348,000**
Sodium (Dissolved)	**342,000**

LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- SB02/MW02 — 2017 RI SOIL BORING AND MONITORING WELL LOCATION
- SB26/MW26 (D) — 2017 RI SOIL BORING AND DEEP MONITORING WELL LOCATION
- SB11/MW11 (SD) — 2017 RI SOIL BORING AND SHALLOW/DEEP MONITORING WELL COUPLET LOCATION
- MW-4 (EPA) — EXISTING UNITED STATES ENVIRONMENTAL PROTECTION AGENCY MONITORING WELL

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SEE FIGURE 5B FOR BLOCK NO. 431, LOT NOS. 12 AND 17 (SOUTHERN PORTION OF SITE).
4. GROUNDWATER ANALYTICAL RESULTS ARE COMPARED TO NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION (NYSDEC) TECHNICAL AND OPERATIONAL GUIDANCE SERIES (TOGS) 1.1.1 AMBIENT WATER QUALITY STANDARDS AND GUIDANCE VALUES (SGVs) FOR CLASS GA DRINKING WATER.
5. ONLY CONCENTRATIONS FOR COMPOUNDS ABOVE CLASS GA SGVs ARE SHOWN.
6. CONCENTRATIONS DETECTED ABOVE TOGS SGVs ARE SHADED AND BOLDED.
7. TOGS CLASS GA SGVs ARE PRESENT IN THE TABLE BELOW.
8. RI = REMEDIAL INVESTIGATION
9. VOC = VOLATILE ORGANIC COMPOUND.
10. SVOC = SEMIVOLATILE ORGANIC COMPOUND.
11. PCB = POLYCHLORINATED BIPHENYL.
12. µg/L = MICROGRAMS PER LITER.
13. NA = NOT ANALYZED
14. ND = NO DETECTIONS
15. NE = NO DETECTIONS ABOVE THE RESPECTIVE CRITERION.
16. J = THE COMPOUND WAS DETECTED ABOVE THE METHOD DETECTION LIMIT, BUT BELOW THE REPORTING LIMIT; THEREFORE THE RESULT IS AN ESTIMATED CONCENTRATION.

Analyte	NYSDEC SGVs
VOCs (µg/L)	
1,2,4,5-Tetramethylbenzene	5
1,2,4-Trimethylbenzene	5
1,2-Dichloroethane	0.6
1,3,5-Trimethylbenzene (Mesitylene)	5
Acetone	50
Benzene	1
cis-1,2-Dichloroethene	5
Ethylbenzene	5
Isopropylbenzene (Cumene)	5
m,p-Xylene	5
Naphthalene	10
n-Butylbenzene	5
n-Propylbenzene	5
o-Xylene (1,2-Dimethylbenzene)	5
Sec-Butylbenzene	5
Styrene	5
Tert-Butyl Methyl Ether	10
Toluene	5
Total Xylenes	5
Trichloroethene (TCE)	5
SVOCs (µg/L)	
2,4-Dimethylphenol	1
Acenaphthene	20
Benzo(a)Anthracene	0.002
Benzo(a)Pyrene	0
Benzo(b)Fluoranthene	0.002
Benzo(k)Fluoranthene	0.002
Biphenyl (Diphenyl)	5
Bis(2-Ethylhexyl) Phthalate	5
Chrysene	0.002
Fluorene	50
Indeno(1,2,3-c,d)Pyrene	0.002
Naphthalene	10
Phenanthrene	50
Phenol	1
Pesticides (µg/L)	
Dieldrin	0.004
Inorganics (µg/L)	
Antimony	3
Arsenic	25
Chromium, Total	50
Iron	300
Lead	25
Magnesium	35,000
Manganese	300
Mercury	0.7
Selenium	10
Sodium	20,000

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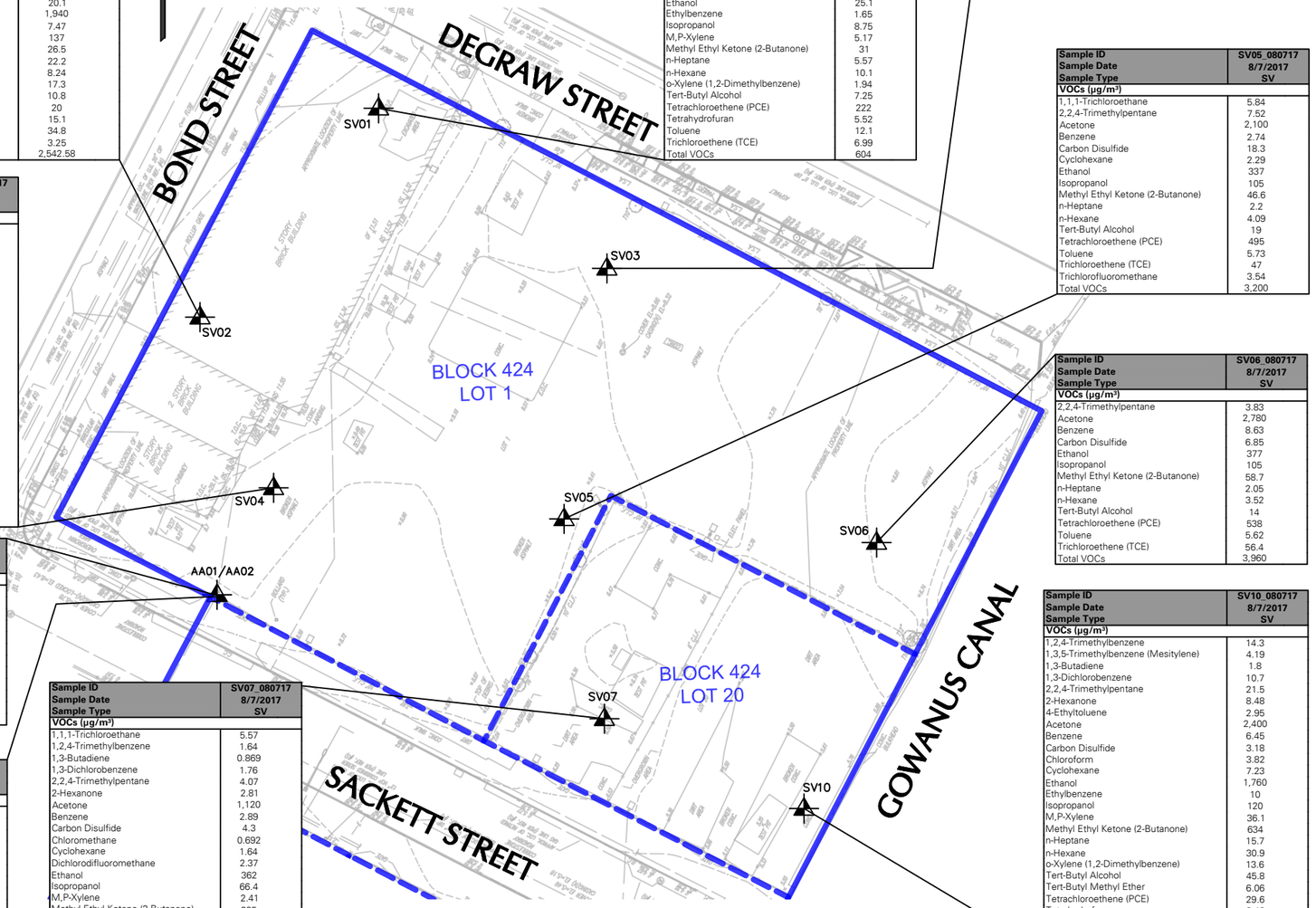
Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
GROUNDWATER SAMPLE LOCATION AND RESULTS MAP - LOT 1 AND LOT 20

Project No. 170295301
Date 9/23/2019
Drawn By CMA
Checked By PF

Figure No. 5A

Sheet 6 of 11



Sample ID	SV02_080717	SVDUP01_080717
Sample Date	8/7/2017	8/7/2017
Sample Type	SV	SV
VOCs (µg/m³)		
1,2,4-Trimethylbenzene	12.1	13
1,3,5-Trimethylbenzene (Mesitylene)	4.22	4.17
1,3-Dichlorobenzene	4.1	4.06
2,2,4-Trimethylpentane	63.5	53.2
4-Ethyltoluene	2.32	2.45
Acetone	204	191
Benzene	7.32	8.02
Carbon Disulfide	2.95	3.92
Cyclohexane	23.6	20.1
Ethanol	1,650	1,940
Ethylbenzene	7.34	7.47
Isopropanol	124	137
M,P-Xylene	24.7	26.5
Methyl Ethyl Ketone (2-Butanone)	16.5	22.2
n-Heptane	8.4	8.24
n-Hexane	16	17.3
o-Xylene (1,2-Dimethylbenzene)	10.5	10.8
Tert-Butyl Alcohol	19.5	20
Tetrachloroethene (PCE)	14.8	15.1
Toluene	34.6	34.8
Trichloroethene (TCE)	3.47	3.25
Total VOCs	2,253.92	2,542.58

Sample ID	SV01_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	1.76
1,4-Dichlorobenzene	3.99
2,2,4-Trimethylpentane	26.2
2-Hexanone	2.08
Acetone	208
Benzene	7.7
Carbon Disulfide	9.03
Cyclohexane	2.94
Ethanol	25.1
Ethylbenzene	1.65
Isopropanol	8.75
M,P-Xylene	5.17
Methyl Ethyl Ketone (2-Butanone)	31
n-Heptane	5.57
n-Hexane	10.1
o-Xylene (1,2-Dimethylbenzene)	1.94
Tert-Butyl Alcohol	7.25
Tetrachloroethene (PCE)	222
Tetrahydrofuran	5.52
Toluene	12.1
Trichloroethene (TCE)	6.99
Total VOCs	604

Sample ID	SV03_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
2,2,4-Trimethylpentane	129,000
Benzene	712
Cyclohexane	36,500
n-Heptane	2,580
n-Hexane	7,580
Total VOCs	176,372

Sample ID	SV04_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	4.97
1,2-Dichloroethane	5.99
1,3,5-Trimethylbenzene (Mesitylene)	2.13
1,3-Butadiene	6.81
2,2,4-Trimethylpentane	10.9
2-Hexanone	8.4
Acetone	2,370
Benzene	24.8
Carbon Disulfide	38.9
Chloromethane	1.3
Cyclohexane	19.1
Dichlorodifluoromethane	2.24
Ethanol	129
Ethylbenzene	2.27
Isopropanol	61.2
M,P-Xylene	7.73
Methyl Ethyl Ketone (2-Butanone)	94.4
Methylene Chloride	4.69
n-Heptane	24.1
n-Hexane	75.4
o-Xylene (1,2-Dimethylbenzene)	2.73
Tert-Butyl Alcohol	15.2
Tetrachloroethene (PCE)	215
Toluene	31.2
Trichloroethene (TCE)	6.61
Total VOCs	3,170

Sample ID	SV05_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,1,1-Trichloroethane	5.84
2,2,4-Trimethylpentane	7.52
Acetone	2,100
Benzene	2.74
Carbon Disulfide	18.3
Cyclohexane	2.29
Ethanol	337
Isopropanol	105
Methyl Ethyl Ketone (2-Butanone)	46.6
n-Heptane	2.2
n-Hexane	4.09
Tert-Butyl Alcohol	19
Tetrachloroethene (PCE)	495
Toluene	5.73
Trichloroethene (TCE)	47
Trichlorofluoromethane	3.54
Total VOCs	3,200

Sample ID	SV06_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
2,2,4-Trimethylpentane	3.83
Acetone	2,780
Benzene	8.63
Carbon Disulfide	6.85
Ethanol	377
Isopropanol	105
Methyl Ethyl Ketone (2-Butanone)	58.7
n-Heptane	2.05
n-Hexane	3.52
Tert-Butyl Alcohol	14
Tetrachloroethene (PCE)	538
Toluene	5.62
Trichloroethene (TCE)	56.4
Total VOCs	3,960

Sample ID	AA01_080717
Sample Date	8/7/2017
Sample Type	AA
VOCs (µg/m³)	
2,2,4-Trimethylpentane	1.86
Benzene	0.696
Chloromethane	1.2
Dichlorodifluoromethane	2.01
Ethanol	11.4
Isopropanol	1.45
Methyl Ethyl Ketone (2-Butanone)	2.19
Methylene Chloride	1.74
n-Hexane	1.36
Toluene	2.42
Trichlorofluoromethane	1.21
Total VOCs	27.53

Sample ID	AA02_080717
Sample Date	8/7/2017
Sample Type	AA
VOCs (µg/m³)	
2,2,4-Trimethylpentane	0.962
Acetone	10.8
Benzene	0.885
Chloromethane	0.843
Ethanol	12.4
Isopropanol	1.98
Methyl Ethyl Ketone (2-Butanone)	8.55
Methylene Chloride	2.06
n-Hexane	1.67
Toluene	4.03
Total VOCs	44.18

Sample ID	SV07_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,1,1-Trichloroethane	5.57
1,2,4-Trimethylbenzene	1.64
1,3-Butadiene	0.869
1,3-Dichlorobenzene	1.76
2,2,4-Trimethylpentane	4.07
2-Hexanone	2.81
Acetone	1,120
Benzene	2.89
Carbon Disulfide	4.3
Chloromethane	0.692
Cyclohexane	1.64
Dichlorodifluoromethane	2.37
Ethanol	362
Isopropanol	66.4
M,P-Xylene	2.41
Methyl Ethyl Ketone (2-Butanone)	295
Methylene Chloride	1.96
n-Heptane	4.51
n-Hexane	9.37
o-Xylene (1,2-Dimethylbenzene)	0.951
Tert-Butyl Alcohol	20.2
Tetrachloroethene (PCE)	252
Tetrahydrofuran	2.7
Toluene	4.07
Trichloroethene (TCE)	14.5
Trichlorofluoromethane	2.75
Total VOCs	2,190

Sample ID	SV10_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	14.3
1,3,5-Trimethylbenzene (Mesitylene)	4.19
1,3-Butadiene	1.8
1,3-Dichlorobenzene	10.7
2,2,4-Trimethylpentane	21.5
2-Hexanone	8.48
4-Ethyltoluene	2.95
Acetone	2,400
Benzene	6.45
Carbon Disulfide	3.18
Chloroform	3.82
Cyclohexane	7.23
Ethanol	1,760
Ethylbenzene	10
Isopropanol	120
M,P-Xylene	36.1
Methyl Ethyl Ketone (2-Butanone)	634
n-Heptane	15.7
n-Hexane	30.9
o-Xylene (1,2-Dimethylbenzene)	13.6
Tert-Butyl Alcohol	45.8
Tert-Butyl Methyl Ether	6.06
Tetrachloroethene (PCE)	29.6
Tetrahydrofuran	6.46
Toluene	49.7
Trichloroethene (TCE)	53
Total VOCs	5,300

LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- SV06 — 2017 RI SOIL VAPOR SAMPLE LOCATION
- AA01 — 2017 RI AMBIENT AIR SAMPLE LOCATION

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SEE FIGURE 6B FOR BLOCK NO. 431, LOT NOS. 12 AND 17 (SOUTHERN PORTION OF SITE).
4. ONLY DETECTED CONCENTRATIONS ARE SHOWN.
5. RI = REMEDIAL INVESTIGATION
6. VOC = VOLATILE ORGANIC COMPOUND.
7. $\mu g/m^3$ = MICROGRAMS PER CUBIC METER

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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
SOIL VAPOR SAMPLE LOCATION AND RESULTS MAP - LOT 1 AND LOT 20

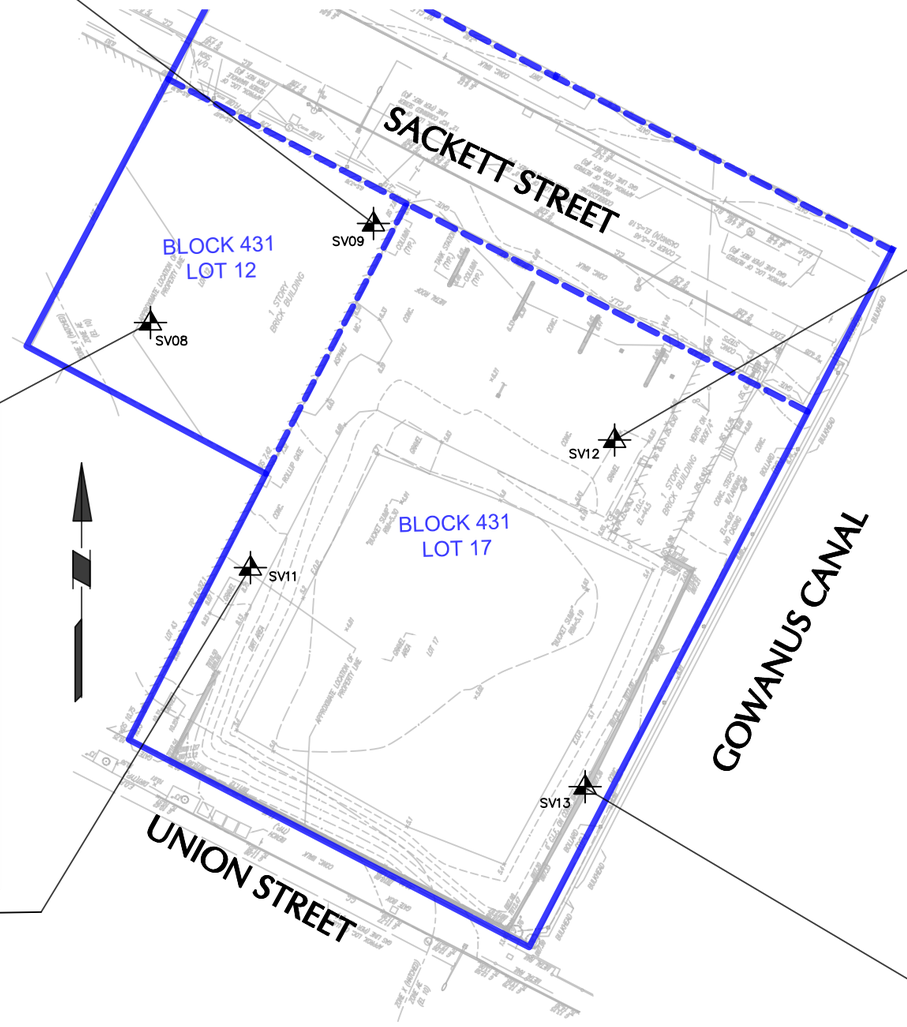
Project No. 170295301
Date 9/23/2019
Drawn By CMA
Checked By PF

Figure No. 6A
Sheet 8 of 11

Sample ID	SV09_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,2,4-Trimethylbenzene	2.1
1,3-Butadiene	0.451
1,3-Dichlorobenzene	2.22
2,2,4-Trimethylpentane	4.18
2-Hexanone	1.59
Acetone	193
Benzene	15.8
Carbon Disulfide	5.85
Chloroform	4.86
Cyclohexane	1.5
Ethanol	54.3
Ethylbenzene	1.21
Isopropanol	14.6
M,P-Xylene	4.06
Methyl Ethyl Ketone (2-Butanone)	27.8
n-Heptane	5.78
n-Hexane	13.4
o-Xylene (1,2-Dimethylbenzene)	1.47
Tert-Butyl Alcohol	3.3
Tetrachloroethene (PCE)	237
Tetrahydrofuran	3.6
Toluene	10.5
Trichloroethene (TCE)	8.97
Total VOCs	617

Sample ID	SV08_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
1,1,1-Trichloroethane	79.7
1,1-Dichloroethane	30.9
1,2,4-Trimethylbenzene	16.7
1,3,5-Trimethylbenzene (Mesitylene)	5.41
1,3-Dichlorobenzene	5.5
2,2,4-Trimethylpentane	17.3
4-Ethyltoluene	3.33
Acetone	85.5
Benzene	4.63
Carbon Disulfide	5.98
Cyclohexane	5.82
Ethanol	1,770
Ethylbenzene	10.5
Isopropanol	94.9
M,P-Xylene	37.4
Methyl Ethyl Ketone (2-Butanone)	11.7
n-Heptane	9.18
n-Hexane	17.2
o-Xylene (1,2-Dimethylbenzene)	15.1
Tert-Butyl Alcohol	10.3
Tetrachloroethene (PCE)	19.2
Tetrahydrofuran	3.45
Toluene	47.1
Trichloroethene (TCE)	4.5
Total VOCs	2,310

Sample ID	SV11_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
2,2,4-Trimethylpentane	3.87
Acetone	3,230
Benzene	21.8
Carbon Disulfide	8.88
Cyclohexane	2.36
Ethanol	364
Isopropanol	124
Methyl Ethyl Ketone (2-Butanone)	56.3
n-Heptane	4.75
n-Hexane	28.4
Tert-Butyl Alcohol	17.1
Tetrachloroethene (PCE)	383
Toluene	5.2
Trichloroethene (TCE)	31.2
Total VOCs	4,280



Sample ID	SV12_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
2,2,4-Trimethylpentane	3.77
Acetone	3,540
Benzene	2.01
Carbon Disulfide	2.96
Ethanol	145
Isopropanol	60.5
Methyl Ethyl Ketone (2-Butanone)	92
n-Hexane	3.46
Tert-Butyl Alcohol	15.8
Tetrachloroethene (PCE)	494
Toluene	4.9
Trichloroethene (TCE)	41.2
Total VOCs	4,410

Sample ID	SV13_080717
Sample Date	8/7/2017
Sample Type	SV
VOCs (µg/m³)	
2,2,4-Trimethylpentane	4.37
2-Hexanone	2.17
Acetone	2,640
Benzene	5.69
Ethanol	339
Isopropanol	85.3
Methyl Ethyl Ketone (2-Butanone)	64
n-Heptane	2.55
n-Hexane	3.59
Tert-Butyl Alcohol	12.9
Tetrachloroethene (PCE)	351
Toluene	5.2
Trichloroethene (TCE)	28.6
Total VOCs	3,544

LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- SV06 — 2017 RI SOIL VAPOR SAMPLE LOCATION

NOTES :

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).
3. SEE FIGURE 6A FOR BLOCK NO. 424, LOT NOS. 1 AND 20 (NORTHERN PORTION OF SITE).
4. ONLY DETECTED CONCENTRATIONS ARE SHOWN.
5. RI = REMEDIAL INVESTIGATION
6. VOC = VOLATILE ORGANIC COMPOUND.
7. µg/m³ = MICROGRAMS PER CUBIC METER

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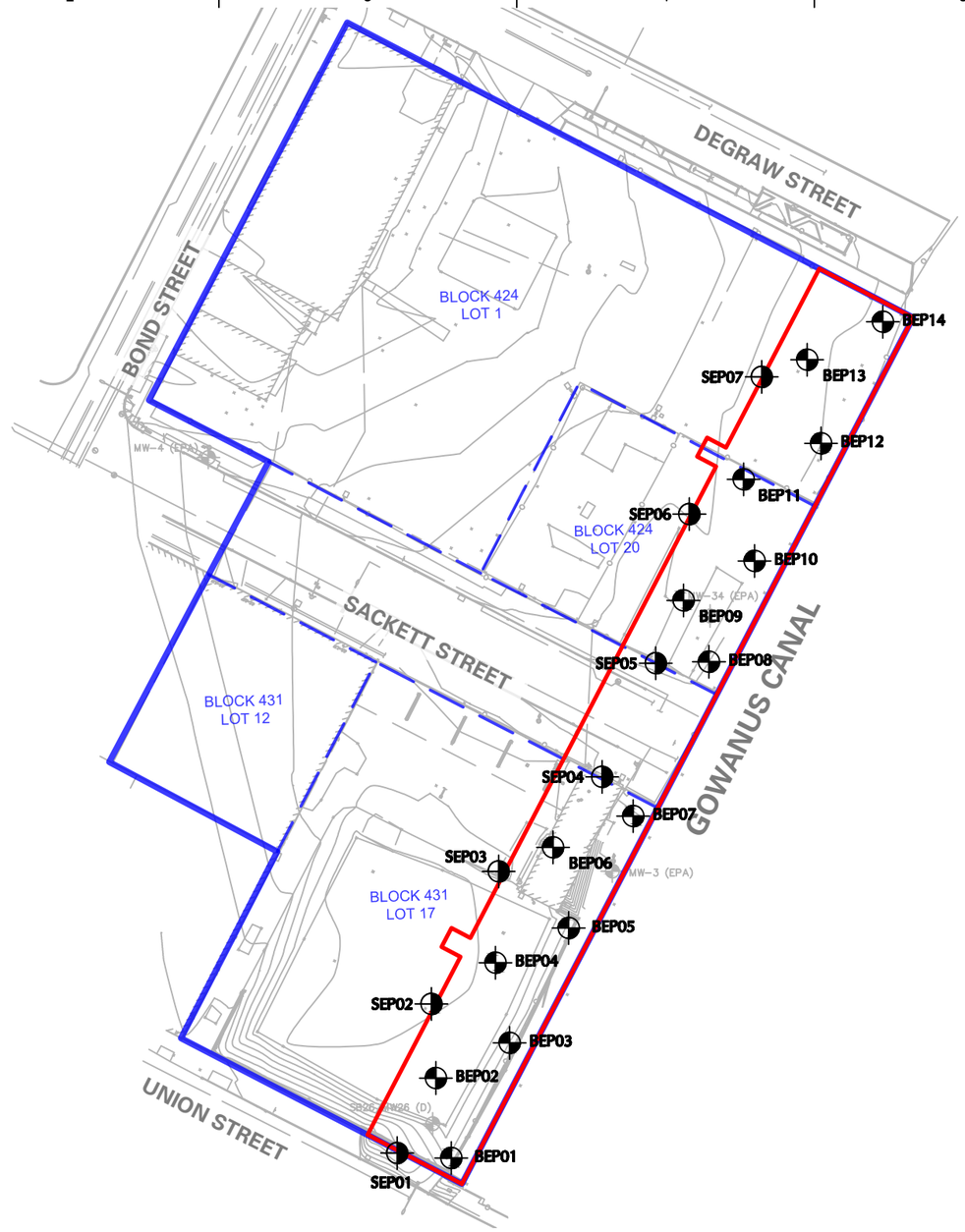
Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
SOIL VAPOR SAMPLE LOCATION AND RESULTS MAP - LOT 12 AND LOT 17

Project No. 170295301
Date 9/23/2019
Drawn By CMA
Checked By PF

Figure No. 6B
Sheet 9 of 11

Filename: \\Langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\IRMWP (BH)\Figure X - TAG Maps.dwg Date: 10/3/2019 Time: 13:31 User: pstovall Style Table: Langan.stb Layout: SOUTH-SV TAG TABLE



LEGEND:

- SITE BOUNDARY
- LOT BOUNDARY
- PROPOSED EXTENTS OF EXCAVATION TO ABOUT ELEVATION (EL.) 1
- BEP01 — PROPOSED BOTTOM DOCUMENTATION SAMPLE LOCATION
- SEP01 — PROPOSED SIDEWALL DOCUMENTATION SAMPLE LOCATION

NOTES:

1. BASE MAP SOURCE: SURVEY BY CONTROL POINT ASSOCIATES, INC. PC (MARCH 22, 2017).
2. 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 GEOLOGICAL SURVEY (USGS NGVD 1929).

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SCALE IN FEET

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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
EXCAVATION EXTENTS AND DOCUMENTATION SAMPLE LOCATION PLAN

Project No.	170295301
Date	9/23/2019
Drawn By	CMA
Checked By	PF

Figure No. 7
Sheet 10 of 11

Filename: \\Langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\IRMWP (BH)\Excavation Extents and Documentation Sample Location.dwg Date: 3/17/2020 Time: 15:53 User: canderson Style Table: Langan.stb Layout: ANSIB-BL

LEGEND:

SITE BOUNDARY

NOTES:

1. TRUCK ROUTE BASE MAP ADAPTED FROM NEW YORK CITY DEPARTMENT OF TRANSPORTATION (NYCDOT) 2015 NEW YORK CITY TRUCK ROUTE MAP.
2. AERIAL BASE MAP OBTAINED FROM GOOGLE MAPS ON 24 SEPTEMBER 2019.

Legend

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

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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 432, LOT Nos. 1 & 20
BLOCK No. 431, LOT Nos. 12 & 17
BROOKLYN NEW YORK

Figure Title
TRUCK ROUTE MAP

Project No.	170295301
Date	9/24/2019
Drawn By	CMA
Checked By	PF

Figure No. 8

Sheet 11 of 11

APPENDIX A
HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN

FOR

GOWANUS CANAL NORTHSIDE
BROOKLYN, NEW YORK
Tax Block 424, Lots 1 and 20
And
Block 431, Lots 12 and 17
NYSDEC BCP Site No. C224080

Prepared For

Gowanus Canal LLC
111 Fifth Avenue, Floor 6
New York, NY 10003

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

LANGAN

March 2020
Langan Project No. 170295301

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

1.0 INTRODUCTION

1.1 General

This HEALTH AND SAFETY PLAN (HASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b)(4), *Hazardous Waste Operations and Emergency Response* during anticipated site work at at Gowanus Canal Northside site, defined as:

- Block 424, Lot 1: 479-493 Sackett Street, 267-285 Bond Street, and 484-508 Degraw Street, Brooklyn, New York
- Block 424, Lot 20: 495-505 Sackett Street, Brooklyn, New York
- Block 431, Lot 12: 498-502 Sackett Street, Brooklyn, New York
- Block 431, Lot 17: 508-520 Sackett Street and 505-517 Union Street, Brooklyn, New York

("the Site"). This HASP provides the minimum requirements for implementing site operations during future remedial measure activities. All contractors performing work on this site shall implement their own HASP that, at a minimum, adheres to this HASP. The contractor is responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this HASP while onsite.

The management of the day-to-day site activities and implementation of this HASP in the field is the responsibility of the site Langan Field Team Leader (FTL). Assistance in the implementation of this HASP 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 HASP 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 comprises four lots (Block 424, Lots 1 and 20 and Block 431, Lots 12 and 17) transected by Sackett Street in the Gowanus neighborhood of Brooklyn, New York. The site occupies an area of about 98,800 square feet and is bounded by Degraw Street to the north, the Gowanus Canal to the east, Union Street and multiple-story commercial buildings to the south, and Bond Street and multiple-story commercial buildings to the west. The site was most recently occupied by the Bayside Fuel Oil Depot Corp. and is a registered inactive Major Oil Storage Facility (MOSF). The site contains an out-of-service wholesale fuel oil distribution facility with a two-story office building (Block 431, Lot 17), automobile maintenance garages formerly used to service the

Bayside Fuel fleet of vehicles (Block 431, Lot 12 and Block 424, Lot 1) and a vacant parking lot and equipment storage areas (Block 424, Lots 1 and 20).

The site is located in an area of historical industrial usage and has been used for industrial and manufacturing purposes since as early as 1886. In addition to its current use as a truck repair and storage facility, past uses of the site include the following: a coal yard from 1886 to 1915; a fuel company from 1922 to 1928 and in 1938, an auto repair shop from 1938 to 1969, a wood box manufacturer in 1950, a fuel depot with filling stations and auto repair facility from 1950 to 2007, private garage with two gasoline tanks from 1950 to 2007, a truck repair shop from 1969 to 2007, a telephone company in 1977, and a truck rental company from 1979 to 2007. A site location map is provided as Figure 1

1.3 Summary of Work Tasks

1.3.1 Monitoring Turbidity

Langan will monitor East River turbidity in accordance with the work plan. These activities may require be performed from the barge or float stage. The float stage may require repositioning to allow turbidity monitoring from one or more locations adjacent to the turbidity curtain. The work plan may require several readings within a given work day. Specific details governing the number of readings, the position of the readings and the other details has been specified in the work plan and are subject to change when such changes are verified by the project manager.

1.3.2 Demolition of Exiting Bulkhead, Excavation of Debris and Shoreline Stabilization

Langan will observe the demolition and removal of the existing bulkhead and 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 are detailed in the Work Plan.

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. Personnel conducting activities will report to Langan when encountering impacted historic fill, petroleum impacted material or impacted groundwater and shall abide to the provisions of this HASP.

1.3.2 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.

1.3.4 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.

1.3.5 Limited Removal of Portions of Existing Crib Wall

Portions of the existing crib wall will be excavated and removed as required for installation of the wale, and tiebacks as shown on the Construction Drawings and as specified in the work plan.

1.3.6 Installation of Tiebacks

Tiebacks are to be installed as shown on the Construction Drawings and as specified in the work plan.

1.3.7 Installation of Pretreatment Unit

Pretreatment Units (PTUs) are to be installed as shown on the Construction Drawings and as specified in the work plan. Installation will require excavation and backfilling.

1.3.8 Management of Investigative-Derived Waste

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

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

1.3.9 Drum Sampling

Langan personnel 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.

1.3.10 Surveying

Surveying activities, if defined in the work plan, may be completed by Langan. Surveying will be conducted by licensed surveyors.

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

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

2.1 Langan Project Manager

The Langan Environmental Project Managers (PM) is Patrick Farnham and the Geotechnical PM is Kenneth Huber. There responsibilities include:

- Ensuring that this HASP 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 HASP.

2.2 Langan Corporate Health and Safety Manager

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

- Updating the *Construction Health and Safety Program for Hazardous Waste Operations*.
- Assisting the site Health and Safety Officer (HSO) with development of the HASP, updating HASP as dictated by changing conditions, jobsite inspection results, etc. and approving changes to this HASP.
- Assisting the HSO in the implementation of this HASP 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 HASP.
- 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 HASP 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 HASP 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 HASP will be at least as stringent as this Langan HASP. The contractor must be familiar with and abide by the requirements outlined in their own HASP. A contractor may elect to adopt Langan's HASP as its own provided that it has given written notification to Langan, but where Langan's HASP excludes provisions pertinent to the contractor's work (i.e., confined space entry); the contractor must provide written addendums to this HASP. 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

3.3.1 Monitoring Turbidity

Monitoring East River turbidity in accordance with the work plan will position Langan engineers on a barge or float stage (temporary dock). At a minimum, Langan engineers are required to don a Coast Guard approved personal flotation device (PFD) and the barge or float stage must have readily available Coast Guard approved life rings. Before boarding the barge or float stage, monitor East River tidal and wave conditions. In rough water, the activities should be postponed. In addition, Langan staff should pay close attention to the float stage stability while

in use and if necessary require hand rails be installed to prevent accidental falling into the East River. While completing the turbidity activity from the float barge, a second person equipped with a Coast Guard approved life ring must monitor the work from a position where the life ring may be easily tossed to the Langan engineer if required.

3.1.2 Demolition of Exiting Bulkhead, 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.

3.1.3 Barge Based Activities

The work plan includes one or more of the geotechnical tasks to be anchored from a barge. This HASP directs that only Langan employees or direct hires of the barge and geotechnical contractor be permitted unfettered access to the barge. Langan personnel are permitted on the barge when consistent with their site duties and responsibilities. Persons working on or visiting the barge must don personal flotation device (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.

3.1.4 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 device (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.

3.1.5 Indoor Drilling and Excavation

The work scope may require indoor drilling or drilling in locations where there may not be adequate ventilation sufficient to safely operate any rig or excavation equipment powered by an internal combustion engine. Where possible, all such work should be done by equipment powered by electricity. If such equipment is used and must be directly wired to the buildings electrical system or to an independent system, this work must be completed by a licensed electrician in accordance with all electrical codes applicable to the work.

Indoor work which is to be completed with equipment powered by an internal combustion engine must incorporate air monitoring of carbon monoxide (CO) using calibrated air monitoring equipment (MultiRAE or equivalent). In addition, the work plan should incorporate mitigation for venting engine exhaust fumes directly to the outdoors and for circulating fresh air into the work area.

The OSHA Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for CO from 50 to 35 parts per million (ppm). Langan will monitor CO with a suitable monitoring device. If CO levels exceed 5 ppm, Langan will instruct contractors to begin mitigation measures. These measures are at a minimum:

- Increase air circulation using industrial size fans to bring additional fresh air into the building or vent exhaust to the outside;
- Modify the passive exhaust method being used to increase venting circulation by using wider diameter tubing or sealing tubing connections; or
- Modify the work schedule where the rig is turned off to allow time for CO levels to fall back to background

All work must cease if CO levels reach 35 ppm. The Langan engineer is to report to the PM and H&S officer when an action level is reached.

3.1.6 Construction Activity Inspection

The contractor will operate equipment used to install sheet piles, caissons and rock anchors. In addition, the contractor will assemble and install the equipment to perform lateral load-test. Langan personnel will inspect in accordance with specification in the work plan and record the data the work plan requires. The installation of the sheet piles, caissons and rock anchors 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.

3.1.7 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soil samples and cuttings will be containerized in 55-gallon drums for disposed off-site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Sampling drums requires the donning of work gloves when opening the drums and chemical resistant gloves when sampling in addition to standard PPE.

Langan personnel and contractors are not to move or opened 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)

3.3.7.1 Utility Clearance

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All excavation work will be preceded by review of available utility drawings and by notification of the subsurface work to the N.Y. One –Call--Center.

3.3.7.2 Lockout-Tagout

The potential adverse effects of electrical hazards include burns and electrocution, which could result in death. Therefore, there is a procedure that establishes the requirements for the lockout/tagout (LOTO) of energy isolating devices in accordance with the OSHA electrical lockout and tagging requirements as specified in 29 CFR 1926.417. This procedure will be used to ensure

that all machines and equipment are isolated from potentially hazardous energy. If possible, equipment that could cause injury due to unexpected energizing, start-up, or release of stored energy will be locked/tagged, before field personnel perform work activities.

Depending upon the specific work task involved, Langan's SSC or FTL will serve as the authorized lockout/tagout coordinator, implement the lockout/tagout procedure and will be responsible to locate, lock and tag valves, switches, etc.

SPECIAL NOTE: Project personnel will assume that all electrical equipment at surface, subsurface and overhead locations is energized, until equipment has been designated and confirmed as de-energized by a utility company representative. Langan will notify the designated utility representative prior to working adjacent to this equipment and will verify that the equipment is energized or de-energized in the vicinity of the work location.

No project work shall be performed by Langan personnel or subcontractors on or near energized electrical lines or equipment unless hazard assessments are completed in writing, reviewed by Langan's SSHO, and clearly communicated to the field personnel.

The FTL shall conduct a survey to locate and identify all energy isolating devices. They shall be certain which switches, valves or other isolating devices apply to the equipment. The lockout/tagout procedure involves, but is not limited to, electricity, motors, steam, natural gas, compressed air, hydraulic systems, digesters, sewers, etc.

3.3.8 Physical Hazard Considerations for Material Handling

There are moderate to severe risks associated with moving heavy objects at the Site. The following physical hazards should be considered when handling materials at the Site:

- Heavy objects will be lifted and moved by mechanical devices rather than manual effort whenever possible.
- The mechanical devices will be appropriate for the lifting of moving task and will be operated only by trained and authorized personnel.
- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects.
- Lifting devices will be inspected, certified, and labeled to confirm their weight capacities. Defective equipment will be taken out of service immediately and repaired or destroyed.
- The wheels of any trucks being loaded or unloaded will be chocked to prevent movement. Outriggers will be fully extended on a flat, firm surface during operation.

- Personnel will not pass under a raised load, nor will a suspended load be left unattended.
- Personnel will not be carried on lifting equipment, unless it is specifically designed to carry passengers.
- All reciprocating, rotating, or other moving parts will be guarded at all times.
- Accessible fire extinguishers, currently (monthly) inspected, will be available in all mechanical lifting devices.
- Verify all loads/materials are secure before transportation.

Material handling tasks that are unusual or require specific guidance will need a written addendum to this HASP. The addendum must identify the lifting protocols before the tasks are performed. Upon approval, the plan must be reviewed with all affected employees and documented. Any deviation from a written plan will require approval by the Langan HSM.

3.3.9 Hearing Conservation

Under the construction industry standard, the maximum permissible occupational noise exposure is 90 dbA (8-hour TWA), and noise levels in excess of 90 dbA must be reduced through feasible administrative and engineering controls. (20 CFR 1926.52). Hearing protection is required when working within 15 feet of vacuum extraction equipment and drill rigs.

3.3.9 Open Water

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests. Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

And should a worker fall into the water, OSHA requires (29 CFR 1926.106(c)) that ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet. Another remedial action required by OSHA (29 CFR 1926.106(d)) is the use of lifesaving skiffs.

OSHA requires that at least one lifesaving skiff shall be immediately available at locations where employees are working over or adjacent to water and must include the following provisions.

- The skiff must be in the water or capable of being quickly launched by one person.
- At least one person must be present and specifically designated to respond to water emergencies and operate the skiff at all times when there are employees above water.
- When the operator is on break another operator must be designated to provide requisite coverage when there are employees above water.

- The designated operator must either have the skiff staffed at all times or have someone remain in the immediate area such that the operator can quickly reach the skiff and perform rescue services.
- The skiff operator maybe assigned other tasks provided the tasks do not interfere with the operator's ability to quickly reach the skiff.
- A communication system, such as a walkie-talkie, must be used to inform the skiff operator of an emergency and to inform the skiff operator where the skiff is needed.
- The skiff must be equipped with both a motor and oars.

With regard to the number of skiffs required and the appropriate maximum response time, the following factors must be evaluated:

- The number of work locations where there is a danger of falling into water;
- The distance to each of those locations;
- Water temperature and currents;
- Other hazards such as, but not limited to, rapids, dams, and water intakes;

Other regulations that present S&H practices and PPE for work on or near water include: 29 CFR 1910, Subpart T (401 – 440)

3.4 Biological Hazards

3.4.1 Animals

There is a possibility of encountering wildlife including reptiles, rodents and other small and medium size mammals. The Langan personnel is to avoid interacting with any wildlife.

3.4.2 Insects

Ticks and other biting or stinging insects may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and insecticide to prevent bites and stings. After field work, Langan personnel should perform a complete visual inspection of their clothing to insure they are not inadvertently harboring ticks. If they do observe a tick bite, they are to contact the HSM or HSO and report the event.

3.4.3 Plants

Poisonous plants may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and applying preventative poison Ivy/Sumac lotion to prevent or limit effects of exposure. If after field work, Langan employees do observe a reaction to poisonous plant exposure, they are to contact the HSM or HSO and report the event.

3.4.4 Coronavirus

3.4.4.1 General Preventative Measures

Field personnel must follow general proper hygiene measures while in the field including:

- Avoid touching eyes, nose and mouth.
- Cover cough or sneeze with tissue, and throw in trash.
- Wash hands often with soap and water for 20 seconds after going to bathroom, before eating, after blowing nose, coughing or sneezing.
- Use hand sanitizer with at least 60% alcohol if soap and water are not available.
- Avoid physical contact with other people (e.g., no handshakes).
- Maintain a safe distance of at least 6 feet from other people (social distancing).

3.4.4.2 Construction Trailers

Employees should avoid use of shared construction trailers or where employees cannot maintain a safe distance (minimum 6 feet) from other workers. If trailer use is needed, areas such as desks, phones, chairs and other common areas, should be cleaned and disinfected before and after use. Protocols should be developed to minimize trailer use to essential personal, restrict use from any workers who are ill or showing symptoms of being ill, and ensure a safe distance of 6 feet can be established between workers.

3.4.4.3 Communication

Include Coronavirus topics and prevention topics in daily tailgate meetings to ensure Coronavirus awareness is communicated daily. Discussions can focus on general topics including: social distancing, prevention measures for field personnel, signs and symptoms and recent news on the Coronavirus. Site-specific topics should include minimizing face-to-face contact, disinfecting/sterilizing field equipment, use of PPE to reduce exposure, site security and other potential exposure issues/concerns.

3.4.4.4 Sick/Ill Workers

No Langan employee is permitted to be onsite when ill and/or showing potential symptoms of the Coronavirus. Symptoms of the Coronavirus may appear 2-14 days after exposure and can range from mild to severe. The most common symptoms include: fever, fatigue, dry cough and shortness of breath. If an employee or subcontractor is observed being ill or exhibiting symptoms of Coronavirus, employees must immediately utilize their Stop Work Authority and contact their project manager to address the situation. If an employee observes another worker onsite

exhibiting symptoms of Coronavirus, immediately utilize Stop Work Authority and notify their project manager and site construction manager or safety officer. Work should resume when the safety and health of Langan and subcontractors is adequately addressed.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

There is potential for exposure to NAPL at this site. Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or ground water from wells containing NAPL) must be intrinsically safe. Equipment that directly contacts NAPL must also be resistant to organic solvents.

At a minimum, a PID should be used to monitor for VOCs when NAPL is observed. If NAPL is expected to be observed in an excavation or enclosed area, air monitoring must be started using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation.

When NAPL is present, Langan personnel are required to use disposable nitrile gloves at all times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

All contaminated disposables including PPE and sampling equipment must be properly disposed of in labeled 55-gallong drums

3.6 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled or minimized. A JSA will be performed at the beginning of each work day, and additionally whenever an employee begins a new task or moves to a new location. All JSAs must be developed and reviewed by all parties

involved. A blank JSA form and documentation of completed JSAs are in Attachment G.

4.0 PERSONNEL TRAINING

4.1 Basic Training

Completion of an initial 40-hour HAZWOPER training program as detailed in OSHA's 29 CFR 1910.120(e) is required for all employees working on a site engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances, health hazards, or safety hazards as defined by 29 CFR 1910.120(a). Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, all employees must complete the OSHA 10 hour Construction Safety and Health training and supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

4.2 Initial Site-Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail all the provisions contained within this HASP. 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 HASP 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 HASP.

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 shut down.

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/m³ above the background level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration.

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:

Brooklyn Hospital Center
121 DeKalb Avenue
Brooklyn, NY
718-250-8000

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, and preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. In case of emergency, in addition to 911, call *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

Should outside assistance be needed for accidents, fire, or release of hazardous substances, the emergency numbers will be available and posted at the site (Table 5) where a readily accessible telephone is made available for emergency use.

Also, in the event of an incident where a team member becomes exposed or suffers from an acute symptom from contact with site materials and has to be taken to a hospital, a short medical data sheet (Attachment T) for that individual will be made available to the attending physician. The medical data sheet will include the following:

- Name, address, home phone
- Age, height, weight
- Name of person to be notified in case of an accident
- Allergies
- Particular sensitivities
- Does he/she wear contact lenses
- Short checklist of previous illness

- Name of personal physician and phone
- Name of company physician and phone
- Prescription and non-prescription medications currently used.

A sample medical data sheet is included in Attachment T.

16.2 Responsibilities

16.2.1 Health and Safety Officer (HSO)

The HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The HSO is responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can notify OSHA within the required time frame.

16.2.2 Emergency Coordinator

The HSO or their designated alternate will serve as the Emergency Coordinator. The Emergency Coordinator is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. They are also responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The Emergency Coordinator is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized.

The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator is responsible for implementing the Emergency Response Plan.

16.2.3 Site Personnel

Project site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency. Project site personnel, including all subcontractors will be trained in the Emergency Response Plan.

16.3 Communications

Once an emergency situation has been stabilized, or as soon as practically, the injured Langan personnel should contact *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

16.4 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during investigative activities at the site, the Emergency Notification Numbers (Table 5) will be posted and provided to all personnel conducting work within the EZ.

Figure 2 shows the hospital route map. Outside emergency number 911 and local ambulance should be relied on for response to medical emergencies and transport to emergency rooms. Always contact first responders when there are serious or life threatening emergencies on the site. Project personnel are instructed not to drive injured personnel to the Hospital. In the event of an injury, provide first aid and keep the injured party calm and protected from the elements and treat for shock when necessary.

16.5 Pre-Emergency Planning

Langan will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this HASP 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 Vehicles
- Emergency Eye Wash: Contractor Vehicles

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person

can be transported to the hospital, will be followed closely.

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.

In the event that an emergency situation arises, the FTL will implement an immediate evacuation of all project personnel due to immediate or impending danger. The FTL will also immediately communicate with the contractor to coordinate any needed evacuation of the property.

The FTL or Site Supervisor will give necessary instructions until the Designated Incident Commander (IC) assumes control. After the emergency has been resolved, the FTL or Site Supervisor will coordinate with the IC and indicate when staff should resume their normal duties. If dangers are present for those at the designated assembly point, another designated location of assembly will be established.

It will be the responsibility of the FTL or Site Supervisor to report a fire or emergency, assess the seriousness of the situation, and initiate emergency measures until the arrival of the local fire fighters or other first responders, should they be necessary. The FTL, working with emergency responders, may also order the closure of the Site for an indefinite period as long as it is deemed necessary.

Under no circumstances will incoming visitors be allowed to proceed to the area of concern, once an emergency evacuation has been implemented. Visitors or other persons present in the area of the emergency shall be instructed to evacuate the area. The FTL will ensure that access roads are not obstructed and will remain on-site to provide stand-by assistance upon arrival of

emergency personnel.

If it is necessary to temporarily control traffic in the event of an emergency, those persons controlling traffic will wear proper reflection warning vests until the arrival of police or fire personnel.

16.8.1 Designated Assembly Locations

All personnel will evacuate the site and assemble at a designated assembly location. The assembly location will be designated by Langan personnel and discussed during each shift's pre-job safety briefing.

16.8.2 Accounting for Personnel

All contractor and subcontractor supervisors are responsible for the accounting of all personnel assembled at the designed assembly area. The Designated Incident Commander shall be notified if personnel are not found.

16.9 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site and notification of the Langan Project Manager of the investigation activities. Portable fire extinguishers will be provided at the work zone. The extinguishers located in the various locations should also be identified prior to the start of work. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

16.9.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials.
    - Storage of flammable liquids and gases away from oxidizers.
    - Shutting off engines to refuel.
    - Grounding and bonding metal containers during transfer of flammable liquids.
    - Use of UL approved flammable storage cans.
    - Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities.

The person responsible for the control of fuel source hazards and the maintenance of fire prevention and/or control equipment is the HSO.

16.10 Significant Vapor Release

Based on the proposed tasks, the potential for a significant vapor release is low. However, if a release occurs, the following steps will be taken:

- Move all personnel to an upwind location. All non-essential personnel shall evacuate.
- Upgrade to Level C Respiratory Protection.
- Downwind perimeter locations shall be monitored for volatile organics.
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator shall notify the Langan Project Manager.
- Local emergency response coordinators will be notified.

16.11 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet (MSDS) will be followed, when necessary.

SKIN AND EYE: Use copious amounts of soap and water from eye-wash kits and portable hand wash stations.

CONTACT: Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Skin shall also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs. Affected items of clothing shall also be removed from contact with skin.

Providing wash water and soap will be the responsibility of each individual contractor or subcontractor on-site.

16.12 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted. The HSO or designee will accompany contaminated victims to the medical facility to advice on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life

to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

16.13 Adverse Weather Conditions

In the event of adverse weather conditions, the HSO will determine if work will continue without potentially risking the safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds).
- Limited visibility (fog).
- Potential for electrical storms.
- Earthquakes.
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

16.14 Spill Control and Response

All small spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining proper waste characterization and the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill.

All contractor vehicles shall have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment shall be inspected prior to be admitted on site. Any vehicle or piece of equipment that develops a leak will be taken out of service and removed from the job site.

The following seven steps shall be taken by the Emergency Coordinator:

1. Determine the nature, identity and amounts of major spills.

2. Make sure all unnecessary persons are removed from the spill area.
3. Notify the HSO immediately.
4. Use proper PPE in consultation with the HSO.
5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosion-proof equipment to contain or clean up the spill (diesel-only vehicles, air-operated pumps, etc.)
6. If possible, try to stop the leak with appropriate material.
7. Remove all surrounding materials that can react or compound with the spill.

In addition to the spill control and response procedures described in this HASP, Langan personnel will coordinate with the designated project manager relative to spill response and control actions. Notification to the Project Manager must be immediate and, to the extent possible, include the following information:

- Time and location of the spill.
- Type and nature of the material spilled.
- Amount spilled.
- Whether the spill has affected or has a potential to affect a waterway or sewer.
- A brief description of affected areas/equipment.
- Whether the spill has been contained.
- Expected time of cleanup completion. If spill cleanup cannot be handled by Langan's on-site personnel alone, such fact must be conveyed to the Project Manager immediately.

Langan shall not make any notification of spills to outside agencies. The client will notify regulatory agencies as per their reporting procedures.

16.15 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on site:

- Industrial first aid kit.
- Fire extinguishers (one per site).

16.16 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers.
- Refilling medical supplies.
- Recharging eyewashes and/or showers.

- Replenishing spill control supplies.

16.17 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the HSO and affected employee will complete and submit an Employee Exposure/Injury Incident Report (Attachment C) to the Langan Corporate Health and Safety Manager as soon as possible following the incident.

17.0 SPECIAL CONDITIONS

This guideline contains information and requirements for special conditions that may not be routinely encountered.

17.1 Scope

The guideline applies to the specific projects identified within this document. Additional provisions will be addressed in each Site-Specific HEALTH AND SAFETY PLAn (HASP), as needed.

17.2 Responsibilities

Site Personnel - All site personnel must be alert to safety hazards on work sites and take action to minimize such hazards. Personnel must utilize the buddy system, watch for inappropriate behavior, and be alert to changes in site conditions.

Health and Safety Officer (HSO) - The HSO is responsible for considering these procedures in the development of site specific HASPs. The HSO shall schedule frequent "tail gate" safety briefings to enhance safety awareness and discuss potential problems.

17.3 Procedures

The procedures outlined below shall be followed when such conditions are encountered.

17.3.1 Ladders

Langan safety procedures shall be used to ensure employee safety when using ladders in the office or work sites. All ladders shall be coated or repaired to prevent injury to the employee from punctures or lacerations and to prevent snagging or clothing. Any wood ladders used must

have an opaque covering except for identification or warning labels, which may be placed on one face only of a side rail.

17.3.1.1 Ladder Use

Employees shall only use ladders for the purposes, which they were designed and shall not be used as scaffolding. Ladders will be maintained and inspected prior to use for slip hazards including oil and grease. Employees shall use ladders only on stable and level surfaces unless the ladder is secured to prevent possible displacement. Ladders should not be used on slippery surfaces unless secured or provided with slip resistant feet to prevent accidental displacement. Ladders should not be used in locations where they could be displaced by workplace activities or traffic. Ladder rungs, cleats and steps shall be parallel, level and uniformly spaced when the ladder is in the use position.

Employees should not be carrying anything including equipment that could cause injury if there was a fall while utilizing the ladder. The top and bottom of the ladder area must remain clear while in use. When ascending and descending the ladder, employees must face the ladder.

Ladders shall not be loaded beyond the maximum intended load for which they were built or the manufacturer's rated capacity.

17.3.1.2 Portable Ladders

Rungs, cleats and steps for portable ladders and fixed ladders shall be spaced not less than 10 inches apart, nor more than 14 inches apart, as measured between center lines of the rungs, cleats and steps. When used to access an upper landing surface, the ladder side rails must extend at least three feet above the upper landing surface to which the ladder is used to gain access. If this is not possible, due to the ladders length, then the top of the ladder shall be secured at its top to a rigid support.

17.3.1.3 Step Stools

Rungs, cleats and steps of step stools shall not be less than 8 inches apart, nor more than 12 inches apart, as measured between center lines of the rungs, cleats and steps.

17.3.1.4 Extension Ladders

Rungs, cleats and steps of the base section of extension trestle ladders shall be spaced not less than 8 inches apart, nor more than 18 inches apart, as measured between center lines of the rungs, cleats and steps. The rung spacing on the extension section of the extension trestle ladder

shall not be less than 6 inches nor more than 12 inches, as measured between center lines of the rungs, cleats and steps. Ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

17.3.1.5 Inspection

Ladders will be inspected for visible detects periodically, prior to utilization or after any occurrence that could have negatively affected the ladder. Portable ladders with defects including broken or missing rungs, cleats, or steps, broken or split rails, corroded components or other faulty or defective components shall not be used. The ladder will be immediately marked as defective, tagged as "Do Not Use" or blocked from being used and removed from service until repaired.

17.3.2 First Aid/Cardiopulmonary Resuscitation (CPR)

Langan field and office personnel will be encouraged to be trained in First Aid and Cardiopulmonary Resuscitation (CPR). Training will be provided free of charge by Langan to all employees. Employees will receive a training certificate that will be kept on file with the Health & Safety Coordinator (HSC). Training and certification will be provided by a credited provider such as American Red Cross or equivalent.

17.3.2.1 Emergency Procedures

Prior to work at sites the Langan employees certified in first aid and CPR will be identified in the site specific HASP. Langan will endear to have at least one employee at a job site trained and able to render first aid and CPR. The site specific HASP will contain first aid information on both potential chemical and physical hazards. Emergency procedures to be followed are in case of injury or illnesses are provided in the HASP. The HASP will include emergency contact information including local police and fire departments, hospital emergency rooms, ambulance services, on-site medical personnel and physicians. The HASP will also include directions and contact information to the nearest emergency facility in case immediate medical attention is required. The emergency contact information will be conspicuously posted at the worksite. Employees that are injured and require immediate medical attention shall call either 911 or the local posted emergency contacts. Employees should use ambulatory services to transport injured workers to the nearest facility for emergency medical care. In areas where 911 is not available, the telephone numbers of the physicians, hospitals, or ambulances shall be conspicuously posted.

17.3.2.2 First Aid Supplies

First aid supplies are readily available to all Langan employees when required. First aid kits are located in each Langan office. Portable first aid kits are available for employees to use at work sites. First aid kits should consist of items needed to treat employees for potential chemical and physical injuries. At a minimum, first aid kits should contain items to allow basic first aid to be rendered. Where the eyes or body of an employee may be exposed to corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use including eye wash.

First aid kits will be weatherproof with individual sealed packages of each item. All portable first aid kits shall be inspected by Langan employees before and after use to ensure all used items are replaced. When out in the field, employees shall check first aid kits weekly to ensure used items are replaced.

17.3.3 Hydrogen Sulfide

Langan employees with the potential to be exposed to hydrogen sulfide while at work sites shall have training in hydrogen sulfide awareness. The training will include identification of areas where employees could be exposed to hydrogen sulfide, health effects, permissible exposure limits, first aid procedures and personnel protective equipment. Langan employees could be exposed to hydrogen sulfide while at job sites including petroleum refineries, hazardous waste treatment, storage and disposal facilities, uncontrolled hazardous waste sites and remediation projects.

17.3.3.1 Characteristics

Hydrogen sulfide is a colorless gas with a strong odor of rotten eggs that is soluble in water. Hydrogen sulfide is used to test and make other chemicals. It is also found as a by-product of chemical reactions, such as in sewer treatment. It is a highly flammable gas and a dangerous fire hazard. Poisonous gases are produced in fires including sulfur oxides. Hydrogen sulfide is not listed as a carcinogen.

17.3.3.2 Health Effects

Hydrogen Sulfide can affect employees if inhaled or through contact with skin or eyes. Acute (or short term) health effects of hydrogen sulfide exposure include irritation of the nose and throat, dizziness, confusion, headache and trouble sleeping. Inhalation of hydrogen sulfide can irritate the lungs causing coughing and/or shortness of breath. Higher levels of exposure can cause build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic (or long term) health effects of low levels of exposure to hydrogen sulfide can cause pain and redness of the eyes with blurred vision. Repeated exposure may cause bronchitis with cough, phlegm and shortness of breath.

17.3.3.3 Protective Clothing and Equipment

Respirators are required for those operations in which employees will be exposed to hydrogen sulfide above OSHA permissible exposure level. The maximum OSHA permissible exposure limit (PEL) for hydrogen sulfide is 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm) for an 8-hour workday and the maximum short-term exposure limit (STEL) is 10 ppm for any 10-minute period.

Where employees are exposed to levels up to 100 parts of hydrogen sulfide vapor per million parts of air (100 ppm), the following types of respiratory protection are allowed:

- Any powered, air purifying respirator with cartridge(s);
- Any air purifying, full-facepiece respirator (gas mask) with a chin style, front- or back-mounted canister;
- Any supplied air system with escape self-contained breathing apparatus, if applicable; and,
- Any self-contained breathing apparatus with a full facepiece.

Respirators used by employees must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval. Cartridges or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. Langan employees that have the potential to be exposed to hydrogen sulfide will be trained in the proper use of respirators. Respirator training is discussed under– Langan's Respiratory Protection Program.

Employees with potential exposure to hydrogen sulfide, or when required by the client, will wear a portable hydrogen sulfide gas detector. The detector should have an audible, visual and vibrating alarm. The detector may also provide detection for carbon monoxide, sulfur dioxide and oxygen deficient atmospheres. The hydrogen sulfide monitor will, at a minimum, be calibrated to detect hydrogen sulfide at a level of 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm). Many portable gas detectors will have factory defaults with a low level alarm at 10 ppm and a high level alarm at 15 ppm. Langan employees shall consult clients to determine if any site specific threshold levels exist.

If the hydrogen sulfide gas detector sounds and employees are not wearing appropriate respiratory protection, employees must immediately vacate the area and meet at the assigned

emergency location. Langan employees may not re- enter the site without proper respiratory protection and approval from the client or property owner, if needed.

Employees shall wear PPE to prevent eye and skin contact with hydrogen sulfide. Employees must wear appropriate protective clothing including boots, gloves, sleeves and aprons, over any parts of their body that could be exposed to hydrogen sulfide. Non-vented, impact resistant goggles should be worn when working with or exposed to hydrogen sulfide.

17.3.3.4 Emergency and First Aid Procedures

Eye and Face Exposure

If hydrogen sulfide comes in contact with eyes, it should be washed out immediately with large amounts of water for 30 minutes, occasionally lifting the lower and upper eye lids. Seek medical attention immediately.

Skin Exposure

If hydrogen sulfide contaminates clothing or skin, remove the contaminated clothing immediately and wash the exposed skin with large amounts of water and soap. Seek medical attention immediately. Contaminated clothing should either be disposed of or washed before wearing again.

Breathing

If a Langan employee or other personnel breathe in hydrogen sulfide, immediately get the exposed person to fresh air. If breathing has stopped, artificial respiration should be started. Call for medical assistance or a doctor as soon as possible.

Safety Precautions

Hydrogen sulfide is a highly flammable gas and a dangerous fire hazard. Containers of hydrogen sulfide may explode in a fire situation. Poisonous gases are produced during fires.

Langan employees should contact property owners and operators prior to conducting work onsite to be aware of any site specific contingency plans, identify where hydrogen sulfide is used at the facility and be informed about additional safety rules or procedures.

19.3.4 Fire Protection/Extinguishers

Langan field personnel that have been provided with portable fire extinguishers for use at

worksites will be trained to familiarize employees with general principles of fire extinguisher use and hazards associated with the incipient stage of firefighting. Training will be provided prior to initial assignment for field work and annually thereafter.

Portable fire extinguishers shall be visually inspected monthly and subjected to an annual maintenance check. Langan shall retain records of the annual maintenance date.

17.3.5 Overhead lines

When field work is performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before the work shall commence. If overhead lines are to be deenergized, arrangements shall be made with the client, property owner or organization that operates or controls the electric circuits involved to deenergize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

When unqualified Langan personnel are working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object they may contact cannot come closer to any unguarded, energized overhead line than the following distances:

1. For voltages to ground 50kV or below - 10 feet; and
2. For voltages to ground over 50kV - 10 feet, plus 4 inches for every 10kV over 50kV.

As previously indicated, Langan does not retain qualified employees to perform work on energized equipment.

17.3.5.1 Vehicle and Equipment Clearance

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 feet is maintained. If the voltage of the overhead lines is higher than 50kV, the clearance shall be increased 4 inches for every 10kV over that voltage.

If any of the following discussed conditions occur, the clearance may be reduced.

- If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10 kV over that voltage.
- If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to

the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless the employee is using protective equipment rated for the voltage; or the equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the overhead line than permitted.

If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

17.3.6 Trade Secret

Langan employees could potentially be provided trade secret information by the client or property owner when site specific information is provided about highly hazardous chemicals. Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Langan employees understand that this information should be kept confident and if required, may enter into a confidentially agreement with the client.

17.3.7 Bloodborne Pathogens

Langan employees that can reasonably anticipate exposure to blood or other potentially infectious material while at work sites shall have training in bloodborne pathogens. Applicable employees would include those trained in first aid and serving a designated role as an emergency medical care provider. Bloodborne pathogens are pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus and human immunodeficiency virus.

17.3.7.1 Training

Langan employees with potential occupational exposure to blood or other potentially infectious material must participate in a training program. Training must be conducted prior to initial

assignment where there would be potential for exposure and annually thereafter within one year of previous training. The training program will be provided to Langan employees at no cost to them and during working hours.

Langan will ensure the training program shall consist of the following:

- An accessible copy of the regulatory text of 29 CFR 1910.1030 and an explanation of its contents;
- A general explanation of the epidemiology and symptoms of bloodborne diseases;
- An explanation of the modes of transmission of bloodborne pathogens;
- An explanation of Langan's exposure control plan and the means by which the employee can obtain a copy of the written plan;
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials;
- An explanation of the use and limitations of personal protective
    - equipment (PPE) to prevent and reduce exposure;
    - Information on the types, proper use, location, removal, handling and disposal of PPE;
    - An explanation of the basis for selection of PPE;
    - Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge;
    - Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;
    - An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available;
    - Information on the post-exposure evaluation and follow-up that the
    - employer is required to provide for the employee following an exposure incident;
    - An explanation of the signs and labels and/or color coding required by paragraph 29 CFR 1910.1030(g)(1); and
    - An opportunity for interactive questions and answers with the person conducting the training session.

Langan will develop and implement a written Exposure Control Plan, which will be designed to eliminate or minimize employee exposure to bloodborne pathogens. The Exposure Control Plan will contain the following elements:

- An exposure determination for employees;
- The schedule and method of implementation for Methods of Compliance (29 CFR 191.1030(d)), Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up (29 CFR 1910.1030(f)), Communication of Hazards to Employees (29 CFR 1910.1030(g)) and

(h) Recordkeeping (29 CFR 1910.1030(h));

- The procedure for the evaluation of circumstances surrounding exposure incidents;
- Ensure a copy of the Exposure Control Plan will be accessible to employees; and,
- The Exposure Control Plan shall be reviewed and updated at least annually.

Langan employees with occupational exposure to bloodborne pathogens include any employees trained in first aid that would be expected to provide emergency medical care. This determination is made without regards to the use of PPE, which could eliminate or minimize exposure.

Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for bloodborne pathogens. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

Work practice controls shall be used to eliminate or minimize employee exposure, if applicable. Since Langan employees will have occupational exposure only during rendering of first aid, personnel protective equipment will be utilized to reduce or minimize exposure. PPE that could be available to Langan personnel when administering first aid includes safety glasses, gloves, and Tyvek suits or sleeves. PPE and first aid kits will be provided to employees at no cost to them.

Langan employees that render first aid in office areas will have access to hand washing facilities or restrooms. For first aid rendered at field locations, first aid kits will contain an appropriate antiseptic hand cleanser and clean cloth/paper towels or antiseptic towelettes. After using antiseptic hand cleansers or towelettes, employees shall wash their hands with soap and running water as soon as feasible.

After administering first aid, potentially infectious materials, including towels, personnel protective equipment, clothes and bandages, shall be placed in a container, which prevents leakage during collection, handling, processing, storage, transport, or shipping. All PPE will be dispose of after use. Any equipment or working surfaces which was been exposed to blood or potentially infectious materials due to an injury, will be decontaminated prior to reuse.

Langan will make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. These services will be available to the employee at no cost to them through a medical provider.

17.3.7.2 Recordkeeping

Langan will maintain training and medical records for each employee with occupational exposure to blood or potentially infectious materials. Medical and training records will be maintained by Langan's H&S Department.

Training records will include the following:

- Dates of the training sessions;
- Contents or a summary of the training sessions;
- Names and qualifications of persons conducting the training; and
- Names and job titles of all persons attending the training sessions.

Training records shall be maintained for 3 years from the date on which the training occurred. Medical records will be will be preserved and maintained for the duration of employment plus 30 years.

All records will be made available upon request to employees, the Assistant Secretary of Labor for Occupational Safety and Health, and Director of National Institute for Occupational Safety and Health Director of OSHA for examination and copying. Medical records must have written consent from employee before releasing.

If Langan ceases to do business, all records shall be transferred to the successor employer. The successor employer shall receive and maintain these records.

If there will not be a successor, Langan will notify current employees of their rights to access records at least three months prior to the cessation of business.

18.0 RECORDKEEPING

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

18.1 Field Change Authorization Request

Any changes to the work to be performed that is not included in the HASP will require an addendum that is approved by the Langan project manager and Langan HSM to be prepared. Approved changes will be reviewed with all field personnel at a safety briefing.

18.2 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training, documentation of three-day OJT, and respirator fit-test records) and medical clearance for site work and respirator use will be maintained in the office and available upon request. Records for all subcontractor employees must also be available upon request. All employee medical records

will be maintained by the HSM.

18.3 Onsite Log

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

18.4 Daily Safety Meetings ("Tailgate Talks")

Completed safety briefing forms will be maintained by the HSO.

18.5 Exposure Records

All personal monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be maintained by the HSO during site work. At the end of the project they will be maintained according to 29 CFR 1910.1020.

18.6 Hazard Communication Program/MSDS-SDS

Material safety data sheets (MSDS) of Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this HASP (Attachment D). Langan's written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

18.7 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan incident/injury hotline at 1-800-952-6426, extension 4699 and the Project Manager to report the incident or near miss. The Project Manager will contact the client or client representative. A written report must be completed and submitted HSM within 24 hours of the incident. For emergencies involving personnel injury and/or exposure, employee will complete and submit the Langan incident/injury report to the Langan corporate health and safety manager as soon as possible following the incident. Accidents will be investigated in-depth to identify all causes and to recommend hazard control measures.

18.7.1 Accident and Injury Report Forms

18.7.1.1 Accident/Incident Report

All injuries, no matter how slight, shall be reported to the FTL and the PM immediately. The accident/incident report forms, attached in Attachment U and Attachment V will be filled out on all accidents by the applicable contractor supervision personnel, the FTL, or the HSO. Copies of all accident/incident reports shall be kept on-site and available for review. Project personnel will be instructed on the location of the first aid station, hospital, and doctor and ambulance service

near the job. The emergency telephone numbers will be conspicuously posted in site vehicles near the work zone. First aid supplies will be centrally located and conspicuously posted between restricted and non-restricted areas to be readily accessible to all on the site.

18.7.1.2 First Aid Treatment Record

The forms in will be used for recording all non-lost time injuries treated by the project first-aid attendant, the local physician or hospital will be entered in detail on this record. "Minor" treatment of scratches, cuts, etc. will receive the same recording attention as treatment of more severe injuries.

18.7.1.3 OSHA Form 300

An OSHA Form 300 will be kept at the Langan Corporate Office in Parsippany, New Jersey. All recordable injuries or illnesses will be recorded on this form. Subcontractor employers must also meet the requirements of maintaining an OSHA 300 form. The Incident Report form used to capture the details of work-related injuries/illnesses meets the requirements of the OSHA Form 301 (supplemental record) and must be maintained with the OSHA Form 300 for all recordable injuries or illnesses. Forms for recording OSHA work-related injuries and illnesses are included in Attachment U and Attachment V.

19.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the Site during planned construction activities. If confined spaces are identified, the contractor must implement their own confined space program that all applicable federal, state and local regulations. Confined spaces **will not** be entered by Langan personnel.

20.0 HASP ACKNOWLEDGEMENT FORM

All Langan personnel and contractors will sign this HASP Compliance Agreement indicating that they have become familiar with this HASP 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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	1,1'-Biphenyl 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 – 1.3.9	1,1-Dichloroethane Asymmetrical dichloroethane Ethylidene chloride 1,1-Ethylidene dichloride 1,1-DCA	75-34-3	PID	100 ppm 3000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the skin; central nervous system depression; liver, kidney, lung damage	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	1,2,3-Trichlorobenzene vic-Trichlorobenzene 1,2,6-Trichlorobenzene	87-61-6	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 – 1.3.9	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 – 1.3.9	1,2,4-Trichlorobenzene Unsym-Trichlorobenzene 1,2,4-Trichlorobenzol	120-82-1	NA	None None	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; In Animals: liver, kidney damage; possible teratogenic effects	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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 – 1.3.9	1,2-Dichlorobenzene	95-50-1	PID	50 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eye, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	1,2-Dichloroethane Ethylene dichloride 1,2-DCA DCE[1] Ethane dichloride Dutch liquid, Dutch oil Freon 150 Glycol dichloride	107-06-2	PID	1 ppm 50 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin absorption, skin and/or eye contact	irritation to the eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	1,2-Dichloroethene 1,2-Dichloroethylene 1,2-DCE Total 1,2-Dichloroethene cis-1,2-Dichloroethylene mixture of cis and trans Acetylene dichloride cis-Acetylene dichloride sym-Dichloroethylene cis- 1,2-Dichloroethene cDCE 1,1-dimethyl-;dimethyl1,1-cyclohexane	156-59-2 540-59-0	PID	200 ppm 4000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene	106-99-0	PID	1 ppm 2000 ppm	Vapor	inhalation, skin and/or eye contact (liquid)	irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.9	1,4-Dichlorobenzene para-Dichlorobenzene p-Dichlorobenzene p-DCB PDB Paramoth Para crystals Paracide Dichlorocide	106-46-7	PID	75 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	2,4,5-Trichlorophenoxyacetic acid 2,4,5-T Trioxone	93-76-5	NA	10 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.9	2,4-Dichlorophenoxyacetic acid 2,4-D hedonal trinoxol	94-75-7	NA	10 ppm 100 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.9	2,4-Dimethylphenol 2,4-Xylenol m-Xylenol 1-Hydroxy-2,4-dimethylbenzene 2,4-Dimethylphenol 4-Hydroxy-1,3-dimethylbenzene 4,6-Dimethylphenol 1,3-Dimethyl-4-hydroxybenze	105-67-9	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache, narcosis, coma; dermatitis; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	2-Butanone Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.9	2-Hexanone Butyl methyl ketone MBK Methyl butyl ketone Methyl n-butyl ketone	591-78-6	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; peripheral neuropathy: lassitude (weakness, exhaustion), paresthesia; dermatitis; headache, drowsiness	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	4,4′-DDD Dichlorodiphenyldichloroethane 1,1'-(2,2-Dichloroethylidene)bis (4-chlorobenzene)	72-54-8	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	4-Isopropyltoulene 1-Methyl-4-(1-methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; 1-Methyl-4-isopropylbenzene Dolcymene Camphogen Paracymene Cymene p-Cymene p-Isopropyltoluene	99-87-6	PID	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	4-Nitroaniline p-Nitroaniline 1-Amino-4-nitrobenzene	100-01-6	NA	6 mg/m^3 300 mg/m^3	Soil	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Remove 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 – 1.3.9	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 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Acetophenone 1-phenylethanone Methyl phenyl ketone Phenylethanone	98-86-2	None	NA NA	Groundwater 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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Alpha-BHC alpha-Hexachlorocyclohexane -alpha,2-alpha,3-beta,4-alpha,5-beta,6-beta-Hexachlorocyclohexane alpha-1,2,3,4,5,6-Hexachlorocyclohexane alpha-Benzenehexachloride α-1,2,3,4,5,6-hexachlorocyclohexane α-HCH α-Benzenehexachloride alpha-hexacloran(e) alpha-Lindane Alpha Hexachlorocyclohexane	319-84-6	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane possible carcinogenic, effects to liver, blood, and central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Alpha-Chordane	5103-71-9	None	0.5 mg/m³ 100 mg/m³	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Aluminum	7429-90-5	None	0.5 mg/m3 50 mg/m3	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.9	Anthracene	120-12-7	PID	0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to the skin, eyes, mucous membranes and upper respiratory tract, abdominal pain if ingested.	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention; Swallow: refer to medical attention

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	Aroclor 1254	11097-69-1	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 – 1.3.9	Aroclor 1260	11096-82-5	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 – 1.3.9	Aroclor 1268	11100-14-4	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 – 1.3.9	Arsenic	NA	None	0.5 mg/m³ NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Barium	10022-31-8	None	0.5 mg/m³ 50 mg/m³	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Benzene Benzol Phenyl hydride	71-43-2	PID	3.19 mg/m³ 1,595 mg/mg³	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m³ 80 mg/m³ (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	Benzyl Alcohol Benzenemethanol Phenyl carbinol alpha-Hydroxytoluene Benzoyl alcohol Phenyl methanol	100-51-6	PID	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.9	Benzyl butyl phthalate Butyl benzyl phthalate Butylbenzylphthalate	86-66-7	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid	
1.3.1 – 1.3.9	Beryllium	7440-41-7	None	0.002 mg/m³ 4 mg/m³	Soil	inhalation, skin and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air	
1.3.1 – 1.3.9	Beta-Endosulfan Beta Endosulfan Endosulfan II (beta) Endosulfan II	33213-65-9	None	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: imme Skin: imme Breat Resp supp Swal atten imme
1.3.1 – 1.3.9	Bis(2-ethylhexyl)phthalate Bis(2-Ethylhexyl) Phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate bis(2-ethylexyl)phthalate Bis(2-Ethylhexyl) Phthalate	117-81-7	None	5 mg/m³ 5000 mg/m³	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	

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Cadmium	7440-43-9	None	0.005 mg/m³ 9 mg/m³	Soil	inhalation, ingestion	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Calcium	7440-70-2	None	NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Carbon disulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.9	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 – 1.3.9	Chloroform Methane trichloride Trichloromethane Chloro-3-methyl phenol	67-66-3	None	50 ppm 500 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Chromium Total Chromium Chromium, Total	7440-47-3	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	cis-1,2-Dichloroethene	156-59-2	PID	200 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, respiratory system; central nervous system depression	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Cis-Chlordane Cic-Chlordane a-Chlordane alpha 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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	Copper	7440-50-8	None	1.0 mg/m^3 100 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Cyanide	57-12-5	None	5 mg/m^3 25 mg/m^3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	DDE 4,4-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
1.3.1 – 1.3.9	DDT 4,4-DDT 4,4′-DDT p,p′-DDT Dichlorodiphenyltrichloroethane 1,1,1-Trichloro-2,2-bis(p-chlorophenyl)ethane	50-29-3	None	1 mg/m^3 500 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Delta BHC Delta-BHC Delta-hexachlorocyclohexane Delta Hexachlorocyclohexane	319-86-8	None	0.5 mg/m^3 50 mg/m^3	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; headache; nausea; clonic convulsions; resp difficulty; cyanosis; aplastic anemia; muscle spasm; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Dibenz(a,h)anthracene Dibenzo(a,h)anthracene	53-70-3	PID	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately
1.3.1 – 1.3.9	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 – 1.3.9	Dibutyl phthalate Di-n-butyl phthalate Butyl phthalate n-Butyl phthalate 1,2-Benzenedicarboxylic acid dibutyl ester o-Benzenedicarboxylic acid dibutyl ester DBP Palatinol C, Elaol Dibutyl-1,2-benzene-dicarboxylate Di-n-butylphthalate	84-74-2	None	5 mg/m^3 4000 mg/m^3	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, upper respiratory system, stomach	Eye: Irrigate immediately Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Dichlorodifluoromethane Difluorodichloromethane, Fluorocarbon 12 Freon 12 Freon® 12 Genetron® 12 Halon® 122 Propellant 12 Refrigerant 12 Dichlorodifluromethane	75-71-8	None	1000 pp, 15,000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Dieldrin HEOD 1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-endo exo-5,8-dimethanonaphthalene	60-57-1	PID	0.25 mg/m^3 50 mg/m^3	Groundwater Soil Water	inhalation, skin absorption, ingestion, skin and/or eye contact	headache, dizziness; nausea, vomiting, malaise (vague feeling of discomfort), sweating; myoclonic limb jerks; clonic, tonic convulsions; coma; [potential occupational carcinogen]; in animals: liver, kidney damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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 – 1.3.9	Diethyl phthalate DEP Diethyl ester of phthalic acid Ethyl phthalate Diethylphthalate	84-66-2	PID	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat; headache, dizziness, nausea; lacrimation (discharge of tears); possible polyneuropathy, vestibular dysfunc; pain, numb, lassitude (weakness, exhaustion), spasms in arms & legs; In Animals: reproductive effects	Eye: Irrigate immediately Skin: Wash regularly 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 – 1.3.9	Dimethyl phthalate Dimethylphthalate dimethyl benzene-1,2-dicarboxylate	131-11-3	None	5 mg/m3 2000 mg/m3	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, upper respiratory system; stomach pain	Eye: Irrigate promptly Skin: Wash regularly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Endosulfan I Alpha Endosulfan	959-98-8	None	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation skin; nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions, headache; in animals: kidney, liver injury; decreased testis weight	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Endosulfan sulfate 1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol, cyclic sulfate 6,7,8,9,10,10-hexachloro01,5,5a,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3,3-dioxide	1031-07-8	None	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Hypersensitive to stimulation, sensation of prickling, tingling or creeping on skin. Headache, dizziness, nausea, vomiting, incoordination, tremor, mental confusion, hyperexcitable state. In severe cases: convulsions, seizures, coma and respiratory depression.	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Endrin aldehyde	7421-93-4	None	0.1 mg/m3 2 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Endrin ketone	53494-70-5	None	0.1 mg/m3 2 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	epileptiform convulsions; stupor, headache, dizziness; abdominal discomfort, nausea, vomiting; insomnia; aggressiveness, confusion; drowsiness, lassitude (weakness, exhaustion); anorexia; in animals: liver damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethylic alcohol EtOH ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol	64-17-5	PID	1000 ppm 3300 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	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
1.3.1 – 1.3.9	Fluorene	86-73-7	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 attenti

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	gamma-Chlordane Gamma Chlordane	5566-34-7	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Goundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Hexavalent Chromium Chromium VI Chromium, Hexavalent	18540-29-9	None	1.0 mg/m^3 250 mg/m^3	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Indeno(1,2,3-cd)pyrene Indeno(1,2,3-c,d)Pyrene Indeno(1,2,3-cd)Pyrene	193-39-5	None	0.2 mg/m^3 80 mg/m^3 (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately, wash mouth with water
1.3.1 – 1.3.9	Iron	7439-89-6	None	10 mg/m^3 NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Isopropyl alcohol Iso-Propyl Alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol Isopropylalcohol	67-63-0	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	m-Cresol meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Mercury	7439-97-6	None	0.1 mg/m³ 10 mg/m³	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Methoxychlor 4,4'-Methoxychlor p,p'-Dimethoxydiphenyltrichloroethane DMDT Methoxy-DDT 2,2-bis(p-Methoxyphenyl)-1,1,1-trichloroethane 1,1,1-Trichloro-2,2-bis-(p-methoxyphenyl)ethane	72-43-5	None	15 mg/m³ 5000 mg/m³	Groundwater Soil Vapor	inhalation, ingestion	fasciculation, trembling, convulsions; kidney, liver damage; [potential occupational carcinogen]	Skin: Soap wash Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Methyl Chloride Chloromethane Monochloromethane Refrigerant-40 R-40	74-87-3	NA	100 ppm 2000 ppm	Groundwater Soil	inhalation, skin and/or eye contact	dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.9	Methyl *tert*-butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe Methyl tert butyl ether	1634-04-4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Methylene Chloride Dichloromethane Methylene dichloride	75-09-2	PID	25 ppm 2300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	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 – 1.3.9	n-Butylbenzene Butylbenzene 1-phenylbutane	104-51-8	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Nickel	7440-02-0	None	NA 10 mg/m^3	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	o-Cresol ortho-Cresol 2-Cresol o-Cresylic acid 1-Hydroxy-2-methylbenzene 2-Hydroxytoluene 2-Methyl phenol 2-Methylphenol 2-Metyhlphenol	95-48-7	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediatelyethylphhhhhhhhhh
1.3.1 – 1.3.9	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 – 1.3.9	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	p-Dichlorobenzene p-DCB 1,4-Dichlorobenzene para-Dichlorobenzene Dichlorocide	106-46-7	PID	75 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	p-Ethyltoluene 4-Ethyltoluene 1-ethyl-4-methyl-benzene 1-methyl-4-ethylbenzene	622-96-8	NA	NA NA	Soil	ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	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 – 1.3.9	sec-Butylbenzene	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Silver	7440-22-4	None	0.01 mg/m³ 10 mg/m³	Soil	inhalation, ingestion, skin and/or eye contact	blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Silvex 2-(2,4,5-Trichlorophenoxy)propionic acid Fenoprop 2,4,5-TP Acid 2,4,5-TP	93-72-1	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention
1.3.1 – 1.3.9	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 – 1.3.9	Styrene Ethenyl benzene Phenylethylene Styrene monomer Styrol Vinyl benzene	100-42-5	PID	100 ppm 700 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Tert-Butyl Alcohol Tertiary Butyl Alcohol Tert-Butanol Butyl alcohol 2-Methyl-2-propanol Trimethyl carbinol TBA	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	tert-Butylbenzene *t*-Butylbenzene 2-Methyl-2-phenylpropane Pseudobutylbenzene	98-06-6	PID	10 ppm NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	eye, skin irritation; dry nose, throat; headaches; low blood pressure, tachycardia; abnormal cardiovascular system; central nervous system depression; hematopoietic depression	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Tetrachloroethylene Perchlorethylene Perchloroethylene PCE Perk Tetrachlorethylene Tetrachloroethene	127-18-4	PID	100 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Thallium	7440-28-0	None	0.1 mg/m^3 15 mg/m^3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	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

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	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 – 1.3.9	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 – 1.3.9	Trans-1,2-Dichloroethene trans-1,2-Dichloroethylene tDEC trans-Acetylene dichloride	156-60-5	PID	200 ppm 4000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.9	Trans-Chlordane	5103-74-2	None	0.5 mg/m³ 100 mg/m³	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Trichloroethylene Ethylene trichloride TCE Trichloroethene Trilene	79-01-6	PID	100 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.9	Trivalent Chromium Chromium III Chromium, Trivalent	NA	None	1.0 mg/m³ 250 mg/m³	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	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 – 1.3.9	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 – 1.3.9	Vinyl Chloride Chloroethene Chloroethylen Ethylene monochloride Monochloroethene Monochloroethylene VC Vinyl chloride monomer (VCM)	75-01-4	PID	1 ppm NA	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.9	Vinylidene chloride 1,1-DCE 1,1-Dichloroethene 1,1-Dichloroethylene VDC Vinylidene chloride monomer Vinylidene dichloride	75-35-4	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	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 – 1.3.9	Zinc	7440-62-2	None	15 mg/m³ 500 mg/m³	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/m^3

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	Harlem Hospital Center	911 or 212-939-1000
Langan Incident Hotline		800-952-6426 ex 4699
Medical Treatment Hotline	Incident Intervention	888-449-7787
Langan Geotechnical Project Manager	Kenneth Huber	631-525-6007 (cell)
Langan Environmental Project Manager	Patrick Farnham	646-593-0849 (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	Richard Lam	212-610-1863
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

Immediately following an injury, unless immediate emergency medical treatment is required, the injured employee must contact Incident Intervention® at 888-449-7787.

For all other incidents or near misses, unless emergency response is required, either the employee or a coworker must contact the Langan Incident Hotline at 1-(800)-9-LANGAN (ext. #4699).

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

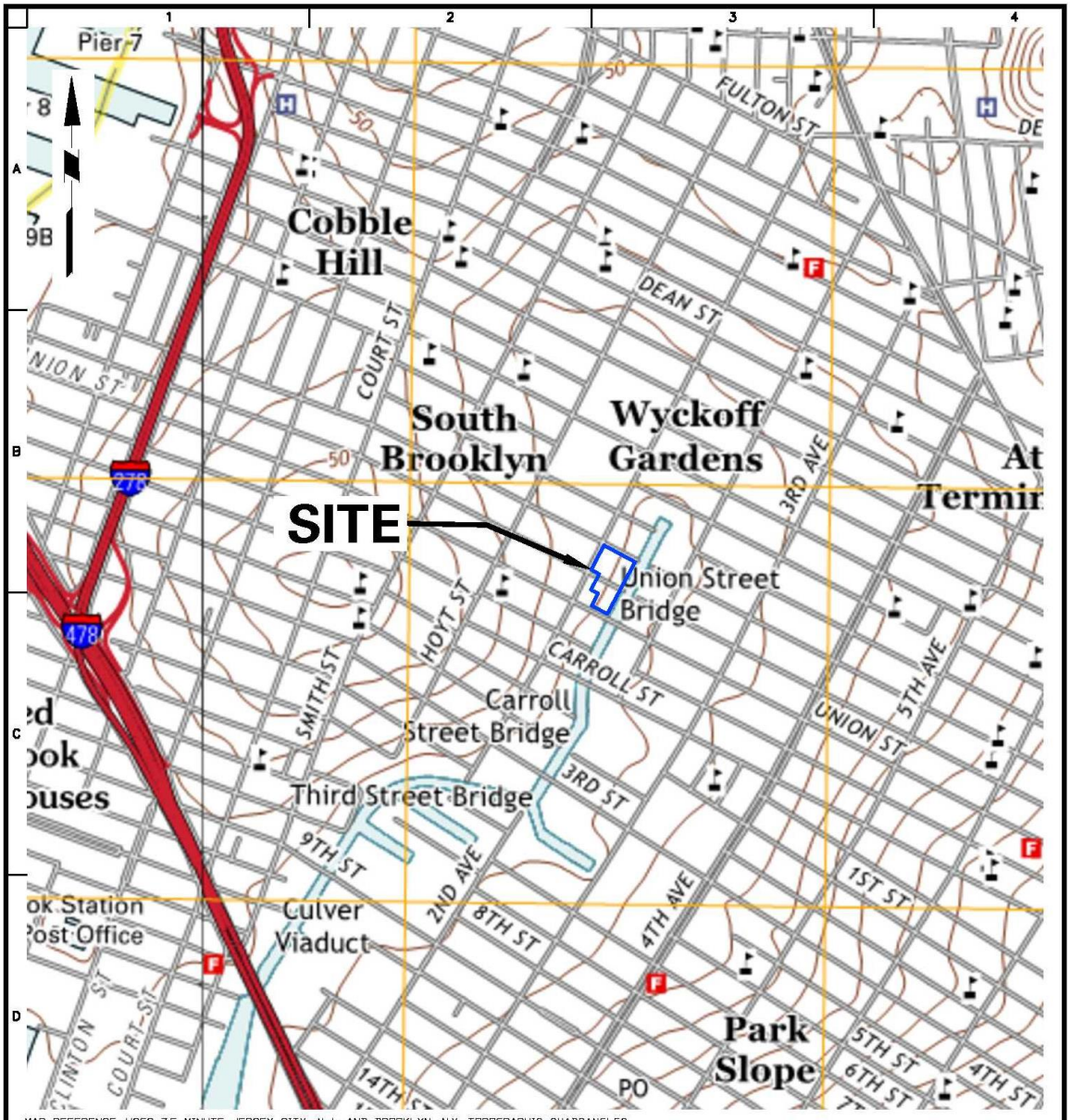
Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

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



LANGAN
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Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

Project	GOWANUS CANAL NORTHSIDE BLOCK No. 424, LOT Nos. 1 & 20 BLOCK No. 431, LOT Nos. 12 & 17 BROOKLYN KINGS NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	170295301
Date	10/3/2016
Scale	NTS
Drawn By / Checked By	PTF / GFN
Submission Date	
Figure No.	1
Sheet	1 of 4

Filename: \\langan.com\data\NY\data3\170295301\Cadd Data - 170295301\SheetFiles\RIWP\Figure 1 - Site Location Map.dwg Date: 10/3/2016 Time: 13:27 User: pfarnham Style Table: Langan.stb Layout: ANSIA-BP

FIGURE 2

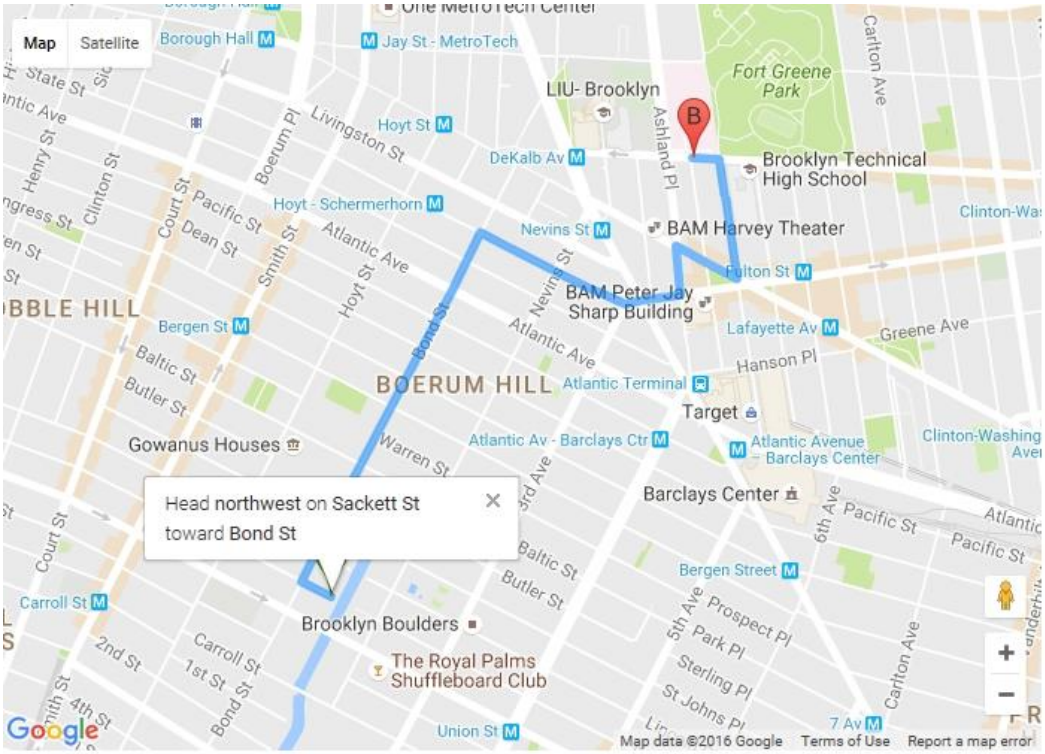
HOSPITAL ROUTE PLAN

Hospital Location: **Brooklyn Hospital Center**
121 DeKalb Avenue
New York, NY
718-250-8000

START: 510 Sackett Street, Brooklyn, New York

1. Head northwest on Sackett Street toward Bond Street
2. Turn right at the 1st cross street onto Bond Street
3. Turn right onto Schermerhorn Street
4. Slight left onto Lafayette Avenue
5. Turn left onto Ashland Place
6. Turn right onto Fulton Street
7. Turn left onto Fort Greene Place
8. Turn left onto DeKalb Avenue, destination will be on the right

END: Brooklyn Hospital Center, 121 DeKalb 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 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. HASP available onsite for inspection?				
2. Health & Safety Compliance agreement (in HASP) appropriately signed by Langan employees and contractors?				
3. Hospital route map with directions posted on site?				
4. Emergency Notification List posted on site?				
5. First Aid kit available and properly stocked?				
6. Personnel trained in CPR/First Aid on site?				
7. MSDSs readily available, and all workers knowledgeable about the specific chemicals and compounds to which they may be exposed?				
8 Appropriate PPE being worn by Langan employees and contractors?				
9. Project site safe practices ("Standing Orders") posted?				
10. Project staff have 40-hr./8-hr./Supervisor HAZWOPER training?				
11. Project staff medically cleared to work in hazardous waste sites and fit-tested to wear respirators, if needed?				
12. Respiratory protection readily available?				
13. Health & Safety Incident Report forms available?				
14. Air monitoring instruments calibrated daily and results recorded on the Daily Instrument Calibration check sheet?				
15. Air monitoring readings recorded on the air monitoring data sheet/field log book?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr. HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily available?				
19. Mark outs of underground utilities done prior to initiating any subsurface activities?				
20. Decontamination procedures being followed as outlined in HASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground objects including utilities?				

23. Adequate size/type fire extinguisher supplied?				
24. Equipment at least 20 feet from overhead 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: COVID-19 Awareness – Site Work **JSA Number: JSA046-00**	
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
☒ Safety Boots	☐ Long Sleeves	☐ Safety Vest (Class 2)	☐ Hard Hat	☐ Hearing Protection
☐ Safety Glasses	☐ Safety Goggles	☐ Face Shield	☐ Nitrile Gloves	☐ PVC Gloves
☐ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection	☐ Fire Resistant Clothing	☐ Rubber Boots
☐ Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	☐ Traffic Cones/Signs	☐ Life Vest/Jacket	
☒ Other: Alcohol-based hand sanitizer, disinfectant wipes/spray				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. All Activities	1. Transmittal/exposure of COVID-19	1. Ask yourself and your managers – is this work essential? Can this be done remotely? 2. Stay home if sick or showing symptoms of COVID-19 (e.g. fever, cough, etc.). 3. Carry nitrile gloves, alcohol-based hand sanitizer, and disinfectant wipes/spray during field work. 4. Check federal, state, and/or local travel restrictions **prior** to travel. Many states, counties, and cities are passing strict "shelter-in-place" or business restrictions in response to COVID-19. 5. Immediately notify Beverly Williams or Rory Johnston (Supervisor if employee chooses) if you display symptoms of COVID-19. Symptoms include fever (over 100.4 F), cough, and shortness of breath. 6. Notify Beverly Williams or Rory Johnston, Supervisor and Coronavirus Task Force if you had close contact with an individual who tested positive or displayed symptoms of COVID-19. 7. Do not touch your face, to the extent possible. 8. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. Avoid gatherings of more than 10 people. Limit, to the extent possible, contact with public items/objects.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		9. Clean your hands frequently with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, sneezing, or using the rest room. 10. If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry. 11. Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. 12. Clean and disinfect frequently touched surfaces daily, for example, cell phones, computer equipment, headsets, tables, doorknobs, light switches, countertops, handles, desks, toilets, faucets, and sinks.
2. Travel to Jobsite	1. Transmittal/exposure of COVID-19 between passengers 2. Transmittal/exposure of COVID-19 from previous occupants (rental and fleet vehicles) 3. Transmittal/exposure of COVID-19 while refueling	1. Limit the number of occupants to each vehicle to 2 people. Employees should sit as far away from each other as possible. 2. Disinfect high "hand-traffic" areas of the vehicle: Door handles, steering wheel, turn signal and control rods, dashboard controls, seatbelts, armrests, etc. To the extent possible, do not use recycled air for heat/AC and travel with the windows open. 3. Use hand sanitizer before and after pumping gas and only return to the inside of the vehicle after refueling is complete. 4. Wear nitrile gloves if available or disinfect the key pad, pump handle, and fuel grade button prior to use.
3. Conduct Tailgate Safety Meeting & Complete H&S Paperwork	1. Transmittal/exposure of COVID-19 between meeting participants	1. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. 2. Hold meetings outside and keep in mind wind direction. To the extent possible, remain cross-wind from other people. 3. Designate a single person to maintain sign-in sheets/permits throughout the day to limit the passing of pens/clipboards between people. 4. Each person should complete their own JSA, even if they are completing similar tasks as others in order to limit the passing of paper/pens/clipboards between people. 5. Include COVID-19 topics and prevention measures in safety meetings.
4. Conduct Site Work	1. Transmittal/exposure of COVID-19 between site workers and public.	1. Practice social distancing maintaining 6 feet of distance between yourself and others. 2. To the extent possible, do not interact with the public. If it is necessary, politely explain you are practicing social distance and request they stay at least 6 feet away and they do not attempt to pass objects to you. 3. Wear nitrile gloves during site work underneath the appropriate gloves for your task. Utilize appropriate decontamination procedures, securely bag all waste (including nitrile gloves) generated during site work and dispose of. 4. Do not share tools. Each person should be equipped with the tools to complete their task or tasks should be divided to remove the need to share tools. If tools must be shared, surfaces should be disinfected. 5. Clean and disinfect surfaces of rental tools and equipment upon receipt. To the extent possible rent equipment from Langan's internal equipment reservation center, where cleaning/disinfecting procedures can be verified.
5. Use of Construction Trailers	1. Transmittal/exposure of COVID-19 between site workers and others.	1. Avoid use of shared trailers, if possible. Minimize trailer use to essential personnel. 2. Practice social distancing; maintaining 6 feet of distance between yourself and others in trailer. 3. Clean and disinfect areas including desks, phones, chairs and other common areas, before and after use.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
6. Purchasing Food from a Restaurant	1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.	1. To the extent possible, bring your own food. 2. If you must visit a restaurant, call ahead for take-out or "contactless delivery". Do not dine in. When picking up food, follow guidelines for Job Step #8: Purchasing Supplies at Retail/Shipping Centers. 3. Wash hands before and after eating.
7. Smoking Cigarettes	1. Transmittal/exposure of COVID-19 by touching mouth with hands	1. Cigarette smokers maybe at greater risk of complications arising from COVID-19. Nicotine patches/lozenges/gum, smoking cessation programs, and prescription medications may aid in "kicking the habit" if you decide to quit. 2. Wash hands thoroughly before and after smoking. 3. Discard cigarette butts properly. Do not light cigarettes from others and do not give cigarettes to others.
8. Hotel Stay	1. Transmittal/exposure of COVID-19 from previous occupants, hotel staff, common areas.	1. Verify the hotel chain/brand has modified cleaning procedures to reflect risk of COVID-19. Most hotel companies have issued statements on their websites and in email blasts reflecting these new procedures. 2. Use the front door, and not peripheral entrances. Front doors of hotels are generally automatic. 3. Request ground floor room to avoid elevator use. 4. If elevator use is required, do not directly touch elevator buttons with your hands. Do not ride elevators with other people, to the extent possible. 5. Bring disinfecting wipes or sanitizing spray. Upon arrival, disinfect high "hand-traffic" areas of the hotel room: Door handles, light switches, shower/sink faucet handles, TV remote, curtain/blind handles. Clean these surfaces daily. 6. Place the "Do Not Disturb" Sign on your door to prevent people (housekeeping) from entering your room. 7. Avoid common spaces and hotel sponsored events where crowds will be present. 8. Confirm hotel cleaning procedures have been modified to address COVID-19. Confirm no COVID-19 cases have occurred in hotel
9. Purchasing Supplies at Retail/Shipping Centers	1. Transmittal/exposure of COVID-19 from other customers, staff, surfaces.	1. Plan your travel to limit the need to visit retail/shipping centers. 2. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. If the store is too crowded/small, consider visiting another store or returning at a different time. 3. Avoid high "hand-traffic" items/areas like door handles (i.e. use your shoulder, hip/butt, or open with a disposable napkin/paper towel), credit cards terminals (i.e. use Apple/Android pay if available), shopping carts/baskets (i.e. bring your own shopping bags), counter tops (i.e. ask clerk if you can hold the items while they are scanned) and bulk/buffet items (i.e. just avoid them). 4. Disinfect your hands before and after visiting a retail/shipping center.

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **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
1. 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
2. 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.
3. 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)	1. 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. 2. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block 3. Wear proper clothing/ dress in layers/ take regular breaks. 4. 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). 5. 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
		6. See AGI Sting R1 operating manual for specific concerns during operating instrument
4. All activities	1. Slips/ Trips/ Falls 2. Hand injuries, cuts or lacerations during manual handling of materials 3. Foot injuries 4. Back injuries 5. Traffic 6. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 7. High Noise levels 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries	7. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 8. 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 9. Wear Langan approved safety shoes 10. 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 11. Wear high visibility clothing & vest / Use cones or signs to designate work area 12. 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 13. Wear proper hearing protection 14. Wear hard hat / Avoid areas were overhead hazards exist. 15. 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 16. 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
5. 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).
6. Initial Site Arrival-Site Assessment	1. Traffic	1. Situational awareness (be alert of your surroundings). Secure area from through traffic.
7. Surface Water Sampling	1. 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.
8. Sampling from bridges	1. Struck by vehicles	1. Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
9. Icing of Samples/ Transporting coolers/equipment from work area.	11. Back Strains 12. Slips/Trips/Falls 13. Cuts/Abrasions from equipment 14. Pinch/Crushing Hazards.	17. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 18. Have unobstructed path from work area. Aware of surroundings. 19. Wear proper PPE (Leather gloves, long sleeves) 20. Wear proper PPE (Leather gloves, long sleeves)
10. 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.
11. 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 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	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 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 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: **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
12. Transport equipment to work area	10. Back Strain 11. Slips/ Trips/ Falls 12. Traffic 13. Cuts/abrasions from equipment 14. 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)
13. Moving equipment to its planned location	2. Pinch Hazard 3. Slips/ Trips/ Falls	1. Wear proper PPE (leather gloves) 2. Be aware of potential trip hazards / Practice good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint
14. Equipment Set-up	2. Pinch Hazard 3. Cuts/abrasions to knuckles/hands 4. Back Strain	1. Wear proper PPE (leather gloves) 2. Wear proper PPE (leather gloves) 3. Use proper lifting techniques / Use wheeled transport
15. All activities	21. Slips/ Trips/ Falls 22. Hand injuries, cuts or lacerations during manual handling of materials 23. Foot injuries 24. 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	27. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 28. 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 29. Wear Langan approved safety shoes 30. 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

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)		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: **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
16. Unpack/Transport equipment to work area.	15. Back Strains 16. Slip/Trips/Falls 17. Cuts/Abrasions from equipment 4. Contusions from dropped equipment	10. Use proper lifting techniques/Use wheeled transport 11. Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. 12. Wear proper PPE (leather gloves, long sleeves). 4. Wear proper PPE (Langan approved safety shoes).
17. 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.
18. Collecting Soil/Fluid Sample	4. Irritation to eye from vapor, soil dust, or splashing 5. Irritation to exposed skin	2. 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) 3. Wear proper skin protection including nitrile gloves.
19. Closing Drums	1. Hand Injuries, cuts or lacerations when untightening drum locking bolt, removing drum lid strap, or removing lid.	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.
20. 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
21. 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 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: **Bulkhead Install**

JSA Number: **JSA2018-01**

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	☐ Rubber 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	☐ Air Monitoring
☒ Other: Personal Flotation Devise (PFD) as required				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
22. Transport equipment to work site	18. Back Strain 19. Slips/ Trips/ Falls 20. Traffic 21. Cuts/Abrasions/Contusions from 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/ Mark tripping hazards with spray paint or cones. 3. Wear proper PPE (high visibility vest or clothing) 4. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes)
23. Check calibration curve for the testing equipment	1. No hazards	
24. Hoist	6. Hand injuries(pinch points) 7. Equipment fall hazard (2 to 3 ft. drop) 8. Airborne objects	1. Keep fingers and hands out of pinch point areas/ Wear proper PPE (work gloves) 2. Stay away from equipment until load has been stabilized and secured. 3. Wear proper PPE (safety glasses) at all times/ Stand to side of possible projection area
25. Alignment of vibratory hammer/hydraulic ram by contractor	1. Hand injuries(pinch points) 2. Equipment fall hazard (2 to 3 ft. drop) 3. Airborne objects	1. Keep fingers and hands out of pinch point areas/ Wear proper PPE (work gloves) 2. Stay away from equipment until load has been stabilized and secured. 3. Wear proper PPE (safety glasses) at all times/ Stand to side of possible projection area
5. Installing Bulkhead	1. Hand injuries (pinch points) 2. Airborne objects from vibratory hammer/hydraulic ram 3. Drowning	3. Keep fingers and hands away from pinch point areas/ Wear proper PPE (leather gloves) 4. Stand away to safe side of the work zone. Wear proper PPE (safety glasses, PFD, hearing protection). 5. Wear PFD, identify nearest flotation ring to use in an emergency (usually spaced every 200 feet across the water front
6. All activities	1. Slips/ Trips/ Falls	47. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with caution tape, cones, or spray paint

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	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 or cold injuries 10. Eye Injuries	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 or 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 life / Obtain assistance when possible 51. Wear high visibility clothing & vest/ Use cones or signs to designate work area 52. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray animals/ Carry and use animal repellant when needed/ 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/ Take breaks as necessary to avoid heat or cold stress 56. Wear safety glasses
Additional items.		

Print Name	Sign Name	Date
Prepared by:		
William Bohrer		
Reviewed by:		
Kenneth Huber		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Tieback Testing**

JSA Number: **JSA036-01**

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	☐ Rubber 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	☐ Air Monitoring
☐ Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
26. Transport equipment to work site	22. Back Strain 23. Slips/ Trips/ Falls 24. Traffic 25. Cuts/Abrasions/Contusions from equipment	13. Use proper lifting techniques/ Use wheeled transport 14. Minimize distance to work area/ Have unobstructed path to work area/ Follow good housekeeping procedures/ Mark tripping hazards with spray paint or cones. 15. Wear proper PPE (high visibility vest or clothing) 16. Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes)
27. Check calibration curve for the testing equipment	1. No hazards	1.
28. Alignment of hydraulic ram by contractor	9. Hand injuries(pinch points) 10. Equipment fall hazard (2 to 3 ft. drop) 11. Airborne objects	4. Keep fingers and hands out of pinch point areas/ Wear proper PPE (work gloves) 5. Stay away from equipment until load has been stabilized and secured. 6. Wear proper PPE (safety glasses) at all times/ Stand to side of possible projection area
29. Conduct proof or performance test	1. Hand injuries (pinch points) 2. Airborne objects from Hydraulic ram	6. Keep fingers and hands away from pinch point areas/ Wear proper PPE (leather gloves) 7. Stand away to safe side of the shoring beam (opposite side of the beam from the tieback pocket)/ Wear proper PPE (safety glasses and face shield)
30. Conduct Lift-Off test	1. Hand injuries (pinch points) 2. Airborne objects (splintered wedges)	1. Keep fingers and hands away from pinch point areas/ Wear proper PPE (leather gloves)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		2. Wear proper PPE (safety glasses) at all times/ Stand to safe side of the shoring beam (opposite side of the beam from the tieback pocket)
6. 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 or cold injuries 10. Eye Injuries	57. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with caution tape, cones, or spray paint 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 or cut-resistant gloves 59. Wear proper PPE (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 life / 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 animals/ Carry and use animal repellant when needed/ 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/ Take breaks as necessary to avoid heat or cold stress 10. Wear safety glasses
Additional items.		

Print Name	Sign Name	Date
Prepared by:		
Antonio R. Mencarini		
Scott A. Walker		
Reviewed by:		

LANGAN

Job Safety Analysis (JSA)
Health and Safety

JSA Title: **Building Construction Oversight**

JSA Number: **JSA006-01**

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

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
31. Transport equipment to work area	26. Back Strain 27. Slips/ Trips/ Falls 28. Traffic 29. Cuts/abrasions from equipment 30. 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)
32. Drilling/anchor bolt installation	12. Hazards associated with drilling, flying objects, heavy equipment, ground level hazards and dust 13. Slips/ Trips/ Falls 14. Hazards associated with concrete work	3. Maintain a safe distance from drilling operation / Wear proper PPE (hard hat, safety glasses, safety shoes, safety vest) 4. Be aware of potential trip hazards / Follow good housekeeping procedures / Mark significant below-grade hazards (i.e. holes, trenches) with safety cones or spray paint / Wear the proper PPE (safety shoes) 5. Maintain a safe distance from pouring operation
33. Steel building erection	5. Overhead hazards, falling objects 6. Pinching/crushing hazards	5. Wear proper PPE (hard had, safety glasses, safety vest) / Be aware of overhead hazards and maintain a safe distance of at least 10 ft. 6. All personnel should make others aware of moving objects or their inten to move objects / Avoid areas where pinching and crushing hazards are possible
34. 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	66. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 67. 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 68. Wear Langan approved safety shoes 69. 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)	49. Heat Stress/ Cold Stress 50. Eye Injuries	70. Wear high visibility clothing & vest / Use cones or signs to designate work area 71. 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 72. Wear hearing protection 73. Wear hard hat / Avoid areas were overhead hazards exist. 74. 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 75. 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
35. Jobsite Pre-briefing	31. None	17. 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	4. Uneven terrain 5. Wildlife: Stray animals, mice/rats, vectors (i.e. mosquitoes, bees, etc.) 6. Weather: Heat/cold stress 7. Slip/Trips/Falls 8. Foot injuries 9. Eye injuries	4. Pay attention to surrounding area (puddles, wet, frozen, uneven areas); Mark with cones or spray paint. 5. Use bug spray/ Avoid stray animals/Use repellant when needed. 6. 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	51. Slips/ Trips/ Falls 52. Hand injuries, cuts or lacerations during manual handling of materials 53. Foot injuries 54. Back injuries 55. Traffic	76. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 77. 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 78. Wear Langan approved safety shoes

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	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	79. 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 80. Wear high visibility clothing & vest / Use cones or signs to designate work area 81. 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 82. Wear hearing protection 83. Wear hard hat / Avoid areas were overhead hazards exist. 84. 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 85. 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 B
CUT-OFF WALL DESIGN

GOWANUS CANAL NORTHSIDE

(BLOCK 424, LOTS 1 AND 20 AND BLOCK 431, LOTS 12 AND 17)

IN

BROOKLYN, NEW YORK

PREPARED FOR

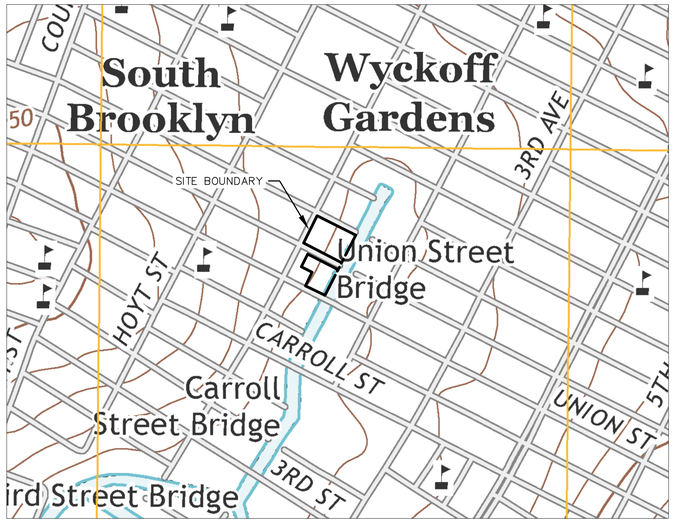
GOWANUS CANAL LLC C/O PROPERTY MARKETS GROUP, INC.

PREPARED BY

LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING, AND LANDSCAPE ACHITECTURE AND GEOLOGY, D.P.C.

DRAWING LIST

DRAWING NO.	TITLE
MA-000	COVER SHEET
MA-010	NOTES - 1 OF 2
MA-011	NOTES - 2 OF 2
MA-012	TAX MAP
MA-013	FEMA FLOOD HAZARD MAPS
MA-101	MONITORING PLAN
MA-102	DIMENSIONAL CONTROL PLAN
MA-103	REMOVALS PLAN
MA-201	BULKHEAD PLAN AND ELEVATION
MA-301	BULKHEAD SECTION
MA-401	BRIDGE PART PLAN AND SECTION
MA-501	DETAILS - 1 OF 2
MA-502	DETAILS - 2 OF 2



SOURCE: BROOKLYN QUADRANGLE NEW YORK 7.5-MINUTE SERIES", U.S. GEOLOGICAL SURVEY, 2011-2013

SITE LOCATION PLAN

SCALE: 1" = 500'

SOURCE: AERIAL IMAGERY TAKEN FROM NEARMAP ON 5 AUGUST 2019

AERIAL MAP

SCALE: 1" = 200'

Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
11/26/19	REVISED PER USEPA COMMENTS	1

REVISIONS

SIGNATURE DATE SIGNED

GREGORY BIESIADECKI
PROFESSIONAL ENGINEER STATE LIC. No. 63718–1

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Project

GOWANUS CANAL NORTHSIDE

BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN

KINGS **NEW YORK**

Drawing Title

COVER SHEET

Project No.	Drawing No.
170295301	MA-000
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 1 of 13

PROJECT NO. 170295301

LANGAN

Filename: \\langan.com\data\NYC\data3\170295301\Cadd Data - 170295301\SheetFiles\Bulkhead\170295301-BW001-0101.dwg Date: 2/14/2020 Time: 14:56 User: wzhao Style Table: Langan.stb Layout: COVER PAGE

GENERAL

1. ALL WORK SHALL BE COMPLETED IN ACCORDANCE WITH THE REQUIREMENTS OF THE CONTRACT DRAWINGS.
2. THE CONTRACTOR SHALL VISIT THE SITE BEFORE PROCEEDING WITH ANY WORK AND VERIFY EXISTING CONDITIONS, UTILITIES, PROJECT DIMENSIONS, AND REPAIR QUANTITIES.
3. THE CONTRACTOR SHALL THEN NOTIFY THE OWNER AND DESIGN ENGINEER IN WRITING OF ANY DISCREPANCIES NOTED BETWEEN THE CONTRACT DRAWINGS AND THE OBSERVED FIELD CONDITIONS.
4. THE CONTRACTOR SHALL FURNISH ALL LABOR, MATERIAL, AND EQUIPMENT TO COMPLETE THE WORK SHOWN IN THE CONTRACT DOCUMENTS. ALL MATERIALS SHALL BE NEW AND UNUSED UNLESS OTHERWISE APPROVED BY THE OWNER AND DESIGN ENGINEER.
5. THE OWNER WILL PROCURE PERMITS/APPROVALS FROM THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (USEPA) FOR THE PROPOSED BULKHEAD. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL OTHER PERMITS FOR CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM THE WORK IN ACCORDANCE WITH ALL PERMIT TERMS AND CONDITIONS AND THE USEPA CONSENT ORDER.
6. ALL WORK SHALL COMPLY WITH THE 2014 NEW YORK CITY BUILDING CODE (NYCBC). THE CONTRACTOR SHALL ABIDE BY ALL APPLICABLE FEDERAL, STATE AND LOCAL STANDARDS, LAWS, AND REGULATIONS.
7. THE CONTRACTOR SHALL STRICTLY FOLLOW ALL APPLICABLE OSHA, STATE, AND CITY SAFETY REGULATIONS.
8. METHODS OF DEMOLITION AND CONSTRUCTION ARE THE CONTRACTOR'S RESPONSIBILITY.
9. THE CONTRACTOR SHALL MAKE NO DEVIATION FROM THE CONTRACT DRAWINGS WITHOUT PRIOR WRITTEN APPROVAL OF THE OWNER AND DESIGN ENGINEER.
10. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFICATIONS REQUIRED BY THE NEIGHBORS, USEPA, U.S. COAST GUARD, US ARMY CORPS OF ENGINEERS, NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION AND THE CITY FOR WORK.
11. UNLESS OTHERWISE NOTED, THE CONTRACTOR SHALL PROTECT FROM DAMAGE ALL EXISTING STRUCTURES AT OR NEAR THE WORK. ANY SUCH DAMAGE AS A RESULT OF THE CONTRACTOR'S WORK, EITHER BY NEGLECT OR DIRECT CONTACT, SHALL BE REPAIRED OR REPLACED IN-KIND AT NO EXPENSE TO THE OWNER.
12. THE CONTRACTOR SHALL KEEP THE WORK AREA IN NEAT ORDER. DEBRIS RESULTING FROM DEMOLITION AND CONSTRUCTION WORK SHALL BE DISPOSED OF IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS. THE CONTRACTOR SHALL PREVENT DEBRIS FROM FALLING INTO THE WATER. AT THE CONCLUSION OF ALL WORK, THE CONTRACTOR SHALL REMOVE FROM THE PROJECT SITE ALL EQUIPMENT, DEMOLITION AND CONSTRUCTION WASTE, AND MATERIALS NOT PART OF THE PERMANENT CONSTRUCTION THAT THEY ARE RESPONSIBLE FOR.
13. THE CONTRACTOR SHALL PROVIDE UTILITIES AS NECESSARY TO COMPLETE THE WORK.
14. FOR SUBSURFACE INFORMATION REFER TO THE GEOTECHNICAL ENGINEERING REPORT MEMORANDUM PREPARED BY LANGAN DATED 11 SEPTEMBER 2019. (1)
15. SELECTIVE DEMOLITION OF PORTIONS OF THE EXISTING CONCRETE HEADWALL AND TIMBER CRIBBING MAY BE REQUIRED TO INSTALL THE NEW ANCHORED BULKHEAD. THE CONTRACTOR SHALL PERFORM ALL WORK WITH CARE TO AVOID DAMAGE TO THE CRIBBING TO REMAIN.

DATUMS AND REFERENCE WATER LEVELS

1. ALL ELEVATIONS PROVIDED HEREIN REFER TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
2. SITE SPECIFIC WATER ELEVATIONS (TAKEN FROM VDATUM SOFTWARE V4.0 PUBLISHED BY NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) AT LATITUDE AND LONGITUDE 40.668719 AND −73.999758 RESPECTIVELY.
   A. MEAN HIGHER HIGH WATER (MHHW) EL 2.38
   B. MEAN HIGH WATER (MHW) EL 2.05
   C. MEAN LOW WATER (MLW) EL −2.66
   D. MEAN LOWER LOW WATER (MLLW) EL −2.86
3. PER FLOOD INSURANCE RATE MAPS PUBLISHED BY THE FEDERAL EMERGENCY MANAGEMENT AGENCY AND 2014 NYCBC REQUIREMENTS, THE GOVERNING FLOOD HAZARD AREA DESIGNATION FOR DESIGN IS "ZONE AE" AND THE BASE FLOOD ELEVATION (BFE) IS EL 10. SEE MA-013 FOR FLOOD HAZARD MAPS.

DESIGN STANDARDS

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE FOLLOWING UNLESS OTHERWISE NOTED:
   A. NEW YORK CITY BUILDING CODE, 2014 NYCBC.
   B. AMERICAN INSTITUTE OF STEEL CONSTRUCTION, AISC 360-11.
   C. OCCUPATIONAL SAFETY AND HEALTH STANDARDS, OSHA 2016.
   D. AMERICAN SOCIETY OF CIVIL ENGINEERS, ASCE 24- 14
   E. AMERICAN SOCIETY OF CIVIL ENGINEERS, ASCE 7-10
   F. AMERICAN CONCRETE INSTITUTE, ACI 301-05
2. THE ENTIRE STRUCTURE IS DESIGNED IN ACCORDANCE WITH ASCE 24, INCLUDING THAT THE PILE OR COLUMN FOUNDATION AND BUILDING OR STRUCTURE TO BE ATTACHED THERETO IS DESIGNED TO RESIST FLOTATION, COLLAPSE AND LATERAL MOVEMENT DUE TO THE EFFECTS OF WIND AND FLOOD LOADS ACTING SIMULTANEOUSLY ON ALL BUILDING COMPONENTS, AND OTHER LOAD REQUIREMENTS OF CHAPTER 16 OF THE NEW YORK CITY BUILDING CODE.
3. NO FILL SHALL BE PLACED WITHIN THE GOWANUS CANAL.

DESIGN CRITERIA

1. GROUND SURFACE AT EL 7.
2. UPLAND SURCHARGE
   A. SERVICE CONDITIONS: 300 PSF
   B. DURING DREDGING: 100 PSF
   C. DURING EXTREME FLOOD: 0 PSF
3. WATER LEVEL CONDITIONS
   A. INBOARD WATER LEVEL FOR:
      - SERVICE AND DREDGING CONDITIONS: MHW
      - EXTREME FLOOD CONDITION: TOP OF BULKHEAD
   B. OUTBOARD WATER LEVEL FOR ALL CONDITIONS: MLW
   C. DESIGN FLOOD ELEVATION DFE = EL 10
4. CANAL MUDLINE CONDITIONS
   A. TEMPORARY DREDGE LEVEL AT EL −19.5
   B. FINAL TOP OF ENVIRONMENTAL CAP AT EL −16
   C. TEMPORARY AND TOP OF CAP ELEVATIONS BASED ON LANGAN GEOTECHNICAL MEMORANDUM AND USEPA RECORD OF DECISION: GOWANUS CANAL SUPERFUND SITE, DATED SEPTEMBER 2013.

SUBMITTALS AND SHOP DRAWINGS

1. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS THAT WILL BE REVIEWED AND RETURNED.
2. THE SUBMITTAL PROCESS SHALL NOT BE USED AS A SUBSTITUTE FOR REQUEST FOR, OR APPROVALS OF SUBSTITUTIONS OR OTHER CHANGES OR PROCEDURES REQUIRED BY THE CONTRACT.
3. THE SUBMITTAL REVIEW IS ONLY FOR THE LIMITED PURPOSE OF CHECKING FOR CONFORMANCE WITH THE DESIGN INTENT AND INFORMATION EXPRESSED IN CONTRACT DOCUMENTS PREPARED BY THE DESIGN TEAM.
4. THE SUBMITTAL REVIEW SHALL NOT BE A CERTIFICATION OF THE ACCURACY OR COMPLETENESS OF DETAILS SUCH AS WEIGHTS, GAUGES, FABRICATION OR ERECTION PROCESS, CONSTRUCTION MEANS OR METHODS, COORDINATION OF THE WORK WITH OTHER TRADES OR CONSTRUCTION SAFETY PRECAUTIONS, ALL OF WHICH ARE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
5. THE SUBMITTAL REVIEW OF A SPECIFIC ITEM SHALL NOT EXTEND TO A REVIEW OF AN ASSEMBLY OF WHICH THE ITEM IS A COMPONENT.
6. NO WORK SHALL COMMENCE FOR A GIVEN CONSTRUCTION STAGE UNTIL ALL RELEVANT SHOP DRAWINGS HAVE BEEN SUBMITTED AND REVIEWED.
7. THE USE OF THE "REQUEST FOR INFORMATION" (RFI) PROCESS IS STRICTLY A FORM OF COMMUNICATION AND ITS SOLE PURPOSE IS TO RESOLVE MINOR ISSUES AND SHALL NOT BE USED TO PREPARE SHOP DRAWINGS.
8. THE CONTRACTOR SHALL PROVIDE THE FOLLOWING SUBMITTALS
   A. TWO WEEKS PRIOR TO MOBILIZATION:
      a. LIST OF KEY PERSONNEL THAT WILL BE INVOLVED IN THE PROJECT.
      b. STAGING, SEQUENCING, SCHEDULE, AND SITE SAFETY PLANS.
      c. METHOD STATEMENT DESCRIBING HOW WORK WILL BE COMPLETED, WHAT EQUIPMENT WILL BE USED, AND HOW THE WORK WILL BE SEQUENCED TO CONSTRUCT THE WORK.
      d. LIST OF LARGE EQUIPMENT THAT WILL BE USED ON SITE.
      e. SITE SPECIFIC HEALTH AND SAFETY PLAN THAT INCLUDES THE REQUIRED ELEMENTS ESTABLISHED BY THE OWNER.
      f. COPIES OF THE NOTIFICATIONS TO THE REGULATORY AGENCIES THAT ARE REQUIRED UNDER THE PERMIT CONDITIONS.
   B. TWO WEEKS PRIOR TO INITIAL USE/IMPLEMENTATION OF GIVEN ITEM:
      a. PRODUCT DATA SHEETS
      b. EQUIPMENT DATA SHEETS
      c. MANUFACTURER'S CERTIFICATES AND INSTRUCTIONS
      d. MILL CERTIFICATES AND COUPON TESTS RESULTS FOR STEEL ELEMENTS
      e. CONCRETE MIX DESIGN REPORT FOR EACH DESIGN MIX PER ACI 301 AND THESE NOTES.
      f. SHOP DRAWINGS:
         - SHEET PILES
         - WALES
         - TIE RODS
   C. EVERY TWO WEEKS AS WORK PROGRESSES
      a. AS-BUILT SURVEY OF SHEET PILES, SOLDIER PILES, WALES, TIE RODS AND BULKHEAD CAPS.
   D. FOUR WEEKS AFTER COMPLETION OF ALL WORK
      a. FINAL AS-BUILT SURVEY OF SHEET PILES, SOLDIER PILES, WALES, TIE RODS AND BULKHEAD CAP.
      b. COPIES OF ANY NOTIFICATIONS OR REQUIRED DOCUMENTATION BY THE PERMITTING AND LOCAL AGENCIES.

PRE-CONSTRUCTION CONDITIONS DOCUMENTATION NOTES:

1. PRE-CONSTRUCTION CONDITIONS DOCUMENTATION SHALL BE PERFORMED FOR ALL STRUCTURES NEAR THE PROJECT SITE INDICATED HEREIN PRIOR TO CONSTRUCTION.
2. PRE-CONSTRUCTION CONDITIONS DOCUMENTATION SHALL CONSIST OF PHOTOGRAPHIC AND WRITTEN DOCUMENTATION OF EXISTING STRUCTURE CONDITIONS.
3. AREAS TO BE DOCUMENTED INCLUDE THE UNION STREET BRIDGE, ROADWAY AND SIDEWALK.
4. THE PRE-CONSTRUCTION REPORT FOR THE UNION STREET BRIDGE SHALL BE SUBMITTED TO NEW YORK CITY DEPARTMENT OF TRANSPORTATION (NYCDOT) AT LEAST 10 WORKING DAYS PRIOR TO THE START OF WORK.

MONITORING NOTES:

1. STRUCTURES INDICATED ON THE CONTRACT DRAWINGS SHALL BE MONITORED DURING EXCAVATION AND BULKHEAD CONSTRUCTION, INCLUDING DURING PLACEMENT OF BACKFILL ABOVE THE TIE RODS. THE MONITORING PROGRAM SHALL CONSIST OF THE FOLLOWING:
   A. OPTICAL SURVEY MONITORING FOR VERTICAL AND HORIZONTAL MOVEMENT.
      a. REFLECTIVE SURVEY PRISMS OR TARGETS (FOR OPTICAL SURVEY MONITORING) SHALL BE INSTALLED AT LOCATIONS SHOWN ON THE CONTRACT DRAWINGS.
      b. SURVEY READINGS SHALL BE TAKEN AT EVERY OPTICAL MONITORING POINT TWICE A WEEK AND REPORTS SHALL BE ISSUED EVERY WEEK.
   B. VIBRATION MONITORING USING SEISMOGRAPHS
      a. SEISMOGRAPHS SHALL BE INSTALLED AT LOCATIONS SHOWN ON THE CONTRACT DRAWINGS.
      b. SEISMOGRAPHS TO BE LOCATED CLOSEST TO AND ORIENTED TOWARD CONSTRUCTION ACTIVITY.
      c. VIBRATIONS SHALL BE CONTINUOUSLY MONITORED USING THRESHOLD-TYPE SEISMOGRAPHS CAPABLE OF RECORDING VIBRATION EVENTS UP TO 10 INCHES PER SECOND WITHIN AN ACCURACY OF 5% OVER FREQUENCIES FROM 2 TO 250 HZ. SEISMOGRAPHS SHALL BE SET TO AUTOMATICALLY ISSUE EMAIL ALERTS WHEN ALERT AND THRESHOLD LEVELS ARE EXCEEDED. REPORTS SHALL BE ISSUED WEEKLY AND SHALL INCLUDE HISTOGRAM PLOTS AND WAVEFORMS FOR ALL EVENTS EXCEEDING 0.25 INCHES PER SECOND.
   C. CRACK MONITORING USING TELLTALE CRACK GAUGES
      a. CRACK GAUGES SHALL BE INSTALLED OVER CRACKS IDENTIFIED DURING PRE-CONSTRUCTION CONDITIONS DOCUMENTATION TO MONITOR RELATIVE CRACK MOVEMENTS DURING CONSTRUCTION
      b. CRACK GAUGES SHALL BE READ WEEKLY. REPORTS SHALL BE ISSUED WEEKLY AND ANYTIME ALERT OR THRESHOLD LEVELS ARE EXCEEDED.
2. REPORTING: REPORTS SHALL BE ISSUED AS SPECIFIED ABOVE. REPORTS SHALL BE ISSUED TO NYCDOT, THE OWNER'S ENGINEER, THE ENGINEER RESPONSIBLE FOR STRUCTURAL STABILITY OF ADJACENT STRUCTURES, THE CONSTRUCTION MANAGER AND THE OWNER.
3. ALERT LEVELS: THE FOLLOWING ALERT LEVELS SHALL REQUIRE THAT THE CONTRACTOR CEASE CONSTRUCTION CAUSING THE EXCEEDANCE, REVIEW THEIR MEANS AND METHODS OF CONSTRUCTION AND SUGGEST REVISED MEANS AND METHODS TO LIMIT MOVEMENTS AND VIBRATIONS IN ADJACENT STRUCTURES. A WRITTEN DESCRIPTION OF REVISED MEANS AND METHODS MUST BE SUBMITTED BY THE CONTRACTOR BEFORE WORK CAN PROCEED.
   A. OPTICAL MONITORING POINTS: VERTICAL AND HORIZONTAL MOVEMENT EXCEEDING 0.125 INCHES.
   B. VIBRATIONS: PEAK PARTICLE VELOCITY (PPV) EXCEEDING 0.250 INCHES PER SECOND MEASURED ALONG ANY AXIS.
   C. CRACK GAUGES: TWO CONSECUTIVE READINGS OF 1 MILLIMETER , OR CUMULATIVE READING OF 2 MILLIMETERS.
4. THRESHOLD LEVELS: THE FOLLOWING THRESHOLD LEVELS SHALL REQUIRE THE CONTRACTOR TO CEASE ALL CONSTRUCTION ACTIVITIES AND NOTIFY THE DOB AND OTHER AFFECTED PARTIES, INSPECT THE AFFECTED STRUCTURES, SUBMIT MODIFIED PROCEDURES TO PREVENT FUTURE EXCEEDANCES , AND REPAIR ANY DAMAGE TO THE ADJACENT STRUCTURES AS DESCRIBED BELOW. ACTIVITIES SHALL NOT CONTINUE UNTIL ADEQUATE MEASURES ARE IN PLACE TO ENSURE STABILITY OF ADJACENT STRUCTURES OR EXCAVATION SUPPORT SYSTEMS. WHERE SIGNIFICANT MOVEMENTS ARE DETECTED THE FREQUENCY OF DATA COLLECTION SHALL BE INCREASED TO ONCE DAILY OR AS DIRECTED BY THE OWNER'S ENGINEER.
   A. OPTICAL MONITORING POINTS: VERTICAL AND HORIZONTAL MOVEMENT EXCEEDING 0.250 INCHES.
   B. VIBRATIONS: PEAK PARTICLE VELOCITY (PPV) EXCEEDING 0.500 INCHES PER SECOND MEASURED ALONG ANY AXIS.
   C. CRACK GAUGES: 3 MILLIMETER INCREASE OR DOUBLING IN ORIGINAL CRACK WIDTH.

INSPECTIONS

1. THE CONTRACTOR SHALL COORDINATE AND ARRANGE FOR THE OWNER'S SPECIAL INSPECTION AGENCY AS NOTED BELOW.
2. NOTIFY THE OWNER AT LEAST 72-HOURS IN ADVANCE OF ANY SPECIAL INSPECTIONS OR ENGINEERING OBSERVATION REQUIRED BY THE CONTRACT DOCUMENTS OR THE NEW YORK CITY BUILDING CODE.
3. ALL WORK FOR WHICH INSPECTION OR OBSERVATION IS REQUIRED SHALL REMAIN ACCESSIBLE AND EXPOSED BY THE CONTRACTOR UNTIL APPROVED BY THE OWNER'S INSPECTOR.
4. THE FOLLOWING SPECIAL INSPECTIONS ARE REQUIRED:
   A. STRUCTURAL STEEL – WELDING (BC 1704.3.1)
   B. STRUCTURAL STEEL – DETAILS (BC 1704.3.2)
   C. STRUCTURAL STEEL – HIGH STRENGTH BOLTS (1704.3.3)
   D. STRUCTURAL STABILITY – EXISTING BUILDINGS (BC 1704.20.1)
   E. FLOOD ZONE COMPLIANCE (BC 1704.29 AND G105)
   F. FILL PLACEMENT AND IN-PLACE DENSITY TESTING (BC 1704.7.2 AND BC 1704.7.3)
   G. FINAL (28-116.2.4.2., BC 110.5, DIRECTIVE 14 OF 1975, AND 1 RCNY §101-10)
5. IN ADDITION TO THE ABOVE SPECIAL INSPECTIONS, THE FOLLOWING SITE OBSERVATIONS DURING CONSTRUCTION ARE REQUIRED:
   A. BULKHEAD CONSTRUCTION
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL REQUIRED TESTING.

LANGAN

PROJECT NO. 170295301

Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
11/26/19	REVISED PER USEPA COMMENTS	1

REVISIONS

SIGNATURE DATE SIGNED

GREGORY BIESIADECKI
PROFESSIONAL ENGINEER STATE LIC. No. 63718-1

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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS NEW YORK

Drawing Title
NOTES - 1 OF 2

Project No. 170295301	Drawing No. MA-010
Date 01/27/2020	
Drawn By FDM	
Checked By KAH	Sheet 2 of 13

SELECTIVE DEMOLITION AND DISPOSAL

1. DEBRIS RESULTING FROM DEMOLITION WORK SHALL BE CAPTURED FOR OFF-SITE DISPOSAL.
2. THE CONTRACTOR SHALL LEGALLY DISPOSE OF STRUCTURES AND DEBRIS RESULTING FROM WORK SHOWN TO BE REMOVED ON THE CONTRACT DRAWINGS.
3. PRIOR TO COMMENCEMENT OF SELECTIVE DEMOLITION, THE CONTRACTOR SHALL SUBMIT A DISPOSAL PLAN FOR ITEMS TO BE DEMOLISHED. DEMOLITION MATERIAL DESIGNATED BY THE OWNER TO BE REMOVED FROM THE SITE SHALL BECOME THE PROPERTY OF THE CONTRACTOR. THE DEBRIS DISPOSAL PLAN SHALL ACKNOWLEDGE THE OWNERSHIP AND SHALL IDENTIFY THE MEANS AND METHODS AND FINAL DISPOSITION FOR DISPOSAL MATERIALS.
4. COMPLETELY REMOVE ITEMS DESIGNATED, AS SPECIFIED IN THE CONTRACT DOCUMENTS, LEAVING SURFACES CLEAN, SOUND AND READY TO RECEIVE NEW MATERIALS.

EROSION AND SEDIMENT CONTROL PRACTICES

1. THE CONTRACTOR SHALL DEVELOP AND INSTALL SOIL EROSION AND SEDIMENT CONTROL MEASURES PER CONTRACT DRAWINGS AND SPECIFICATIONS. THE CONTRACTOR IS TO REPAIR OR REPLACE ANY EROSION CONTROL MEASURES THAT THEY DAMAGE. THE CONTRACTOR WILL CONTINUE TO MAINTAIN AND MONITOR EROSION CONTROL MEASURES FOR THE FULL DURATION OF THE PROJECT.
2. TURBIDITY CURTAIN SHALL BE INSTALLED ALONG THE SHORELINE.
3. TURBIDITY CURTAIN SHALL BE A FULL DEPTH TYPE 2 DOT SILT AND TURBIDITY BARRIER.
4. SILT FENCE SHALL BE INSTALLED ALONG THE AREAS OF DISTURBANCE AND AROUND ANY STOCKPILE AREAS.
5. A STABILIZED CONSTRUCTION ENTRANCE SHALL BE INSTALLED AND MAINTAINED AT THE ENTRANCE OF THE SITE.
6. ANY EXCESSIVE DUST SHALL BE CONTROLLED BY WATER SPRINKLING.
7. DEP AND DEC APPROVED DEWATERING PRACTICES SHALL BE USED TO PREVENT PONDING OF WATER DURING CONSTRUCTION.
8. INLET PROTECTION SHALL BE USED AT DRAINAGE INLETS WITHIN THE PROJECT LIMITS OF THE SITE.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PROPER DISPOSAL OF STORMWATER RUN-OFF DURING CONSTRUCTION TO AN ON-SITE STORMWATER FILTRATION AND DRAINAGE SYSTEM IN CONFORMANCE WITH NYC DEC REGULATIONS AND SPECIFICATIONS.

EXCAVATION AND BACKFILL

1. ALL EXCAVATION SHALL BE PERFORMED IN ACCORDANCE WITH OSHA REQUIREMENTS.
2. HAND-EXCAVATION SHALL BE USED WITHIN 3-FT OF THE BRIDGE ABUTMENTS, BULKHEADS, RETAINING WALLS, UTILITY LINES TO REMIAN, CATCH BASINS, AND MANHOLE STRUCTURES.
3. EXCAVATIONS SHALL BE TEMPORARY IN NATURE AND EXIST ONLY AS LONG AS THE NECESSARY WORK REQUIRES. SIDE SLOPES SHALL BE NO STEEPER THEN 1 VERTICAL TO 1 HORIZONTAL OR AS REQUIRED BY OSHA FOR GIVEN SITE/SOIL CONDITIONS . ANY REQUIRED EXCAVATION SHALL TAKE INTO FULL CONSIDERATION THE CONDITION OF ADJACENT STRUCTURES.
4. DEMOLITION DEBRIS (INCLUDING CONCRETE, METAL, RUBBER, WOOD, BRICK, ETC.) IS ANTICIPATED DURING EXCAVATION. CONCRETE MAY BE CRUSHED AND REUSED, OR REMOVED FROM THE SITE. ALL OTHER DEBRIS SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT A FACILITY APPROVED TO RECEIVE IT.
5. EXCAVATIONS SHALL BE TO ELEVATIONS REQUIRED FOR INSTALLATION OF PERMANENT CONSTRUCTION WITHOUT DISTURBANCE TO SUBGRADE BELOW SUCH ELEVATIONS.
6. BACKFILL THAT IS PLACED BELOW EL 3 SHALL BE AASHTO #57 CRUSHED STONE AND SHALL BE WRAPPED IN FILTER FABRIC (MIRAFI 140N BY TENCATE, OR EQUIVALENT).
7. BACKFILL THAT IS PLACED ABOVE EL 3 SHALL CONSIST OF WELL-GRADED GRANULAR SOILS. THE FILL SHALL HAVE A MAXIMUM PARTICLE SIZE NO GREATER THAN 3 INCHES AND NO MORE THAN 10% PASSING THE NO. 200 SIEVE. ON-SITE SOIL MEETING THIS REQUIREMENT MAY BE USED AS BACKFILL, PROVIDED THE SOIL IS NOT GROSSLY CONTAMINATED.
8. SOIL BACKFILL SHALL BE PLACED IN MAXIMUM 12-INCH LOOSE LIFTS. EACH LIFT SHALL BE COMPACTED TO 95% OF ITS MAXIMUM DRY DENSITY AS DETERMINED BY THE MODIFIED PROCTOR TEST (ASTM D1557).
9. THE RESULTS OF THE SIEVE ANALYSIS, MODIFIED PROCTOR TEST (FOR SOIL), AND FILL SAMPLES FOR ALL FILL PROPOSED FOR USE SHALL BE SUBMITTED TO THE ENGINEER PRIOR TO USE.
10. AREAS SHOWING SIGNS OF PUMPING, RUTTING, BLEEDING, OR OTHER SIGNS OF SOFT OR WET SOILS AS DETERMINED BY THE ENGINEER SHALL BE REMOVED AND REPLACED WITH SUITABLE BACKFILL.

STEEL BULKHEAD

1. EPOXY COATING
   A. ALL STEEL SHALL BE EPOXY COATED EXCEPT AS NOTED FOR SHEET PILES.
   B. EPOXY SHALL COMPLY WITH THE US ARMY CORPS OF ENGINEERS SPECIFICATION C-200/C-200A. EPOXY COAT TYPE, PREPARATION, AND THICKNESS SHALL BE PER THE EPOXY MANUFACTURER'S RECOMMENDATIONS.
2. SHEET PILES
   A. SHEET PILES SHALL CONFORM TO ASTM A572, GRADE 60.
   B. BULKHEAD SHEET PILES SHALL BE NZ 26 OR APPROVED EQUIVALENT WITH A MINIMUM PLASTIC SECTION MODULUS OF 57-INCH^3/FT AND MAXIMUM DEPTH OF 20 INCHES.
   C. DEADMAN SHEET PILES SHALL BE NZ 14 OR APPROVED EQUIVALENT WITH A MINIMUM PLASTIC SECTION MODULUS OF 30-INCH^3/FT.
   D. IF A DIFFERENT SHEET PILE IS TO BE USED THE CONTRACTOR IS REQUIRED TO SUBMIT A NEW LAYOUT PLAN TO THE DESIGN ENGINEER. THE LAYOUT PLAN SHALL SHOW SHEET PILES, TIE RODS AND WALE SPLICES.
   E. SHEET PILES SHALL HAVE HANDLING HOLES LOCATED PER THE RECOMMENDATION OF THE MANUFACTURER.
   F. SHEET PILES SHALL HAVE AN EPOXY COAT OVER BOTH SIDES FOR THE UPPER 35 FT FROM CUTOFF.
   G. SHEET PILES WITHIN 75 FEET OF THE UNION STREET BRIDGE SHALL BE INSTALLED WITH SILENT PILER BY GIKEN. SHEET PILES BEYOND 75 FEET OF BRIDGE SHALL BE INSTALLED VIA VIBRATORY OR IMPACT HAMMER. CONTRACTOR MAY NEED TO SPUD OF PRE-DRILL SHEET PILE LOCATIONS TO PENETRATE OBSTRUCTIONS.
   H. SHEET PILES SHALL BE INSTALLED PLUMB AND STRAIGHT WITH ALL INTERLOCKS PROPERLY CONNECTED. ALLOWABLE TOLERANCES ARE AS FOLLOWS:
      a. HORIZONTAL: 1-INCH PER 20-FT
      b. VERTICAL: ¼-INCH PER FT
   J. SHEET PILE INTERLOCKS SHALL BE SEALED BY WELDING THE INTERLOCK OF ADJOINING SHEET PILES TOGETHER, OR WITH ADEKA ULTRASEAL P-200 SEALING COMPOUND. THE SEALING COMPOUND SHALL BE APPLIED ON SITE IN THE FEMALE INTERLOCKS PER THE MANUFACTURER. SHEET PILES WITH ADEKA SHALL BE STORED AND HANDLED PER THE MANUFACTURER'S RECOMMENDATIONS.
3. WALES
   A. WALES SHALL CONFORM TO ASTM A572, GRADE 50.
   B. WALES SHALL BE 2 MC-18X42.7 DOUBLE CHANNELS.
   C. WALES SHALL BE INSTALLED LEVEL, CONTINUOUS, AND PROPERLY CONNECTED TO THE SHEET PILES.
4. MISCELLANEOUS STEEL
   A. MISCELLANEOUS STEEL SHALL CONFORM TO A MINIMUM OF ASTM A572, GRADE 50, UNLESS OTHERWISE NOTED.
   B. BOLTS SHALL CONFORM TO ASTM F3125 GRADE A325.
   C. ALL HARDWARE INCLUDING BOLTS, NUTS, WASHERS, AND PLATES SHALL BE EPOXY COATED.

TIE RODS

1. TIE RODS SHALL CONFORM TO ASTM A615 GRADE 75 THREADBAR WITH DOUBLE CORROSION PROTECTION (DCP) PROVIDED PER MANUFACTURER'S RECOMMENDATIONS.
2. TIE RODS SHALL BE #18 THREADBARS.
3. ANCHOR NUTS & COUPLERS SHALL BE PROVIDED BY TIE ROD MANUFACTURER AND SHALL BE CAPABLE OF DEVELOPING 100% OF THE ULTIMATE STRENGTH OF THE TIE RODS.

WELDING

1. ALL WELDING SHALL CONFORM WITH THE AMERICAN WELDING SOCIETY (AWS) D1.1 AND NYCBC.
2. ALL WELDERS SHALL BE CERTIFIED BY AWS .
3. UNLESS OTHERWISE INDICATED, ALL FILLET WELDS SHALL BE CONTINUOUS.
4. ALL ELECTRODES USED FOR FIELD WELDS SHALL COMPLY WITH ABS OR AWS SPECIFICATIONS AND SHALL BE E70XX LOW HYDROGEN.
5. ANY DEFECTS SHALL BE CORRECTED IN ACCORDANCE WITH AWS RECOMMENDATIONS AT NO ADDITIONAL COST TO THE OWNER.

CONCRETE

1. ALL CONCRETE SHALL BE MIXED, TRANSPORTED, TESTED AND PLACED IN ACCORDANCE WITH ACI RECOMMENDATIONS.
2. ALL CONCRETE WORK SHALL BE PERFORMED IN ACCORDANCE WITH ACI 301.
3. CURING OF CONCRETE SHALL START AS SOON AS THE FINISH WILL NOT BE MARRED. IT SHALL NOT BE PERMISSIBLE TO DELAY THE CURING UNTIL THE MORNING AFTER THE CONCRETE IS CAST.
4. DIMENSIONS FOR CONCRETE ELEMENTS SHOWN ON THE CONTRACT DRAWINGS ARE NOMINAL. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR APPROVAL.
5. CONCRETE SHALL CONFORM TO THE FOLLOWING REQUIREMENTS UNLESS OTHERWISE NOTED:
   A. CONCRETE SHALL BE NORMAL WEIGHT.
   B. CONCRETE SHALL BE DESIGNED FOR THE FOLLOWING ACI 318 EXPOSURE CLASSES.
      a. FREEZING AND THAWING: F3
      b. SULFATE: S1
      c. PERMEABILITY: W1
      d. CORROSION: NOT APPLICABLE
   C. CAST IN PLACE CONCRETE SHALL HAVE A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 5000 PSI AT 28 DAYS.
   D. CONCRETE SHALL HAVE A MAXIMUM WATER-CEMENTITOUS RATIO OF 0.40.
   E. PORTLAND CEMENT SHALL BE ASTM C150 TYPE IIA.
   F. AGGREGATE SHALL CONFORM TO ASTM C33 AND HAVE A MAXIMUM SIZE OF 3/4 INCHES.
   G. WATER SHALL CONFORM TO ASTM C94.
   H. NON-SHRINK GROUT SHALL HAVE THE PERFORMANCE REQUIREMENTS OF ASTM C1107, GRADE C
   I. CONTRACTOR IS RESPONSIBLE TO DESIGN THE MIX TO MEET THEIR OWN WORKABILITY REQUIREMENTS.

Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
11/26/19	REVISED PER USEPA COMMENTS	1

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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS NEW YORK

Drawing Title
NOTES - 2 OF 2

Project No.	Drawing No.
170295301	MA-010
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 3 of 13

PROJECT NO. 170295301

Filename: \\langan.com\data\NYC\data3\170295301\Cadd Data - 170295301\SheetFiles\Bulkhead\170295301-BI003-0101.dwg Date: 2/14/2020 Time: 14:56 User: wzhao Style Table: Langan.stb Layout: NOTES - 2 OF 2

LEGEND:

	Borough Boundary	C50	Condo Flag/Condo Nunber
	Tax Block Boundary	A50	Air Right Flag/Lot Number
50	Tax Block Number	S50	Subterranean Right Flag/Lot Number
	Tax Lot Boundary	R	REUC Flag
50	Tax Lot Number		Under Water Tax Lot Boundary
~~50~~	Condo FKA Tax Lot Number		Other Boundary
50.5	Tax Lot Dimension	1	Possession Hook
+/-5.5	Approximate Tax Lot Dimension	Misc	Miscelaneous Text
1500 - 1530	Condo Units Range Label		Small Tax Lot Dimension

NOTES:

1. BASE PLAN TAKEN AND PROPERTY INFORMATION FROM 'NYC DEPARTMENT OF FINANCE – DIGITAL TAX MAP', <GIS.NYC.GOV/TAXMAP/MAP.HTM> ACCESSED 06 AUGUST 2019.
2. PROJECT BOUNDARY INCLUDES NEW YORK CITY TAX BLOCK 424, TAX LOTS 1 AND 20, AND TAX BLOCK 431, TAX LOTS 12 AND 17.

PROPERTY INFORMATION:

Borough: BROOKLYN **Block:** 424 **Lot:** 1
Police Precinct: 76
Owner: VICTOR ALLEGRETTI CRE

Address: 267 BOND STREET 11217
Lot Area: 47500 sf
Lot Frontage: 200' **Lot Depth:** 300
Year Built: 1931 N/A
Number of Buildings: 2
Number of Floors: 2
Gross Floor Area: 11,100 sf (estimated)
Residential Units: 0 **Total # of Units:** 1
Land Use: Parking Facilities
Zoning: M2-1
Commercial Overlay:
Zoning Map #: 16C

Dept. of City Planning, PLUTO 18v2.1 © 2019 and other city agency sources

Borough: BROOKLYN **Block:** 424 **Lot:** 20
Police Precinct: 76
Owner: LAA REALTY LLC

Address: 495 SACKETT STREET 11231
Lot Area: 12500 sf
Lot Frontage: 125' **Lot Depth:** 100
Year Built: unknown N/A
Number of Buildings: 0
Number of Floors: 0
Gross Floor Area: 0 sf (estimated)
Residential Units: 0 **Total # of Units:** 0
Land Use: Vacant Land
Zoning: M2-1
Commercial Overlay:
Zoning Map #: 16C

Dept. of City Planning, PLUTO 18v2.1 © 2019 and other city agency sources

Borough: BROOKLYN **Block:** 431 **Lot:** 12
Police Precinct: 76
Owner: OAA REALTY LLC

Address: 498 SACKETT STREET 11231
Lot Area: 8978 sf
Lot Frontage: 89.17' **Lot Depth:** 100.83
Year Built: 1946 N/A
Number of Buildings: 1
Number of Floors: 1
Gross Floor Area: 8,978 sf (estimated)
Residential Units: 0 **Total # of Units:** 1
Land Use: Parking Facilities
Zoning: M2-1
Commercial Overlay:
Zoning Map #: 16C

Dept. of City Planning, PLUTO 18v2.1 © 2019 and other city agency sources

Borough: BROOKLYN **Block:** 431 **Lot:** 17
Police Precinct: 76
Owner: SACKETT STREET PROPER

Address: 510 SACKETT STREET 11231
Lot Area: 29800 sf
Lot Frontage: 149' **Lot Depth:** 200
Year Built: 1946 N/A
Number of Buildings: 1
Number of Floors: 1
Gross Floor Area: 8,150 sf (estimated)
Residential Units: 0 **Total # of Units:** 1
Land Use: N/A
Zoning: M2-1
Commercial Overlay:
Zoning Map #: 16C

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Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
11/26/19	REVISED PER USEPA COMMENTS	1

REVISIONS

SIGNATURE DATE SIGNED
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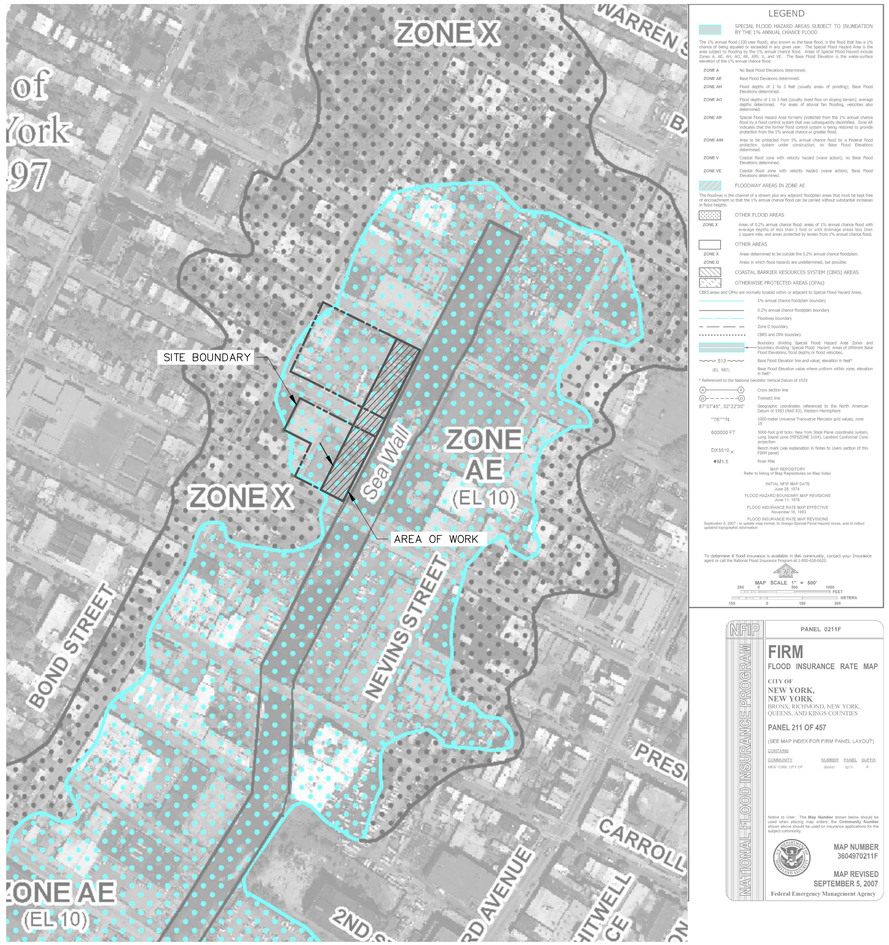
Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS NEW YORK

Drawing Title
TAX MAP

Project No. 170295301	Drawing No. MA-012
Date 01/27/2020	
Drawn By FDM	
Checked By KAH	Sheet 4 of 13

PROJECT NO. 170295301

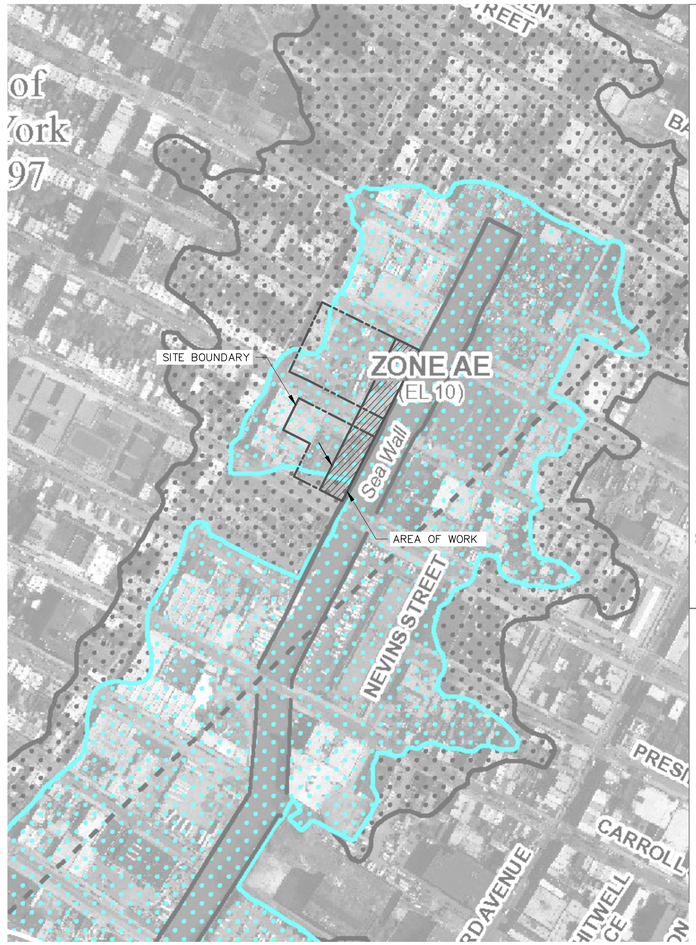
Filename: \\langan.com\data\NYC\data3\170295301\Cadd Data - 170295301\SheetFiles\Bulkhead\170295301-BI002-0102.dwg Date: 2/14/2020 Time: 14:57 User: wzhao Style Table: Langan.stb Layout: TAX MAP

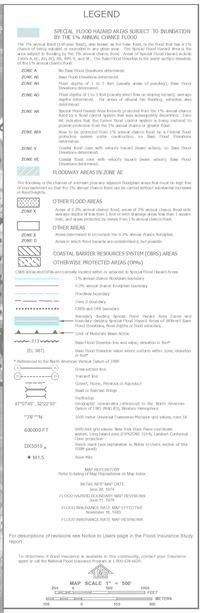


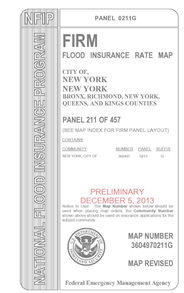
2007 FIRM MAP NO. 3604970211F

1" = 200'

SOURCE: FEMA.GOV







2013 FIRM MAP NO. 3604970211G

1" = 200'

SOURCE: FEMA.GOV

NOTES

1. AS PER THE NEW YORK CITY BUILDING CODE, THE 2007 FEMA FIRM AND THE 2013 FEMA PRELIMINARY FIRM FOR THE SITE ARE SHOWN.
2. BASE MAP LEFT: FLOOD INSURANCE RATE MAP (FIRM) FOR THE CITY OF NEW YORK, NEW YORK MAP NO 3604970211F, MAP REVISED SEPTEMBER 5, 2007.
3. BASE MAP RIGHT: PRELIMINARY FIRM FLOOD INSURANCE RATE MAP (FIRM) FOR THE CITY OF NEW YORK, NEW YORK MAP NO 3604970211G, MAP REVISED DECEMBER 5, 2013.
4. CONTROLLING FLOOD HAZARD:
   A. 2007 FIRM: FLOOD HAZARD ZONE = "ZONE AE" BFE = EL 10 NGVD (EL 8.9 NAVD88).
   B. 2013 PRELIMINARY FIRM: FLOOD HAZARD ZONE = "ZONE AE" BFE = EL 10 NAVD88.
   C. THE 2013 PRELIMINARY FIRM GOVERNS FOR FLOOD HAZARD ZONE AND BASE FLOOD ELEVATION, PER NEW YORK CITY BUILDING CODE.
5. THE PROPOSED WORK IS IN ACCORDANCE WITH APPENDIX G OF THE NEW YORK CITY BUILDING CODE.
6. PER SECTION BC G104.5.2, THE BULKHEAD SHOWN HEREIN IS DESIGNED IN ACCORDANCE WITH ASCE 24, INCLUDING THAT THE STRUCTURES ATTACHED THERETO ARE DESIGNED TO BE ANCHORED TO RESIST FLOTATION, COLLAPSE AND LATERAL MOVEMENT DUE TO THE EFFECTS OF WIND AND FLOOD LOADS ACTING SIMULTANEOUSLY ON ALL COMPONENTS, AND OTHER LOAD REQUIREMENTS OF CHAPTER 16 OF THE NEW YORK CITY BUILDING CODE.

200 0 100 200
SCALE IN FEET

Date	Description	No.
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REVISIONS

SIGNATURE DATE SIGNED

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Project

GOWANUS CANAL NORTHSIDE

BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN

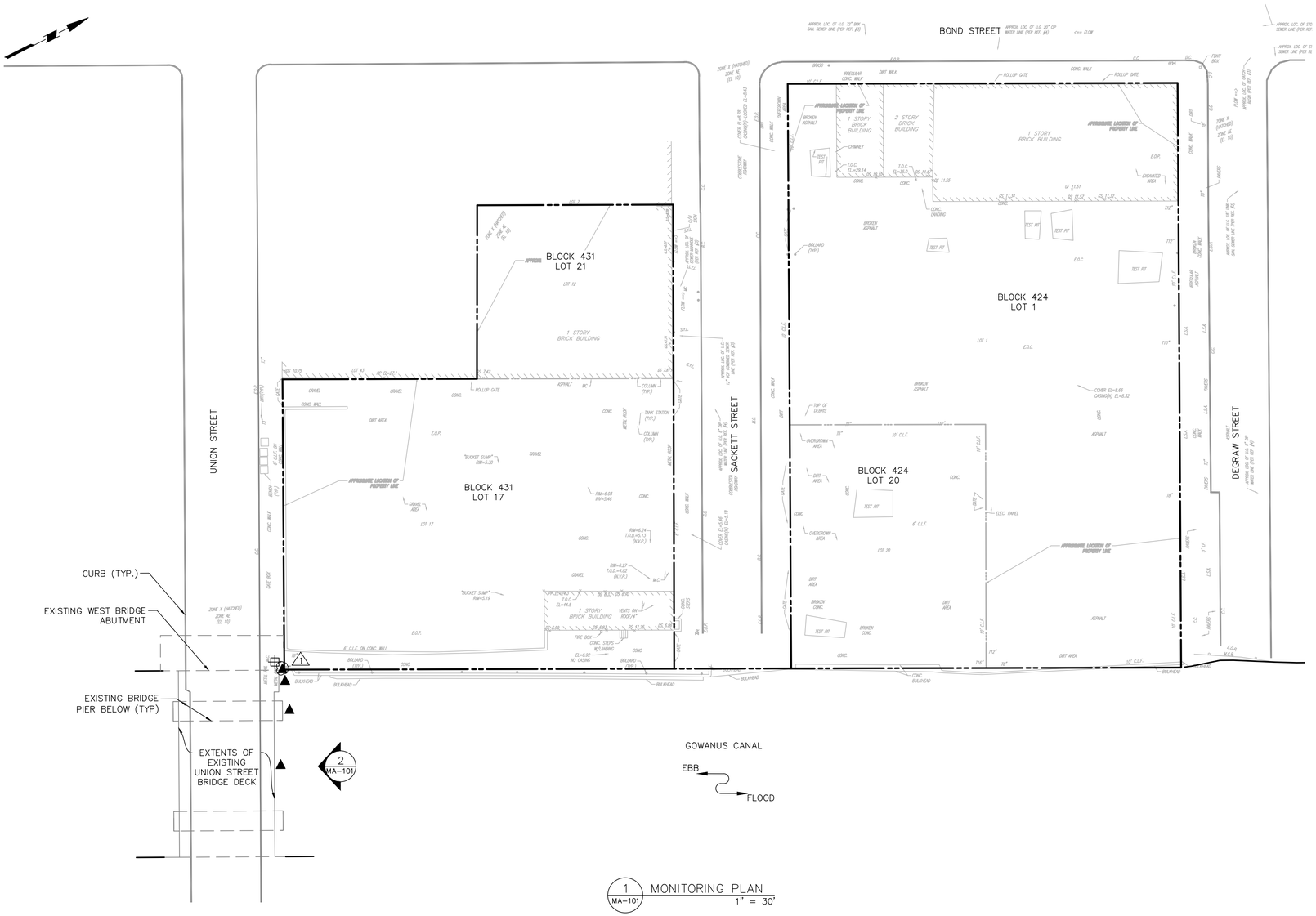
KINGS **NEW YORK**

Drawing Title

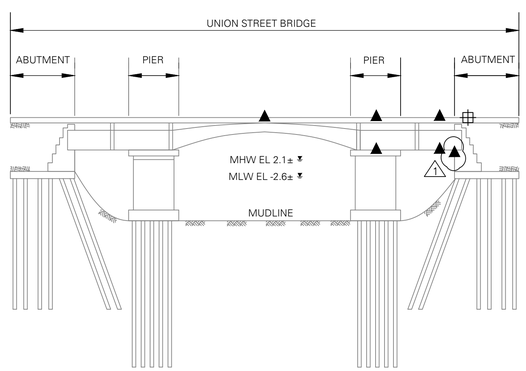
FEMA FLOOD HAZARD MAPS

Project No.	Drawing No.
170295301	MA-013
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 5 of 13

LANGAN
PROJECT NO. 170295301



1 MA-101 MONITORING PLAN
1" = 30'



2 MA-101 BRIDGE MONITORING ELEVATION
1" = 20'

LEGEND:

- EXISTING BUILDING
- SITE BOUNDARY
- LOT LINE
- SEISMOGRAPGH
- OPTICAL MONITORING POINT

NOTES:

1. SEE SHEET MA-010 FOR MONITORING NOTES.
2. BACKGROUND REFERENCED FROM BOUNDARY & TOPOGRAPHIC SURVEY BY CONTROL POINT ASSOCIATES DATED 13 MARCH 2017.
3. SEE SHEET MA-102 FOR DIMENSIONAL CONTROL PLAN.
4. SEE SHEET MA-103 FOR REMOVALS PLAN.
5. SEE SHEET MA-201 FOR BULKHEAD PLAN AND ELEVATION.
6. SEE SHEET MA-301 FOR BULKHEAD SECTION.
7. SEE SHEET MA-401 FOR BRIDGE PART PLAN AND SECTION.

30 0 15 30
SCALE IN FEET

20 0 5 10 20
SCALE IN FEET

Date	Description	No.
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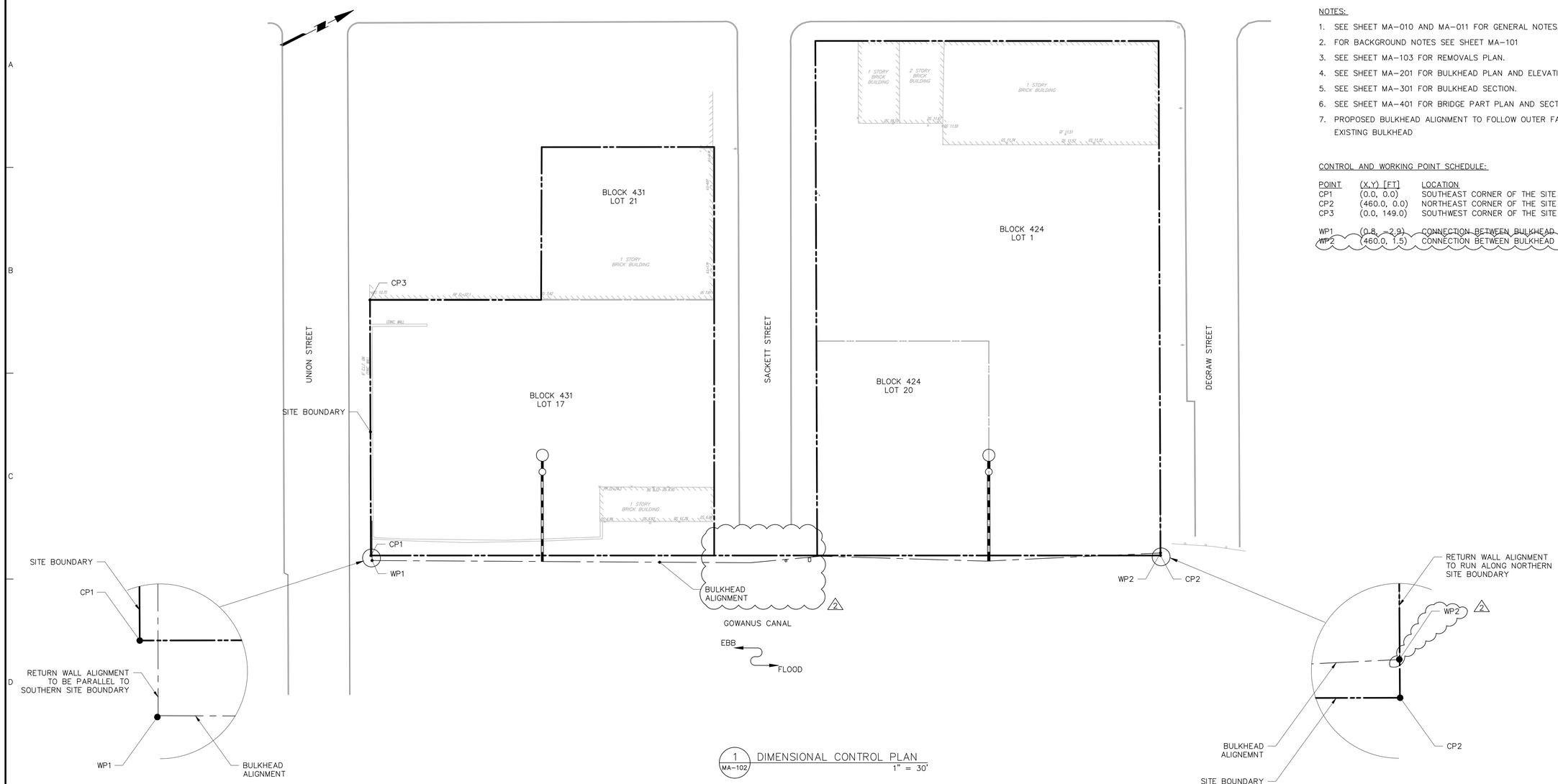
BROOKLYN
KINGS NEW YORK

Drawing Title
MONITORING PLAN

Project No.	Drawing No.
170295301	MA-101
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 6 of 13

PROJECT NO. 170295301

Filename: \\langan.com\data\NYC\data3\170295301\Cadd Data - 170295301\SheetFiles\Bulkhead\170295301-BM101-0101.dwg Date: 2/14/2020 Time: 14:57 User: wzhao Style Table: Langan.stb Layout: MONITORING PLAN



1 MA-102 DIMENSIONAL CONTROL PLAN
1" = 30'

NOTES:

1. SEE SHEET MA-010 AND MA-011 FOR GENERAL NOTES.
2. FOR BACKGROUND NOTES SEE SHEET MA-101
3. SEE SHEET MA-103 FOR REMOVALS PLAN.
4. SEE SHEET MA-201 FOR BULKHEAD PLAN AND ELEVATION.
5. SEE SHEET MA-301 FOR BULKHEAD SECTION.
6. SEE SHEET MA-401 FOR BRIDGE PART PLAN AND SECTION.
7. PROPOSED BULKHEAD ALIGNMENT TO FOLLOW OUTER FACE OF EXISTING BULKHEAD

CONTROL AND WORKING POINT SCHEDULE:

POINT	(X,Y) [FT]	LOCATION
CP1	(0.0, 0.0)	SOUTHEAST CORNER OF THE SITE BOUNDARY
CP2	(460.0, 0.0)	NORTHEAST CORNER OF THE SITE BOUNDARY
CP3	(0.0, 149.0)	SOUTHWEST CORNER OF THE SITE BOUNDARY
WP1	(0.8, 2.9)	CONNECTION BETWEEN BULKHEAD AND SOUTHERN RETURN WALL
WP2	(460.0, 1.5)	CONNECTION BETWEEN BULKHEAD AND NORTHERN RETURN WALL

30 0 15 30
SCALE IN FEET

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Drawing Title
DIMENSIONAL CONTROL PLAN

Project No.	Drawing No.
170295301	MA-102
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 7 of 13

PROJECT NO. 170295301

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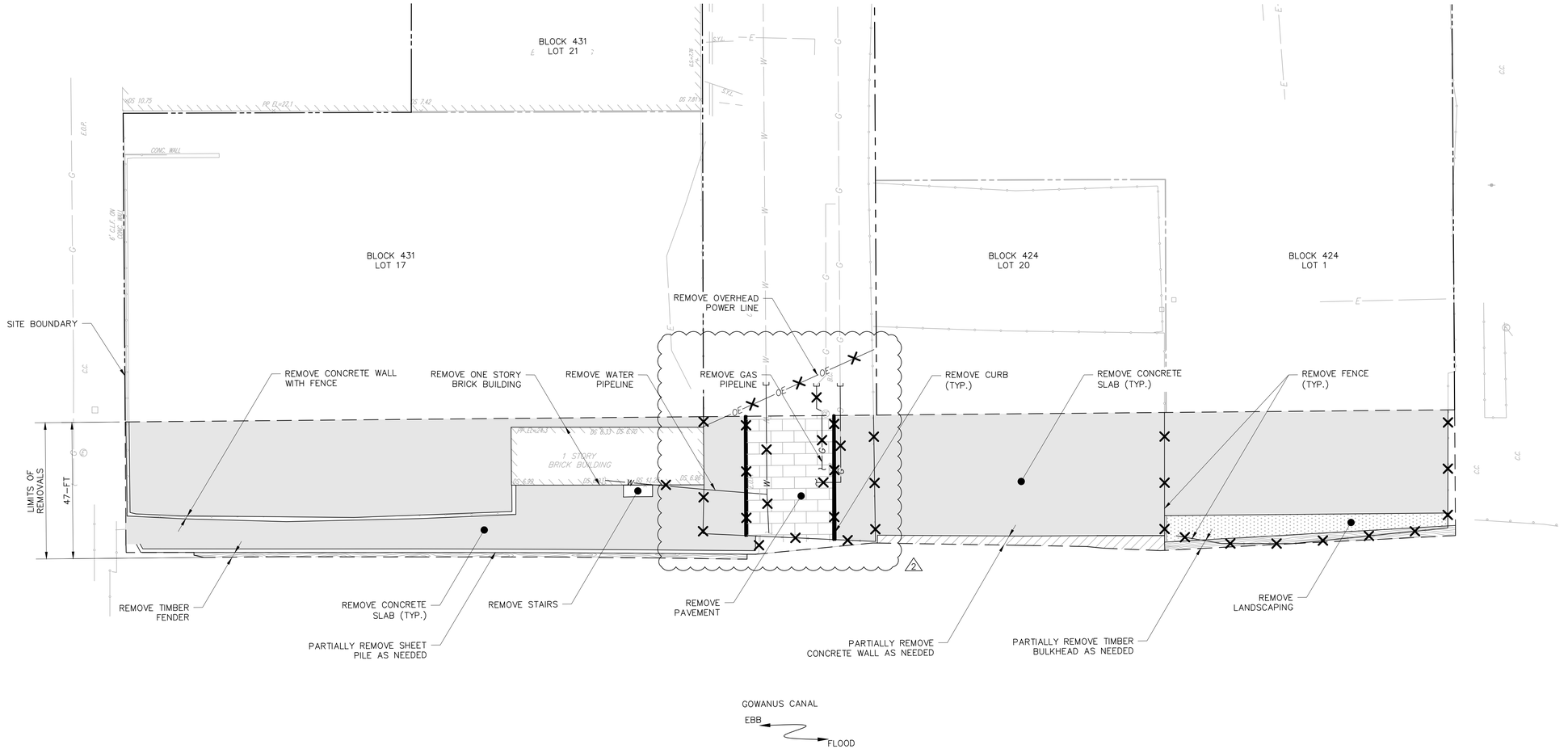

GOWANUS CANAL
EBB
FLOOD

1 (MA-103) REMOVALS PLAN
1" = 20'

NOTES:

1. FOR BACKGROUND NOTES SEE SHEET MA-101.
2. BRIDGE ABUTMENT NOT SHOWN (SEE SHEET MA-401)

REMOVAL NOTES:

1. REMOVE PAVEMENT, VEGETATION, STEEL SHEET PILE, CONCRETE WALL, TIMBER BULKHEAD, TIMBER FENDER, GAS PIPELINE, WATER PIPELINE, OVERHEAD POWER LINE AND ANY OTHER ELEMENTS WITHIN LIMITS OF REMOVAL THAT MAY INTERFERE WITH PROPOSED DEVELOPMENT.
2. CAP GAS PIPELINE AND WATER PIPELINE 15 FEET BEHIND PROPOSED DEADMAN SHEET PILE. (2)
3. LEGALLY DISPOSE OF ALL REMOVED ELEMENTS & DEBRIS AT AN APPROPRIATE RECYCLING OR DISPOSAL FACILITY IN ACCORDANCE WITH APPLICABLE REGULATIONS INCLUDING, BUT NOT LIMITED TO, NEW YORK STATE PART 360 SOLID WASTE REGULATIONS.
4. PROTECT BRIDGE, PAVEMENT, UTILITIES AND OTHER STRUCTURES TO REMAIN.
5. PARTIAL REMOVAL OF SHEET PILE, CONCRETE WALL, AND TIMBER BULKHEAD SHALL BE LIMITED TO ONLY NECESSARY TO INSTALL TIE RODS.

20 0 5 10 20
SCALE IN FEET

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11/26/19	REVISED PER USEPA COMMENTS	1

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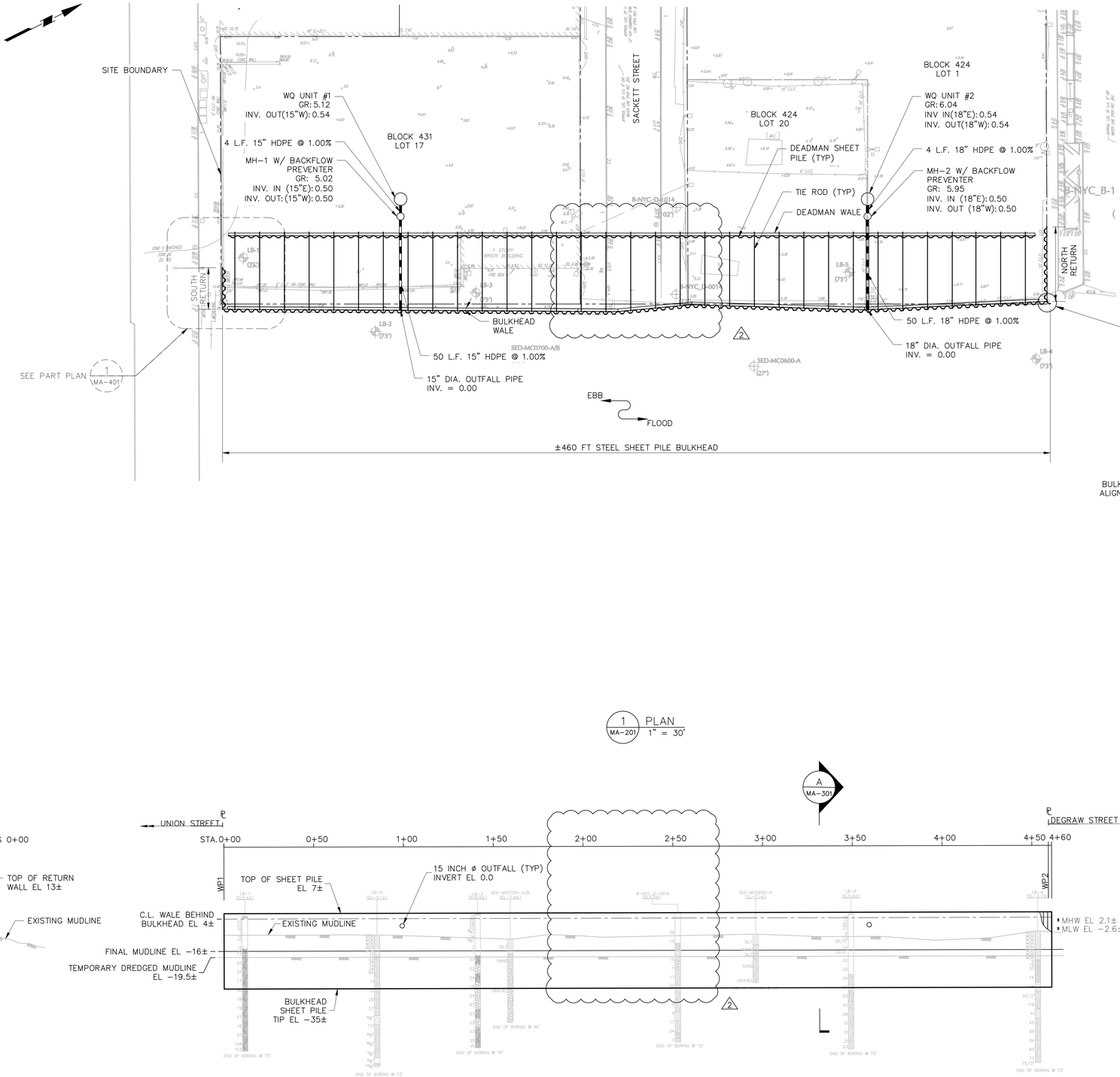
BROOKLYN
KINGS NEW YORK

Drawing Title
REMOVALS PLAN

Project No.	Drawing No.
170295301	MA-103
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 8 of 13

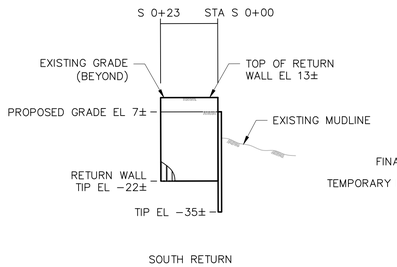
PROJECT NO. 170295301



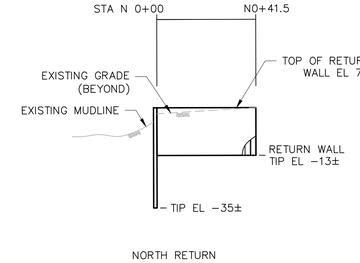
NOTES:

1. FOR GENERAL NOTES SEE SHEET MA-010.
2. FOR BACKGROUND REFERENCE SEE SHEET MA-101.
3. BORINGS LB-1 THROUGH LB-5 WERE PERFORMED BY WARREN GEORGE INC., BETWEEN 22 JULY AND 6 AUGUST 2019.
4. B-NYC SERIES BORINGS WERE PERFORMED BY AQUIFER DRILLING AND TESTING INC., BETWEEN 1 JULY AND 5 AUGUST 2015.
5. BORING SED-MC0600 WAS PERFORMED BY AQUIFER DRILLING AND TESTING INC., BETWEEN 1 JUNE AND 2 JUNE 2015.
6. BORINGS SEC-MC0700 WERE PERFORMED BY CASCADE ON 29 APRIL 2015.
7. BORING LOCATIONS SHOWN ARE APPROXIMATE.
8. SUBSURFACE CONDITIONS MAY VARY ALONG THE LENGTH OF THE BULKHEAD.
9. WALES SHALL BE CONTINUOUSLY SPLICED. SEE DETAILS FOR WALE SPLICE.

1 PLAN
MA-201
1" = 30'



SOUTH RETURN



NORTH RETURN

2 ELEVATION
MA-201
1" = 30'

30 0 15 30
SCALE IN FEET

Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
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PROFESSIONAL ENGINEER STATE LIC. No. 63718-1

LANGAN
Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C.
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New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Project

GOWANUS CANAL NORTHSIDE

BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN

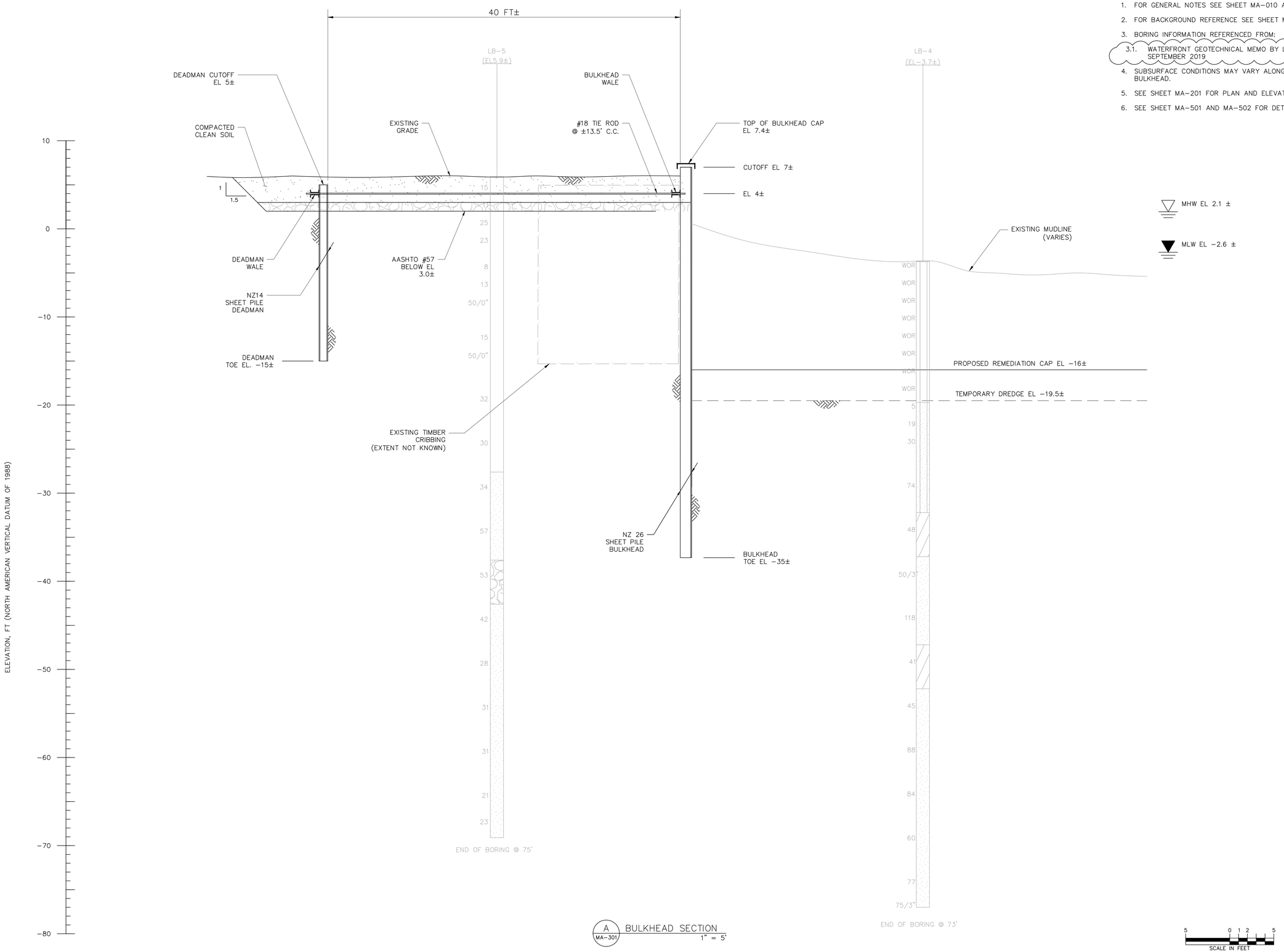
KINGS **NEW YORK**

Drawing Title

BULKHEAD PLAN AND ELEVATION

Project No. **170295301**	Drawing No. **MA-201**
Date **01/27/2020**	
Drawn By **FDM**	
Checked By **KAH**	Sheet 9 of 13

PROJECT NO. 170295301



A MA-301 BULKHEAD SECTION
1" = 5'

5 0 1 2 5
SCALE IN FEET

NOTES:

1. FOR GENERAL NOTES SEE SHEET MA-010 AND MA-011.
2. FOR BACKGROUND REFERENCE SEE SHEET MA-101.
3. BORING INFORMATION REFERENCED FROM:
   - 3.1. WATERFRONT GEOTECHNICAL MEMO BY LANGAN, DATED 11 SEPTEMBER 2019 (1)
4. SUBSURFACE CONDITIONS MAY VARY ALONG THE LENGTH OF THE BULKHEAD.
5. SEE SHEET MA-201 FOR PLAN AND ELEVATION.
6. SEE SHEET MA-501 AND MA-502 FOR DETAILS.

Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
11/26/19	REVISED PER USEPA COMMENTS	1

REVISIONS

SIGNATURE DATE SIGNED

GREGORY BIESIADECKI
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Project

GOWANUS CANAL NORTHSIDE

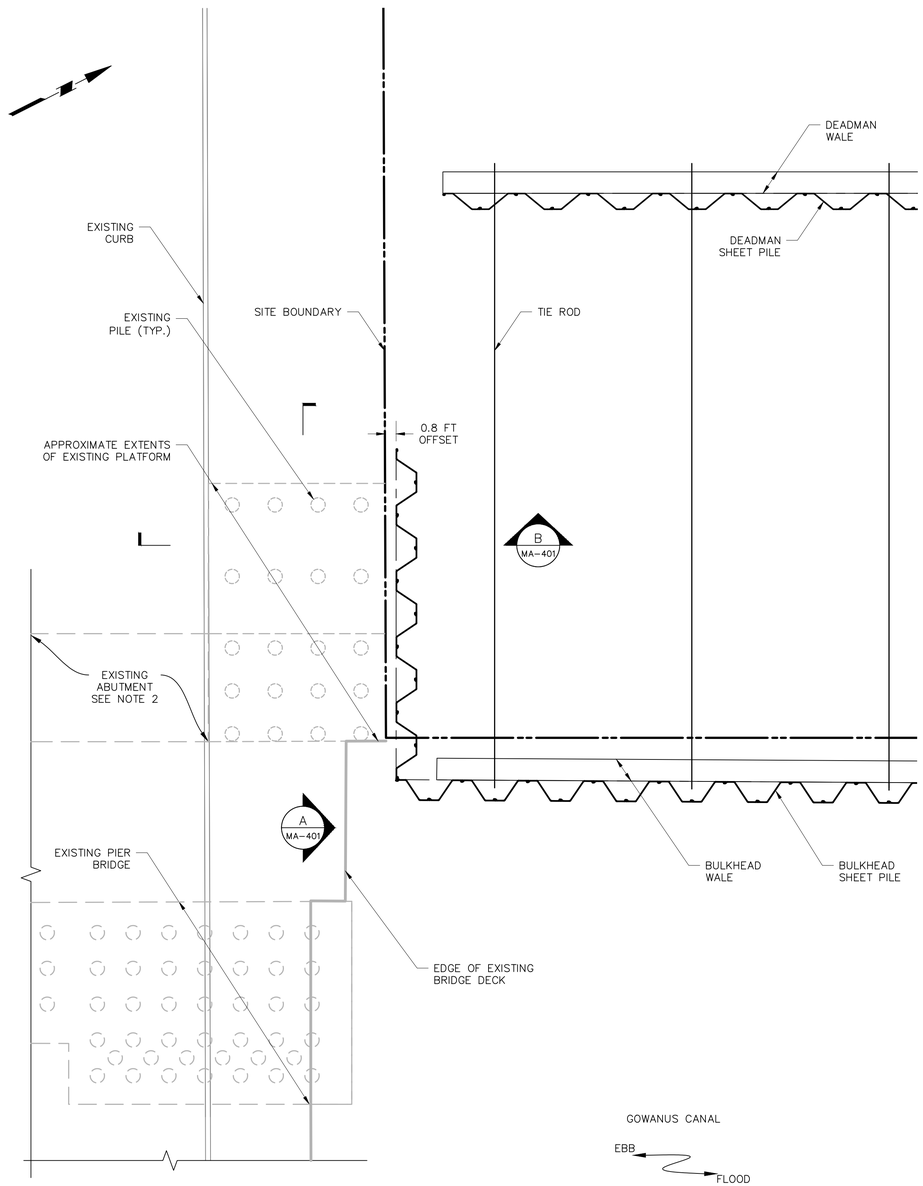
BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS **NEW YORK**

Drawing Title

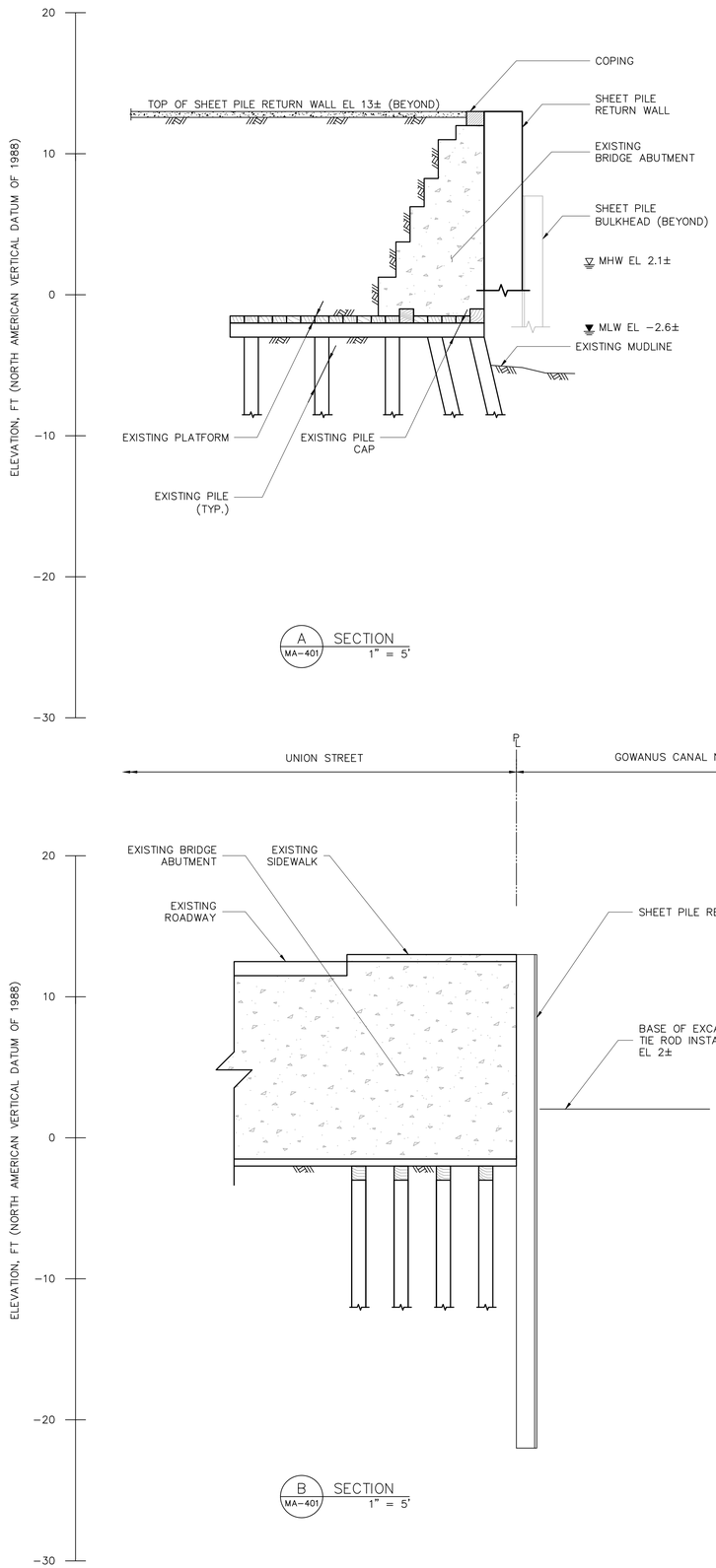
BULKHEAD SECTION

Project No.	Drawing No.
170295301	MA-301
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 10 of 13

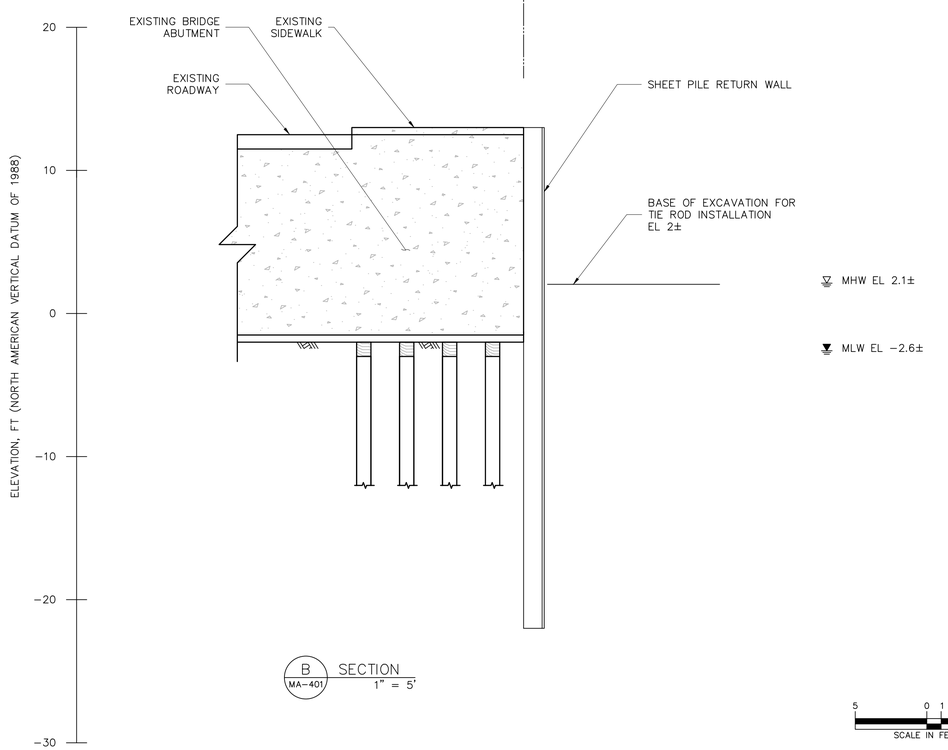
PROJECT NO. 170295301



1 MA-401 PART PLAN 1" = 5'



A MA-401 SECTION 1" = 5'



B MA-401 SECTION 1" = 5'

5 0 1 2 5
SCALE IN FEET

NOTES:

1. DOT FOUNDATION LAYOUT BASED ON DRAWINGS:
   - "UNION STREET BRIDGE OVER GOWANUS CANAL: SUBSTRUCTURE" CITY OF NEW YORK: DEPARTMENT OF BRIDGES, DATED 4 MAY 1904
   - "UNION STREET BRIDGE OVER GOWANUS CANAL: MASONRY" CITY OF NEW YORK: DEPARTMENT OF BRIDGES, DATED 15 DECEMBER 1903
2. CENTRAL PORTION OF ABUTMENT CONSTRUCTED PRIOR TO 1903. NO FOUNDATION INFORMATION IS AVAILABLE FOR THIS PORTION OF THE ABUTMENT.
3. WITHIN 75 FT OF BRIDGE SHEETS TO BE INSTALLED WITH SILENT PILER

Date	Description	No.
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Project

GOWANUS CANAL NORTHSIDE

BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS **NEW YORK**

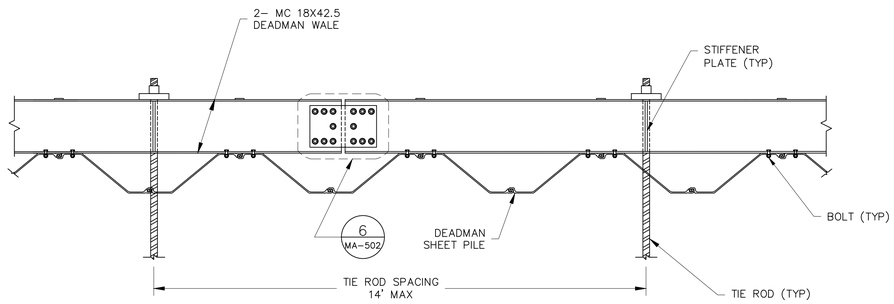
Drawing Title

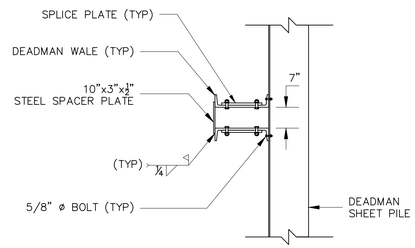
BRIDGE PART PLAN AND SECTION

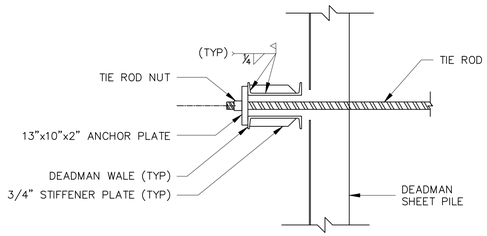
Project No.	Drawing No.
170295301	MA-401
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 11 of 13

LANGAN
PROJECT NO. 170295301

Filename: \\langan.com\data\NYC\data3\170295301\Cadd Data - 170295301\SheetFiles\Bulkhead\170295301-BW301-0102.dwg Date: 2/14/2020 Time: 14:58 User: wzhao Style Table: Langan.stb Layout: BRIDGE PART PLAN AND SECTION





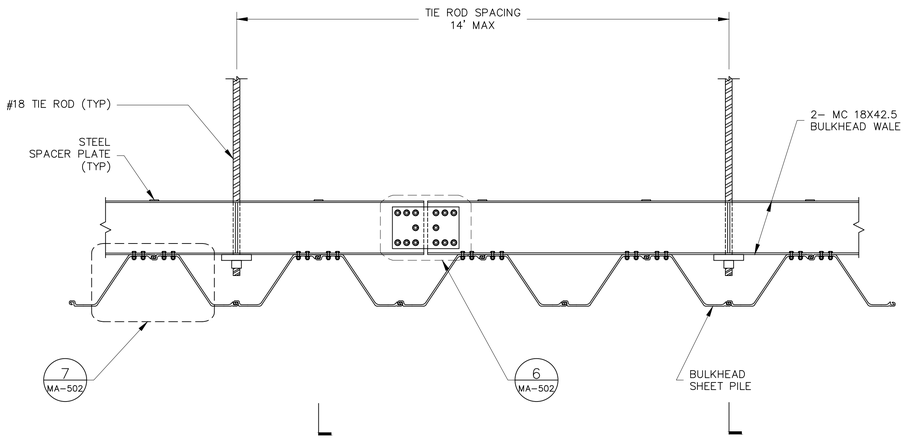


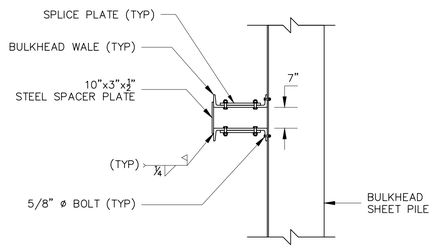
NOTE:

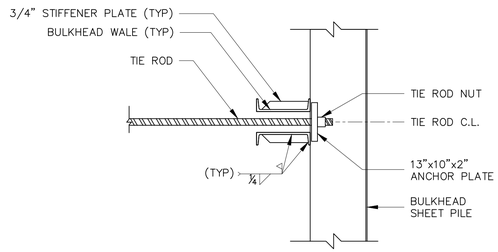
1. BULKHEAD CAP AND CONNECTING ANGLES NOT SHOWN FOR CLARITY.
2. SEE MA–010 AND MA–011 FOR GENERAL NOTES.
3. SEE MA–103 FOR PLAN AND ELEVATION.
4. SEE MA–301 FOR SECTION.

2 MA–501 SECTION DETAIL – WALE CONNECTION AT DEADMAN
1/2" = 1'–0"

3 MA–501 SECTION DETAIL – WALE/TIE ROD CONNECTION AT DEADMAN
1/2" = 1'–0"







1 MA–501 PLAN DETAIL – BULKHEAD
1/2" = 1'–0"

4 MA–501 SECTION DETAIL – WALE CONNECTION AT BULKHEAD
1/2" = 1'–0"

5 MA–501 SECTION DETAIL – WALE/TIE ROD CONNECTION AT BULKHEAD
1/2" = 1'–0"

NOTE: BULKHEAD CAP AND CONNECTING ANGLES NOT SHOWN FOR CLARITY

Date	Description	No.
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11/26/19	REVISED PER USEPA COMMENTS	1

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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS NEW YORK

Drawing Title
DETAILS - 1 OF 2

Project No.	Drawing No.
170295301	MA-501
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 12 of 13

PROJECT NO. 170295301

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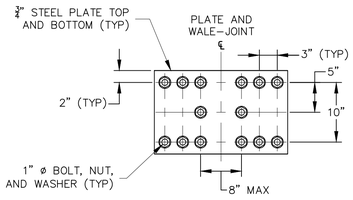
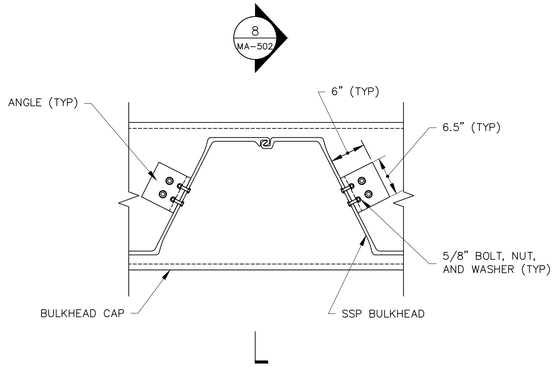
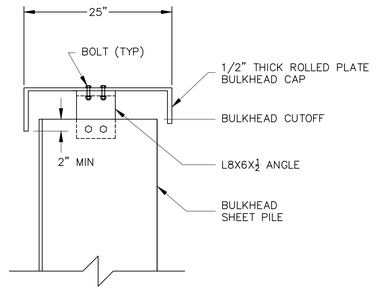


NOTE: BOTTOM SPLICE PLATE MIRRORED.

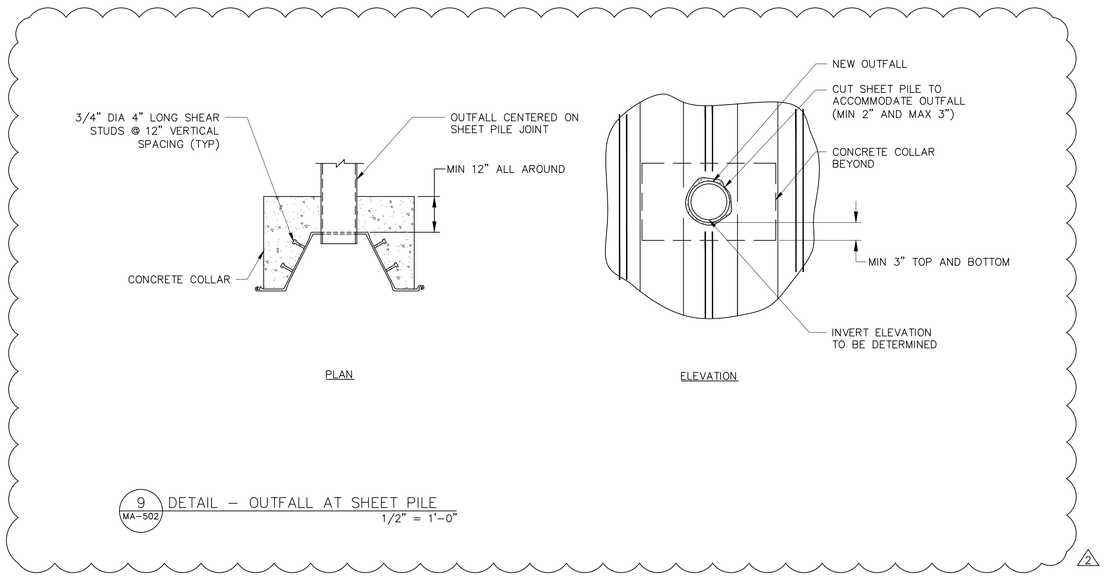
6 MA-502 PLAN DETAIL – WALE SPLICE
1" = 1'–0"



7 MA-502 PLAN DETAIL – BULKHEAD CAP CONNECTION
1" = 1'–0"



8 MA-502 SECTION DETAIL – BULKHEAD CAP CONNECTION
1" = 1'–0"



9 MA-502 DETAIL – OUTFALL AT SHEET PILE
1/2" = 1'–0"

2

Date	Description	No.
01/27/20	REVISED PER USEPA COMMENTS	2
11/26/19	REVISED PER USEPA COMMENTS	1

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SIGNATURE DATE SIGNED
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Project
GOWANUS CANAL NORTHSIDE
BLOCK No. 424, LOT No. 1 AND 20
BLOCK NO. 431, LOT No. 12 AND 17
BROOKLYN
KINGS NEW YORK

Drawing Title
DETAILS - 2 OF 2

Project No.	Drawing No.
170295301	MA-502
Date: 01/27/2020	
Drawn By: FDM	
Checked By: KAH	Sheet 13 of 13

PROJECT NO. 170295301

Filename: \\langan.com\data\NYC\data3\170295301\Cadd Data - 170295301\SheetFiles\Bulkhead\170295301-BW501-0101.dwg Date: 2/14/2020 Time: 14:58 User: wzhao Style Table: Langan.stb Layout: DETAILS - 2 OF 2

APPENDIX C
QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN

for

GOWANUS CANAL NORTHSIDE

Brooklyn, New York 11231
Block 424, Lots 1 and 20;
Block 431, Lots 12 and 17
NYSDEC BCP Site No. C224080

Prepared For:

Gowanus Canal LLC
111 Fifth Avenue, Floor 6
New York, New York 10003

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

March 2020
Langan Project No. 170295301

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LIST OF FIGURES

LIST OF ATTACHMENTS

1.0 PROJECT DESCRIPTION

1.1 INTRODUCTION

The about 98,800-square-foot property (the "site") is identified as:

- Block 424, Lot 1: 479-493 Sackett Street, 267-285 Bond Street, and 484-508 Degraw Street, Brooklyn, New York;
- Block 424, Lot 20: 495-505 Sackett Street, Brooklyn, New York;
- Block 431, Lot 12: 498-502 Sackett Street, Brooklyn, New York; and
- Block 431, Lot 17: 508-520 Sackett Street and 505-517 Union Street, Brooklyn, New York.

Pursuant to an April 16, 2015 Brownfield Cleanup Agreement (BCA), the Site is enrolled in the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program, and is identified by the NYSDEC as Site No. C224036.

The site was previously occupied by the Bayside Fuel Oil Depot Corporation and is a registered inactive Major Oil Storage Facility (MOSF). The site contains an out-of-service wholesale fuel oil distribution facility with a vacant two-story office building (Block 431, Lot 17); vacant automobile maintenance garages formerly used to service the Bayside Fuel vehicle fleet (Block 431, Lot 12 and Block 424, Lot 1); and a vacant parking lot and equipment storage areas (Block 424, Lots 1 and 20). Oil storage containers associated with the inactive MOSF on Lot 17 have been dismantled and removed. Refer to the Interim Remedial Measures Work Plan (IRMWP) for additional details.

This Quality Assurance Project Plan (QAPP) specifies analytical methods and evaluation procedures to be used to ensure that data from the proposed interim remedial measures (IRM) at the Site are precise, accurate, representative, comparable, and complete.

1.2 PROJECT OBJECTIVES

The objective of this project is to address both emergency and non-emergency site conditions to prevent, mitigate, or remedy environmental damage associated with activities at the site, including, but not limited to: construction of diversion ditches; collection systems; drum removal; leachate collection systems; construction of fences or other barriers; installation of water filters; provision of alternative water systems; the removal of source areas; or plume control. The final remedial measure needed for a permanent remedy will be described in a forthcoming Remedial Action Work Plan (RAWP).

1.3 SCOPE OF WORK

The specific scope of work for this IRM is described in detail in Section 2.0 of the IRMWP. The proposed IRM consist of the following tasks:

1. Partial demolition of the existing concrete seawall, steel sheet piles, timber bulkhead, and associated structures, as needed, to install a sheet pile cut-off wall

2. Installation of a sealed-seam, sheet pile cut-off wall outboard of the existing bulkhead to stabilize the shoreline and reduce contaminant migration

3. Excavation, handling, transportation, and off-site disposal of material, as necessary, to complete construction of the cut-off wall and upland components (i.e., sheet pile deadman, tie rods, walers, and pretreatment units [PTUs])

4. Implementation of a Community Air Monitoring Plan (CAMP) for dust, odors, and volatile organic compounds (VOCs) during ground-intrusive activities

5. Dewatering and treatment as necessary to facilitate excavation necessary for cut-off wall construction

6. Collection and analysis of base of excavation endpoint and sidewall soil samples from the tie rod and waler excavation area

7. Surveying of cut-off wall, excavation, and backfilling extents by a surveyor licensed to practice in the state of New York

8. Preparation of a Construction Completion Report (CCR) to document construction of the steel sheet pile cut-off wall and satisfactory implementation of the IRMWP

The IRM will be performed in accordance with applicable federal, state, and city regulations and a Health and Safety Plan (HASP), which is provided as Appendix A of the IRMWP. Concept design for the cut-off wall is provided in Appendix B of the IRMWP.

2.0 DATA QUALITY OBJECTIVES AND PROCESSES

Data Quality Objectives (DQOs) are qualitative and quantitative statements to help ensure that data of known and appropriate quality are obtained during the project. 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 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. Sampling accuracy will be determined through the assessment of the analytical results of equipment blanks and trip blanks (organic analysis of aqueous matrices only) 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.

- **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, instrument calibrations, 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.

The above objectives are discussed in detail in Section 4.0.

3.0 PROJECT ORGANIZATION

The IRM will be overseen by Langan on behalf of Gowanus Canal LLC. Langan will oversee soil screening, waste characterization, soil staging and stockpiling, material loading and transport, documentation samples, and import of backfill and clean fill material. Langan will collect soil samples as outlined by the IRMWP. The analytical services will be provided by Alpha Analytical Laboratories Inc. (Alpha).

Key contacts for this project are summarized below; Langan resumes are included in Attachment A:

Personnel	Investigation Role	Contact Information
Patrick Farnham, P.E. Langan Engineering	Langan Project Manager	Phone – 212-479-5578 Email – pfarnham@langan.com
Jason Hayes, P.E. Langan Engineering	Langan Quality Assurance Officer (QAO)	Phone – 212-479-5427 Email – jahayes@langan.com
Gerald Nicholls, P.E. Langan Engineering	Program Quality Assurance Monitor	Phone – 212-479-5559 Email – gnicholls@langan.com
Emily Strake Langan Engineering	Data Validator / Program Quality Assurance Manager	Phone – 215-491-6500 Email – estrake@langan.com
Ben Rao Alpha Analytical Laboratories	Laboratory Representative	Phone – 201-812-2633 Email – brao@alphalab.com

4.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OBJECTIVES FOR MEASUREMENT OF DATA

The quality assurance and quality control objectives for all measurement data include precision, accuracy, representativeness, completeness, comparability, and sensitivity. These objectives are defined in following subsections. 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 5x the reporting limit (RL) meet the precision criteria if the absolute difference is less than ±2x the RL for soil or ±1x for groundwater. For results greater than 5x the RL, the acceptance criteria is a relative percent difference (RPD) of ≤50% (soil) or ≤30% (groundwater). 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 with 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 will be considered for non-aqueous matrices where high concentrations of volatile organic compounds (VOCs) are anticipated based on field screening.

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 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 analytical methods, laboratory-issued SOPs, the laboratory's Quality Assurance Manual, and this QAPP. The laboratory is required to be properly certified and accredited.

4.4 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.

Soil and soil vapor 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.

4.5 COMPARABILITY

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 by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the U.S. Environmental Protection Agency (USEPA) or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);

- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on documentation sampling analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

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 the 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. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch.

5.0 SAMPLING PROGRAM

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

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(s)
- Date and time of activity
- Sample identification number(s)
- 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 and abbreviation in accordance with the sample nomenclature guidance provided in the following table and the Standard Operating Procedure provided in Attachment D.

Sample Nomenclature Summary	
AA	Ambient Air
DUP	Field Duplicate
EA	Effluent Air
FB	Field Blank
IA	Indoor Air
MW	Monitoring Well
SB	Soil Boring
SSV	Sub-slab Vapor
TB	Trip Blank
(#-#)	Depth Interval
MMDDYY	Date of Sampling

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 photoionization detector (PID) will be used during the sampling activities to evaluate work zone action levels, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and the Site Health & Safety Officer, 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

Below is a brief summary of anticipated sample collection during IRM activities. An Analytical Methods and Quality Assurance Summary Table providing detail for specific media and associated analytical parameters is included in Attachment C.

Soil Samples

Endpoint soil samples will be collected and will be analyzed for the following analyses:

- Part 375 VOCs (USEPA Method 8260C);
- Part 375 semivolatile organic compounds (SVOCs) (USEPA Method 8270D);
- Part 375 polychlorinated biphenyls (PCBs) (USEPA Method 8082A);
- Part 375 Pesticides (USEPA Method 8081B); and
- Part 375 Metals (USEPA Methods 6010D and 7473).

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 En Core® or Terra Core® sampling equipment. For analysis of non-volatile parameters, samples will be homogenized and placed into glass jars. Samples will be collected with unused sterile sampling scoops or spoons and homogenized in unused sterile polyethylene zipper bags. 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 Sections 5.4 and 5.6. 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 samples will meet all quality assurance criteria set forth by this QAPP and DER-10.

Sample Field Blanks, Equipment Blanks, and Duplicates

Field blanks will be collected for quality assurance purposes at a rate of one per 20 soil investigation samples per analysis. Field blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Field blank samples will be analyzed for the complete list of analytes on the day of sampling. Trip blanks will be collected at a rate of one per day if soil samples are analyzed for VOCs during that day.

Duplicate soil samples will be collected and analyzed for quality assurance purposes. Duplicate samples will be collected at a frequency of one per 20 investigative soil samples per analysis and will be submitted to the laboratory as "blind" samples. If less than 20 samples are collected during a particular sampling event, one duplicate sample will be collected.

5.4 SAMPLE CONTAINERS AND HANDLING

Certified, commercially clean sample containers will be obtained from the analytical laboratory. 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 and groundwater (contingency) 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 sample HASP included in Appendix A of the IRMWP. 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 personal protective equipment) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Decontamination and fluids will be placed in UN/Department of Transportation (DOT) approved fluid drums with closed tops. All drums will be properly labeled, sealed, and characterized as necessary.

If previous analytical data is insufficient to gain disposal facility acceptance, waste characterization samples will be analyzed for parameters that are typically required by disposal facilities, such as target compounds list (TCL) VOCs, SVOCs, Resource Conservation and Recovery Act (RCRA) metals, PCBs, pesticides, herbicides, Toxicity Characteristic Leaching Procedure (TCLP) VOCs, TCLP SVOCs, TCLP metals, ignitability, corrosivity, reactivity, and paint filter. Additional sampling and analyses may be required based on the selected disposal facility.

Samples will be collected in accordance with the selected disposal facility's requirements and will be collected to be representative of the material requiring disposal at a frequency consistent with disposal facility requirements. It is anticipated that all drummed material will be transported off-site and disposed of at a permitted facility.

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.

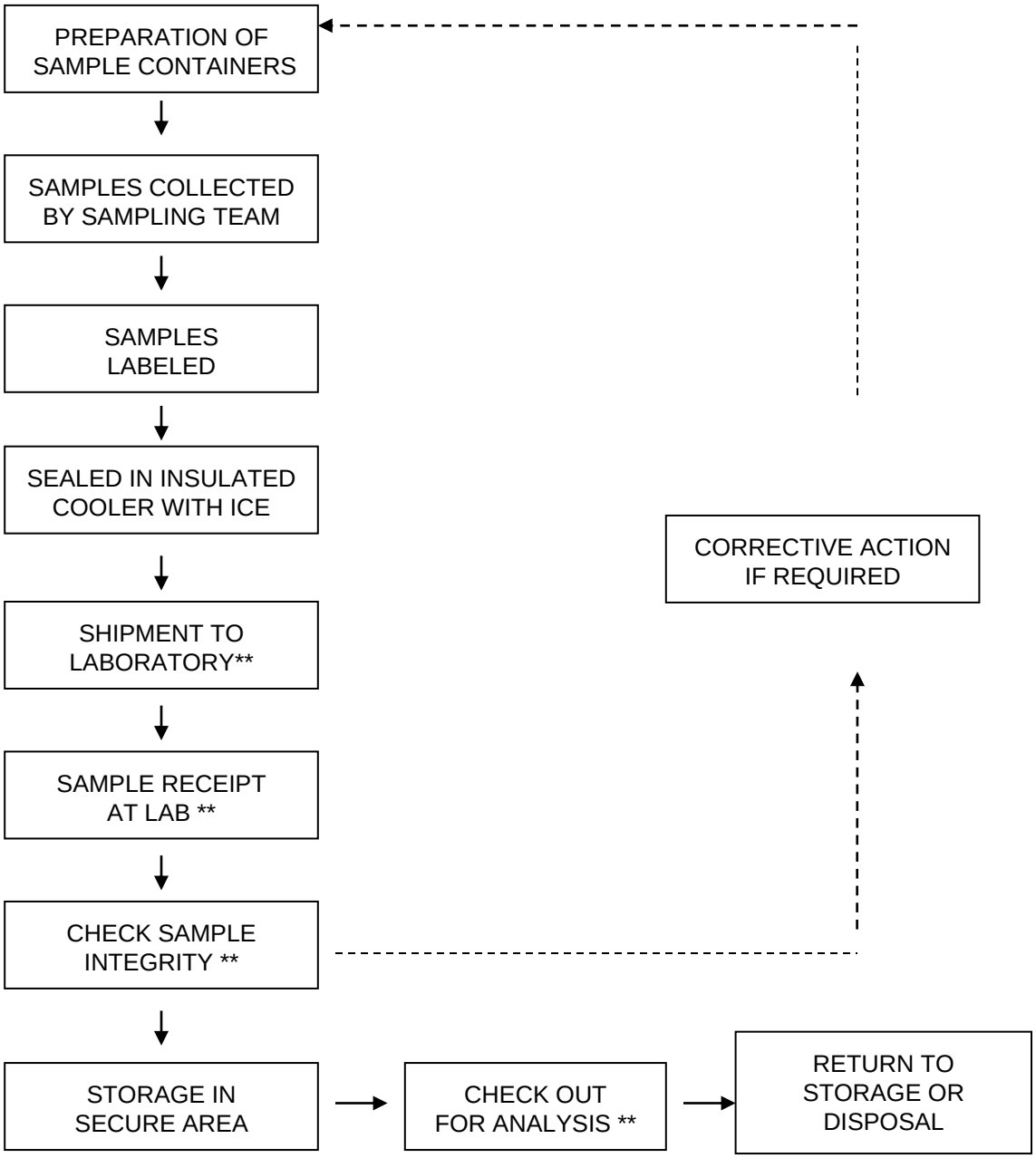
- Langan field personnel will be responsible for the care and custody of the samples collected until the samples are transferred to another party, dispatched to the laboratory, or disposed. The sampling team leader will be responsible for enforcing chain-of-custody procedures during field work.

- 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.

When soil and samples are collected, 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 an example chain-of-custody form for soil and groundwater (contingency) samples is included as Figure 5.2.

Figure 5.1 Sample Custody



** REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 5.2 Sample Chain-of-Custody Form – Soil and Groundwater Samples

NEW YORK CHAIN OF CUSTODY

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

Container Type
Preservative

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

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 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 analytical methodology (Attachment C) 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 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 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 of documentation soil sample results will be performed in accordance with the USEPA Region II validation guidelines for organic and inorganic data review and the National functional Guidelines (USEPA 2017, USEPA 2017b). Validation will include the following:

- Verification of the QC sample results,
- Verification of the identification of sample results (both positive hits and non-detects),
- Preparation of Data Usability Summary Reports (DUSR).

A DUSR will be prepared and reviewed by the Quality Assurance Officer (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;
- 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.

6.4 Reporting

Upon receipt of validated analytical results, NYSDEC format EDDs, compatible with EQuIS™, will be prepared and submitted to the NYSDEC.

7.0 QUALITY ASSURANCE, PERFORMANCE, 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 9.1 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

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

3. 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

4. USEPA, 2016. Region II SOP #HW-33A, "Low/Medium 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 2015. Region II SOP #HW-3a, "ICP-AES Data Validation" (July 2015, Revision 0), USEPA Hazardous Waste Support Section. USEPA Region II

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

10. USEPA, 2016. Region II SOP #HW-3c, "Mercury and Cyanide Data Validation" (September 2016, Revision 1), USEPA Hazardous Waste Support Section. USEPA Region II

11. 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.

12. 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

MICHAEL D. BURKE, PG, CHMM, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING AND REMEDIATION

Mr. Burke is a geologist/environmental scientist whose practice involves site investigation and remediation, transactional due diligence, environmental site assessments, in-situ remedial technology, and manufactured gas plant (MGP) site characterization and remediation. His additional services include multi-media compliance audits, sub-slab depressurization system design, non-hazardous and hazardous waste management, emergency response, community air monitoring programs, environmental and geotechnical site investigations, and health and safety monitoring. He has experience with projects in the New York State Department of Environmental Conservation (NYSDEC) and New York State Brownfield Cleanup (NYS BCP) Programs; Inactive Hazardous Waste, and Spill Programs, and New York City Office of Environmental Remediation (OER) e-designated and New York City Voluntary Cleanup Program (NYC VCP) sites.

SELECTED PROJECTS

- 432 Rodney Street, NYS Brownfield Cleanup Program, Petroleum and Chlorinated Volatile Organic Compound Investigation and Remediation, Brooklyn, NY
- 563 Sacket Street, NYS Brownfield Cleanup Program Site, MGP Investigation, and Remediation, Brooklyn, NY
- New York University Tandon School of Engineering, Spill Investigation/Remediation Dual Phase Recovery, and Laser Fluorescence Investigation, Brooklyn, NY
- Former Watermark Locations, NYS Brownfield Cleanup Program, Chlorinated Volatile Organic Compound Investigation and Remediation; AS/SVE, Brooklyn, NY
- Urban Health Plan, Medical Building, NYS Brownfield Cleanup Program CVOC Investigation and Remediation, Bronx, NY
- Whitehead Realty Solvent Site, Inactive Hazardous Waste site, CVOC Investigation and Remediation, Brooklyn, NY
- Con Edison on Governors Island, Dielectric Fluid Spill, Investigation and Remediation, New York, NY
- West 17th Street Development, NYS Brownfield Cleanup Program, MGP Investigation and Remediation, New York, NY
- Montefiore Medical Center, Emergency Response, PCB Remediation, Bronx, NY
- New York University, 4 Washington Square Village Fuel Oil Remediation, New York, NY
- Residential Building at 82 Irving Place, Environmental Remediation, New York, NY
- 420 Kent Avenue, NYS Brownfield Cleanup Program, Brooklyn, NY
- 572 Eleventh Avenue, NYC VCP, New York, NY
- 537 Sackett Street, Gowanus Canal Due Diligence/MGP Site, Brooklyn, NY
- 431 Carroll Street, Gowanus Canal Due Diligence, Brooklyn, NY

EDUCATION

M.S., Environmental Geology
Rutgers University

B.S., Geological Sciences
Rutgers University

B.S., Environmental Science
Rutgers University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

Certified Hazardous Materials Manager – CHMM No. 15998

LEED Accredited Professional (LEED AP)

OSHA Certification for Hazardous Waste Site Supervisor

OSHA 29 CFR 1910.120 Certification for Hazardous Waste Operations and Emergency Response

NJDEP Certification for Community Noise Enforcement

Troxler Certification for Nuclear Densometer Training

JASON J. HAYES, PE, LEED AP

PRINCIPAL/VICE PRESIDENT

ENVIRONMENTAL ENGINEERING

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

SELECTED PROJECTS

- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 627 Smith Street (RI and Report), Brooklyn, NY
- Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY

EDUCATION

M.S., Environmental Engineering
Columbia University

B.S., Chemistry, Environmental Toxicology Humboldt State University

Business Administration (minor)
Humboldt State University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

CPR and First Aid Certification

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

AFFILIATIONS

US Green Building Council, NYC Chapter (USGBC), Communications Committee

Urban Land Institute (ULI), member

Commercial Real Estate Development Associations (NAIOP), member

NYC Brownfield Partnership, member

GERALD F. NICHOLLS, PE, CHMM

ASSOCIATE

ENVIRONMENTAL ENGINEERING & HAZARDOUS MATERIALS MANAGMENT

Mr. Nicholls' expertise includes management of remediation and site investigations, brownfield cleanups, remedial design, industrial hygiene, air monitoring and environmental health and safety projects including data collection, inspection and reporting for projects throughout New York and New Jersey. He works closely with various private, Department of Defense, state, commercial, industrial, and municipal clients, acting as a liaison between the client and project team.

As an Associate, Mr. Nicholls is responsible for supervising project staff; conducting technical review; maintaining quality control; budget forecasting and control; and managing the technical and financial aspects of active projects.

In 2019, Real Estate Weekly named Mr. Nicholls one of the Rising Stars of Real Estate.

SELECTED PROJECTS

- 140 6th Avenue, Sub-Membrane Depressurization System Design, Spill Remediation, Subslab Remediation and Monitoring Well Piping Design, Remediation Oversight, and Construction Administration, New York, NY
- 23-01 42nd Road, Phase I, Phase II Remedial Investigation, Remedial Action Work Plan, Sub-Membrane Depressurization System Design, Underground Storage Tank Closure and Remediation, Brownfield Cleanup Program, Remediation Oversight, Construction Administration, Long Island City, NY
- 23-10 Queens Plaza South, Phase I, Phase II Remedial Investigation, Remedial Action Work Plan, Sub-Membrane Depressurization System Design, Underground Storage Tank Closure and Remediation, Brownfield Cleanup Program, Remediation Oversight, Construction Administration, Long Island City, NY
- 170 Amsterdam Avenue, Remedial Action Work Plan, Voluntary Cleanup Program, Remediation Oversight, Construction Administration, New York, NY
- West 17th Street Development, DNAPL Assessment, DNAPL Recovery, Remedial Design, Closure through Brownfield Cleanup Program, Remediation Oversight, Bid Documents, ISS and Containment Wall Design, Construction Administration, New York, NY
- Surfactant Remediation Project, In-Situ Chemical Oxidation Design and Implementation and Site Closure, Margate City, NJ
- NYU Langone Medical Center, New Science Building, Remediation Oversight and Construction Administration, Voluntary Cleanup Program, New York, NY
- Gowanus Canal Northside, Demolition and Decommissioning of MOSF, Remediation Investigation, Brownfield Cleanup Program, Brooklyn, NY

EDUCATION

M.S., Environmental Engineering New Jersey Institute of Technology

B.S., Chemistry and Environmental Studies (Double Major) Ursinus College

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

Certified Hazardous Materials Manager (CHMM)

AFFILIATIONS

City of Jersey City Environmental Commission, Former Commission, Vice Chair and Chair

Alliance of Hazardous Materials Professionals (AHMP)

Academy of Hazardous Materials Managers (ACHMM), NJ Chapter

American Chemical Society

Association of NJ Environmental Commissions (ANJEC)

PATRICK T. FARNHAM, PE, LEED GA

PROJECT ENGINEER

ENVIRONMENTAL ENGINEERING

Mr. Farnham has experience in environmental, civil, and biological engineering. His expertise includes environmental quality engineering, soil and water remediation, solid waste engineering, hydrology, physical/chemical processes in wastewater treatment, and water and landscape engineering. Mr. Farnham's responsibilities have also included project management, air monitoring, air/water/soil sampling, construction oversight, waste characterization, emergency spill response, Phase I ESAs and Phase II ESIs, and waste disposal oversight.

Mr. Farnham was named as one of the 2017 Young Professional of Year Winners by the American Council of Engineering Companies.

SELECTED PROJECTS

- Hudson Yards Development, remediation oversight at former MGP, New York, NY
- Columbia University, Manhattanville Campus, remediation oversight and management, New York, NY
- 160 Leroy Street, remediation management (Voluntary Cleanup Program), New York, NY
- 140 Sixth Avenue, remediation oversight, former gas station, New York, NY
- Gowanus Canal Northside, remediation management (Brownfield Cleanup Program), Brooklyn, NY
- Peter Cooper Village/Stuyvesant Town, remediation oversight at former MGP, New York, NY
- 42 West Street, Residential Conversion, remediation oversight, Brooklyn, NY
- Public Safety Answering Center II, remediation oversight, Bronx, NY
- 855 Sixth Avenue, remediation oversight, New York, NY
- 261 Hudson Street, remediation oversight, New York NY
- 23-01 42nd Road, remediation oversight, Long Island City, NY
- 309 Gold Street, remediation oversight, Brooklyn, NY
- 535 4th Avenue, remediation oversight, Brooklyn, NY
- 2nd Avenue Subway (96th Street Station), community and worker safety air monitoring at former MGP, New York, NY
- 111 Leroy Street, Phase II ESI and RAWP Preparation (Voluntary Cleanup Program), New York, NY
- NYU Washington Square Campus, SPCC plan preparation and compliance oversight, New York, NY
- New York University, Tandon School of Engineering, SPCC compliance oversight, Brooklyn, NY
- Jacob K. Javits Center, New York, NY
- New York City School Construction Authority (NYCSCA), Various Projects, NY
- The Shops at Atlas Park, AS/SVE and SSDS monitoring and maintenance, Glendale, NY

EDUCATION

M. Eng., Civil and Environmental Engineering
Cornell University

B.S., Biological and Environmental Engineering
Cornell University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Green Associate (LEED GA)

NISTM 3rd New York Storage Tank Conference

40-Hour OSHA HAZWOPER

OSHA 8-Hour Health & Safety Refresher

OSHA Confined Space Entry Training

AFFILIATIONS

Engineers Without Borders, New York Professionals Chapter, Vice President Emeritus

American Society of Civil Engineers (ASCE)

American Council of Engineering Companies

EMILY STRAKE, CEP

SENIOR PROJECT CHEMIST / RISK ASSESSOR

HUMAN HEALTH RISK ASSESSMENT / CHEMICAL DATA VALIDATION

Ms. Strake has 18 years of environmental chemistry, risk assessment, auditing, and quality assurance experience. 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 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 broad experience in environmental data validation, focused on ensuring laboratory deliverables follow specific guidelines as described by regulatory agencies and the analytical methods employed. She 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.

SELECTED PROJECTS

- 365 Bond Street Development, Brooklyn, NY
- 420 Kent Avenue, Brooklyn, NY
- 521-539 4th Ave, Brooklyn, NY
- 1525 Bedford Avenue, Brooklyn, NY
- Avon, Rye, NY
- FONF Expansion/Sabre Park BCP, Niagara Falls, NY
- Whitehead Realty - Former ACME Sites, Brooklyn, NY
- 55 Bank Street, White Plains, NY
- 268 West Street, New York, NY
- 2420 - 2430 Amsterdam Avenue, New York, NY
- Air Products and Chemicals, Edison, NJ
- Alcatel-Lucent, Holmdel, NJ
- Fairlawn Superfund Site, Fairlawn, NJ
- Former Plessey Dynamics Site, Hillside, NJ
- Honeywell, Highland Park, NJ
- Mannington Mills, Mannington, NJ
- Paulsboro Packaging Inc, Paulsboro, NJ
- Ryder, Hartford, CT
- John Evans Superfund, Lansdale, PA
- Floreffe Terminal, Pittsburgh, PA
- Rohm and Haas, Philadelphia, PA
- Sunoco Refineries, Philadelphia, PA
- 300 Jackson Ave. RA/RI, Downingtown, PA

EDUCATION

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

B.S., Chemistry
Cedar Crest College

CERTIFICATION

Board Certified Environmental Professional (CEP) in Assessment

MEMBERSHIPS

Interstate Technology and Regulatory Council

Montgomery Township Environmental Advisory Committee, Vice-Chair, Term ending 1/1/2022.

Society for Risk Analysis

TRAINING

40 hr. OSHA HAZWOPER Training/Nov 2002

8 hr. HAZWOPER Supervisor/June 2004

8 hr. OSHA HAZWOPER Refresher/Oct 2017

ATTACHMENT B

LABORATORY REPORTING LIMITS AND METHOD DETECTION LIMITS

LANGAN

Date Created: 09/27/19
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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	10	0.816	ug/kg	70-130	30	70-130	30	30			
1,1-Dichloroethane	75-34-3	1.5	0.2952	ug/kg	70-130	30	70-130	30	30			
Chloroform	67-66-3	1.5	0.3246	ug/kg	70-130	30	70-130	30	30			
Carbon tetrachloride	56-23-5	1	0.2112	ug/kg	70-130	30	70-130	30	30			
1,2-Dichloropropane	78-87-5	3.5	0.255	ug/kg	70-130	30	70-130	30	30			
Dibromochloromethane	124-48-1	1	0.3078	ug/kg	70-130	30	70-130	30	30			
1,1,2-Trichloroethane	79-00-5	1.5	0.393	ug/kg	70-130	30	70-130	30	30			
Tetrachloroethene	127-18-4	1	0.3062	ug/kg	70-130	30	70-130	30	30			
Chlorobenzene	108-90-7	1	0.1862	ug/kg	70-130	30	70-130	30	30			
Trichlorofluoromethane	75-69-4	5	0.3914	ug/kg	70-139	30	70-139	30	30			
1,2-Dichloroethane	107-06-2	1	0.2274	ug/kg	70-130	30	70-130	30	30			
1,1,1-Trichloroethane	71-55-6	1	0.2698	ug/kg	70-130	30	70-130	30	30			
Bromodichloromethane	75-27-4	1	0.3848	ug/kg	70-130	30	70-130	30	30			
trans-1,3-Dichloropropene	10061-02-6	1	0.3006	ug/kg	70-130	30	70-130	30	30			
cis-1,3-Dichloropropene	10061-01-5	1	0.2672	ug/kg	70-130	30	70-130	30	30			
1,1-Dichloropropene	563-58-6	5	0.4556	ug/kg	70-130	30	70-130	30	30			
Bromoform	75-25-2	4	0.4954	ug/kg	70-130	30	70-130	30	30			
1,1,2,2-Tetrachloroethane	79-34-5	1	0.2402	ug/kg	70-130	30	70-130	30	30			
Benzene	71-43-2	1	0.2972	ug/kg	70-130	30	70-130	30	30			
Toluene	108-88-3	1.5	0.2416	ug/kg	70-130	30	70-130	30	30			
Ethylbenzene	100-41-4	1	0.2214	ug/kg	70-130	30	70-130	30	30			
Chloromethane	74-87-3	5	0.7832	ug/kg	52-130	30	52-130	30	30			
Bromomethane	74-83-9	2	0.6478	ug/kg	57-147	30	57-147	30	30			
Vinyl chloride	75-01-4	2	0.7534	ug/kg	67-130	30	67-130	30	30			
Chloroethane	75-00-3	2	0.4384	ug/kg	50-151	30	50-151	30	30			
1,1-Dichloroethene	75-35-4	1	0.2598	ug/kg	65-135	30	65-135	30	30			
trans-1,2-Dichloroethene	156-60-5	1.5	0.3916	ug/kg	70-130	30	70-130	30	30			
Trichloroethene	79-01-6	1	0.224	ug/kg	70-130	30	70-130	30	30			
1,2-Dichlorobenzene	95-50-1	5	0.3642	ug/kg	70-130	30	70-130	30	30			
1,3-Dichlorobenzene	541-73-1	5	0.3996	ug/kg	70-130	30	70-130	30	30			
1,4-Dichlorobenzene	106-46-7	5	0.4198	ug/kg	70-130	30	70-130	30	30			
Methyl tert butyl ether	1634-04-4	2	0.487	ug/kg	66-130	30	66-130	30	30			
p/m-Xylene	179601-23-1	2	0.43	ug/kg	70-130	30	70-130	30	30			
o-Xylene	95-47-6	2	0.4174	ug/kg	70-130	30	70-130	30	30			
cis-1,2-Dichloroethene	156-59-2	1	0.3014	ug/kg	70-130	30	70-130	30	30			
Dibromomethane	74-95-3	10	0.4348	ug/kg	70-130	30	70-130	30	30			
Styrene	100-42-5	2	0.726	ug/kg	70-130	30	70-130	30	30			
Dichlorodifluoromethane	75-71-8	10	0.3888	ug/kg	30-146	30	30-146	30	30			
Acetone	67-64-1	10	3.235	ug/kg	54-140	30	54-140	30	30			
Carbon disulfide	75-15-0	10	0.3754	ug/kg	59-130	30	59-130	30	30			
2-Butanone	78-93-3	10	3.8772	ug/kg	70-130	30	70-130	30	30			
Vinyl acetate	108-05-4	10	0.751	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		
4-Methyl-2-pentanone	108-10-1	10	0.8164	ug/kg	70-130	30	70-130	30	30			
1,2,3-Trichloropropane	96-18-4	10	0.387	ug/kg	68-130	30	68-130	30	30			
2-Hexanone	591-78-6	10	0.3964	ug/kg	70-130	30	70-130	30	30			
Bromochloromethane	74-97-5	5	0.3022	ug/kg	70-130	30	70-130	30	30			
2,2-Dichloropropane	594-20-7	5	0.795	ug/kg	70-130	30	70-130	30	30			
1,2-Dibromoethane	106-93-4	4	0.4088	ug/kg	70-130	30	70-130	30	30			
1,3-Dichloropropane	142-28-9	5	0.5656	ug/kg	69-130	30	69-130	30	30			
1,1,1,2-Tetrachloroethane	630-20-6	1	0.3284	ug/kg	70-130	30	70-130	30	30			
Bromobenzene	108-86-1	5	0.2202	ug/kg	70-130	30	70-130	30	30			
n-Butylbenzene	104-51-8	1	0.3144	ug/kg	70-130	30	70-130	30	30			
sec-Butylbenzene	135-98-8	1	0.2756	ug/kg	70-130	30	70-130	30	30			
tert-Butylbenzene	98-06-6	5	0.6032	ug/kg	70-130	30	70-130	30	30			
o-Chlorotoluene	95-49-8	5	0.313	ug/kg	70-130	30	70-130	30	30			
p-Chlorotoluene	106-43-4	5	0.3608	ug/kg	70-130	30	70-130	30	30			
1,2-Dibromo-3-chloropropane	96-12-8	5	0.8366	ug/kg	68-130	30	68-130	30	30			
Hexachlorobutadiene	87-68-3	5	0.4582	ug/kg	67-130	30	67-130	30	30			
Isopropylbenzene	98-82-8	1	0.177	ug/kg	70-130	30	70-130	30	30			
p-Isopropyltoluene	99-87-6	1	0.2732	ug/kg	70-130	30	70-130	30	30			
Naphthalene	91-20-3	5	0.7696	ug/kg	70-130	30	70-130	30	30			
Acrylonitrile	107-13-1	10	0.3756	ug/kg	70-130	30	70-130	30	30			
n-Propylbenzene	103-65-1	1	0.284	ug/kg	70-130	30	70-130	30	30			
1,2,3-Trichlorobenzene	87-61-6	5	0.4034	ug/kg	70-130	30	70-130	30	30			
1,2,4-Trichlorobenzene	120-82-1	5	0.7898	ug/kg	70-130	30	70-130	30	30			
1,3,5-Trimethylbenzene	108-67-8	5	0.6016	ug/kg	70-130	30	70-130	30	30			
1,2,4-Trimethylbenzene	95-63-6	5	0.573	ug/kg	70-130	30	70-130	30	30			
1,4-Dioxane	123-91-1	100	17.4	ug/kg	65-136	30	65-136	30	30			
1,4-Diethylbenzene	105-05-5	4	0.2	ug/kg	70-130	30	70-130	30	30			
4-Ethyltoluene	622-96-8	4	0.097	ug/kg	70-130	30	70-130	30	30			
1,2,4,5-Tetramethylbenzene	95-93-2	4	0.181	ug/kg	70-130	30	70-130	30	30			
Ethyl ether	60-29-7	5	0.3798	ug/kg	67-130	30	67-130	30	30			
trans-1,4-Dichloro-2-butene	110-57-6	5	1.478	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*		

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.

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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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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	37-127	50	37-127	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	108-39-4/106-44-5	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			
1,4-Dioxane	123-91-1	25.05	7.682	ug/kg	40-140	50	40-140	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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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	1.6008	0.31349	ug/kg	30-150	30	30-150	50	50			
Lindane	58-89-9	0.667	0.298149	ug/kg	30-150	30	30-150	50	50			
Alpha-BHC	319-84-6	0.667	0.189428	ug/kg	30-150	30	30-150	50	50			
Beta-BHC	319-85-7	1.6008	0.60697	ug/kg	30-150	30	30-150	50	50			
Heptachlor	76-44-8	0.8004	0.358846	ug/kg	30-150	30	30-150	50	50			
Aldrin	309-00-2	1.6008	0.563615	ug/kg	30-150	30	30-150	50	50			
Heptachlor epoxide	1024-57-3	3.0015	0.90045	ug/kg	30-150	30	30-150	50	50			
Endrin	72-20-8	0.667	0.27347	ug/kg	30-150	30	30-150	50	50			
Endrin aldehyde	7421-93-4	2.001	0.70035	ug/kg	30-150	30	30-150	50	50			
Endrin ketone	53494-70-5	1.6008	0.412206	ug/kg	30-150	30	30-150	50	50			
Dieldrin	60-57-1	1.0005	0.50025	ug/kg	30-150	30	30-150	50	50			
4,4'-DDE	72-55-9	1.6008	0.370185	ug/kg	30-150	30	30-150	50	50			
4,4'-DDD	72-54-8	1.6008	0.570952	ug/kg	30-150	30	30-150	50	50			
4,4'-DDT	50-29-3	3.0015	1.28731	ug/kg	30-150	30	30-150	50	50			
Endosulfan I	959-98-8	1.6008	0.378189	ug/kg	30-150	30	30-150	50	50			
Endosulfan II	33213-65-9	1.6008	0.534934	ug/kg	30-150	30	30-150	50	50			
Endosulfan sulfate	1031-07-8	0.667	0.317492	ug/kg	30-150	30	30-150	50	50			
Methoxychlor	72-43-5	3.0015	0.9338	ug/kg	30-150	30	30-150	50	50			
Toxaphene	8001-35-2	30.015	8.4042	ug/kg	30-150	30	30-150	50	50			
cis-Chlordane	5103-71-9	2.001	0.557612	ug/kg	30-150	30	30-150	50	50			
trans-Chlordane	5103-74-2	2.001	0.528264	ug/kg	30-150	30	30-150	50	50			
Chlordane	57-74-9	13.0065	5.30265	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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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	2.9748	ug/kg	40-140	50	40-140	50	50			
Aroclor 1221	11104-28-2	33.5	3.3567	ug/kg	40-140	50	40-140	50	50			
Aroclor 1232	11141-16-5	33.5	7.102	ug/kg	40-140	50	40-140	50	50			
Aroclor 1242	53469-21-9	33.5	4.5158	ug/kg	40-140	50	40-140	50	50			
Aroclor 1248	12672-29-6	33.5	5.025	ug/kg	40-140	50	40-140	50	50			
Aroclor 1254	11097-69-1	33.5	3.6649	ug/kg	40-140	50	40-140	50	50			
Aroclor 1260	11096-82-5	33.5	6.1908	ug/kg	40-140	50	40-140	50	50			
Aroclor 1262	37324-23-5	33.5	4.2545	ug/kg	40-140	50	40-140	50	50			
Aroclor 1268	11100-14-4	33.5	3.4706	ug/kg	40-140	50	40-140	50	50			
PCBs, Total	1336-36-3	33.5	2.9748	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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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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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	0.05216	mg/kg	72-128		80-120	20	20		28 days	1 - Metals Only-Glass 60mL/2oz unpreserved

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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
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

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ATTACHMENT C

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

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ATTACHMENT C

ANALYTICAL METHODS/QUALITY ASSURANCE SUMMARY TABLE

Matrix Type	Estimated No. of Samples	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	MS/MSD Samples
Soil	31	Total VOCs via PID	Part 375 VOCs	EPA 8260C	Cool to 4°C	Two 40-ml VOC vials with 5ml H_2O, one with MeOH; or 3 EnCore Samplers (separate container for % solids)	Analyze within 48 hours of sampling if not frozen or extruded into methanol. If frozen or extruded into methanol, analyze within 14 days of collection	1 per 20 samples (minimum 1)	1 per 20 samples (minimum 1)	1 per Shipment of VOC samples	1 per 20 samples
			Part 375 SVOCs	EPA 8270D		4 oz. amber glass jar	14 days extract, 40 days after extraction to analysis			NA	
			Part 375 PCBs	EPA 8082A							
			Part 375 Pesticides	EPA 8081B							
			Part 375 Metals	EPA 6010D, 7473		2 oz. amber glass jar	6 months, except mercury 28 days				
			Total Cyanide	EPA 9010C/9014			14 days				
			Hexavalent Chromium	EPA 7196A			30 days to extract; 7 days after extraction to analysis				

Notes:
1. PID - Photoionization Detector
2. VOC - Volatile organic compound
3. SVOC - Semivolatile organic compound
4. PCB - Polychlorinated biphenyl
5. EPA - Environmental Protection Agency
6. MeOH - Methanol
7. NA - Not applicable

ATTACHMENT D

SAMPLE NOMENCLATURE STANDARD OPERATING PROCEDURE

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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.