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Remedial Alternatives Analysis Report

K – Williamsburg Works: Operable Unit 1 (OU 1)

Brooklyn, New York

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Professional Engineer Certification

I, Matthew J. O'Neil certify that I am currently a NYS registered professional engineer and that this Remedial Alternatives Analysis Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

_____ _____

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Acronyms and Abbreviations

AACE	Association for the Advancement of Cost Engineering
ANSI	American National Standards Institute
AOC	Administrative Order on Consent
BASE	Building Assessment and Survey Evaluation
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BUG	Brooklyn Union Gas
CAMP	Community Air Monitoring Plan
CBS	Chemical Bulk Storage
Colonial	Colonial Mirror and Glass Corp
COCs	Contaminants of Concern
COPCs	Contaminants of Potential Concern
d/b/a	doing business as
EDR	Environmental Data Resources, Inc.
GEI	GEI Consultants, Inc. DBA GEI Consultants Engineering, Geology, Architecture & Landscape Architecture
IRM	Interim Remedial Measure
MGP	Manufactured Gas Plant
MOSF	Major Oil Storage Facility
MTBE	Methyl tertiary butyl ether
NAPL	Non-Aqueous Phase Liquid
NAVD	North American Vertical Datum
NYC	New York City
NYCDOS	New York City Department of Sanitation
NYCDPR	New York City Department of Parks and Recreation
NYSAWQS	New York State Ambient Water Quality Standards
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated biphenyls
PCE	Tetrachloroethene
PDI	Pre-Design Investigation
PFAS	Per- and polyfluoroalkyl substances
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
POGSCOs	Protection of Groundwater Soil Cleanup Objective
PWS	Public water supply

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QHHEA	Qualitative Human Health Exposure Assessment
RAAR	Remedial Alternatives Analysis Report
RAO	Remedial Action Objective
RI	Remedial Investigation
ROI	Radius of Influence
ROW	Right of Way
Sanborn	Sanborn Fire Insurance
SCG	Standards, Criteria and Guidance
SCO	Soil Cleanup Objective
SOCONY	Standard Oil Company of New York
SSGV	Saltwater Sediment Guidance Values
SVOC	Semi Volatile Organic Compound
TCE	Trichloroethene
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compound
Measurements	
cm/s	centimeters per second
ft	feet
mg/kg	milligrams per kilogram
ng/L	nanograms per liter
µg/L	micrograms per liter

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1. Introduction

On behalf of The Brooklyn Union Gas Company (BUG) d/b/a National Grid NY (National Grid), GEI Consultants, Inc. DBA GEI Consultants Engineering, Geology, Architecture & Landscape Architecture (GEI) has prepared this Remedial Alternatives Analysis Report (RAAR) to document the development and evaluation of remedial alternatives, as well as provide recommendations, for three parcels of the K - Williamsburg Works site (the Site) in Brooklyn, Kings County, New York (Figure 1), the location of a former manufactured gas plant (MGP). The specific parcels, identified as Parcels 2, 3, and 4 in Figure 2, are located west of Kent Avenue and between North 11th Street and North 12th Street and collectively comprise Operable Unit (OU) 1, as established by New York State Department of Environmental Conservation (NYSDEC).

In February 2007, BUG, then d/b/a KeySpan Energy Delivery New York, and NYSDEC entered into an Order on Consent and Administrative Settlement (AOC), Index No. A2-0552-0606, to evaluate environmental conditions at a number of sites. The former Williamsburg Works MGP site was added to the AOC by a modification dated August 10, 2007. In 2017, the former Williamsburg Works MGP site was withdrawn from AOC Index No. A2-0552-0606 to allow the former Williamsburg Works MGP site to be evaluated under a site-specific AOC. In September 2021, BUG, now d/b/a National Grid NY, and NYSDEC entered into AOC Index No. CO 2-20200910-300 with respect to the former Williamsburg Works MGP site (the AOC). The former Williamsburg Works MGP site is referenced as Site No. 224055 in both AOCs and in the NYSDEC's Environmental Site Remediation Database.

A Remedial Investigation (RI) of the former Williamsburg Works MGP site and off-site areas was conducted between 2009 and 2024, and the RI Report for Parcels 2, 3, and 4, dated August 2025, was approved by NYSDEC on September 23, 2025. The approval letter established OUs for the Site, with OU-1 consisting of Parcels 2, 3, and 4 and OU-2 consisting of Parcel 1 and stated that subsequent RIs may be required for OU-2 and off-site areas.

This report has been developed in accordance with the AOC, the factors set forth in Title 6 of the New York Code of Rules and Regulations Part 375 for remedial action selection, and the May 2010 NYSDEC Division of Environmental Remediation *(DER-10) Technical Guidance for Site Investigation and Remediation*. National Grid reserves its rights, as appropriate, to seek contribution or other appropriate relief from parties responsible for impacts not attributable to former MGP operations.

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2. Site Summary

2.1. Site Location and Description

The former Williamsburg Works MGP site is located in the Williamsburg neighborhood of Brooklyn, New York and consists of four parcels (Parcels 1 through 4; Figure 2) which have been divided into two OUs, as established by NYSDEC. OU-1 consists of Parcels 2, 3, and 4 and OU-2 consists of Parcel 1. Collective of both OUs, the former Williamsburg Works MGP site encompasses approximately 5.7 acres. It is National Grid's understanding that, following remediation, two parcels (Parcels 3 and 4) will be redeveloped as part of the New York City Department of Parks and Recreation (NYCDPR) Bushwick Inlet Park (the Park) complex. Parcel 2 was previously subject to two interim remedial measures (IRMs) addressing subsurface soil impacts and has already been redeveloped as part of the Park complex. Parcel 1 is currently occupied with no immediate plan for demolition of the existing structure known by National Grid at this time. As identified in Section 1, the remedial alternatives developed in this RAAR are intended to address impacts identified within OU-1 only. Details related to parcels outside OU-1 are provided in the RI Report (GEI, 2025).

Parcel IDs have been assigned to each Williamsburg Works MGP parcel discussed in this RAAR for ease of reference throughout this report. The Parcels IDs, addresses, and tax map information for these properties are listed below.

Operable Unit	Parcel ID	Address	Current Owner	Block	Lot
Within Williamsburg Works MGP Footprint					
OU-2	Parcel 1	35 Kent Avenue Brooklyn, NY	North 12TH Associates	2288	1
OU-1	Parcel 2	21 North 12th Street (50 Kent Avenue) Brooklyn, NY	NYCDPR	2287	1
	Parcel 3	20 North 12th Street Brooklyn, NY	NYCDPR	2287	16
	Parcel 4	2 North 11th Street Brooklyn, NY	NYCDPR	2287	30

Source: New York City ArcGIS Map https://experience.arcgis.com/experience/d826b115c87841d491c2b41fcb175305 accessed 7/8/2025

The former Williamsburg Works MGP site is located within a dense urban area of mixed commercial, industrial, and residential land use. OU-1 is bounded to the north by North 12th Street, to the east by Kent Avenue, to the south by North 11th Street, and to the west by the East River.

2.1.1. Site Features Relevant to Remedial Alternative Development

Several features adjacent to OU-1 are relevant to the development and evaluation of remedial alternatives, including adjacent public rights-of-way, subsurface utilities, the East River shoreline, and the East River bulkhead. These features may influence remedy access, remedy limitations, support-of-

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excavation requirements, dewatering requirements, waterfront protection measures, and coordination with public agencies, utility owners, other stakeholders, or third parties. Of these features, the East River shoreline, the active combined sewer within North 12th Street, and the East River bulkhead are expected to present the most significant constraints; utilities within Kent Avenue and other adjacent rights-of-way are also relevant but are generally secondary to the East River shoreline, North 12th Street sewer, and East River bulkhead in terms of anticipated remedial design considerations.

2.1.1.1. East River Shoreline Setting

The East River forms the western shoreline boundary of OU-1 and is a tidal waterway that influences adjacent shoreline and groundwater conditions. Because Parcel 4 extends to the East River shoreline, remedial alternatives for OU-1 must account for the physical relationship between impacted upland media, the shoreline edge, and the tidally influenced surface-water system.

2.1.1.2. Adjacent Roadways

OU-1 is bordered by North 12th Street to the north, Kent Avenue to the east, and North 11th Street to the south. North 11th Street and North 12th Street adjacent to OU-1 are not currently active roadways; however, these rights-of-way remain relevant to remedial alternative development because utilities, access requirements, construction logistics, and the limits of potential excavation or support-of-excavation systems may affect remedy implementation.

Kent Avenue is an active roadway. Along Kent Avenue, a bike lane is present on the OU-1 side of the roadway, and vehicles entering or exiting OU-1 will be required to cross the bike lane.

2.1.1.3. North 12th Street Combined Stormwater and Sanitary Sewer

Adjacent to OU-1 is an active sewer within North 12th Street. This is a twin 78-inch brick, combined stormwater and sanitary sewer that extends along the length of North 12th Street. The sewer conveys combined stormwater and sanitary flow and discharges local wastewater directly to the East River during heavy rainfall events. Available 1962 utility drawings indicate that the top of the North 12th Street combined sewer is approximately six feet below the existing roadway elevation near Kent Avenue and is shallower moving towards the East River. Due to its size, the sewer occupies the majority of the paved portion of the North 12th Street right-of-way. As a result, other utilities servicing properties on either side of North 12th Street are generally located beneath the concrete sidewalks, including several utilities located directly adjacent to OU-1.

2.1.1.4. East River Bulkhead

The East River bulkhead extends along the length of Parcel 4 and forms the western boundary between OU-1 and the East River. The date and method of original construction are not known; however, the bulkhead is believed to have been constructed in the early 1980s to support or facilitate construction of a warehouse formerly present on Parcel 4. FOIA requests have not identified relevant bulkhead design drawings, construction details, or specifications.

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Based on visible conditions documented in September 2009 and included in the RI Report, the river-facing bulkhead wall appears to consist of horizontal timber walers secured to vertical timber piles, with a cast-in-place concrete headwall. In several areas, the timber pile and waler system appears to have been supplemented or backfilled with rubble stone, broken concrete, and miscellaneous demolition debris exposed at and below the concrete cap. Photographs taken in 2009 documented that the bulkhead was at that time in poor to failed condition along much of its length, with timber deterioration, displacement and loss of structural members, large voids exposing upland fill, apparent erosion of backfill material toward the East River, and vegetation growth through debris. These conditions indicate long-term structural deterioration and progressive failure.

Because the bulkhead defines the shoreline edge of Parcel 4 and is in poor condition, it is a significant constraint on remedial alternatives that involve excavation, stabilization, or work near the East River. Its unknown construction and deteriorated condition may affect excavation setbacks, support-of-excavation requirements, access, dewatering, erosion and sediment controls, and the need for repair, replacement, or supplemental stabilization as part of remedial design.

2.1.1.5. Other Subsurface Utilities

Other utilities are also present within the public rights-of-way adjacent to OU-1. As noted above, because the twin 78-inch combined sewer occupies much of the paved portion of the North 12th Street right-of-way, other utilities within North 12th Street are generally located beneath the concrete sidewalks, including several utilities directly adjacent to OU-1. Utilities are also present within the North 11th Street and Kent Avenue rights-of-way; however, unlike the North 12th Street utilities located beneath the sidewalk, the North 11th Street and Kent Avenue utilities are understood to be located within the limits of the roadway. The utilities present within North 11th Street and North 12th Street, with the exception of the sewer are expected to be manageable using standard construction methods, as needed.

A 7.5-foot by 7.5-foot intercepting sewer is also present within Kent Avenue. The aforementioned 1962 utility drawings show the top of the intercepting sewer is approximately 20 feet below the existing roadway elevation. Because of its depth and location within Kent Avenue, this sewer is a relevant remedial design consideration and was one of the factors that informed selection of the IRM scope for Parcel 2.

2.1.1.6. 50 Kent Avenue Subsurface Sheetpile Wall

At the request of the NYSDEC, a sheetpile wall was left in place following completion of the Parcel 2 IRM. The wall, fully described in the 50 Kent Avenue Construction Completion Report (AECOM, 2018), generally extends to the clay layer at an approximate depth of 60 feet below grade, was cut to at least 5 feet below IRM finished grade, and includes 2-foot by 2-foot notches at approximately 30-foot spacing to allow groundwater flow and improve local drainage. The wall was not designed as an environmental containment structure with sealed or grouted interlocks and therefore is not intended to prevent groundwater contact with impacts remaining beneath the completed excavation. Because Parcel 2 has

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since been redeveloped as part of Bushwick Inlet Park, additional remediation within the sheetpile wall footprint would require substantial disturbance to the existing park, potentially including demolition of park features, temporary closures, access restrictions, and restoration following construction.

2.1.2. Bushwick Inlet Park Development

OU-1 is part of the planned regional redevelopment of the Williamsburg waterfront into Bushwick Inlet Park. NYCDPR currently owns Parcels 2, 3, and 4 (i.e., OU-1), as well as Parcels 5 and 6, all of which are planned to be incorporated into the park. Following completion, in 2017, of two IRMs at Parcel 2, NYCDPR redeveloped the parcel as part of Bushwick Inlet Park and the parcel is no longer accessible for intrusive activities.

Based on discussions with NYCDPR, National Grid understands that the final design for redevelopment of Parcels 3 and 4 will not be established until after completion of the OU-1 remedy. Future park improvements may include athletic fields, walking paths, playgrounds, water features, waterfront access, and support facilities. In a June 2026 memorandum to NYSDEC and National Grid, NYCDPR further confirmed several redevelopment objectives relevant to remedial design, including acceptance of a hard waterfront edge and secant wall bulkhead along portions of the shoreline, retention of infrastructure (i.e., the North 12th Street sewer) within the North 12th Street corridor to support a future park pathway, and a preference for locating long-term monitoring and recovery infrastructure, if any, along site perimeters and within paved pathways where practicable to minimize impacts on park users and operations. NYCDPR also emphasized the importance of continued coordination among NYCDPR, NYSDEC, and National Grid as future phases of Bushwick Inlet Park are advanced. National Grid remains committed to ongoing coordination with NYCDPR and NYSDEC during remedial alternative development, remedial design, and remedy implementation to support selection of a remedy that is protective of human health and the environment while remaining compatible with the planned future use of the property as part of Bushwick Inlet Park.

2.2. Geology and Hydrogeology

The following geologic materials are present in stratigraphic order (from deepest to shallowest):

- Bedrock (Fordham Gneiss)
- Glacial deposits (glacial till, glacial outwash, glacial lacustrine)
- Alluvial deposits
- Fill

2.2.1. Natural Deposits

Bedrock encountered beneath OU-1 is described as a metamorphosed, igneous rock unit of the Precambrian Age (Brock and Brock, 2001). Within the vicinity of OU-1, bedrock elevations are approximately -100 feet (ft) National Geodetic Vertical Datum 1929 (Buxton et. al., 1981). Regional

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down-warping of bedrock has resulted in a southeast-dipping bedrock surface of approximately 80 feet per mile (United States Environmental Protection Agency [USEPA], 1983 and Cartwright, 2002). Overlying bedrock, the Upper Pleistocene glacial deposits consist of terminal moraine and ground moraine deposits, which consist of poorly sorted mixtures of clay, silt, sand, gravel, and boulders, and glacio-fluvial outwash deposits typically ranging in thickness between 100 and 200 feet (Cartwright, 2002). The Holocene age marsh/alluvial deposits consist of sand, silt, organic material deposited along stream channels and in marshes and have a maximum thickness of 50 feet within limited areas of Kings and Queens County (Busciolano, 2002). Organic clays and peats are found along the East River and Bushwick Inlet.

2.2.2. Historic Fill Deposits

Fill is defined as soil or rock used to raise the surface of the ground (Lauber, 2014). Fill, dating from as early as the mid-1800s, has been reworked to the current grades. The fill at OU-1 primarily consists of loose, non-cohesive sand, and silty-sand mixed with ash, gravel, and fragments of brick, concrete, coal, and wood. Fill depths ranged from a few feet to approximately 10 to 20 feet along the East River with thickness of fill deposits increasing east to west, consistent with the land filling of shorelines of the East River and Bushwick Inlet.

2.2.2.1. Post-MGP Redevelopment Fill

A surficial wedge of soil/fill, hereafter referred to as the "Fill Wedge," is present above the historic industrial surface of Parcels 3 and 4 and adjacent streets. The Fill Wedge is relatively thin along the eastern portion of Parcel 3 and increases in thickness westward toward the East River, where it is at least nine feet thick. Based on available historical information and RI findings, the Fill Wedge appears to represent a distinct post-MGP-era fill placement event that was likely imported from an off-site source and placed to raise and level portions of OU-1 for subsequent redevelopment and building construction following cessation of MGP operations.

During RI activities, the Fill Wedge was evaluated using lithologic observations, field screening results, analytical data, and its physical relationship to documented MGP-related impacts. Notably, post-MGP-era rail infrastructure was identified at the base of the Fill Wedge, demonstrating that the wedge material was emplaced after the construction of those features and supporting the interpretation that the Fill Wedge post-dates MGP operations. The Fill Wedge also occurs above the historic industrial grade and is physically separable from underlying MGP-Related Source Materials.

The physical configuration of the former warehouse building, further discussed in Section 2.3.3, provides additional evidence regarding the origin of the Fill Wedge. The Fill Wedge forms a localized elevated land surface that is substantially higher than adjacent grades along North 11th Street and North 12th Street. The former warehouse slab and perimeter foundation walls were constructed at this higher grade, indicating that the fill was intentionally incorporated into the site redevelopment that culminated in warehouse construction during the early 1980s. The presence of the Fill Wedge within the footprint of the former warehouse further supports the conclusion that the fill was placed to establish the building

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pad for the warehouse rather than representing a broader historic land surface. When considered together with post-MGP rail infrastructure identified beneath the Fill Wedge, these observations support the interpretation that the Fill Wedge represents a distinct post-MGP redevelopment-related fill placement.

Visual observations within the Fill Wedge generally did not identify evidence of MGP impacts, and analytical results exhibited patterns more consistent with historic urban fill than with MGP source material. In addition, the potential for commingling was evaluated in areas where the Fill Wedge is adjacent to documented MGP-related impacts. Based on the RI data, no widespread commingling between the Fill Wedge and impacted source material was identified.

Collectively, these lines of evidence indicate that the Fill Wedge represents a distinct post-MGP redevelopment-related fill unit and is generally separable from documented MGP source materials and impacts.

2.2.3. Hydrogeology

The groundwater aquifer present at OU-1 is named the Upper Glacial Aquifer and consists of Upper Pleistocene glacial deposits. The Upper Glacial Aquifer is generally unconfined; however, it can be locally confined by the presence of silt and clay layers within moraine deposits. Based on investigation observations, the Upper Glacial Aquifer is unconfined within OU-1. Groundwater at OU-1 flows to the northwest toward the East River during both high and low tides. Based on June 2025 gauging data, the depth to groundwater across Parcels 3 and 4 ranges from approximately 5 to 14 feet below ground surface (bgs) and 5 to 16 feet bgs during high and low tide, respectively. Groundwater depth was generally observed to increase with proximity to the East River. The horizontal hydraulic conductivity of glacial outwash deposits has been calculated at 270 feet per day [9.5 x 10^{-2} centimeters per second (cm/s)] and are likely retarded to 135 feet per day (4.4 x 10-2 cm/s) in localized poorly sorted moraine deposits (Cartwright, 2002).

Contours presenting high and low groundwater surface elevations are shown in Figures 3 and 4, respectively.

2.2.4. Regional Water Use

Potable water is currently provided to OU-1 and the surrounding area by the New York City Water Supply System from interconnected watershed areas, the Catskill/Delaware Watersheds and Croton Watershed, located 50 to 125 miles north of New York City.

An environmental database search for available federal and state well data within the vicinity of OU-1 was performed by Environmental Data Resources, Inc. (EDR). The EDR report identified that there is one public water supply well (PWS ID: NY0007257) within a 1-mile radius of OU-1. The well is located to the south-southeast, up gradient of OU-1, near the intersection of Metropolitan Avenue and N. 6th Street in

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Brooklyn. A search of the United States Geological Survey (USGS) National Water Inventory System listed twenty-one wells within a 1-mile radius of OU-1. None of the identified wells are within ¼ mile of OU-1.

2.3. MGP Site History

The history of the former Williamsburg Works MGP and surrounding area was developed through the review of selected historical maps, photographs, historic drawings from BUG, available Ordinance Department of the War Department files, available Sanborn Fire Insurance (Sanborn) maps, and information presented in previous reports. The historical site information provided below has been summarized for the purpose of this RAAR; more detailed historical information are provided in the Parcel 2 Soil IRM CCR (AECOM, 2018) and the RI Report (GEI, 2025).

2.3.1. Pre-MGP Operational History

Prior to the operation of the former MGP, historical maps depict a former marsh and shorelines surrounding OU-1 and Bushwick Creek extending to the east along North 14th and North 15th Street with the shoreline recessed to First Avenue (now Kent Avenue). As such, Parcels 1 and 2 were partially submerged and Parcels 3 and 4 were submerged. Additionally, off-site Parcel 5 and 25 Kent Avenue were partially submerged, and Parcel 6 was submerged. Off-site Parcels 5 and 6 and 25 Kent Avenue are further discussed in Sections 2.4.1, 2.4.2, and 2.4.3, respectively. Sometime between 1849 and 1855, fill extended the land area westward into the East River. An 1868 insurance map shows Parcel 6 and Bushwick Creek filled and reshaped into what is now Bushwick Inlet. This filling also created a basin at the end of North 12th Street, which was filled in between 1887 and 1898.

2.3.2. MGP Operational History

The Williamsburg Gas Light Company was incorporated in 1850 (Murphy, 1995) and was the first known operator of the Williamsburg Works MGP. The MGP first appeared on an 1868 fire insurance map as Gas Works (Higginson, 1868). The Williamsburg Works MGP appear on the 1887 Sanborn map with a similar configuration to the 1868 map, where gas production facilities (retort house, an engine room, a meter house, and a condenser house) were isolated to Parcels 2, 3, and 4. At the time, gas storage and purification facilities included three gas holders, a governor house, a purifying house, two tar tanks, scrubbers and lime houses. Gas holders were constructed with subsurface brick tanks and concrete foundations with capacities ranging between 306,000 and 460,000 cubic feet. In 1888, an additional holder was built at Parcel 1 with a capacity of 1,100,000 cubic feet.

In 1895, the Williamsburg Gas Light Company and several other Brooklyn gas manufacturing companies were acquired by BUG. A 1905 Sanborn map depicts that gas production facilities at Parcel 4 remained relatively unchanged following the BUG acquisition, except for the addition of iron tanks and a pump house. One circular gas tank, a generator house, a condenser house, and exhauster houses were added to Parcel 3 and purifying houses were added to Parcel 2. The northeast corner of Parcel 2, along Kent Avenue, appears to have been used for storage with several small sheds and buildings. It does not appear this area of the property was used for former MGP activities. The holder continued to be shown

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on Parcel 1.BUG drawings and Sanborn maps show additional MGP infrastructure at the Williamsburg former MGP until 1916, indicating that these features were either present or under consideration during that period. The 1916 Sanborn map depicts various supporting infrastructure, including, but not limited to, pump houses, separators, generators, oil tanks, a tar slop tank, and a settling tank. Two oil pipe conduits appear to have connected the Pratt Works facilities on Parcels 5 and 6, adjacent to the north and south of OU-1, to each other. Pratt Works had already been acquired by Standard Oil Company of New York (SOCONY) in 1874, prior to the 1916 Sanborn map. SOCONY later became Mobil and is now Exxon Mobil.

During World War I the United States government, acting through the Ordinance Department of the War Department, constructed a toluol manufacturing plant within the Williamsburg Works MGP property. Title search review indicated the United States of America owned a portion of Parcel 2 from May 29, 1919, to October 31, 1921, post-dating documented toluol operations. Review of title search information for Parcels 1, 3, and 4 did not document any ownership by the United States of America. However, the toluol operations likely occurred on at least three of the four MGP Site Parcels.

Construction of the toluol plant began on April 19, 1918 with pipes and other service lines installed under and along the northerly sidewalk of North 11th Street, between the East River and Kent Avenue, under and along the westerly sidewalk of Kent Avenue and North 11th Street, and under and across Kent Avenue (about midway between North 11th Street and North 12th Street). These pipelines were likely installed within Parcels 1 and 2. The toluol plant began operations on October 8, 1918, and was discontinued shortly thereafter, between November 19 and 22, 1918. The toluol plant was rated to scrub 16 million cubic feet of water gas per day with an estimated annual pure toluol production of 407,000 gallons. Given the short period of operation, actual production was 39,829 gallons. In addition to toluol, other petroleum distillates (light oil, crude benzol, and solvent naphtha) were produced as reported by the Ordinance Department.

Available data show that gas production at Williamsburg Works declined significantly in the late 1920s and that, by 1935, the plant was used for standby only. The Williamsburg Works MGP ceased operation and the MGP structures were dismantled prior to 1941.

A summary of former Parcel use is provided in the table below. Historical structure locations are shown in Figures 5, 6, and 7.

Parcel ID	Former Gas Plant Use
Parcel 1	Holder No. 3, Tank No. 12-a gas oil tank, a coal bin, a storage shed, and pipelines and five 20,000-gallon vertical steel tanks within two tank pits associated with the toluol plant
Parcel 2	Holder No. 1, Holder No. 2, a relief holder, purifying, condenser, exhauster, lime, and meter houses, saltwater condensers, storage sheds, storage buildings, and pipelines and a still house associated with the toluol plant
Parcel 3	One circular iron gas tank; generator, condenser, and exhauster houses; a retort house; an engine room; an oil separator; office and storage space; blacksmith, paint, machine, and carpentry shops and pipelines, two benzol vaporizers, and a catch scrubber for gas enrichment associated with the toluol plant

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Parcel ID	Former Gas Plant Use
Parcel 4	Coal shed, iron, and wooden tar tanks, (3) gas oil tanks, (4) tar tanks, an oil separator, purifying houses, a tar slop tank, and pump house

2.3.3. Post-MGP Operation

Subsequent to MGP decommissioning and demolition, the Williamsburg Works property was subdivided and redeveloped for commercial, industrial, and manufacturing uses. All these properties are currently owned by third parties with respect to the AOC.

Beginning July 1, 1945, Parcels 2 through 4 were leased by the United States Navy with permission to stay until June 30, 1946, or six months after the end of the war. The same lease was noted for Parcel 1, with cancellation in June 1946. Title searches for Parcels 1 through 4 did not indicate purchase of property by the United States Government between 1945 and 1946. In 1945 the United States Navy utilized Parcels 1 through 4 as a firefighting school. The Parcels were then under contract of sale in May 1946 with the condition that a railroad connection could be extended to the property. The connection was unable to be made, and the contract was canceled.

- **Parcel 1:** Post-MGP decommissioning, Parcel 1 was sold and developed as a beverage warehouse and garage in 1951. Subsequent Sanborn maps indicate the property used as a garage until 1979. Further, the property was sold to NYC Industrial Development Agency and to Colonial Mirror and Glass Corp. (Colonial) in 1979 and 1996, respectively. Colonial operated a garage at the property until selling it in 2002 to George Weiner and Abe aka Abraham Weiner, individually and as trustees of the Colonial trust. The current owner, North 12th Associates, LLC., purchased the property on June 29, 2006. As of August 2013, Amazon had opened a photography studio at the property.
- **Parcel 2:** BUG sold the property to Kent Industrial Corp. on July 22, 1946. By 1951, a warehouse/industrial building was constructed and occupied by the Ferro-Co. Corp. for sheet metal product manufacturing until being occupied by Commercial Corrugated Container Corp in 1965. On June 2, 1971, the property was owned by American Sandfill and Marine Corp. By 1978, the property was occupied by a New York City Department of Sanitation (NYCDOS) garage, which occupied the property until February 2009 when the building was demolished. NYC Department of City Planning acquired the property by condemnation on September 11, 2007.

  During a Phase I Environmental Site Assessment (1988), an underground storage tank, used as an oil/water separator for rainwater runoff, was identified beneath the floor of the building. A Consolidated Edison drawing dated 2013 shows an oil pipeline (Pipeline #7) along Kent Avenue between Parcels 1 and 2. The parcel was the subject of two IRMs that were conducted by National Grid during the years 2014 - 2017 (see Section 2.3.4, below). The Parcel has since been developed as part of Bushwick Inlet Park by NYCDPR.
- **Parcel 3:** BUG sold the property to Havemeyer and Elder Inc. on January 31, 1947, and Havemeyer and Elder, Inc. sold the property to Brooklyn Eastern District Terminal on August 31, 1948. Paragon Oil Co. Inc., a Chevron/Texaco predecessor, purchased the property from the

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Brooklyn Eastern District Terminal on August 14, 1958. A 1965 Sanborn depicts two railroad spurs, a repair shop, office, scale, and scrap metal storage on the property. By 1978, the property and buildings were vacant except for the office. Texaco Inc. sold the property to Bridge Lumber Co. Inc. on May 24, 1982, who then sold the property to the New York City Industrial Development Agency on October 5, 1982. The buildings were not shown on the 1982 Sanborn Map, and the property was used for parking. On March 26, 1987, the property was repurchased by the Bridge Lumber Co. Inc., which sold it to the R.A.R Realty Corp. on the same day. CitiPostal acquired the property from R.A.R Realty Corp. on June 29, 1995. 10th Street LLC acquired the parcel from CitiPostal on December 12, 2001, and New 10th Street LLC acquired the property on October 7, 2004. In 2017, New York City acquired the property for its incorporation into Bushwick Inlet Park.

A warehouse building was constructed circa 1982, apparently coincidental with the purchase of the property by Bridge Lumber that year. It appears fill was used to level the property for construction (see Section 2.2.2.1) because railroad ties which appeared to be in place adjacent to Parcel 4, were found approximately 3 feet below present-day street level during the 2022 field activities. The building constructed atop the Fill Wedge was used for lumber storage until 1995. The building was later used for document storage business, by CitiStorage, until January 31, 2015, when it was destroyed by a fire. The remnants of the building have been demolished, and the parcel is currently vacant.

- **Parcel 4:** Prior to September 23, 1991, Parcel 4's ownership history is identical to that of Parcel 3. NYSDEC records indicate that a construction and demolition debris transfer station operated in the southwestern portion of the parcel from approximately 1987 through the early 1990s (NYSDEC, 1987 and 1991). The facility operated without a permit from September 1988 until at least 1991. Available records indicate the facility handled construction and demolition debris and that the facility transitioned from largely unpaved conditions to a predominantly paved surface during this period (IPB, 1991). By 1994, aerial photographs suggest that transfer station activities had ceased and the parcel was fully paved (USGS, 1994). Between 1996 and 2001, the property was developed into multiple adjoining buildings, the easternmost of which was interconnected with the warehouse on Parcel 3. Similar to Parcel 3, it appears that fill was used to level the property at this time, as indicated by railroad ties, which appeared to be in place, found approximately 3 feet below present-day street level during the 2022 field activities. The buildings were used for offices and document storage until January 31, 2015, when they were destroyed by a fire. The remnants of the buildings have been demolished, and the parcel is currently vacant. In 2017, New York City acquired the property for its incorporation into Bushwick Inlet Park.

2.3.4. Previous Interim Remedial Measures

In 2014, a NAPL recovery well IRM was performed for Parcel 2. Thirteen passive NAPL recovery wells were installed on or along the boundary of Parcel 2; eight were installed along North 12th Street, two were installed along North 11th Street, and three were located near the western boundary of Parcel 2. NAPL recovery began in 2014 and is an ongoing program.

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From October 2015 through June 2017, an excavation/stabilization based IRM was performed for Parcel 2. In-situ stabilization (ISS) of the Holder No. 2 tank contents was performed using bucket soil mixing under a temporary fabric structure. Excavation was performed around the Relief Holder and Holder No. 1 tanks to approximately 30 feet bgs, completely removing them and their foundations (a steel sheet pile support of excavation wall was installed/utilized to allow the foundation excavation). Additional stabilization was performed on soils containing leachable lead prior to disposal off-Site as non-hazardous waste. Recovery wells located on Parcel 2 were abandoned, and the remainder of Parcel 2 was excavated to a minimum depth of 5 feet bgs. Materials suitable for reuse, as well as imported material meeting Restricted Residential SCO, were placed to bring Parcel 2 back up to the grade of the adjacent streets prior to development into a park by NYCDPR. The NYSDEC-approved IRM Design and Implementation Plan and Construction Completion Report states the following regarding the IRM implemented at the Parcel 2:

> "The intent of the Interim Remedial Measure (IRM) is to implement a remedy at the Site where such remedy would be considered final and be considered interim only from the standpoint that it would be part of a larger remedy that would be implemented later. A "final" IRM would allow for the Site to be used by the property owner (the New York City (NYC) Parks Department) with few or no restrictions before the entire former Manufactured Gas Plant (MGP) footprint, which occupies properties beyond the Site, is remediated. The IRM is therefore a remedy that shall not require any re-work/removal in the future and where there is minimal risk that implementing the IRM might be redundant as far as an eventual remedy of the entire former MGP is concerned, thereby creating a cost-efficient IRM."

2.4. Non-MGP Parcel Histories

The history of the properties surrounding the former Williamsburg Works MGP is important to understanding the environment at the former Williamsburg Works MGP site. A brief history of the surrounding area was developed through the review of selected historical maps, photographs, historic drawings from BUG, available Sanborn maps, and information presented in previous reports. More detailed historical information is provided in the RI Report submitted to the NYSDEC in August 2025 (GEI, 2025). Figure 8 shows identified historical non-MGP structures presented on a 2024 aerial of the former Williamsburg Works MGP site and surrounding properties.

2.4.1. Parcel 5

Parcel 5, located to the south of the former MGP footprint (16 North 11th Street and 33 North 10th Street), historically contained oil and manufacturing operations, and is considered a potential additional non-aqueous phase liquid (NAPL) source area. As of July 2026, these properties are currently a P site with NYSDEC (Site No. 224341). Impacts related to the former operations at Parcel 5 are being investigated by NYSDEC as of July 23, 2026. Below is a brief summary of Parcel 5's occupation history.

- 1868 – Occupied by C. Pratt & Co. Oil Works, except for a row of residential properties along Kent Avenue. Known oil barrel storage in the center of the property.

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- 1905 – Standard Oil Co. Pratt Works appeared to operate in the eastern and central portions of Parcel 5. SOCONY and Pratt Works (the latter acquired by SOCONY in 1874) both performed oil refining, packing, and shipping operations (Tarbell, 1904). SOCONY and Pratt Works continued to occupy the property in the 1916 Sanborn map.
- 1941 – Occupied by the Brooklyn Eastern District Terminal; previously used oil storage tanks, coal pockets, and cooperage had been removed. From 1942 to 1946, the property was used primarily for bulk flour storage and rail lines. One chemical storage building was depicted to the southwest of the property along North 10th Street.
- 1982 – Property operations remained similar with exception of additional railroad lines and spurs through the northern portion of the property into the former MGP footprint. Additional buildings were constructed to the north, adjacent to the railroad spurs, for lockers and general storage.
- 1990s – A warehouse was constructed in the 1990s and used by CitiStorage for document storage until circa 2021. This warehouse was demolished in 2024 and 2025.
- 2017 – New York City acquired the property for incorporation into Bushwick Inlet Park.

2.4.2. Parcel 6

Parcel 6, located north of the former MGP footprint (1-26 N. 12th Street and portions of 1 Franklin Street), has been used for petroleum product manufacturing, as a large-scale refinery, and as an oil terminal. This historical use of this property for a variety of oil-related industries and manufacturing processes indicates it is a potential additional NAPL source area. Material spills reported at Parcel 6 include coal tar pitch volatiles, gasoline, methyl tertiary butyl ether (MTBE), and creosote.

This property is currently a P site with NYSDEC (Site No. 224402), Voluntary Cleanup Program Site No. V00587, and State Superfund Program Site No. 224055A. This property has been operated by Pratt Works, SOCONY, Exxon Mobil, Paragon Oil Co. (a Division of Texaco, Inc.), Bayside Fuel Oil, TransGas Energy Systems, Motiva, and Sunoco. The property has been acquired by New York City for incorporation into Bushwick Inlet Park.

- 1867 – Charles Pratt and Company began operations at the Astral Oil Works, a kerosene refinery, located between North 12th Street, 1st Avenue (now Kent Avenue), the East River and Newtown Creek (Wilson, 1918) (Explosion, 1880). By 1872, Astral Oil Works was rated at a capacity of 1,500 barrels of oil daily, making it one of the three largest oil companies around Manhattan. Additionally, Astral Oil Works had the rated capacity of a daily output of illuminating oils exceeding 1,100 barrels, or about 1,200 barrels of refined oils of all kinds, including naphthas. Astral Oil Works became part of the Standard Oil Trust in 1874 (Tarbell, 1904) (Explosion, 1880). Circa 1883, oil was also delivered to the facility via pipeline from Standard Oil Works on Newtown Creek (Brooklyn Daily Eagle, 1883).
- 1882 – A 16-foot-wide underground tunnel was approved for construction connecting Parcel 6 with the property across Kent Avenue, 25 Kent Avenue, discussed below. The tunnel was used to

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contain pipes for the conveyance of oil, steam, water, foam, etc. between the properties (City of New York, 1921). The pipelines that connected Parcel 5 and Parcel 6 transected the former MGP.

- 1887 to 1941 – Pratt Manufacturing began using the property with the northwestern section used primarily for manufacturing tin cans, boxes, and barrels while the southeastern portion contained oil refining operations. Tanks depicted on the property included: tar, gasoline, and oil. Depending on oil prices, plants were known to alternate between the use of coal and crude petroleum as feed stocks (Gesner 1865). This coal distillation process is very similar to the MGP coal carbonization process, and the tar produced from both processes would be chemically similar (Scientific American 1974). The December 1900 Standard Oil Co. of NY Pratt Works Business Analysis gives the following income breakdown: approximately 46 million gallons of crude oil sold, 9.5 million gallons of naphtha, 390,000 gallons of gas oil, 7.8 million gallons of tar (itemized separately from asphalt and pitch), and 316,000 gallons of acid oil.

  The 1941 Sanborn map shows that the property remained in use by SOCONY Pratt Work; however, the industrial property use was reduced with the construction of buildings used for office space, a restaurant, club house, and automobile storage.

- 1965 – The property was used by Paragon Oil Company Division of Texaco Inc. and all, but one formerly existing building as well as all former tanks appeared to have been removed.

- 1978 – An addition of a garage on the eastern portion of the property was observed in Sanborn maps. Sometime after 1982, the property was converted for use by Bayside Fuel, who used it through 2011, when Bayside Fuel began dismantlement. Bayside Fuel was listed by the NYSDEC Bulk Storage Database as a Major Oil Storage Facility (MOSF) and for Chemical Bulk Storage (CBS). In 2016, New York City acquired the property for its incorporation into Bushwick Inlet Park. Along with the real estate, New York City acquired the responsibility to close the MOSF. All structures, including the oil tanks, were removed by 2019.

Multiple newspaper articles dated between 1871 and 1910 document the occurrence of several fires at the plant that resulted in the burning of tar and oil tanks and releases of product to the environment including 90,000 ft^3 of gas following an agitator explosion (Explosion, 1880). On one occasion, the entire property was destroyed. An article cites drainage from SOCONY as the source of fire on Bushwick Creek (New York Times, 1909).

2.4.3. 25 Kent Avenue

The 25 Kent Avenue property, located northeast of the former MGP footprint, has been formerly used for oil storage, for refining, and for other industrial/manufacturing purposes. Oil storage tanks appear as early as 1868 in Sanborn maps.

The 1887 Sanborn map indicates the property was used by Pratt Manufacturing Company. The 1905 and 1916 Sanborn maps indicate the property was used by Standard Oil Co Pratt Works and show tanks and a pump house. The 1941 Sanborn map indicates the property was used by SOCONY, Pratt Works, however the property is vacant except for a pump house and adjacent structure. The Refinery operated until

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1949. The Hildreth Varnish Company operated on the property until at least 1942. Varnish works are shown, in the middle portion of the property, on historical maps dating back to 1868.

By the early 1950s, the property was occupied by metal and lumber storage yards and a paint manufacturer. Between the mid-1960s and late-1970s, the paint manufacturing building was converted into a warehouse. By the mid-1980s, the property was occupied by an equipment rental facility and storage yard. The westernmost structure was demolished in 2012, and the property was vacated sometime after April 2014. The property was remediated under the Brownfield Cleanup Program (C224207 with a Certificate of Completion issued in December 2017. As of 2016, the property was owned by 19 Kent Acquisition LLC. In 2017, a commercial/office building was constructed.

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3. Summary of Remedial Investigation

The RI evaluated the nature and extent of impacts at the Site, identified impacts associated with other sources including the former Pratt Works parcels (Parcels 5 and 6 and 25 Kent Avenue), and evaluated the potential human health and ecological risks associated with the identified impacts. Accordingly, the following discussion focuses on RI findings relevant to OU-1. References to adjacent areas outside OU-1, including other parcels, roadways, and East River sediments, are provided where necessary to present the full environmental context of conditions within OU-1. Where areas outside OU-1 are referenced, additional details regarding those areas can be found in the RI Report (GEI, 2025).

The presence of additional non-MGP related chemicals observed throughout the RI including metals, solvents, pesticides, and polychlorinated biphenyls (PCBs) in soils confirm the presence of multiple sources of impacts.

3.1. Identification of Standards, Criteria, and Guidance

In accordance with NYSDEC regulations, Site media was compared to the following Standards, Criteria and Guidance (SCGs) values.

Media	SCGs
Soil	Title 6, Chapter 100, Part 700-705, Subpart 375-6 of the New York State Code of Rules, and Regulations (6NYCRR Part 375) Unrestricted Use Soil Cleanup Objective (SCOs) (NYSDEC, 2006) (Unrestricted SCOs).
	Restricted Use Restricted Residential SCOs (subparagraph 1.8(g)(2)(ii)) (Restricted Residential SCOs) OR Restricted Use Industrial SCOs (subparagraph 1.8(g)(2)(iv) (Industrial SCO).
	Protection of Groundwater SCOs (POGSCOs) under Section 375-6.5
Sediment	June 24, 2014, NYSDEC Screening and Assessment of Contaminated Sediment Saltwater Sediment Guidance Values (SSGVs)
Groundwater	New York State Ambient Water Quality Standards (NYSAWQS) for a GA area
Ambient Air	USEPA Building Assessment and Survey Evaluation (BASE), conducted by USEPA in 2001 (NYSDOH, 2006)
Soil Vapor	EPA Vapor Intrusion Screening Levels (VISL)

The Restricted Residential SCOs apply to properties where the land use includes active recreational uses, such as public uses with a reasonable potential for soil contact. Parcels 2, 3, and 4 were compared to Restricted Residential SCOs because the currently understood future land use for these properties is as park land. Concentrations of individual compounds in soils associated with groundwater sample exceedances were compared to Protection of Groundwater SCOs.

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It should be noted that while the results were compared to the NYSDEC's GA standards per NYSDEC guidance, NYC provides potable water to Brooklyn and therefore, potential exposures related to consumption of groundwater are not of concern for OU-1.

3.2. NAPL Migration

The overall vertical extent of NAPL migration within OU-1 was defined by the RI. The vertical extent of NAPL migration appears to be limited by the underlying glacial lacustrine clay layer. Visible impacts were not observed below the clay layer within surrounding deep borings installed by GEI on Parcels 2, 3, and 4. Most of the NAPL-saturated soils that were identified on Parcel 2 were in proximity to the former gas holders and were removed during an IRM. Tar tanks on Parcel 6 are an additional potential source of NAPL. A portion of the NAPL migrated laterally to the northwest along the top of less permeable layers. NAPL appears to have migrated from the source areas vertically and laterally through coarse-grained material. The lateral extent of NAPL at the former Williamsburg Works MGP site has been defined to the north, extending to North 12th Street and onto the southern portion of Parcel 6, to the east, extending to Parcel 1, to the south, extending to North 11th Street and onto the northern property boundary of Parcel 5, and to the west, extending to the boundary of Parcel 4. The former Pratt Works properties appear to be a source of NAPL and other impacts that have commingled with MGP-related impacts to the north and south.

3.3. Soil

Physical impacts to soil, including NAPL saturation and coating, sheens, staining, and odors, are present at OU-1 and are described in detail in the RI Report (GEI, 2025). Summaries of physical impacts observed are shown in Figures 9 through 12.

Analytical result summaries in relation to Unrestricted; Protection of Groundwater; and Restricted Residential or Industrial SCOs are provided in Figures 13 through 16. In addition, Tables 1a, b, c, d, and e summarize the soil analytical data generated during the RI, including the number of samples analyzed, detection frequency, concentration ranges, and the number of exceedances of applicable cleanup levels for each chemical evaluated.

While background metal concentrations are discussed to provide context regarding site conditions and to aid in interpretation of the RI data, remedial decisions are determined based on comparison to the SCGs provided in Section 3.1.

3.3.1. Surface Soil

There was not any exposed surface soil within the footprint of the former MGP at the time of investigation. Therefore, surface samples were collected adjacent to the former footprint from planter boxes in the current sidewalks. NAPL was not observed within surface soil. Laboratory testing results indicated that volatile organic compound (VOCs) (including benzene, toluene, ethylbenzene, and toluene [BTEX] compounds), semi volatile organic compound (SVOCs), polycyclic aromatic hydrocarbon (PAHs),

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pesticides, PCBs, metals, and free cyanide were detected in surface soils. Table 1a summarizes the surface soil analytical data collected adjacent to OU-1 during the RI.

3.3.2. Shallow Subsurface Soil

For the purpose of the RI and this RAAR, shallow subsurface soil is defined as the top five feet of soil that may be excavated during utility or construction activities. Tables 1b and 1c summarize the shallow subsurface soil analytical data generated during the RI on Parcels 2 following the completion of the IRM, and 3 and 4, respectively.

3.3.2.1. Parcel 2

Fill materials were encountered within the top 5 feet in addition to brick and concrete associated with three gas holders. The previous concrete building slab from the NYCDOS was evident at the surface and identified in borings on the western portion of the parcel prior to the IRM. Approximately 5 feet of concrete was observed at WW-MW-04, within the footprint of the former still house. During the IRM, the northeastern and southwestern sections of the parcel were excavated to a minimum depth of 5 feet bgs, while the central portion including within former Holder No. 1 and the former Relief Holder were excavated to 30 feet bgs. Following completion of the IRM, one shallow sample had analytical concentrations exceeding Protection of Groundwater SCOs for several individual PAH compounds.

3.3.2.2. Parcels 3 and 4

3.3.2.2.1. Fill Wedge

As previously discussed in Section 2.2 the Fill Wedge is a surficial wedge of soil/fill, placed post MGP operation and post BUG ownership of Parcels 3 and 4, present above the historic industrial surface of Parcels 3 and 4 and adjacent streets. Based on available historical information and RI findings, the Fill Wedge appears to have been placed after the end of MGP operations to raise and level portions of OU-1 for subsequent building construction on Parcels 2, 3, and 4.

The Fill Wedge covers the top 1 to 5 feet of Parcel 3 and at least the top 5 feet of Parcel 4. Within samples collected from the top 5 feet of subsurface soil across Parcels 3 and 4, BTEX values did not exceed the appropriate Restricted-Residential SCO criteria, however, individual and total PAH values were detected in some samples above the appropriate Restricted-Residential SCO criteria. Elevated PFOS, PCBs, pesticides, and metal concentrations (arsenic, barium, cadmium, chromium, copper, lead, and mercury) were also detected. These shallow soil contaminants of potential concern (COPCs) are likely associated with historic fill material used in the development and post-MGP operation of Parcels 3 and 4.

3.3.2.2.2. Non-Fill Wedge

Solvents, PCBs, pesticides, and metals not associated with MGP operations were found in shallow soil/fill across all sampled areas. The presence of these additional non-MGP related chemicals indicates that

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sources of impacts unrelated to former MGP operations have contributed to shallow soil/fill conditions within and adjacent to OU-1.

Environmental impacts (including odors, sheens, and stains) in shallow fill along North 12th Street appear to be predominantly petroleum-related, based on olfactory observations or forensic analysis, possibly from the adjacent Parcel 6 long-term use as a fuel oil distribution facility.

3.3.2.2.3. General Summary – Shallow Subsurface Soil

The following summarizes the shallow subsurface soil sample analytical results for Parcels 3 and 4, which are presented in the RIR.

- Total BTEX and VOC concentrations ranged from non-detect to 7.779 milligrams per kilogram (mg/kg) and 81.971 mg/kg in WW-TP-203A (2.5 feet), respectively. Individual BTEX and VOC compounds did not exceed Restricted Residential SCOs.
- Total PAH concentrations ranged from 0.0196 mg/kg in WW-SB-217 (0 to 5 feet) to 1,108.3 mg/kg in WW-SB-14 (1 to 5 feet). Individual PAH concentrations exceeded the Restricted Residential SCOs in 61 samples. Concentrations of other SVOCs did not exceed the Restricted Residential SCOs. Alkylated PAH concentrations exceeded Restricted Residential SCOs in 35 samples.
- Individual concentrations of PCBs, pesticides, and herbicides did not exceed the Restricted Residential SCOs.
- Metal concentrations ranged from non-detect to exceeding Restricted Residential SCOs for arsenic, barium, cadmium, chromium, copper, lead, and mercury. Concentrations of arsenic exceeded the Restricted Residential SCO in fourteen sample locations, however, twelve of the locations were within the range of typical background concentrations.
- Per- and polyfluoroalkyl substances (PFAS), perfluorooctanesulfonic acid (PFOS), and perfluorooctanoic acid (PFOA) concentrations did not exceed Restricted Residential SCOs.
- Free cyanide was not detected.

3.3.3. Deep Subsurface Soil

For the purpose of this RAAR, deep subsurface soil is defined as deeper than five feet where physical impacts are generally observed. Tables 1d and 1e summarize the deep subsurface soil analytical data generated during the RI on Parcels 2 following the completion of the IRM, and 3 and 4, respectively.

3.3.3.1. Parcel 2

Fill material was encountered at Parcel 2 to a maximum depth of 25.5 feet bgs (-16.1 feet North American Vertical Datum [NAVD]) within Holder No. 1 and confirmed the presence of holder foundations ranging from 20 to 25.5 feet bgs. Physical impacts were observed across the property in the deep subsurface soil, the heaviest of which were generally near and within the three gas holders. Soil within

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the gas holders and at the center of Parcel 2 was excavated and removed up to 30-ft bgs as part of the IRM. The following summarizes the deep subsurface soil sample analytical results for Parcel 2 following the completion of the IRMs.

- Total BTEX concentrations ranged from non-detect to 4,800 mg/kg in WW-SB-23 (31 to 33 feet).
- Total PAH concentrations ranged from non-detect to 42,930 mg/kg in WW-SB-23 (31 to 33 feet). Many samples also showed individual PAH concentrations that exceeded the Restricted Residential SCOs. Concentrations of other SVOCs exceeding the Restricted Residential SCOs in deep subsurface soil were limited to dibenzofuran in four samples.
- Concentrations of metals including barium, lead, manganese, and mercury were detected exceeding Restricted Residential SCOs primarily within fill. Exponent, a chemical consulting and analysis firm, states that the abrupt drop in metal concentrations with depth indicates that these metals are associated with historical fill. Other sources that potentially contributed to the metals include the former railroads that existed in Parcels 2, 3, 5, and 6; metal works on Parcel 2; and the former tin can factory on Parcel 6.
- Free cyanide was not detected.

The vertical extent of impacts was found to be above the confining clay layer at all boring locations on this Parcel except for WW-SB-09 and WW-SB-23. With the exception of a non-MGP related concentration of barium, sample concentrations collected from below the confining layer did not exceed Restricted Residential SCOs.

3.3.3.2. Parcels 3 and 4

Fill materials, including concrete, coal, brick fragments, and wood, were encountered on and adjacent to Parcels 3 and 4 to a maximum depth of 21 feet bgs (-14.65 feet NAVD), likely from historic filling of the East River.

- Total BTEX concentrations ranged from non-detect to 7,510 mg/kg in sample WW-SB-231 (20 to 25 feet). Total VOC concentrations range from non-detect to 34,339 mg/kg in sample 231 (20 to 25 feet). Individual BTEX and VOC concentrations exceeded the Restricted Residential SCOs in 30 samples.
- Total PAH concentrations ranged from non-detect to 36,451 mg/kg in sample WW-SB-225 (20-25 feet). Many samples from physically impacted strata also showed individual PAH concentrations that exceeded the Restricted Residential SCOs. Dibenzofuran exceeded the Restricted-Residential SCO (18 mg/kg) at seventeen sampling locations, ranging from non-detect to 1,130 mg/kg in WW-SB-225 (20-25 feet). Alkylated PAH concentrations exceeded Restricted Residential SCOs in 66 samples.
- Metals concentrations range from non-detect to exceeding Restricted Residential SCOs for arsenic, barium, copper, lead, manganese, and mercury. Concentrations of arsenic exceeded the Restricted Residential SCO in twenty-seven samples; however, concentrations at twenty-four of

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the locations were within the range of typical background concentrations. Potential contributing sources of metals may have included the former railroads spanning Parcels 3, 4, 5, and 6; the former metal works facility on Parcel 2; as well as the defunct tin can factory formerly located on Parcel 6.

- Free cyanide was not detected.

3.4. Sediment

Sediment samples were collected from varying depths within sections of the East River and the Bushwick Inlet that were adjacent to the Site and the Pratt Works properties (Parcels 5 and 6). Physical impacts from NAPL, including petroleum, were observed in most of the sediment cores, which helped delineate the horizontal extent of impacts. Impacts were not bound to the west of the Site within the East River due to equipment limitations.

The remedial alternatives developed in this RAAR are limited to OU-1 and do not address impacts to sediments. Further details related to sediment impacts are provided in the RI Report (GEI, 2025).

3.5. Groundwater

Analysis of dissolved phase groundwater samples during the RI identified concentrations above NYSAWQS that are likely related to MGP and petroleum impacts. Groundwater samples collected from monitoring wells within OU-1, OU-2, Parcels 5 and 6, and adjacent rights-of-way also contained elevated concentrations of naturally occurring metals (iron, magnesium, manganese, and/or sodium) indicative of the natural groundwater conditions in the area. The following discussion of the nature and extent of groundwater impacts includes samples collected from OU-1 and the rights-of-way adjacent to OU-1 to provide a comprehensive representation of groundwater conditions in the vicinity of OU-1.

A total of forty-five monitoring wells and six temporary groundwater points were installed during the RI at various locations across the area investigated. Shallow permanent and temporary monitoring well screens were installed spanning the groundwater surface. Intermediate wells and temporary groundwater points were screened approximately halfway between the water table and confining clay layer. Deep wells and temporary groundwater points were screened above the confining clay layer. As discussed previously, the holders on Parcel 2 were remediated as part of the IRM. Three of the temporary wells were screened inside the holders. Many well screens were installed within intervals containing NAPL-related impacts including petroleum.

Groundwater analytical results relative to applicable NYSAWQS are summarized in Figures 17 through 22. Figures 17, 19, and 21 depict the analytical results for groundwater samples collected from shallow monitoring wells on Parcels 2, 3, and 4, respectively. Figures 18, 20, and 22 depict the analytical results for groundwater samples collected from intermediate and deep monitoring wells on Parcels 2, 3, and 4, respectively. No intermediate or deep groundwater samples were collected from Parcel 2. In addition, Tables 2a, b, and c summarize the analytical data generated during the RI, including the number of samples analyzed, detection frequency, concentration ranges, and the number of exceedances of

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applicable groundwater standards, criteria, and guidance values for each chemical evaluated. Table 2a summarizes the analytical data for groundwater samples collected from shallow monitoring wells, Table 2b summarizes the analytical data from intermediate monitoring wells, and Table 2c summarizes the analytical data from deep monitoring wells.

3.5.1. Shallow Groundwater

Concentrations of total BTEX in the shallow monitoring wells and temporary groundwater points ranged from non-detect in three samples to 31,100 µg /L in a sample collected from WW-MW-05. WW-MW-05 was formerly located on Parcel 2 and screened in soil where petroleum and naphthalene odors, sheen, NAPL stains, blebs, and coating were observed. This area was excavated to approximately 30 feet bgs during the Parcel 2 IRM. Many individual BTEX compound concentrations in groundwater samples exceeded the NYSAWQS. Generally, the wells with the highest levels of BTEX were located in Parcel 2 or within North 11th Street and North 12th Street adjacent to Parcel 3. Styrene and isopropylbenzene exceeded the NYSAWQS standards in at least one sample. Chloromethane exceeded the NYSAWQS in at two samples, this chlorinated VOC is not related to former MGP operations. MTBE, a gasoline additive, was detected on Parcel 2 (MW-5 at 2 µg /L; Metcalf and Eddy 2007), the source is likely operations that occurred at Parcels 1 or 2 after the MGP operations had ceased.

Concentrations of total PAHs ranged from non-detect in one sample to 7,627 µg /L in a sample collected from WW-MW-05, which was formerly located at Parcel 2 and was screened in soil with NAPL staining, blebs, and partial coating. This area was excavated to approximately 30 feet bgs during the Parcel 2 IRM. Concentrations of individual PAHs were present at levels above the NYSAWQS. Phenol was also detected above the NYSAWQS in a sample collected from WW-MW-13, located within North 12th Street, adjacent to Parcel 3.

Concentrations of total PFAS range from non-detect to 171.2 ng/L in a sample collected from WW-MW-204, which is located on the eastern corner of Parcel 3, adjacent to Parcel 2. Concentrations of individual PFAS were present at levels above the NYSAWQS. Concentrations of perfluorooctanesulfonic acid (PFOS) exceed NYAWQS in five samples ranging from, 19.5 µg /L in a sample collected from WW-MW-14 to 100 µg /L in samples collected from WW-MW-200. Concentrations of perfluorooctanoic Acid (PFOA) exceed the NYSAWQS in five samples ranging from 9.71 µg /L in a sample collected from WW-MW-14 to 23 µg /L in a sample collected from WW-MW-204.

PCBs and herbicides were not detected. Concentrations of pesticides exceeded the NYSAWQS in two samples. Pesticides are not associated with former MGP operations.

Concentrations of metals (including arsenic, barium, chromium, iron, lead, magnesium, manganese, nickel, potassium, selenium, and sodium) were detected above the NYSAWQS in samples collected from all monitoring wells.

Concentrations of total cyanide ranged from non-detect in three samples to 211 µg /L in a sample collected from WW-MW-11.

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3.5.2. Intermediate Groundwater

Concentrations of total BTEX in the intermediate monitoring wells and temporary groundwater points ranged from non-detect in three samples to 8,880 µg /L in a sample collected from WW-MW-204I, located at the eastern corner of Parcel 3, adjacent to Parcel 2. Two of the eight wells on Parcels 3 and 4 contained individual BTEX compound concentrations in groundwater samples exceeding the NYSAWQS. The sample collected at WW-MW-204I exceeded the NYSAWQS for the individual BTEX compounds but was screened in soil with no visual impacts.

Chloroform and isopropylbenzene exceeded the NYSAWQS standards in the sample collected at WW-MW-204I and vinyl chloride exceeded the NYSAWQS standard in the sample collected at WW-MW-205I. Other VOCs, including chloroform and vinyl chloride, exceeded the NYSAWQS standards in at least one sample on Parcels 3 and 4. These chlorinated VOCs are not related to former MGP operations.

Concentrations of total PAHs ranged from 3.6 µg /L in a sample collected from WW-MW-201I to 67.2 µg /L in a sample collected from WW-MW-206I, which is located in the southern corner of Parcel 3, downgradient of Parcel 2. The concentration of naphthalene was detected above the NYSAWQS at the sample collected at WW-MW-206I. Phenol, in a sample collected from WW-MW-204I, was the only other SVOC detected at a concentration exceeding the NYSAWQS in intermediate groundwater.

Concentrations of metals (including iron, magnesium, manganese, nickel, and sodium) were detected above the NYSAWQS in samples collected from all monitoring wells and temporary groundwater points.

Concentrations of total cyanide ranged from 19 µg /L in a sample collected from WW-MW-205I to 160 µg /L in a sample collected from WW-MW-202I. Concentrations of total cyanide did not exceed the NYSAWQS in intermediate groundwater samples.

3.5.3. Deep Groundwater

Concentrations of total BTEX in the deep monitoring wells and temporary groundwater points ranged from non-detect in three samples to 8 µg /L in a sample collected from WW-MW-206D. Benzene concentrations in groundwater samples exceeded the NYSAWQSs in five of nine samples collected on Parcels 3 and 4.

Chloroform was the only other VOC exceeding the NYSAWQS standards in five samples collected on Parcels 3 and 4, which is not related to former MGP operations.

Concentrations of total PAHs ranged from non-detect in five samples to 1.7 µg /L in a sample collected from WW-MW-206-D, which is located in the southern corner of Parcel 3, downgradient of Parcel 2. SVOCs, including PAHs, were not detected above NYSAWQS in samples collected on Parcels 3 and 4.

Concentrations of metals (including iron, magnesium, manganese, and sodium) were detected above the NYSAWQS in samples collected from all of the monitoring wells.

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Concentrations of total cyanide ranged from non-detect in a number of samples to 63 µg /L in a sample collected from WW-MW-206D which is located on Parcel 3. Concentrations of total cyanide did not exceed the NYSAWQS in deep groundwater samples.

3.5.4. Protection of Groundwater

The following discussion evaluates whether soil impacts may be contributing to groundwater impacts by comparing the distribution of BTEX and PAH concentrations in groundwater samples exceeding NYSAWQS with nearby soil samples exhibiting BTEX and PAH concentrations above Protection of Groundwater SCOs. Consistent with the presentation of data in the RI Report (GEI, 2025), results are organized by parcel and depth interval to facilitate comparison between groundwater and soil conditions. Soil samples collected in the top 30 feet are discussed in association with shallow groundwater monitoring wells, whereas deeper soil intervals are discussed in association with intermediate and deep monitoring wells. In addition to the groundwater analytical results relative to applicable NYSAWQS, Figs. 17 through 22 present BTEX and PAH analytical exceedances and observances of NAPL by depth and parcel.

3.5.4.1. Parcel 2

3.5.4.1.1. Shallow Interval

During the RI, some of the highest dissolved COC concentrations were detected in groundwater samples collected from shallow monitoring wells (WW-MW-04, 05, 06, 07, 08, and 17) on and adjacent to Parcel 2 before the soil IRM. As depicted in Fig. 17, BTEX, styrene, acenaphthene, naphthalene, 2-methylphenol, 4-methylphenol, beta-BHC, delta-BHC, iron, lead, magnesium, manganese, sodium, and total cyanide were detected in groundwater samples at concentrations exceeding NYSAWQS. The monitoring wells from which these samples were collected were removed during the soil IRM. Detections of COCs in groundwater samples at concentrations above the NYSAWQS in shallow areas that were not excavated during the IRM included BTEX, styrene, and PAHs. BTEX and PAHs were detected in soil samples collected from two soil borings (WW-MW-17 and BPB-10) at concentrations above the Protection of Groundwater SCOs outside the area where BTEX compounds and PAHs were detected at concentrations above the NYSAWQS in groundwater samples.

3.5.4.1.2. Deep Interval

Deep monitoring wells were not installed on Parcel 2, however NAPL is present in several recovery wells along the Parcel 2 boundary as depicted in Fig. 18.

3.5.4.2. Parcel 3

3.5.4.2.1. Shallow Interval

Six shallow monitoring wells (WW-MW-10, 11, 13, 200, 204, and 206) were sampled on and adjacent to Parcel 3. In addition, monitoring well WW-MW-205 contained LNAPL and was not sampled. As depicted

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in Fig. 19, BTEX, other VOCs, PAHs, and phenol were detected in groundwater samples at concentrations exceeding NYSAWQS. BTEX compounds were detected at concentrations above the Protection of Groundwater SCOs in soil samples collected from two soil borings (WW-SB-240 and WW-SB-241) outside the area where BTEX compounds were detected at concentrations above the NYSAWQS in groundwater samples. PAHs were detected at concentrations above the Protection of Groundwater SCOs in samples collected from three soil borings (WW-SB-239, WW-SB-240, and WW-MW-204) outside the area where PAHs were detected at concentrations above the NYSAWQS in groundwater samples.

3.5.4.2.2. Deep Interval

Eight intermediate and deep monitoring wells (WW-MW-200I and D, 204I and D, 205I and D, and 206I and D) were sampled on Parcel 3. As depicted in Fig. 20, BTEX, other VOCs, naphthalene, and phenol were detected in groundwater samples at concentrations exceeding NYSAWQS. There were no soil borings on or adjacent to Parcel 3 for which BTEX or PAHs were detected above the Protection of Groundwater SCOs outside the area where BTEX and PAHs were detected above NYSAWQS on or adjacent to Parcel 3.

3.5.4.3. Parcel 4

3.5.4.3.1. Shallow Interval

Four shallow monitoring wells (WW-MW-14, 15, 203, and 207) were sampled on and adjacent to Parcel 4. In addition, monitoring wells WW-MW-201 and 202 contained NAPL and were not sampled. As depicted in Fig. 21, BTEX, other VOCs, and PAHs were detected in groundwater samples at concentrations exceeding NYSAWQS. BTEX compounds were detected at concentrations above the Protection of Groundwater SCOs in soil samples collected from three soil borings (WW-SB-15, WW-SB-16, and WW-SB-232) outside the area where BTEX compounds were detected at concentrations above the NYSAWQS in groundwater. PAHs were detected at concentrations above the Protection of Groundwater SCOs in soil samples collected from four soil borings (WW-SB-15, WW-SB-16, WW-SB-227, and WW-MW-14) outside the area where PAHs were detected at concentrations above the NYSAWQS in groundwater samples.

3.5.4.3.2. Deep Interval

Eight intermediate and deep monitoring wells (WW-MW-201I and D, 202I and D, 203I and D, and 207I and D) were sampled on Parcel 4. As depicted in Fig. 22, benzene and chloroform were detected in groundwater samples at concentrations exceeding NYSAWQS. BTEX and PAHs were detected at concentrations above the Protection of Groundwater SCOs in soil samples collected from soil boring WW-MW-14 outside the area where BTEX and PAHs were detected at concentrations above the NYSAWQS in groundwater samples.

3.6. Soil Vapor and Ambient (Outdoor) Air

Soil vapor and ambient (outdoor air) samples were collected within Parcels 3 and 4.

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3.6.1. Soil Vapor

Soil vapor samples were collected from six locations within Parcel 3 and 4. Multiple VOCs, including BTEX and naphthalene, were detected which are commonly associated with petroleum products and MGP operations. Additionally, chlorinated solvents (tetrachloroethene [PCE] and Trichloroethene [TCE]) not typically associated with MGP operations, were also detected.

3.6.2. Ambient Air (Outdoor)

Outdoor ambient air sample WW-AA-01 was collected concurrently with soil vapor samples on October 6, 2022. BTEX compounds were detected in WW-AA-01. All VOC concentrations were below the 90th percentile of USEPA BASE study concentrations for the sample. The ambient air sample demonstrates that concentrations of VOCs detected in the soil vapor samples are not adversely affecting outdoor air quality.

3.7. Qualitative Human Health Exposure Assessment

A qualitative human exposure assessment was completed and discussed in the RI Report (GEI, 2025). Based on the assessment, the following existing or potential exposure pathways are significant and require remedial action at OU-1 for their elimination or mitigation:

- Ingestion, dermal contact, and inhalation of particulates associated with subsurface soil, and ingestion and dermal contact with groundwater.

Potential risk associated with surface soil impacts remaining on Parcels 3 and 4 are limited due to the presence of the concrete foundations across Parcels 3 and 4 but are similar to any urban area and are presumed not related to former MGP operations. Exposure to subsurface soil and groundwater would be expected to occur only during potential future ground-intrusive activities at OU-1. Groundwater is not used for drinking water purposes, as potable water is supplied by the City of New York, nor is it reasonable to expect that it will be in the future. Refer to the exposure assessment in the RI Report (GEI, 2025) for a more detailed discussion of the potentially exposed populations.

A qualitative assessment of human health exposures to COPCs in all media in the area investigated determined that:

- There is limited potential for site users to come into contact with COPCs in excess of the screening values.
- Potential risks associated with surface soil impacts are similar to any urban area and are not related to former MGP operations.
- Greater risk may exist if future construction and utility workers potentially uncover soils and come into contact with impacted soil or groundwater. In these cases, appropriate impacted-material management methods are necessary.

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3.8. Conceptual Model Development and Discussion

Using the physical observations and analytical results of the Remedial Investigation (RI), a quantitative conceptual site model (CSM) was developed to describe the distribution of impacted subsurface soil within OU-1. The CSM integrates lithologic observations, visual evidence of impacts, and analytical data to characterize the vertical and lateral extent of MGP-Related Source Material, Non-MGP-Related Source Material, and soils exceeding the POGSCOs for BTEX compounds and naphthalene. Based on this framework, discrete impact zones were delineated to support evaluation of contaminant distribution and the relative magnitude of impacts. These zones form the basis for the comparative analysis of remedial alternatives, including assessment of the relative reduction in contaminant mass associated with each alternative.

3.8.1. Conceptual Model Development

The CSM was developed by organizing subsurface soil data into discrete vertical and lateral units to evaluate the distribution and magnitude of impacts within OU-1. For the purposes of this evaluation, the subsurface was initially divided into 10-foot discrete depth intervals (e.g., 0–10 feet bgs, 10–20 feet bgs, etc.), extending from ground surface to the top of the underlying clay layer.

Within each depth interval, physical observations (including blebs, globs, NAPL coating, and the presence of NAPL) and analytical results from soil borings were compiled and evaluated to define the lateral extent of impacted soil. These data were used to identify areas of similar impact characteristics across OU-1 and to support interpretation of the horizontal and vertical distribution of impacts.

Based on this interpretation, remedial areas were delineated that incorporate both the vertical depth intervals and the lateral extent of impacts. These remedial areas represent zones of relatively consistent impact type and magnitude and were delineated to support the selection and application of compatible remedial technologies across both the horizontal and vertical extent of OU-1.

Soil analytical results were then evaluated within this framework to develop representative concentration estimates for each remedial area, reflecting the combined horizontal and vertical distribution of impacts as defined by the CSM.

Within each remedial area, soil analytical results were evaluated to develop representative concentration estimates for contaminants of concern. Soil samples exhibiting concentrations exceeding POGSCOs for BTEX compounds and naphthalene were compiled within each remedial area and averaged to characterize impacted conditions. This approach reduces the influence of localized variability and provides a consistent estimate of conditions within zones defined by similar impact type and magnitude.

In some depth intervals or remedial areas, soil samples were not collected. In these cases, representative concentrations were inferred based on samples from adjacent areas or intervals exhibiting similar physical impact characteristics, including blebs, globs, coating, and/or observed NAPL presence.

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Because the analytical dataset used for this evaluation was limited to samples exceeding POGSCOs for BTEX and naphthalene, the resulting representative concentrations are inherently biased toward higher-impact conditions. As such, these estimates are considered conservative and are intended to support comparative evaluation of remedial alternatives, rather than to represent typical site-wide soil conditions.

For each remedial area, the lateral extent of impacts was combined with the corresponding vertical interval thickness to estimate the volume of impacted soil. Representative concentrations developed for each remedial area were then applied to the estimated soil volumes to evaluate the relative distribution of contaminant mass within OU-1. This approach provides a quantitative framework for comparing the magnitude of impacts across remedial areas and supports evaluation of remedial alternatives based on the relative reduction of contaminant mass and source material.

3.8.2. Conceptual Model Discussion

A total of 16 remedial areas were delineated across OU-1 based on the horizontal and vertical distribution of impacts. MGP-related impacts were generally encountered either independently or commingled with non-MGP-related impacts throughout the site. Two discrete remedial areas (RA-1 and RA-5), located along North 12th Street, were identified as containing only non-MGP-related impacts.

The distribution of contaminant mass is highly concentrated within a limited portion of OU-1, with approximately 80% of the total mass contained within two clusters of remedial areas. Of this, approximately 60% is located on Parcel 4 along the bulkhead in the vicinity of former MGP structures, and an additional 19% is associated with the former gas tank area on Parcel 3. In total, the CSM estimates approximately 135,200 kilograms (298,000 pounds) of contaminant mass within OU-1 based on the defined horizontal and vertical limits of impacted soil. The delineation of remedial areas and associated contaminant mass distribution are presented on Figure 23 and summarized in Table 3.

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4. Remedial Goals and Remedial Action Objectives

4.1. Remedial Goals

6 NYCRR Subpart 375.2.8 establishes the following remedial goals for inactive hazardous waste sites:

- Restoration to pre-disposal/pre-release conditions, to the extent feasible.
- At a minimum, to eliminate or mitigate all significant threats to public health and the environment presented by the contaminants disposed at the site through the proper application of scientific and engineering principles and in a manner not inconsistent with the national oil and hazardous substances pollution contingency plan as set forth in section 105 of the Comprehensive Environmental Response, Compensation, Liability Act (CERCLA), as amended as by Superfund Amendments and Reauthorization Act (SARA).

Restoration to pre-disposal/pre-release conditions would be extremely difficult, if not infeasible at OU-1, and may present considerable risks to workers and the community during construction. This lack of feasibility is primarily attributable to the depths to which extend, up to approximately 80 feet bgs, and to the lateral proximity of those impacts to the East River. Dewatering an excavation to this depth at the interface of OU-1 and the East River would not be practicable. Even if a water-tight excavation support system could be implemented to limit groundwater intrusion through the excavation sidewalls, maintaining bottom stability and preventing groundwater intrusion into an excavation extending more than 60 feet below the adjacent East River would not be feasible.

Deep excavation required to restore OU-1 to pre-disposal/pre-release conditions would also pose substantial construction risks due to the presence and unknown construction of existing structures at and adjacent to OU-1, particularly the East River bulkhead wall. Material removal immediately adjacent to the bulkhead, potentially to depths greater than 50 feet bgs, could increase the risk of settlement or failure of adjacent aging structures and infrastructure including the North 12th Street sewer and the existing bulkhead. Failure of the bulkhead could result in a release of impacted materials from Parcel 4 to the East River and require emergency action to repair or replace the wall.

Restoration to pre-disposal/pre-release conditions would also require removal and off-site transportation of substantial volumes of impacted material. Truck transportation from OU-1 would require travel through approximately one mile of densely populated and heavily trafficked neighborhoods to reach the nearest expressway. In addition to the potential for a release during transportation through densely populated and heavily trafficked neighborhoods, the volume of trucking associated with material transport will substantially affect local pedestrian, biker, and vehicle traffic during the remedy.

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Based on the implementation risks and feasibility limitations described above, the remedial goal for OU-1 is to eliminate or mitigate all significant threats to public health and the environment, consistent with 6 NYCRR Subpart 375.2.8.

Several terms, which are used throughout this report, have specific meanings in this report. These terms and definitions for the purpose of this report are as follows:

- ***MGP-Impacted Material*** includes all soils containing concentrations of contaminants of concern (COCs) related to the operations of the former MGP which exceed the 6 NYCRR Subpart 375-6.8 Unrestricted Use SCOs. For the purposes of this RAAR, MGP-Impacted Material may also contain commingled concentrations of COCs which exceed the Unrestricted Use SCOs but are unrelated to the operations of the former MGP.
- ***MGP-Related Source Material*** includes all MGP-related DNAPL present in the subsurface of OU-1 which may provide an ongoing source of groundwater impacts at OU-1. For the purposes of this RAAR, the definition of MGP-Related Source Material includes soil containing MGP-related NAPL saturation, coating, blebs and/or globs as well as commingled concentrations of COCs that exceed the Unrestricted Use SCOs.
- ***Non-MGP-Impacted Material*** includes all petroleum-impacted soils, LNAPL, and soils/sediments impacted with COCs which exceed the Unrestricted Use Criteria but are unrelated to the operation of the former MGP, except where such impacts are commingled with MGP-Impacted Material as defined above.
- ***Non-MGP Source Material*** includes petroleum-impacted material meeting the definition of grossly contaminated media per 6 NYCRR 375-1.2(u) that is unrelated to the operations of the former MGP, except where such material is commingled with MGP-Related Source Material as defined above.
- **Contaminant Source Material** includes all MGP-Related Source Material and Non-MGP Source Material as defined above.

4.2. Remedial Action Objectives

Remedial Action Objectives (RAOs) are medium-specific or operable-unit specific objectives for the protection of human health and the environment. RAOs are established by the NYSDEC and developed based on contaminant-specific SCGs to the extent practicable in a cost-effective manner. The RAOs applicable to OU-1 are presented below:

4.2.1. Groundwater

RAOs for Public Health Protection:

- Prevent contact with, or inhalation of volatiles, from contaminated groundwater.

RAOs for Environmental Protection:

- Prevent the discharge of contaminants to surface water and sediment.

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- Remove the source of ground or surface water contamination.
- Restore the Upper Glacial groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.

4.2.2. Soil

RAOs for Public Health Protection:

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation exposure to contaminants volatilizing from soil.

RAOs for Environmental Protection:

- Prevent migration of contaminants that would result in groundwater, surface water, or sediment contamination.
- Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.

4.2.3. Soil Vapor

RAOs for Public Health Protection:

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

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5. General Response Actions

The following general response actions are being considered as a means of achieving the RAOs for OU-1. The media for which each response action is applicable are indicated along with a brief definition and example technologies.

- **Excavation/Source Removal (soil):** the removal and subsequent on-site treatment and re-use or off-site treatment and disposal of Contaminant Source Material.
- **Treatment (soil and groundwater):** alteration of the physical and/or chemical nature of the subsurface to cause a change in contaminant mass, mobility, or toxicity (*e.g.*, chemical oxidation, stabilization).
- **Containment (soil and groundwater):** isolation of contaminant source areas by constructing and maintaining physical barriers that prevent continued migration of contamination (*e.g.*, in-situ stabilization, sheet pile wall, soil-bentonite cutoff wall, active hydraulic control).
- **Engineering controls (soil):** construction and maintenance of physical barriers to prevent potential exposures to contamination (*e.g.*, surface cap, fencing).
- **Institutional controls (soil, groundwater, soil vapor):** controlling the type and nature of potential exposures through legal or administrative procedures or programs (*e.g.*, deed notice, environmental easement, drinking water/irrigation well restrictions, protocols for managing future excavations, Health & Safety Plan for on-site work).
- **Monitoring (soil, soil vapor, groundwater):** ongoing measurement of contaminant levels to evaluate whether currently incomplete exposure pathways remain incomplete and to identify whether additional mitigative action is needed based on the findings (*e.g.*, groundwater monitoring, indoor air sampling, sediment sampling).

The following matrix shows, for each RAO, the general response actions being considered for OU-1. The response actions are media-specific, and the matrix does not explicitly show positive effects on secondary media.

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	General Response Actions					
RAO	**Excavation/ Source Removal**	**Treatment**	**Containment**	**Eng Controls**	**Inst Controls**	**Monitoring**
Groundwater						
RAOs for Public Health Protection						
▪ Prevent contact with, or inhalation of volatiles, from contaminated groundwater.	X	X	X	X	X	
RAOs for Environmental Protection						
▪ Prevent the discharge of contaminants to surface water and sediment.	X	X	X	X		
▪ Remove the source of ground or surface water contamination.	X	X	X			X
▪ Restore groundwater aquifer to pre-disposal/pre-release conditions, to the extent practicable.	X	X	X			X
Soil						
RAOs for Public Health Protection						
▪ Prevent ingestion/direct contact with contaminated soil.	X	X	X	X	X	X
▪ Prevent inhalation exposure to contaminants volatilizing from soil.	X	X	X	X	X	X
RAOs for Environmental Protection						
▪ Prevent migration of contaminants that would result in groundwater, surface water, and sediment contamination.	X	X	X	X		X
▪ Prevent impacts to biota from ingestion/direct contact with soil causing toxicity or impacts from bioaccumulation through the terrestrial food chain.	X	X	X	X	X	
Soil Vapor						
RAOs for Public Health Protection						
▪ Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.	X	X		X	X	

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6. Identification and Screening of Technologies

On April 19, 2024, on behalf of National Grid, GEI submitted a Preliminary Remedial Technology Screening Letter to NYSDEC providing a preliminary screening of potential remedial technologies to address Contaminant Source Material at OU-1. This preliminary screening focused on alternatives to address Parcel 2 groundwater impacts and remedial activities required to prepare Parcels 3 and 4 for the park redevelopment based on conceptual renderings prepared by NYCDPR. In accordance with the Consent Order between National Grid and NYSDEC, contamination other than MGP Wastes (i.e., the Fill Wedge) was not addressed within the April 2024 submittal unless it was commingled or intermingled with MGP-Site Contamination that alone would independently require the implementation of remedial action. On July 11, 2024, the NYSDEC Division of Environmental Remediation responded requiring the screening memo, and subsequent RAAR, to include removal of the Fill Wedge present at Parcels 3 and 4 as its removal will be necessary to implement removal and/or treatment technologies on deeper impacted environmental media. The Preliminary Remedial Technology Screening Letter was revised and resubmitted to NYSDEC on August 26, 2024.

As described in Section 5, the general response actions considered as a means of achieving the Site RAOs included: excavation/source removal, treatment, containment, engineering controls, institutional controls, and monitoring.

Table 6-1 below evaluates the effectiveness, implementability, relative cost, and status for alternative development for each of the remedial technologies evaluated for the remediation of OU-1. The remedial technologies evaluated primarily focus on Parcels 3 and 4. Because Parcel 2 was previously remediated and has been redeveloped as an active public park, the technology evaluation for Parcel 2 is limited to measures that minimize disruption to ongoing park operations.

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Table 6-1. Summary of Remedial Technology Screening

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Excavation/ Source Removal	Unsaturated Zone Excavation	Effective in elimination of exposure pathways and in providing long-term protection of human health. Involves excavation of shallow subsurface soil to access and remove underlying Contaminant Source Material in the unsaturated zone as defined in the RI. Residual contaminants may pose a future threat to construction and utility workers. Meets Soil RAOs for Public Health Protection.	Technology proven and readily implemented. Large scale removal is necessary and will require dust, emissions, and odor controls. May need to be implemented under a temporary enclosure to prevent emissions and odors.	Low relative to other source removal options. Will require removal of shallow subsurface soil prior to excavation of underlying Contaminant Source Material in the unsaturated zone.	Retained for alternative development.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
	Shallow Saturated Zone Excavation	Effective in elimination of exposure pathways and in providing long-term protection of human health. Involves excavation of shallow subsurface soil to access and remove underlying Contaminant Source Material to a depth up to 15 feet bgs in areas of deeper impacts within Parcels 3 and 4. Residual contaminants will likely not pose a future threat to workers and eliminates potential off-site migration. Meets Soil RAOs for Public Health Protection. Groundwater adjacent to the bulkhead is generally encountered at approximately 10 feet bgs. The practicable depth of direct excavation is generally in the vicinity of the groundwater surface; limited excavation below the groundwater surface may be feasible without substantial dewatering, depending on local conditions, therefore the assumed depth of "Shallow Saturated Zone Excavation" is limited to 15 feet bgs and will be further refined in the design.	Technology proven and readily implemented. Very large-scale removal is necessary and will require dust, emissions, and odor controls. Will require hydraulic controls throughout excavation can be managed in cells with an understanding of tidally influenced groundwater levels. May need to be implemented under a temporary enclosure to prevent emissions and odors	High relative to other source removal options. Will require removal of shallow subsurface soil prior to excavation of underlying Contaminant Source Material in the unsaturated zone	Retained for alternative development.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Excavation/ Source Removal	Deep Saturated Zone Excavation	Effective in elimination of exposure pathways and providing long-term protection of human health. Involves excavation shallow subsurface soil to access and remove underlying Contaminant Source Material to a depth of approximately 57 feet in areas of deeper impacts to restore Parcels 3 and 4 to pre-disposal/pre-release conditions. Meets RAOs for all media without combination of other technologies.	Technology proven and readily implemented at shallow depths. Deep excavation near shoreline may pose technical challenges and hydraulic control necessary to conduct in a tidally influenced aquifer may be insurmountable and quite possibly – infeasible. May need to be implemented under a temporary enclosure to prevent emissions and odors.	Very high relative to other removal options. Will require removal of shallow subsurface soil prior to excavation of underlying Contaminant Source Material in the unsaturated zone	Not retained for alternative development.
Excavation/ Source Removal	NAPL Recovery	Effective at capturing subsurface NAPL. NAPL collection can result in the capture of more groundwater necessitating on-site or off-site treatment. Careful review of investigation data and geology required to predict favorable zones for NAPL recovery. Tidal influence and flow direction changes may impact effectiveness. Soil and groundwater RAOs for Environmental Protection can be achieved over time through source reduction.	Technology proven and readily implemented. Recovery wells may be installed within future trafficked areas of Parcels 2, 3, and 4 which may limit the placement of wells or impact redevelopment plans. Site redevelopment plan may pose challenges related to the recovery, temporary storage, and transportation of collected NAPL.	Low installation costs, but higher operation and maintenance costs relative to other technologies.	Retained for alternative development.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Excavation/ Source Removal	Pressure Pulse Injection	Effective in recovering subsurface NAPL and MGP-Related Source Material by expanding pore space in unconsolidated material to drive NAPL towards designated collection area(s). Soil and groundwater RAOs for Environmental Protection can be achieved over time through source reduction.	Technology proven. May pose technical challenges implementing adjacent to waterway and in areas where a lower confining layer for NAPL is not present.	Capital costs may be high and would require operation expenses unlike other removal options.	Not Retained.
Ex-Situ Treatment	Multi-Phase Extraction	Effective form of groundwater treatment in areas with volatile organic compounds (VOCs) impacts. Can include subsurface LNAPL and groundwater collection and removal of volatile organic compounds within area(s) of applied vacuum. Soil and groundwater RAOs for Public Health Protection can be achieved for VOCs over time. Not effective for remediation of higher molecular weight PAHs or DNAPL.	Readily implemented. Infrastructure required may not be compatible with intended property use.	Capital costs may be medium. Maintenance and potential disposal costs may be high when compared to other ex-situ technologies.	Not Retained.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Ex-Situ Treatment	Off-site Low Temperature Thermal Desorption	Effective form of treatment of soils with low to high levels of organic contamination. Technology has been used effectively to treat soils at other similar sites. Soil and groundwater RAOs for Environmental Protection can be achieved through Contaminant Source Material reduction.	Readily implemented. Permitted facilities are available to receive waste streams.	Medium to high compared to other ex-situ treatment technologies based on the availability of local permitted facilities to accept the waste at the time of the remediation.	Retained for alternative development.
	Ex-Situ Stabilization with Soil Reuse	Effective at meeting RAO for preventing migration and terminating exposure without requiring disposal for all excavated material. Stabilized materials can be reused as fill below redeveloped area following testing. Saline condition chemical compatibility issues must be addressed with mix design to ensure long-term performance. Soil and groundwater RAOs for Public Health and Environmental Protection can be achieved	Technology proven and readily implemented. Requires excavation of material prior to stabilization and reuse. Will require hydraulic controls throughout excavation, placement, and final curing.	Costs may be high compared to other alternatives but reduces amount of soil requiring off-site disposal.	Not Retained.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Ex-Situ Treatment	Ex-Situ Groundwater Pump-and-Treat	Effective groundwater treatment for specific contaminants depending on selected treatment train (air stripping, activated carbon, electrocoagulation, filtration, pH adjustment, etc.). May be effective hydraulic control measure, but not effective source removal. Saline nature of water may require frequent well and pump maintenance. Groundwater RAOs for Public Health Protection can only be achieved with continued operation or additional Contaminant Source Material removal.	Technology proven and readily implemented. Requires off-site water disposal or approved discharge location and permit. Infrastructure required may not be compatible with intended property use.	Capital costs may be medium. regular maintenance required. Long-term operation and maintenance costs may be high. Potential associated water disposal/ discharge costs.	Retained for potential use as hydraulic controls, combined with other containment technologies, only.
Ex-Situ Treatment	Slurry Phase Bioreactors	Treatment of soils with organic contamination. Effectiveness should be field tested before implementation. Soil and groundwater RAOs for Environmental Protection can be achieved for organic compounds only.	Technology proven. Large removal volumes and required residence times may pose challenges. Requires suspension of solids and post-treatment dewatering prior to disposal.	Costs may be high compared to other ex-situ technologies.	Not Retained.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
In-Situ Treatment	Steam Assisted Dual Phase Extraction	Effective on small areas. Larger applications require controls to ensure complete capture of contaminants without spreading impacts vertically or horizontally. Soil and groundwater RAOs for Environmental Protection can be achieved over time through source reduction	Readily implemented. May not be effective on some PAHs and MGP-Related Source Material. Infrastructure required may not be compatible with intended property use.	Capital costs may be medium. Operation and maintenance costs may be high when compared to other in situ technologies.	Not Retained.
	In-Well air stripping	Effective in removing volatile organic compounds within the radius of influence of each well. Soil and groundwater RAOs for Environmental Protection can be achieved for volatile organic compounds only over time through source reduction.	Technology proven to treat surrounding groundwater but may not be effective on some PAHs and MGP-Related Source Material within soils. Infrastructure required may not be compatible with intended property use.	Capital costs may be medium. Operation and maintenance costs may be high when compared to other in situ technologies	Not Retained.
In-Situ Treatment	Soil Vapor Extraction with Air Sparging	Effective in removing volatile organic compounds within area of applied vacuum and controlled air input, Soil and Groundwater RAOs for Environmental and Public Health can be achieved for volatile organic compounds only over time through source reduction. Not effective for remediation of higher molecular weight PAHs or NAPL	Technology proven to remediate unsaturated soil. Effective removal of volatile contaminants (BTEX) but not effective for low volatility PAHs and MGP-Related Source Material. Infrastructure required may not be compatible with intended property use.	Capital costs may be medium. Operation and maintenance costs may be high when compared to other in situ technologies.	Not Retained.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
In-Situ Treatment	Surfactant/Cosolvent flushing	Effective in mobilizing contamination and residual NAPL in soils. Proximity to waterway and tidal action will make delivery, maintaining required contact times, and recovery/treatment difficult. Must be combined with other recovery or treatment technologies to achieve soil and groundwater RAOs for Environmental Protection RAOs.	Technology proven in controlled settings. Tidal action will be difficult to overcome. Hydraulic controls required to prevent discharge to waterway.	High capital costs when compared to other alternatives.	Not Retained.
In-Situ Treatment	In-Situ Oxidation with Permanganate/ Ozone/ Hydrogen Peroxide	Effective in destroying contaminants in soil and groundwater and meeting the RAOs for Environmental Protection at similar sites. Not effective in NAPL zones. Tidal action and influx of extraneous oxidant scavengers make delivery and contact with target MGP-Related Source Material difficult to control in this environment.	Technology proven. However, it will likely be ineffective at OU-1 due to tidal action, limited downgradient area between the impacted zones requiring treatment and the water way for recovery/ treatment. Infrastructure required may not be compatible with intended property use.	High capital and operating costs compared to other alternatives.	Not retained for Source Material removal. May be considered for supplemental treatment.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
In-Situ Treatment	In-Situ Geochemical Stabilization (ISGS)	Effective in immobilizing contaminants in soil and groundwater through containment. Has proven effective in reducing flux of contaminants to groundwater. Tidal action and influx of extraneous oxidant scavengers make delivery and contact with target Contaminant Source Material difficult to control in this environment.	Technology proven. However, effectiveness may be limited at OU-1 due to tidal action, oxygen scavengers, and limited potential access for reinjections.	High capital costs driven by high volume of oxidants potentially required due to the oxygen scavengers when compared to other alternatives.	Not Retained.
In-Situ Treatment	Permeable Reactive Barrier	Effective treatment of impacted groundwater, typically via normal gradient. Groundwater RAOs for Public Health Protections can be achieved. Must be combined with other treatment, containment, or removal technologies to achieve groundwater and soil RAOs for Environmental Protection and soil RAOs for Public Health Protection.	Technology proven. Tidal and saline conditions may require additional considerations. Demolition and restoration may be required for existing features, specifically within Parcel 2, if implemented. Infrastructure required for replacement of barrier media may not be compatible with intended property use	High capital costs due to required earthwork in comparison to other in-situ treatment alternatives. Costs associated with periodic replacement of barrier media may be higher when compared to other in situ technologies depending on frequency required and access to property following redevelopment.	Not Retained.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
In-Situ Treatment	Six Phase Heating	Effective in controlled areas where heating can be achieved without outside influences. Difficult to control adjacent to waterway. Requires extensive controls to capture vapors. Not effective in areas where significant subsurface metal debris or structures may be present. Extent of impacts at OU-1 limits effectiveness. Must be combined with other recovery or treatment technologies to achieve soil and groundwater RAOs for Environmental Protection RAOs.	Technology proven but the horizontal and vertical limits and volume of soils to be treated make it difficult to implement. Infrastructure required may not be compatible with intended property use.	High compared to other alternatives.	Not Retained.
In-Situ Treatment	Oxygenation via Biosparging	Effective in stimulating existing microbial activity within groundwater and saturated soils for light end contaminant mass reduction such as BTEX and naphthalene. May be combined with bioventing to stimulate activity within unsaturated soils. Soil and groundwater RAOs for Environmental Protection can be achieved over time. Not effective for remediation of NAPL.	Technology proven but effectiveness dependent upon soil permeability and contaminant biodegradability. Long-term monitoring for MNA of PAHs is required. Infrastructure required may not be compatible with intended property use.	Low compared to other alternatives.	Retained for alternative development.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
In-Situ Treatment	Monitored Natural Attenuation (MNA), including Enhanced MNA	Effective in reducing the mass and concentration of light end contaminants such as BTEX and naphthalene in soil and groundwater using naturally occurring processes. May utilize amendments to enhance natural contaminant breakdown processes. Soil and groundwater RAOs for Environmental Protection can be achieved over time.	Technology proven. Long-term monitoring for MNA of PAHs is required.	Low compared to other alternatives.	Retained for alternative development.
Engineering Control	Engineered cap/cover system	Effective at controlling the pathways for future worker exposure. Soil and groundwater RAOs for Public Health Protection can be achieved	Technology proven and readily implemented.	Low compared to other technologies like stabilization or source excavation. May require extensive earthwork to accommodate redevelopment plans.	Retained for alternative development.
Containment	Hydraulic Control	Effective in maintaining hydraulic gradient into the contained area. Tidal effects at the Site may require complex modeling and pumping arrangements. Saline nature of water may require frequent well and pump maintenance. Groundwater RAOs for Environmental Protection related to discharge can be achieved.	Technology proven and readily implemented. Treatment system for groundwater would be required on-site along with associated infrastructure/piping. Locations may impact planned park redevelopment Infrastructure required may not be compatible with intended property use.	Medium capital cost, high long-term maintenance, and treatment cost relative to other technologies.	Retained for alternative development.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Containment	Sheet pile wall	Effective at meeting Groundwater and Soil RAOs for Environmental Protection related to preventing migration and terminating exposure. Minimal disturbance of soils. Continuity and compatibility may be concerns. May require grouted interlocks to prevent groundwater migration, modeling to determine edge effects and hydraulic controls to prevent mounding.	Technology proven and readily implemented.	Medium relative to other containment technologies.	Retained for alternative development.
Containment	Soil/bentonite cutoff wall	Effective at meeting Groundwater and Soil RAOs for Environmental Protection related to preventing migration and terminating exposure. However, wall construction may be difficult due to sandy soil and tidal effects. Saline condition chemical compatibility issues must be addressed with mix design to ensure long-term performance. Modeling required to determine edge effects and may require hydraulic controls to prevent mounding.	Technology proven but materials and debris handling will require additional controls during installation. Pilot study would be implemented prior to construction. Mixing operation may need to be constructed under temporary enclosure to prevent emissions and odors.	High relative to other containment technologies.	Retained for alternative development.

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Containment	Jet Grouting	Effective at meeting Groundwater and Soil RAOs for Environmental Protection related to preventing migration and terminating exposure. However, construction may be difficult due to tidal effects. Saline condition chemical compatibility issues must be addressed with mix design to ensure long-term performance. Modeling required to determine edge effects and may require hydraulic controls to prevent mounding.	Technology proven but site-specific issues such as compatibility and continuity are issues to be addressed. Pilot study would be implemented prior to construction. May need to be implemented under a temporary enclosure to prevent emissions and odors.	High relative to other containment technologies.	Retained for alternative development

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General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
Containment	In-Situ Stabilization	Effective at meeting Groundwater and Soil RAOs for Environmental Protection related to preventing migration and terminating exposure. However, large-scale construction may pose difficulties. Saline condition chemical compatibility issues must be addressed with mix design to ensure long-term performance. Must be combined with excavation to remove excess soil from swell. Modeling required to determine edge effects if used along shoreline and may require hydraulic controls to prevent mounding if completed in the shallow soils.	Technology is proven but site-specific materials may be needed. Pilot study would be implemented prior to construction. May need to be implemented under a temporary enclosure to prevent emissions and odors.	High relative to other containment technologies.	Retained for alternative development.
Institutional Controls	Access Controls Environmental Easement Deed Restrictions Health & Safety Plans Long-Term Monitoring Notifications	Effective in preventing risks to future construction workers. Not effective in limiting migration. RAOs for Public Health Protection can be achieved.	Readily implementable.	Low. Monitoring to be performed regularly.	Retained for alternative development.

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6.1.1. Identification and Screening of Technologies

Based on the evaluation documented in Table 6-1, the technologies retained for further analysis in this RAAR are:

- Unsaturated Zone Excavation.
- Shallow Saturated Zone Excavation.
- NAPL Recovery.
- Off-site Low Temperature Thermal Desorption.
- Oxygenation via Biosparging.
- Monitored Natural Attenuation (MNA).
- Engineered Cap/Cover System.
- Hydraulic Control (including ex-situ pump and treat).
- Sheet Pile Wall.
- Soil/Bentonite Cutoff Wall.
- Jet Grouting.
- In-Situ Stabilization.
- Institutional Controls (potentially including access controls, environmental easements, deed restrictions, Health and Safety Plans, long-term monitoring, and notification requirements).

Retention of these technologies for further analysis does not mean that each will be included in the remedial alternatives developed below. Technologies may be omitted from a given alternative where they are redundant, unnecessary, or less effective in combination with other retained technologies.

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7. Development and Analysis of Alternatives

7.1. Assembly of Remedial Alternatives

Based on the remedial technologies retained for further evaluation in Section 6, a series of remedial alternatives were developed for OU-1. These alternatives were assembled by combining compatible technologies to address the distribution of Contaminant Source Material, identified through the CSM, while considering site-specific constraints and anticipated future land use. Each alternative represents a different approach to the removal, treatment, containment, or stabilization of Contaminant Source Material across OU-1.

7.1.1. Alternative 1 - No Action

In many feasibility studies and alternative analyses, a no action alternative is identified and carried through the evaluation process as a point of comparison for other actions. In this case, a No Action alternative would be required to include long-term monitoring and a deed restriction or environmental easement. This alternative would not include any additional removal of Contaminant Source Material beyond the ongoing DNAPL recovery program along the exterior boundary of Parcel 2. This no-action alternative would not meet the property owner's minimum requirements for the planned redevelopment of the property nor would it meet the RAOs for OU-1, and therefore it will not be further evaluated in the RAAR.

7.1.2. Alternative 2 – Shallow Subsurface Soil Removal, Capping, DNAPL Recovery and Groundwater Monitoring

Remedial Alternative 2 will include the following remedial components, as identified on Figure 24:

- Removal of shallow subsurface soil.
- Excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zone.
- Off-site treatment and/or disposal of spoils.
- Installation of a secant pile wall to provide excavation support and facilitate remedy implementation; the wall will remain in place as the permanent riverfront structure following removal of the existing East River bulkhead.
- Demolition and removal of the existing bulkhead and inboard soils to, at a minimum, the existing sediment elevation.
- Implementation of odor and emission controls.
- MNA, including post-construction groundwater monitoring.
- Construction of a composite cover/clean soil cap across Parcels 3 and 4.
- DNAPL recovery activities along the exterior boundary of Parcel 2.

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- Institutional controls, which may include an SMP, EE, and restrictions on the use of groundwater underlying OU-1.

Alternative 2 also includes the following project components and supporting activities that are anticipated to be completed to facilitate remedy implementation or redevelopment: pre-construction activities, including a PDI related to the East River bulkhead condition, and geologic and hydraulic modeling.

Alternative 2 will include the excavation of Non-MGP Impacts and MGP-Impacted Material in the unsaturated zone with off-site treatment and/or disposal. This alternative will include excavation across Parcels 3 and 4 to a target depth sufficient to accommodate the composite cover/clean soil cap and support the future development of Bushwick Inlet Park. Final remedial site grades will be established during remedial design based on remedy requirements and anticipated future park use. Where redevelopment grading requirements have been identified by the property owner, the cap may be designed to be compatible with those requirements. Otherwise, restoration will be completed to an elevation no greater than the existing grades of adjacent streets.

Based on discussions with the property owner, it is GEI's understanding that the final redevelopment plans for Bushwick Inlet Park will continue to evolve during the remedy development and design process. To provide a consistent basis for comparison among alternatives, this evaluation assumes that final restored elevations across Parcels 3 and 4 will generally match the existing elevations of adjacent portions of North 11th Street and North 12th Street. This assumption is intended solely for evaluating remedial alternatives and establishing estimated fill quantities. The assumed restoration elevations do not preclude other final grading configurations or redevelopment options that may ultimately be selected by the property owner, and implementation of the remedy is not dependent upon completion of final redevelopment plans.

Shallow subsurface soils across Parcels 3 and 4 will be excavated and removed from OU-1, where present, to the target excavation depths. This excavation includes the concrete foundation present across the surface of Parcels 3 and 4 and represents approximately 2,900 cubic yards (5,400 tons) of concrete slab and rebar and 21,300 cubic yards (36,210 tons) of Non-MGP-Impacted Material and MGP-Impacted Material. Excavated materials will be transported off-site for treatment and/or disposal as applicable.

Excavations will be backfilled with a minimum of two feet of imported clean fill over a demarcation layer to establish a cover system and final remedial site grade compatible with future site use. The imported clean fill will meet the SCOs for proposed final use of OU-1 as public park.

The existing NAPL recovery wells along the exterior boundary of Parcel 2 will continue to be operated for as long as practicable, or until it is determined that the recovery wells can be abandoned. The benefit of installing additional DNAPL recovery wells and/or the need to relocate recovery wells to accommodate park construction will be evaluated during the design phase of the remedy.

Groundwater from Parcels 2, 3, and 4 will be remediated through removal of MGP-Related Source Material within subsurface soils, through implementation of DNAPL recovery activities along the exterior

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boundary of Parcel 2, and through MNA. Groundwater monitoring will determine effective source material removal and groundwater remediation

7.1.2.1. Screening Guidance Evaluation

With respect to the preliminary screening guidance in DER-10, the alternative is described as follows:

- **Size and Configuration.** Figure 24 illustrates the conceptual layout of this alternative. The entirety of Parcels 3 and 4 will be disturbed during the implementation of this alternative. The footprint of the excavation area at or beneath the water table is approximately 55,750 sq. ft. The maximum excavated thickness in the saturated zone is estimated to be one foot. The conceptual depth of the excavation adjacent to North 12th Street will only be two feet below the street level and will not conflict with the existing sewer line.

  As stated above, this evaluation assumes that final restored elevations across Parcels 3 and 4 will generally match the existing elevations of adjacent portions of North 11th Street and North 12th Street to create a generally level, grass-covered area following completion of the remedy. The actual configuration of post-excavation remedy elements for DNAPL source material recovery and groundwater monitoring will be determined in conjunction with the property owner during the design phase of the remedy.

- **Time for Remediation***.* Assuming an excavation rate of soil is 500 tons per day, the expected duration of the construction work, including disposal, would be approximately 14 months of continuous on-site activities.

  The excavation rate above is based on conventional excavation activities. Since portions of the excavation will be in proximity to the East River bulkhead and the adjacent park, it is possible that the actual excavations rates may be less than conventional rates due to the physical operation constraints from working around the East River bulkhead and administrative constraints related to staging, work sequencing, coordination, and minimizing disruption to park operations.

  To maintain the proposed excavation rate, approximately 20 trucks will be required daily during excavation to transport impacted materials from OU-1. In addition, approximately 20 truckloads of clean fill material will be transported to OU-1 daily. The facility accepting the impacted soils is not the same as the facility providing clean fill. The same trucks cannot be used; therefore, up to 40 trucks may be transporting materials to and from OU-1 on a daily basis. In the event that sufficient trucks cannot be mobilized or local constraints restrict the number of trucks that can be loaded daily (prohibiting staging of trucks on local roads), the time to complete the excavation would be increased based on the volume of soil that can be transported daily.

  Following completion of the soil remedy, DNAPL recovery will continue to remove additional MGP- Related Source Material along the exterior boundary of Parcel 2. Groundwater monitoring will be utilized to confirm the effectiveness of Contaminant Source Material removal and groundwater remediation. Monitoring frequency and duration will be determined during remedial design in consultation with NYSDEC. The property owner will be kept informed of the

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monitoring requirements and consulted, as appropriate, to coordinate access for implementation.

- **Spatial Requirements**. This alternative will require room for equipment and material storage, access, logistics, and operation. Property size limitations and exposure concerns could require that excavations be conducted as a direct load operation with waste characterization performed during a PDI. Due to the shallow nature of the excavation in most areas of OU-1, Parcels 3 and 4 can accommodate these needs, but careful staging and sequencing of the work will be required.

  Further, access to residential roads and highways will be necessary to dispose of impacted materials. During the excavation phase it may be necessary to temporarily stage empty trucks or trucks filled with clean backfill on the adjacent surface streets. Once loaded, trucks transporting impacted soils for treatment and disposal will depart OU-1 for the disposal facility. No staging of trucks filled with impacted material will occur off-site.

  Groundwater monitoring wells and/or DNAPL recovery wells may be installed, as needed, based on the final remedy configuration and design-phase evaluation. The location, schedule, access requirements, and staging of the work would be coordinated with the property owner and NYSDEC to minimize disruption to park operations.

- **Options for Disposal.** Options for disposal of MGP-related materials are readily available off-site at properly permitted, National Grid-approved facilities. However, truck availability, transportation logistics, and disposal facility acceptance capacity may limit the rate at which excavated material can be transported and accepted for off-site disposal during the excavation phase and could result in project delays.

  Concrete and rebar materials can be removed, separated from underlying impacted soils and either disposed of as non-impacted concrete debris or crushed for potential on-site reuse with the approval of the NYSDEC. Shallow subsurface soils have PCB impacts unrelated to the former MGP. These soils may require additional handling, disposal requirements, and alternative disposal facilities following waste disposal characterization. The capacity of alternative disposal facilities for PCBs may impact the project schedule and result in project delays.

  Ongoing waste disposal may be required from long-term groundwater monitoring and DNAPL recovery activities. Temporary storage and/or waste pickup coordination will be required with the property owner as part of long-term Operations & Maintenance (O&M).

- **Permit Requirements** Permits anticipated for Alternative 2 may include road and/or sidewalk permits if street closures are required during construction, and Army Corps of Engineers (ACOE) permits for work adjacent to or within the East River. Additional local NYC permits may be required for implementing remedial activities such as demolition of the concrete foundations and excavation/backfill of the remedial excavation. In addition, a NYSDEC General Permit for Stormwater Discharges from Construction Activity, which will include the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP), will be required for the work.

- **Limitations.** The ability to complete excavation to the required depths in proximity to the East River bulkhead may be limited due to construction and safety constraints. These will include, but are not limited to, excavation limitations associated with the East River bulkhead, right-of-way

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setback distances to the adjacent streets, road closures, the unknown structural and geotechnical integrity of the East River bulkhead and the results of a preconstruction survey of the adjacent park (Parcel 2). Further geotechnical, structural, and excavation evaluation will be required in the design phase to confirm safe setbacks, support requirements, machine limitations and construction schedules.

Restrictions on trucking, waste disposal facility acceptance rates, and bridge weight limits may constrain the daily production rate and project schedule. Based on preliminary volumes, approximately 150 truckloads will be required to transport MGP-impacted excavated materials for off-site treatment and/or disposal in addition to 1,300 trucks to transport shallow subsurface soils and 215 trucks for the concrete and rebar produced during slab demolition. This estimate does not account for the potential debris (boulders, etc.) or other miscellaneous spoils that would have to be transported from OU-1 during construction.

To mitigate potential transportation and disposal challenges (truck availability, landfill acceptance limits, etc.), transporting excavated material from OU-1 via barge may provide an alternative hauling method. Material transport via barge will reduce the trucking traffic required under the alternative. Limitations that would be introduced by facilitating material transport via barge include landfill acceptance limits as well as logistics and/or permitting concerning barge loading near the East River bulkhead.

- **Ecological Impacts.** Due to the extensive remedial activities planned near the East River bulkhead and East River, contaminant precautions (i.e., turbidity curtain networks, water quality monitoring equipment) will be necessary throughout the construction phase to monitor for potential releases. By relocating the shoreline landward through installation of a secant pile wall inboard of the existing structure and removal of the existing bulkhead and adjacent inboard soils, the project would increase the area available to the East River and result in a net gain of intertidal habitat. Overall, neither significant benefits to nor adverse impacts on fish and wildlife resources are expected to result from this alternative.

7.1.3. Alternative 3 – Shallow Subsurface Soil Removal, Source Material Excavation and/or Stabilization, Capping, DNAPL Recovery and Groundwater Monitoring

Remedial Alternative 3 will include the following remedial components, as identified on Figure 25:

- Removal of shallow subsurface soil.
- Excavation of MGP-Impacted Material and Non-MGP-Impacted Material in the unsaturated zone.
- Excavation and/or stabilization of MGP-Related Source Material and Non-MGP-Source Material in the saturated subsurface soils.
- Installation of a secant pile wall to provide excavation support and facilitate remedy implementation; the wall will remain in place as the permanent riverfront structure following removal of the existing East River bulkhead.

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- Demolition and removal of the existing bulkhead and inboard soils to, at a minimum, the existing sediment elevation.
- Implementation of odor and emission controls.
- Off-site treatment and/or disposal of spoils.
- Enhanced MNA, including post-construction groundwater monitoring.
- Construction of a composite cover/clean soil cap across Parcels 3 and 4.
- DNAPL recovery activities along the exterior boundary of Parcel 2.
- Alternative 3 will include the same Institutional controls as Alternative 2, which may include an SMP, EE, and restriction on the use of groundwater underlying OU-1.

Alternative 3 includes the following project components and supporting activities in common with Alternative 2 that are anticipated to be completed to facilitate remedy implementation and redevelopment: PDI related to the East River bulkhead condition, geologic and hydraulic modeling. In addition to these elements, Alternative 3 includes ISS bench-scale testing to establish an ISS mix design to satisfy the desired performance criteria.

Alternative 3 includes removal of shallow subsurface soil and excavation within the unsaturated and shallow saturated zones, the latter to remove Contaminant Source Material to a depth of approximately 15 feet below existing grade. Contaminant Source Material deeper than 15 feet below existing grade within Parcels 3 and 4 will be addressed through ISS. DNAPL recovery activities will be implemented along the exterior of the Parcel 2 boundary to address remaining MGP-Related Source Material at depth while minimizing disturbance to the park.

Installation of temporary subsurface earth support structures may be required in Parcels 3 and 4 to facilitate Contaminant Source Material excavations depending on the excavations' depth and proximity to adjacent surface roads, or other structures such as the East River bulkhead or North 12th Street sewer line. Further excavation to compensate for material swell (estimated as 25%) in ISS locations may be required to maintain the two-foot minimum depth below the final redevelopment elevation for construction of the composite cover/soil cap.

As previously discussed, to provide a consistent basis for comparison among alternatives, GEI has assumed that the final restored composite cover/soil cap elevation of Parcels 3 and 4 will match the existing elevations of North 11th Street and North 12th Street adjacent to Parcels 3 and 4. The assumed restoration elevations do not preclude other final grading configurations or redevelopment options that may ultimately be selected by the property owner, and implementation of the remedy is not dependent upon completion of final redevelopment plans.

Shallow subsurface soils across Parcels 3 and 4 will be excavated and removed from OU-1 to the target excavation depths. This excavation includes the concrete foundation present across the surface of Parcels 3 and 4 and represents approximately 2,900 cubic yards (5,400 tons) of concrete slab and rebar and 21,300 cubic yards (36,210 tons) of Non-MGP-Impacted Material and MGP-Impacted Material.

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Excavation beneath the shallow subsurface soils in the unsaturated and shallow saturated zones will remove approximately 20,000 cubic yards of Contaminant Source Material. Excavated materials will be transported off-site for treatment and/or disposal as applicable.

Contaminant Source Material throughout Parcels 3 and 4 not addressed via excavation will be stabilized via ISS to the approximate limits on Figure 25. Approximately 18,600 cubic yards of ISS will be implemented under this alternative to a maximum depth of 55 feet below existing grade. A PDI and significant hydraulic modelling will be required to evaluate groundwater flow in relation to the proposed ISS monolith(s) and establish an ISS mix design to satisfy the desired performance criteria. ISS performance criteria will be determined during the design phase, but at a minimum will include a minimum 30-year design life and a hydraulic conductivity of 1×10^{-6} cm/sec to restrict groundwater flow through the monolith(s).

A cover system will be established consisting of a minimum of two feet of imported clean fill to the final site grade pending redevelopment. The soil cover will be placed over a demarcation layer. The imported clean fill will meet the SCOs for proposed final use of OU-1 as public park.

Enhanced MNA will be evaluated to address remaining impacts not addressed through excavation or ISS. Enhanced MNA involves combining natural processes with active enhancements in the form of amendments to stimulate indigenous microbes to accelerate the breakdown of contaminants in soil and groundwater. Amendments may be placed at the limits of the excavation or blended with imported backfill materials to enhance the treatment of groundwater impacted by source material remaining at depth. The specific amendments and method of deployment will be determined during the design phase of the remedy.

Similar to Alternative 2, the existing NAPL recovery wells along the exterior boundary of Parcel 2 will continue to be operated for as long as practicable, or until it is determined that the recovery wells can be abandoned. The benefit of installing additional DNAPL recovery wells and/or the need to relocate recovery wells to accommodate park construction will be evaluated during the design phase of the remedy.

Groundwater from Parcels 2, 3, and 4 will be remediated through removal and/or stabilization of Contaminant Source Material within subsurface soils, implementation of DNAPL recovery activities along the exterior boundary of Parcel 2, and through enhanced MNA. Following the soil remediation, groundwater monitoring will determine the effectiveness of source material removal, ISS and groundwater remediation.

7.1.3.1. Screening Guidance Evaluation

With respect to the preliminary screening guidance in DER-10, the alternative is described as follows:

- **Size and Configuration.** Figure 25 illustrates the conceptual layout of this alternative. The entirety of Parcels 3 and 4 will be disturbed during the implementation of this alternative. Excavation within the unsaturated and shallow saturated zones to remove Contaminant Source Material will be required on Parcels 3 and 4, likely requiring excavation support and limited dewatering. The footprint of the excavation area at or beneath the water table is approximately

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56,050 square feet. The maximum excavation thickness in the saturated zone is estimated to be 6 feet. ISS will be performed over approximately 55,313 square feet to stabilize soils with Contaminant Source Material deeper than the planned excavations.

Similar to Alternative 2, this evaluation assumes that final restored elevations across Parcels 3 and 4 will generally match the existing elevations of adjacent portions of North 11th Street and North 12th Street to create a generally level, grass-covered area following completion of the remedy. Additional groundwater monitoring wells or DNAPL recovery wells may be necessary for long-term monitoring. Locations of recovery wells or monitoring wells, if necessary, will be determined in conjunction with the property owner during the design phase of the remedy.

- **Time for Remediation.** Assuming excavation and ISS rates of 500 tons and 410 cubic yards per day, respectively, the expected duration of the construction work, including disposal is approximately 27 months.

  As noted in Alternative 2, factors such as working adjacent the river, the bulkhead, and the North 12th Street sewer, the availability of trucks to transport material to and from OU-1, local traffic constraints or restrictions, as well as daily acceptance limitations from the disposal facility can all have significant implications on the rate which the excavation portion of the work can be completed. ISS rates can be limited by subsurface obstructions and limitations on ISS raw material transportation to OU-1.

  Following completion of the soil remedy, DNAPL recovery will continue to remove additional MGP-Related Source Material from along the exterior boundary of Parcel 2. Groundwater monitoring will be utilized to confirm the effectiveness of Contaminant Source Material removal/stabilization and groundwater remediation. As noted above, the use of amendments in backfill materials will be evaluated to enhance treatment of groundwater impacted by inaccessible Contaminant Source Material remaining at depth within Parcel 2. Similar to Alternative 2, monitoring frequency and duration will be determined during remedial design in consultation with NYSDEC and the property owners will be informed of the monitoring requirements and consulted, as appropriate.

- **Spatial Requirements.** This alternative will require substantial room for equipment and material storage, access, logistics, and operation. Property size limitations and exposure concerns could require that excavations be conducted as a direct load operation with waste characterization performed during a PDI. Excavation within the shallow saturated zone will be performed in select areas of Parcels 3 and 4 which will require groundwater controls including facilities to handle groundwater storage, treatment, and discharge during the construction phase. Dewatering quantities will be estimated during the remedial design following a PDI and hydraulic modelling. Additional area will be required to facilitate the ISS scope of work including mobilization, equipment and material storage, and operation. Spatially, due to the largely shallow nature of the excavations, Parcels 3 and 4 can accommodate these needs, but careful staging and sequencing of the work will be required.

  Further, access to residential roads and highways will be necessary to dispose of impacted materials. During the excavation phase, it may be necessary to temporarily stage equipment, raw materials, and/or empty trucks or trucks filled with clean backfill on the adjacent surface streets.

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Once loaded, trucks transporting impacted soils for treatment and disposal will depart OU-1 for the disposal facility. No staging of trucks filled with impacted material will occur off-site.

Groundwater monitoring wells and/or DNAPL recovery wells may be installed, as needed, based on the final remedy configuration and design-phase evaluation. The location, schedule, access requirements, and staging of the work would be coordinated with the property owner and NYSDEC to minimize disruption to park operations.

- **Options for Disposal.** Options for treatment and disposal of MGP-Impacted Materials are readily available off-site at properly permitted, National Grid-approved facilities. However, truck availability, transportation logistics, and disposal facility acceptance capacity may limit the rate at which excavated material can be transported and accepted for off-site disposal during the excavation phase and could result in project delays.

  Shallow subsurface soils have PCB impacts unrelated to the former MGP. With acceptable laboratory analytical results and approval by the NYSDEC, excavated shallow subsurface soils may be reused on-site as backfill material in the deeper source material excavation areas. On-site material reuse would reduce the volume requirements for material disposal and import. If not reused on-site, these soils may require additional handling, disposal requirements, and alternative disposal facilities following waste disposal characterization. The capacity of alternative disposal facilities for PCBs may impact the project schedule and result in project delays.

  Concrete and rebar materials will be removed, separated from underlying Non-MGP-Impacted Material and either disposed of as non-impacted concrete debris or crushed for potential on-site reuse with the approval of NYSDEC.

  Ongoing waste disposal may be required from long-term groundwater monitoring and DNAPL recovery activities. Temporary storage and/or waste pickup coordination will be required with the property owner as part of long-term Operations & Maintenance (O&M).

- **Permit Requirements.** Permits required for Alternative 3 will be similar to those required for Alternative 2, including road/sidewalk, ACOE, applicable NYC construction permits, and NYSDEC stormwater permit coverage with SWPPP implementation.

- **Limitations.** The ability to complete ISS and excavation to the required depths in proximity to the East River bulkhead and/or the North 12th Street sewer line may be limited due to construction and safety constraints. These will include, but are not limited to, excavation limitations associated with the East River bulkhead, right-of-way setback distances to the adjacent streets, excavation support systems, road closures, the unknown structural and geotechnical integrity of the East River bulkhead and the North 12th Street sewer line, and the results of a preconstruction survey of the adjacent park (Parcel 2). Further geotechnical, structural, and excavation evaluation will be required in the design phase to confirm safe setbacks, support requirements, machine limitations and construction schedules.

  Restrictions on trucking, waste disposal facility acceptance rates, and bridge weight limits may constrain the daily production rate and project schedule. Based on preliminary volumes, approximately 1,510 truckloads will be required to transport Contaminant Source Material excavated materials offsite for off-site treatment and/or disposal in addition to 1,300 trucks to

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transport shallow subsurface soils and 215 trucks for the concrete and rebar produced during slab demolition. This estimate does not account for the potential debris (boulders, etc.) or other miscellaneous spoils that would have to be transported from OU-1 during construction.

To mitigate potential transportation and disposal challenges (truck availability, landfill acceptance limits, etc.), transporting excavated material from OU-1 via barge may provide an alternative hauling method. Material transport via barge will reduce the trucking traffic required under the alternative. Limitations that would be introduced by facilitating material transport via barge include landfill acceptance limits as well as logistics and/or permitting concerning barge loading near the East River bulkhead.

Hydraulic modelling will be required for the ISS monolith construction to evaluate the effect of the low permeability monolith on groundwater flow and ensure surface mounding does not occur.

- **Ecological Impacts.** This alternative will remove and/or stabilize identified Contaminant Source Material located at OU-1. Similar to Alternative 2, due to the extensive remedial activities planned near the East River bulkhead and East River, contaminant precautions (i.e., turbidity curtain networks, water quality monitoring equipment) will be necessary throughout the construction phase to monitor for potential releases. By relocating the shoreline landward through installation of a secant pile wall inboard of the existing structure and removal of the existing bulkhead and adjacent inboard soils, the project would increase the area available to the East River and result in a net gain of intertidal habitat. Overall, neither significant benefits to nor adverse impacts on fish and wildlife resources are expected to result from this alternative.

7.1.4. Alternative 4 – Shallow Subsurface Soil Removal, Source Material Excavation and/or Stabilization, Capping, Parcel 2 Containment Barrier, DNAPL Recovery and Groundwater Monitoring

Remedial Alternative 4 will include the following remedial components, as identified on Figure 26:

- Removal of shallow subsurface soil.
- Excavation of MGP-Impacted Material and Non-MGP-Impacted Materials in the unsaturated zone.
- Excavation and/or stabilization of MGP-Related Source Material and Non-MGP-Source Material in the saturated subsurface soils.
- Installation of a secant pile wall to provide excavation support and facilitate remedy implementation; the wall will remain in place as the permanent riverfront structure following removal of the existing East River bulkhead.
- Demolition and removal of the existing bulkhead and inboard soils to, at a minimum, the existing sediment elevation.
- Implementation of odor and emission controls.
- Off-site treatment and/or disposal of spoils.

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- Enhanced MNA, including post-construction groundwater monitoring.
- Construction of a composite cover/clean soil cap across Parcels 3 and 4.
- DNAPL recovery activities along the exterior of the Parcel 2 boundary.
- ISS containment wall at the boundary of Parcel 2 to address remaining MGP-Related Source Material at depth within Parcel 2.
- Alternative 4 will include the same Institutional controls as Alternatives 2 and 3, which may include an SMP, EE, and restriction on the use of groundwater underlying OU-1.

Alternative 4 includes the following project components and supporting activities in common with Alternative 3 that are anticipated to be completed to facilitate remedy implementation and redevelopment: PDI's related to the East River bulkhead condition, geologic and hydraulic modeling, and ISS bench-scale testing.

Following evaluation and modelling of OU-1-specific geologic and hydraulic conditions, MGP-Related Source Material remaining at depth within Parcel 2 will be rendered hydraulically isolated via the installation of an ISS containment wall along the boundary of Parcel 2. A conceptual ISS containment wall configuration is identified on Figure 26. A final ISS containment wall configuration would be determined during the design phase of the remedy.

Alternative 4 includes removal of shallow subsurface soil and excavation within the unsaturated and shallow saturated zones, the latter to remove Contaminant Source Material to a depth of approximately 15 feet below existing grade. Contaminant Source Material deeper than 15 feet below existing grade within Parcels 3 and 4 will be addressed through ISS. DNAPL recovery activities will be implemented along the exterior of the Parcel 2 boundary to address remaining MGP-Related Source Material at depth while minimizing disturbance to Parcel 2, which is currently operating as part of Bushwick Inlet Park

Installation of temporary subsurface earth support structures may be required in Parcels 3 and 4 to facilitate source material excavations depending on the excavations' depth and proximity to adjacent surface roads or other structures, such as the East River bulkhead. Further excavation to compensate for material swell (estimated as 25%) in ISS locations may be required to maintain the two foot minimum depth below the final redevelopment elevation for construction of the composite cover/soil cap.

As previously discussed, to provide a consistent basis for comparison among alternatives, GEI has assumed that the final restored composite cover/soil cap elevation of Parcels 3 and 4 will match the existing elevations of North 11th Street and North 12th Street adjacent to Parcels 3 and 4. The assumed restoration elevations do not preclude other final grading configurations or redevelopment options that may ultimately be selected by the property owner, and implementation of the remedy is not dependent upon completion of final redevelopment plans.

Shallow subsurface soils across Parcels 3 and 4 will be excavated and removed from OU-1 to the target excavation depths. This excavation includes the concrete foundation present across the surface of Parcels 3 and 4 and represents approximately 2,900 cubic yards (5,400 tons) of concrete slab and rebar and 21,300 cubic yards (36,210 tons) of Non-MGP-Impacted Material and MGP-Impacted Material.

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Excavation beneath the shallow subsurface soils in the unsaturated and shallow saturated zones will remove approximately 20,000 cubic yards of Contaminant Source Material. Excavated materials will be transported off-site for treatment and/or disposal as applicable.

Contaminant Source Material throughout Parcels 3 and 4 not addressed via excavation will be stabilized via ISS to the approximate limits on Figure 26. Approximately 22,730 cubic yards of ISS will be implemented under this alternative to a maximum depth of 60 feet below existing grade. Significant hydraulic modelling will be required to evaluate groundwater flow in relation to the proposed ISS monolith(s), including evaluation of the implications of the proposed ISS containment wall on the lateral displacement of impacted groundwater at and adjacent to Parcel 2. A PDI will be completed to establish an ISS mix design to satisfy the desired performance criteria. ISS performance criteria will be determined during the design phase, but at a minimum will include a minimum 30-year design life and a hydraulic conductivity of 1×10^{-6} cm/sec to restrict groundwater flow through the monolith(s) and containment wall.

Similar to previous alternatives, a cover system will be established consisting of a minimum of two feet of imported clean fill to the final site grade pending redevelopment. The soil cover will be placed over a demarcation layer. The imported clean fill will meet the SCOs for proposed final use of OU-1 as public park.

Similar to Alternative 3, enhanced MNA will be evaluated to address remaining impacts not addressed through excavation or ISS. Enhanced MNA involves combining natural processes with active enhancements in the form of amendments to stimulate indigenous microbes to accelerate the breakdown on contaminants in soil and groundwater. Amendments may be placed at the limits of the excavation or blended with imported backfill materials to enhance the treatment of groundwater impacted by source material remaining at depth. The specific amendments and method of deployment will be determined during the design phase of the remedy.

Similar to previously discussed alternatives, operation of the existing NAPL recovery wells will continue to remove DNAPL from the subsurface along the exterior boundary of Parcel 2. The benefit of installing additional DNAPL recovery wells and/or the need to relocate recovery wells to accommodate park construction will be evaluated during the design phase of the remedy.

Groundwater from Parcels 2, 3, and 4 will be remediated through removal, stabilization, and/or containment of Contaminant Source Material within subsurface soils, through implementation of DNAPL recovery activities along the exterior boundary of Parcel 2, and through enhanced MNA. Following the soil remediation, groundwater monitoring will determine effectiveness of source material removal, ISS, containment and groundwater remediation.

7.1.4.1. Screening Guidance Evaluation

With respect to the preliminary screening guidance in DER-10, the alternative is described as follows:

- **Size and Configuration.** Figure 26 illustrates the conceptual layout of this alternative. The entirety of Parcels 3 and 4 will be disturbed during the implementation of this alternative. Excavation within the shallow saturated zone to remove Contaminant Source Material will be

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required on Parcels 3 and 4, likely requiring excavation support and limited dewatering. The footprint of the excavation area at or beneath the water table is approximately 56,050 square feet. The maximum excavation thickness in the saturated zone is estimated to be at 6 feet. ISS will be performed over approximately 54,539 square feet to stabilize soils with Contaminant Source Material deeper than the planned excavations. The ISS containment wall will be performed over an additional approximate 2,400 square feet along the boundary of Parcels 2 and 3 based on the conceptual design.

Similar to Alternative 2 and 3, this evaluation assumes that final restored elevations across Parcels 3 and 4 will generally match the existing elevations of adjacent portions of North 11th Street and North 12th Street to create a generally level, grass-covered area following completion of the remedy. Additional groundwater monitoring wells or DNAPL recovery wells may be necessary for long-term monitoring. Locations of recovery wells or monitoring wells, if necessary, will be determined in conjunction with the property owner during the design phase of the remedy.

- **Time for Remediation.** Assuming excavation and ISS rates of 500 tons and 410 cubic yards per day, respectively, the expected duration of the construction work, including disposal, would be approximately 27.5 months of continuous on-site activities.

  As noted in Alternative 2 and 3, factors such as working adjacent the river, the bulkhead, and the North 12th Street sewer, the availability of trucks to transport material to and from OU-1, local traffic constraints or restrictions, as well as daily acceptance limitations from the disposal facility can all have significant implications on the rate which the excavation portion of the work can be completed. ISS rates can be limited by subsurface obstructions and limitations on ISS raw material transportation to OU-1.

  Following completion of the soil remedy, DNAPL recovery will continue to remove additional MGP-Related Source Material from OU-1. Groundwater monitoring will be utilized to confirm effective source material removal/stabilization/containment and groundwater remediation. Similar to Alternative 3, the use of amendments in backfill materials will be evaluated to enhance treatment of groundwater impacted by inaccessible Contaminant Source Material remaining at depth within Parcel 2. Similar to Alternatives 2 and 3, monitoring frequency and duration will be determined during remedial design in consultation with NYSDEC and the property owners will be informed of the monitoring requirements and consulted, as appropriate.

- **Spatial Requirements.** This alternative will require substantial room for equipment and material storage, access, logistics, and operation. Property size limitations and exposure concerns could require that excavations be conducted as a direct load operation with waste characterization performed during PDI. Excavation within the shallow saturated zone will be performed in select areas of Parcels 3 and 4 which will require groundwater controls including facilities to handle groundwater storage, treatment, and discharge during the construction phase. Dewatering quantities will be estimated during the remedial design following a PDI and hydraulic modelling. Additional area will be required to facilitate the ISS scope of work including mobilization, equipment and material storage, and operation. Spatially, due to the largely shallow nature of the excavations, Parcels 3 and 4 can accommodate these needs, but careful staging and

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sequencing of the work will be required. Limitations on ISS containment wall installation sequencing may be required to accommodate the existing park operations.

Further, access to residential roads and highways will be necessary to dispose of impacted materials. During the excavation phase, it may be necessary to temporarily stage equipment, materials, and/or empty trucks or trucks filled with clean backfill on the adjacent surface streets. Once loaded, trucks transporting impacted soils for treatment and disposal will depart OU-1 for the disposal facility. No staging of trucks filled with impacted material will occur off-site.

Containment of remaining MGP-Related Source Material at depth within Parcel 2 (currently operating as part of Bushwick Inlet Park) will require limited access and disturbance to the parcel space to complete remedial action. The location and configuration of the ISS containment wall will be determined during remedial design based on the results of groundwater modeling. Additionally, groundwater monitoring wells and/or DNAPL recovery wells may be installed, as needed, based on the final remedy configuration and design-phase evaluation. If access to Parcel 2 is required to complete the work, the location, schedule, access requirements, and staging would be coordinated with the property owner and NYSDEC to minimize disruption to park operations.

- **Options for Disposal.** Options for treatment and disposal of MGP-Impacted Materials are readily available off-site at properly permitted, National Grid-approved facilities. However, truck availability, transportation logistics, and disposal facility acceptance capacity may limit the rate at which excavated material can be transported and accepted for off-site disposal during the excavation phase and could result in project delays.

  Shallow subsurface soils have PCB impacts unrelated to the former MGP. With acceptable laboratory analytical results and approval by the NYSDEC, excavated shallow subsurface soils may be reused on-site as backfill material in the Contaminant Source Material excavation areas. On-site material reuse would reduce the volume requirements for material disposal and import. If not reused on-site, these soils may require additional handling, disposal requirements, and alternative disposal facilities following waste disposal characterization. The capacity of alternative disposal facilities for PCBs may impact the project schedule and result in project delays.

  Concrete and rebar materials will be removed, separated from underlying Non-MGP-Impacted Materials and either disposed of as non-impacted concrete debris or crushed for potential on-site reuse with the approval of NYSDEC.

  Ongoing waste disposal may be required from long-term groundwater monitoring and DNAPL recovery activities. Temporary storage and/or waste pickup coordination will be required with the property owner as part of long-term Operations & Maintenance (O&M).

- **Permit Requirements.** Permits required for Alternative 4 will be similar to those required for Alternatives 2 and 3, including road/sidewalk, ACOE, applicable NYC construction permits, and NYSDEC stormwater permit coverage with SWPPP implementation.

- **Limitations.** The ability to complete ISS and excavation to the required depths in proximity to the East River bulkhead and/or the North 12th Street sewer line may be limited due to construction and safety constraints. These will include, but are not limited to, excavation limitations

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associated with the East River bulkhead, right-of-way setback distances to the adjacent streets, excavation support systems, road closures, the unknown structural and geotechnical integrity of the East River bulkhead and the North 12th Street sewer line, and the results of a preconstruction survey of the adjacent park (Parcel 2). Further geotechnical, structural, and excavation evaluation will be required in the design phase to confirm safe setbacks, support requirements, machine limitations and construction schedules.

Depending on the final design configuration of the containment wall, limited temporary access to Parcel 2 will be required to facilitate wall installation or associated construction activities. Any such access would be coordinated with the property owner to minimize disruption to existing park operations and public use. Based on the current conceptual design, access requirements are anticipated to be limited and would likely be confined to a relatively small area along the western edge of Parcel 2 adjacent to the Parcel 3 boundary, and along North 11th Street and North 12th Street. Temporary access is expected to be limited to approximately one month based on the conceptual design and typical ISS production rates and is not expected to substantially affect operation or use of Bushwick Inlet Park.

Restrictions on trucking, waste disposal facility acceptance rates, and bridge weight limits may constrain the daily production rate and project schedule. Based on preliminary volumes, approximately 1,465 truckloads will be required to transport Contaminant Source Material for off-site treatment and/or disposal in addition to 1,300 trucks to transport shallow subsurface soils and 215 trucks for the concrete and rebar produced during slab demolition. This estimate does not account for the potential debris (boulders, etc.) or other miscellaneous spoils that would have to be transported from OU-1 during construction.

To mitigate potential transportation and disposal challenges (truck availability, landfill acceptance limits, etc.), transporting excavated material from OU-1 via barge may provide an alternative hauling method. Material transport via barge will reduce the trucking traffic required under the alternative. Limitations that would be introduced by facilitating material transport via barge include landfill acceptance limits as well as logistics and/or permitting concerning barge loading near the East River bulkhead.

Significant hydraulic modelling will be required for the ISS monolith construction to evaluate the effect of the low permeability monolith on groundwater flow and ensure surface mounding does not occur. Similarly, hydraulic modelling will be required for determining the final ISS containment wall configuration to ensure that the targeted material is hydraulically isolated and to identify potential lateral displacement of impacted groundwater.

- **Ecological Impacts.** This alternative will remove and/or contain identified Contaminant Source Material located at OU-1. Due to the extensive remedial activities planned near the East River bulkhead and East River, contaminant precautions (i.e. turbidity curtain networks, water quality monitoring equipment) will be necessary throughout the construction phase to monitor for potential releases. By relocating the shoreline landward through installation of a secant pile wall inboard of the existing structure and removal of the existing bulkhead and adjacent inboard soils, the project would increase the area available to the East River and result in a net gain of intertidal habitat. Overall, neither significant benefits to nor adverse impacts on fish and wildlife resources are expected to result from this alternative.

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7.1.5. Alternative 5– Shallow Subsurface Soil Removal, Protection of Groundwater Source Material Removal and/or Stabilization, Capping, Parcel 2 Containment Barrier, DNAPL Recovery and Groundwater Monitoring

Remedial Alternative 5 will include the following remedial components, as identified on Figure 27:

- Removal of the shallow subsurface soil.
- Excavation of MGP-Impacted Material and Non-MGP-Impacted Material in the unsaturated zone.
- Excavation and/or stabilization of MGP-Related Source Material, Non-MGP-Source Material, and soils exceeding the Protection of Groundwater Soil Cleanup Objectives (SCOs) for BTEX compounds and Naphthalene in the saturated subsurface soils.
- Installation of a secant pile wall to provide excavation support and facilitate remedy implementation; the wall will remain in place as the permanent riverfront structure following removal of the existing East River bulkhead.
- Demolition and removal of the existing bulkhead and inboard soils to, at a minimum, the existing sediment elevation.
- Implementation of odor and emission controls.
- Off-site treatment and/or disposal of spoils.
- Enhanced MNA, including post-construction groundwater monitoring.
- Construction of a composite cover/clean soil cap across Parcels 3 and 4.
- DNAPL recovery activities along the exterior of Parcel 2 boundary.
- ISS containment wall at the boundary of Parcel 2 to address remaining MGP-Related Source Material at depth within Parcel 2.
- Alternative 5 will include the same Institutional controls as Alternatives 2, 3, and 4, which may include an SMP, EE, and restriction on the use of groundwater underlying the OU-1.

Alternative 5 includes the following project components and supporting activities from Alternatives 4 that are anticipated to be completed to facilitate remedy implementation and redevelopment: PDI's related to the East River bulkhead condition, geologic and hydraulic modeling, and ISS bench-scale testing.

Similar to Alternative 4 following evaluation and modelling of OU-1-specific geologic and hydraulic conditions, MGP-Related Source Material within Parcel 2 will be rendered hydraulically isolated via the installation of an ISS containment wall. A conceptual ISS containment wall configuration is identified on Figure 27. A final ISS containment wall configuration would be determined during the design phase of the remedy.

Alternative 5 includes removal of shallow subsurface soil and excavation within the unsaturated and shallow saturated zones, the latter to remove Contaminant Source Material, and soils exceeding the

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Protection of Groundwater Soil Cleanup Objectives (SCOs) to a depth of approximately 15 feet below existing grade. Contaminant Source Material, and soils exceeding the Protection of Groundwater SCOs deeper than 15 feet below existing grade within Parcels 3 and 4 will be addressed through ISS. DNAPL recovery activities will be implemented along the exterior of the Parcel 2 boundary to address remaining MGP-Related Source Material at depth while minimizing disturbance to Parcel 2, which is a part of Bushwick Inlet Park.

Installation of temporary subsurface earth support structures may be required in Parcels 3 and 4 to facilitate source material excavations depending on the excavations' depth and proximity to adjacent surface roads or other structures, such as the East River bulkhead. Further excavation to compensate for material swell (estimated as 25%) in ISS locations may be required to maintain the two foot minimum depth below the final redevelopment elevation for construction of the composite cover/soil cap.

As previously discussed, to provide a consistent basis for comparison among alternatives, GEI has assumed that the final restored composite cover/soil cap elevation of Parcels 3 and 4 will match the existing elevations of North 11th Street and North 12th Street adjacent to Parcels 3 and 4. The assumed restoration elevations do not preclude other final grading configurations or redevelopment options that may ultimately be selected by the property owner, and implementation of the remedy is not dependent upon completion of final redevelopment plans.

Shallow subsurface soils across Parcels 3 and 4 will be excavated and removed from OU-1 to the target excavation depths. This excavation includes the concrete foundation present across the surface of Parcels 3 and 4 and represents approximately 2,900 cubic yards (5,400 tons) of concrete slab and rebar and 21,300 cubic yards (36,210 tons) of Non-MGP-Impacted Material.

Excavation beneath the shallow subsurface soils in the unsaturated and shallow saturated zones will remove approximately 21,100 cubic yards of Contaminant Source Material and soils exceeding the Protection of Groundwater SCOs for BTEX compounds and Naphthalene. Excavated materials will be transported off-site for treatment and/or disposal as applicable.

Contaminant Source Material and soils exceeding the Protection of Groundwater SCOs for BTEX compounds and naphthalene throughout Parcels 3 and 4 not addressed via excavation will be stabilized via ISS to the approximate limits on Figure 27. Approximately 25,500 cubic yards of ISS will be implemented under this alternative to a maximum depth of 60 feet below existing grade. Significant hydraulic modelling will be required to evaluate groundwater flow in relation to the proposed ISS monolith(s), including evaluation of the implications of the proposed ISS containment wall on the lateral displacement of impacted groundwater at and adjacent to Parcel 2. A PDI will be completed to establish an ISS mix design to satisfy the desired performance criteria. ISS performance criteria will be determined during the design phase, but at a minimum will include a minimum 30-year design life and a hydraulic conductivity of 1×10^{-6} cm/sec to restrict groundwater flow through the monolith(s) and containment wall.

Similar to previous alternatives, a cover system will be established consisting of a minimum of two feet of imported clean fill to the final site grade pending redevelopment. The soil cover will be placed over a

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demarcation layer. The imported clean fill will meet the SCOs for proposed final use of the OU-1 as public park.

Similar to Alternatives 3 and 4, enhanced MNA will be evaluated to address remaining impacts not addressed through excavation or ISS. Enhanced MNA involves combining natural processes with active enhancements in the form of amendments to stimulate indigenous microbes to accelerate the breakdown on contaminants in soil and groundwater. Amendments may be placed at the limits of the excavation or blended with imported backfill materials to enhance the treatment of groundwater impacted by source material remaining at depth. The specific amendments and method of deployment will be determined during the design phase of the remedy.

Similar to previously discussed alternatives, operation of the existing NAPL recovery wells will continue to remove DNAPL from the subsurface along the exterior boundary of Parcel 2. The benefit of installing additional DNAPL recovery wells and/or the need to relocate recovery wells to accommodate park construction will be evaluated during the design phase of the remedy.

Groundwater from Parcels 2, 3, and 4 will be remediated through removal, stabilization, and/or containment of Contaminant Source Material and soils exceeding the Protection of Groundwater SCOs for BTEX compounds and naphthalene; through implementation of DNAPL recovery activities along the exterior boundary of Parcel 2; and through enhanced MNA. Following the soil remediation, groundwater monitoring will determine the effectiveness of source material removal, ISS, containment and groundwater remediation.

7.1.5.1. Screening Guidance Evaluation

With respect to the preliminary screening guidance in DER-10, the alternative is described as follows:

- **Size and Configuration.** Figure 27 illustrates the conceptual layout of this alternative. The entirety of Parcels 3 and 4 will be disturbed during the implementation of this alternative. Excavation within the shallow saturated zone to remove Contaminant Source Material, and soils exceeding the Protection of Groundwater SCOs for BTEX compounds and naphthalene will be required on Parcels 3 and 4, likely requiring excavation support and limited dewatering. The aerial footprint of the excavation area at the water table is approximately 56,050 square feet. The maximum excavated thickness in the saturated zone is estimated to be 6 feet. ISS will be performed over approximately 59,842 square feet to stabilize Contaminant Source Material and soils exceeding the Protection of Groundwater SCOs for BTEX compounds and naphthalene deeper than the planned excavations. The ISS containment wall will be performed over an additional approximate 2,400 square feet along the boundary of Parcels 2 and 3 based on the conceptual design.

  Similar to previous alternatives, this evaluation assumes that final restored elevations across Parcels 3 and 4 will generally match the existing elevations of adjacent portions of North 11th Street and North 12th Street to create a generally level, grass-covered area following completion of the remedy. Additional groundwater monitoring wells or DNAPL recovery wells may be necessary for long-term monitoring. Locations of recovery wells or monitoring wells, if

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necessary, will be determined in conjunction with the property owner during the design phase of the remedy.

- **Time for Remediation.** Assuming excavation and ISS rates of 500 tons and 410 cubic yards per day, respectively, the expected duration of the construction work, including disposal, would be approximately 28.5 months of continuous on-site activities.

  As noted in previous alternatives, factors such as working adjacent the river, the bulkhead, and the North 12th Street sewer, the availability of trucks to transport material to and from OU-1, local traffic constraints or restrictions, as well as daily acceptance limitations from the disposal facility can all have significant implications on the rate which the excavation portion of the work can be completed. ISS rates can be limited by subsurface obstructions and limitations on ISS raw material transportation to OU-1.

  Following completion of the soil remedy, DNAPL recovery will continue to remove additional MGP-Related Source Material from OU-1. Groundwater monitoring will be utilized to confirm effective source material removal/stabilization/containment and groundwater remediation. Similar to Alternatives 3 and 4, the use of amendments in backfill materials will be evaluated to enhance treatment of groundwater impacted by inaccessible Contaminant Source Material remaining at depth within Parcel 2. Similar to previous alternatives, monitoring frequency and duration will be determined during remedial design in consultation with NYSDEC and the property owners will be informed of the monitoring requirements and consulted, as appropriate.

- **Spatial Requirements.** This alternative will require substantial room for equipment and material storage, access, logistics, and operation. Property size limitations and exposure concerns could require that excavations be conducted as a direct load operation with waste characterization performed during PDI. Excavation within the shallow saturated zone will be performed in select areas of Parcels 3 and 4 which will require groundwater controls including facilities to handle groundwater storage, treatment, and discharge during the construction phase. Dewatering quantities will be estimated during the remedial design following a PDI and hydraulic modelling. Additional area will be required to facilitate the ISS scope of work including mobilization, equipment and material storage, and operation. Spatially, due to the largely shallow nature of the excavations, Parcels 3 and 4 can accommodate these needs, but careful staging and sequencing of the work will be required. Limitations on ISS containment wall installation sequencing may be required to accommodate the existing park operations.

  Further, access to residential roads and highways will be necessary to dispose of impacted materials. During the excavation phase, it may be necessary to temporarily stage equipment, materials, and/or empty trucks or trucks filled with clean backfill on the adjacent surface streets. Once loaded, trucks transporting impacted soils for treatment and disposal will depart OU-1 for the disposal facility. No staging of trucks filled with impacted material will occur off-site.

  Containment of remaining MGP-Related Source Material at depth within Parcel 2 (currently operating as part of Bushwick Inlet Park) will require limited access and disturbance to the parcel space to complete remedial action. The location and configuration of the ISS containment wall will be determined during remedial design based on the results of groundwater modeling. Additionally, groundwater monitoring wells and/or DNAPL recovery wells may be installed, as needed, based on the final remedy configuration and design-phase evaluation. If installation of a

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well within Parcel 2 is determined to be required for this alternative, partial closure of the affected portion of Bushwick Inlet Park may be necessary during installation and related activities.

If access to Parcel 2 is required to complete the work, the location, schedule, access requirements, and staging would be coordinated with the property owner and NYSDEC to minimize disruption to park operations.

- **Options for Disposal.** Options for treatment and disposal of MGP-Impacted Materials are readily available off-site at properly permitted, National Grid-approved facilities. However, truck availability, transportation logistics, and disposal facility acceptance capacity may limit the rate at which excavated material can be transported and accepted for off-site disposal during the excavation phase and could result in project delays.

  Shallow subsurface soils have PCB impacts unrelated to the former MGP. With acceptable laboratory analytical results and approval by the NYSDEC, excavated shallow subsurface soils may be reused on-site as backfill material in the deeper Contaminant Source Material excavation areas. On-site material reuse would reduce the volume requirements for material disposal and import. If not reused on-site, these soils may require additional handling, disposal requirements, and alternative disposal facilities following waste disposal characterization. The capacity of alternative disposal facilities for PCBs may impact the project schedule and result in project delays.

  Concrete and rebar materials will be removed, separated from underlying Non-MGP-Impacted Materials and either disposed of as non-impacted concrete debris or crushed for potential on-site reuse with the approval of NYSDEC.

  Ongoing waste disposal may be required from long-term groundwater monitoring and DNAPL recovery activities. Temporary storage and/or waste pickup coordination will be required with the property owner as part of long-term Operations & Maintenance (O&M).

- **Permit Requirements.** Permits required for Alternative 5 will be similar to those required for previously discussed alternatives, including road/sidewalk, ACOE, applicable NYC construction permits, and NYSDEC stormwater permit coverage with SWPPP implementation.

- **Limitations.** The ability to complete ISS and excavation to the required depths in proximity to the East River bulkhead and/or the North 12th Street sewer line may be limited due to construction and safety constraints. These will include, but are not limited to, excavation limitations associated with the East River bulkhead, right-of-way setback distances to the adjacent streets, excavation support systems, road closures, the unknown structural and geotechnical integrity of the East River bulkhead and the North 12th Street sewer line, and the results of a preconstruction survey of the adjacent park (Parcel 2). Further geotechnical, structural, and excavation evaluation will be required in the design phase to confirm safe setbacks, support requirements, machine limitations and construction schedules.

  Similar to Alternative 4, depending on the final design configuration of the containment wall, limited temporary access to Parcel 2 will be required to facilitate wall installation or associated construction activities. Any such access would be coordinated with the property owner to minimize disruption to existing park operations and public use. Based on the current conceptual

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design, access requirements are anticipated to be limited and would likely be confined to a relatively small area along the western edge of Parcel 2 adjacent to the Parcel 3 boundary, and along North 11th Street and North 12th Street. Temporary access is anticipated to be limited to approximately one month based on the conceptual design and typical ISS production rates and is not expected to substantially affect operation or use of Bushwick Inlet Park.

Restrictions on trucking, waste disposal facility acceptance rates, and bridge weight limits may constrain the daily production rate and project schedule. Based on preliminary volumes, approximately 1,585 truckloads will be required to transport Contaminant Source Material and soils exceeding the Protection of Groundwater Soil Cleanup Objectives (SCOs) for BTEX compounds and Naphthalene for off-site treatment and/or disposal in addition to 1,300 trucks to transport shallow subsurface soils and 215 trucks for the concrete and rebar produced during slab demolition. This estimate does not account for the potential debris (boulders, etc.) or other miscellaneous spoils that would have to be transported from OU-1 during construction.

To mitigate potential transportation and disposal challenges (truck availability, landfill acceptance limits, etc.), transporting excavated material from OU-1 via barge may provide an alternative hauling method. Material transport via barge will reduce the trucking traffic required under the alternative. Limitations that would be introduced by facilitating material transport via barge include landfill acceptance limits as well as logistics and/or permitting concerning barge loading near the East River bulkhead.

Significant hydraulic modelling will be required for the ISS monolith construction to evaluate the effect of the low permeability monolith on groundwater flow and ensure surface mounding does not occur. Similarly, hydraulic modelling will be required for determining the final ISS containment wall configuration to ensure that the targeted material is hydraulically isolated and to identify potential lateral displacement of impacted groundwater.

- **Ecological Impacts.** This alternative will remove and/or contain identified Contaminant Source Material, and soils exceeding the Protection of Groundwater SCOs located at OU-1. Due to the extensive remedial activities planned near the East River bulkhead and East River, contaminant precautions (i.e., turbidity curtain networks, water quality monitoring equipment) will be necessary throughout the construction phase to monitor for potential releases. By relocating the shoreline landward through installation of a secant pile wall inboard of the existing structure and removal of the existing bulkhead and adjacent inboard soils, the project would increase the area available to the East River and result in a net gain of intertidal habitat. Overall, neither significant benefits nor adverse impacts on fish and wildlife resources are expected to result from this alternative.

7.1.6. Alternative 6 – Restore to Pre-Release Conditions

As discussed in Sections 4.1 and 6, restoration to pre-disposal/pre-release conditions would be extremely difficult, if not infeasible at OU-1, and may present considerable risks to workers during construction and to the community, including but not limited to the unknown construction and/or potential failure of structures in the vicinity of OU-1 (e.g.., the North 12th sewer and existing East River bulkhead wall) and the negative community impacts related to transporting removed material, including Contaminant Source Material, through dense population zones.

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Excavation of impacted areas up to 54 ft bgs with off-site disposal to restore Parcels 3 and 4 to pre-disposal/pre-release conditions was not a remedial technology retained for consideration this this RAAR as the excavation adjacent to the river to this depth is extremely difficult, if not infeasible at Parcel 4. On Parcel 2, demolition of the park and further excavation to approximately 81 ft bgs beneath the park would be required to remove all Contaminant Source Material from Parcel 2. Therefore, this alternative is not further evaluated within this RAAR.

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8. Individual Analysis of Alternatives

8.1. Evaluation Criteria

6 NYCRR Part 375 requires a detailed analysis of remedial alternatives against nine criteria, specifying the factors to consider for each. The nine criteria are:

- **Overall Protection of Public Health and the Environment:** This criterion is an evaluation of the alternative's ability to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced, or controlled through removal, treatment, engineering controls or institutional controls. The remedy's ability to achieve each of the RAOs is evaluated. This criterion draws on the assessment of other criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with SCGs.
- **Compliance with SCGs:** Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance. All SCGs for the site will be listed along with a discussion of whether or not the remedy will achieve compliance. For those SCGs that will not be met, a discussion and evaluation of the impacts of each, and whether waivers are necessary will be provided.
- **Long-term Effectiveness and Permanence:** This criterion evaluates the long-term effectiveness of the alternative after implementation.
    - If wastes or treated residuals remain on-site after the selected alternative has been implemented, the following items are evaluated:
    - The magnitude of the remaining risks (i.e., will there be any significant threats, exposure pathways, or risks to the community and environment from the remaining wastes or treated residuals?).
    - The adequacy of the engineering and institutional controls intended to limit the risk.
    - The reliability of these controls.
    - The ability of the alternative to continue to meet RAOs in the future.
- **Reduction of Toxicity, Mobility or Volume with Treatment:** The alternative's ability to reduce the toxicity, mobility or volume of impacted media is evaluated. Preference should be given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the site.
- **Short-term Effectiveness:** The potential short-term adverse impacts and risks of the alternative upon the community, the workers, and the environment during the construction and/or implementation are evaluated. A discussion of how the identified adverse impacts and health risks to the community or workers will be controlled, and the effectiveness of the controls should be presented. A discussion of engineering controls that will be used to mitigate short-term

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impacts (e.g., dust control measures) will be provided. The length of time needed to achieve the remedial objectives is also estimated.

- **Implementability:** The technical and administrative feasibility of implementing the alternative is evaluated. Technical feasibility includes the difficulties associated with construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.
- **Cost Effectiveness:** Capital, operation, maintenance, and monitoring costs are estimated for the alternative and presented on a present worth basis. The remedy is cost effective when its costs are proportional to its overall effectiveness, as determined by evaluating long-term effectiveness and permanence, reduction of toxicity, mobility, or volume, and short-term impact and effectiveness, as defined above.
- **Land Use:** This criterion is an evaluation of the current, intended, and reasonably anticipated future land uses of the site and its surroundings in the selection of the remedy.
- **Community Acceptance:** Thi**s** criterion gauges the acceptance of the selected remedial alternative by the community at large. It is not provided in this RAAR document. It is evaluated and summarized by the NYSDEC as part of the public participation period which precedes approval of this RAAR.

Table 4 presents a comparative evaluation of the remedial alternatives against each of the Part 375 evaluation criteria. A qualitative scoring system was developed to provide a consistent basis for comparing the relative strengths and limitations of each alternative across the evaluation criteria. The evaluation for each alternative includes the assignment of a qualitative grade for each criterion on a scale of 1 to 5. While each alternative satisfies the evaluation criteria to varying degrees, the scoring system facilitates an objective comparison of the tradeoffs associated with each remedial approach. The unweighted sum of the grades for each criterion creates the total score for its respective alternative, which is subsequently used to recommend the preferred remedy for OU-1.

8.2. Alternative 2 – Shallow Subsurface Soil Removal, Capping, DNAPL Recovery and Groundwater Monitoring

8.2.1. Overall Protection of Human Health and the Environment

Alternative 2 will be protective of the public health and environment. The Qualitative Human Health Exposure Assessment (QHHEA) concluded that, under current conditions, potential exposure pathways exist for future utility and construction workers to come into contact with contaminants in subsurface soil and groundwater at Parcel 2 and the adjacent Rights of Way (ROWs). Similarly, potential exposure pathways exist for future utility and construction workers, park visitors, and commercial workers to come into contact with contaminants in surface soils, subsurface soil, soil vapor, and groundwater at Parcel 3 and Parcel 4. Identified Contaminant Source Material will remain in place at OU-1. The existing composite cover on Parcel 2 and proposed cover for Parcels 3 and 4 will prevent exposure for park patrons and workers. Institutional controls will be developed to ensure the protection of public health to any remaining impacts from soil vapor and groundwater.

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8.2.2. Compliance with SCGs

The excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated zone and installation of the cover system will prevent ingestion/direct contact with the remaining impacted soils and will meet the site SCGs for subsurface soil to the depths of the proposed excavation. However, soil in exceedance of the SCOs and residual source material will remain at depth beneath the limits of the excavation. DNAPL recovery conforms with the SCGs by reducing the potential for MGP-Related Source Material migration and removing source material where practicable. Groundwater from Parcels 2, 3, and 4 will be remediated through MGP-Related Source Material removal via DNAPL recovery and MNA. Institutional controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current property use and the planned redevelopment.

8.2.3. Long-Term Effectiveness and Permanence

Removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones at OU-1, installation of the cover system, and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beyond the limits of the excavation, impacted material exceeding SCOs will remain within OU-1. DNAPL recovery will be effective at permanently removing mobile MGP-related Source Material from the subsurface.

8.2.4. Reduction of Toxicity, Mobility, or Volume Through Treatment

The excavation and removal of Non-MGP-Impacted and MGP-Impacted Materials in the unsaturated zone in OU-1 will permanently reduce the mobility and volume of these impacts through off-site treatment and/or disposal. Beneath the limits of the excavation, impacted material exceeding SCOs including MGP-Related Source Material will remain at OU-1 and will be removed through DNAPL recovery, which will reduce the mobility and overall volume of remaining MGP-Related Source Material at OU-1.

As noted in Section 3.8, the CSM estimates approximately 135,100 kilograms (297,900 pounds) of contaminant mass within Parcels 3 and 4 based on the defined horizontal and vertical limits of impacted soil. The remediation planned under Alternative 2 represents removal of approximately 15,860 kilograms (34,950 pounds) of contaminant mass representing 11.73% of the total contaminant mass within Parcels 3 and 4. The remaining 88.27% of contaminant mass will be left at depth below the cover system.

8.2.5. Short-Term Impact and Effectiveness

The excavation of non-MGP and MGP-Related Impacted Material in the unsaturated and shallow saturated zones may increase the short-term potential exposure to workers at OU-1. Controls such as direct loading of excavated materials for off-site treatment and/or disposal and odor suppressant foam, will be utilized to minimize these exposures.

The surrounding community and park patrons of the active park at Parcel 2 will be impacted by construction-related noise, increased vehicle traffic, and potential odors and/or nuisance dust during the

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excavation and backfill operations associated with this alternative. The total estimated duration of remedial construction for Alternative 2 is approximately 14 months.

The volume of soil to be excavated and removed from OU-1 is estimated at 21,300 cubic yards (36,210 tons). Imported clean fill material (approximately 7,300 cubic yards/12,410 tons) will also be required to backfill the excavations to the proposed subgrade requirements for the planned park reconstruction. Waste disposal for MGP sites is limited by the locations of available disposal facilities, with the closest facilities located in New Jersey and Pennsylvania. Based on the limitations of local trucking and the available throughput of these facilities, similar sites in this area are typically limited to no more than 20 tri-axle truckloads per day. The weight limit of these trucks is limited by the NYC bridge restrictions which limit the capacity to 25 tons per truckload. Based on these restrictions, it is anticipated that up to 20 truckloads per day (maximum of 500 tons/day) would be transported through the local community for approximately 72 workdays (~3.5 months). Similarly, an additional 20 trucks per day would be required to transport clean imported materials to OU-1 for 25 workdays (~1 month). The volume of increased truck traffic during this period will have a short-term impact on the community and park patrons during the construction.

8.2.6. Implementability

There are implementation issues associated with the performance of Alternative 2, primarily related to work completed adjacent to the East River bulkhead. PDI activities will be completed to determine current structural and geostructural conditions, additional construction support, and monitoring required during remediation activities. Pending the results of the PDI activities, some of these concerns may be addressed using standard construction techniques. Due to the anticipated depths of excavation to facilitate the installation of the cover system, there are no additional concerns associated with working adjacent the North 12th Street sewer line.

Limitations for work adjacent to, and within, the active park on Parcel 2 may be encountered if the park remains active during portions of the construction. This may include limitations on the time of year or specific days per week when specific remedial work can occur and additional controls required during the work. This could include a phased approach to the remedial work to accommodate future park construction activities and minimize the effects of partial closure of the active park on Parcel 2.

Institutional controls are implementable as they would be consistent with the current and potential future uses of OU-1.

8.2.7. Cost Effectiveness

The estimated cost range for Alternative 2 is between $19.2 and $41.1 million (Table 5), which is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

The costs provided in Table 5 are feasibility level costs. Feasibility level costs are considered an Order of Magnitude estimate under the American National Standards Institute (ANSI) Classification System or a Class 4 estimate under the Association for the Advancement of Cost Engineering (AACE) classification system. This is an estimate completed when the project definition is between 1-15%. The expected range

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of accuracy of this level of estimate is between –30% and +50%. Additional data will be needed to close data gaps and better refine the remedy costs. Changes in the costs will occur as the project definition is refined following collection of future information and data collected during the PDI and engineering design.

Alternative 2 is the most economical alternative from a capital cost perspective, however, its lower cost is accompanied by a low percentage of contaminant mass remediation and reduced long-term effectiveness and a greater reliance on long-term management because a significant portion of contaminant mass remains in place.

8.2.8. Land Use

This alternative supports the current land use and supports the future land use at OU-1. The location and size of remedial components to remain at OU-1 will be determined in conjunction with the property owner to be compatible with the conceptual park redevelopment plans available at the time of the final design. Every effort will be made to ensure that any permanent infrastructure required for implementation of the remedy, such as recovery wells or monitoring wells, will be placed in areas that will be finished as paved pathways and avoid planned main park areas.

This alternative was developed to be protective of public health and the environment while balancing short term and long-term disruptions to the community and allowing for the redevelopment of OU-1 as a public park. As noted above, the final park redevelopment plans have not been developed as of the date of this RAAR. This alternative is intended to be compatible with the plans for the final redevelopment of OU-1 that may be under consideration by the property owner.

8.3. Alternative 3 – Shallow Subsurface Soil Removal, Source Material Excavation and/or Stabilization, Capping, DNAPL Recovery and Groundwater Monitoring

8.3.1. Overall Protection of Human Health and the Environment

Alternative 3 will be protective of the public and environment. The QHHEA concluded that under current conditions, potential exposure pathways exist for future utility and construction workers to come into contact with contaminants in subsurface soil and groundwater at Parcel 2 and the adjacent ROWs. Similarly, potential exposure pathways exist for future utility and construction workers, park visitors, and commercial workers to come into contact with contaminants in surface soils, subsurface soil, soil vapor, and groundwater at Parcel 3, Parcel 4, and the adjacent ROWs. The majority of Non-MGP-Impacted Material and MGP-Impacted Material, to the depths of potential future exposure scenarios for utility and construction workers, will be removed from Parcels 3 and 4. Identified Contaminant Source Material will be removed and/or stabilized throughout Parcels 2, 3, and 4 which will prevent potential source material exposure in scenarios of deeper utility or construction activities at OU-1. The existing composite cover on Parcel 2 and the planned cover for Parcels 3 and 4 will prevent exposure for park patrons and workers. Groundwater from Parcels 2, 3, and 4 will be addressed through removing and/or containing

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Contaminant Source Material in subsurface soils. Institutional controls will be developed to ensure the protection of public health to any remaining impacts from soil vapor and groundwater.

8.3.2. Compliance with SCGs

The excavation of non-MGP-Impacted and MGP-Impacted Material in the unsaturated and shallow saturated zones and installation of the cover system will prevent ingestion/direct contact with the remaining impacted soils and will meet the Site SCGs for subsurface soil to the depths of the proposed excavation. However, soil in exceedance of the SCOs will remain at depth beyond the limits of the excavation. MGP-Related Source Material will be excavated or remain on-site, stabilized via ISS, at depth beyond the limits of the excavation. MGP-Related Source Material removal and stabilization conform with the SCGs by reducing the potential for MGP-Related Source Material migration and removing source material where practicable. Groundwater from Parcels 2, 3, and 4 will be remediated through Contaminant Source Material removal, stabilization of deeper Contaminant Source Material, DNAPL recovery, and MNA. Institutional controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current use and the planned redevelopment.

8.3.3. Long-Term Effectiveness and Permanence

Removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones at OU-1 and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beyond the limits of the excavation, Contaminant Source Material will be removed via DNAPL recovery or stabilized via ISS on Parcels 2 and 3 and 4, respectively.

A combination of Contaminant Source Material removal and stabilization will be effective at permanently removing or containing potentially mobile source material present within the subsurface. While identified source material will be removed or stabilized, impacted material exceeding SCOs will remain at OU-1. Groundwater from Parcels 2, 3, and 4 will be remediated through removing and stabilizing Contaminant Source Material within subsurface soils.

8.3.4. Reduction of Toxicity, Mobility, or Volume Through Treatment

The excavation and removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and saturated zones at OU-1 will permanently reduce the mobility and volume of these impacts through off-site treatment and/or disposal. Contaminant Source Material removal and/or stabilization will reduce the mobility and the overall volume of Contaminant Source Material at OU-1.

As noted in Section 3.8, the CSM estimates approximately 135,100 kilograms (297,900 pounds) of contaminant mass within Parcels 3 and 4 based on the defined horizontal and vertical limits of impacted soil. The remediation planned under Alternative 3 represents removal and/or stabilization of approximately 123,300 kilograms (271,800 pounds) of contaminant mass representing 91.23% of the total contaminant mass within Parcels 3 and 4. The remaining 8.77% of contaminant mass will be left at depth below the cover system. While identified Contaminant Source Material will be removed or stabilized, impacted material exceeding SCOs will remain at OU-1.

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8.3.5. Short-Term Impact and Effectiveness

The excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones may increase the short-term potential exposure to workers at OU-1. However, controls, such as direct loading of excavated materials for off-site treatment and/or disposal and odor suppressant foam, will be utilized to minimize these exposures.

The surrounding community and park patrons of the active park at Parcel 2 will be impacted by construction-related noise, increased vehicle traffic, and potential odors and/or nuisance dust during the excavation, ISS, and backfill operations associated with this alternative. The total estimated duration of remedial construction for Alternative 3 is approximately 27 months.

The volume of soil to be excavated and removed from OU-1 is estimated at 41,300 cubic yards (70,210 tons). Imported clean fill material (approximately 22,500 cubic yards/38,250 tons) will also be required to backfill the excavations to the proposed subgrade requirements for the planned park reconstruction. Waste disposal for MGP sites is limited by the locations of available disposal facilities, with the closest facilities located in New Jersey and Pennsylvania. Based on the limitations of local trucking and the available thruput of these facilities, similar sites in this area are typically limited to no more than 20 tri-axle truckloads per day. The weight limit of these trucks is limited by the NYC bridge restrictions which limit the capacity to 25 tons per truckload. Based on these restrictions, it is anticipated that up to 20 truckloads per day (maximum of 500 tons/day) would be transported through the local community for approximately 140 workdays (~7 months). Similarly, an additional 20 trucks per day would be required to transport clean imported materials to OU-1 for 77 workdays (~4 months). The volume of increased truck traffic during this period will have a short-term impact on the community and park patrons during the construction.

8.3.6. Implementability

There are implementation issues associated with the performance of this alternative. The primary implementation issues will arise from the excavation and ISS activities adjacent to the East River bulkhead and the North 12th Street sewer line. PDI activities will be completed to determine current structural and geostructural conditions, additional construction support, and monitoring required during remediation activities. Pending the results of the PDI activities, some of these concerns may be addressed using standard construction techniques.

In addition to work required to construct the cover system, Alternative 3 includes Contaminant Source Material removal and stabilization along the boundary of Parcels 2 and 3. Limitations for work adjacent to, and within, the active park on Parcel 2 are anticipated if the park remains active during portions of the construction. This may include limitations on the time of year or specific days per week when specific remedial work can occur and additional controls to be required during the work. This could include a phased approach to the remedial work to accommodate future park construction activities and minimize the effects of partial closure of the active park on Parcel 2.

Institutional controls are implementable as they would be consistent with the current and potential future uses of OU-1.

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8.3.7. Cost Effectiveness

The estimated cost range for Alternative 3 is between $42.2 and $90.5 million (Table 5), which is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

As noted in Section 8.2.7 the costs provided in Table 5 are feasibility level costs and the expected range of accuracy of this level of estimate is between –30% and +50%.

Alternative 3 is less cost-effective compared to Alternative 2 because of the increase in capital costs incurred by substantially increasing contaminant mass removal and stabilization. Although it is more costly and has greater short-term impacts than Alternative 2, the additional expense is offset by significant improvements in protectiveness, long-term effectiveness, and reduction of contaminant mobility.

8.3.8. Land Use

This alternative supports the current and proposed future land use at OU-1. The location and size of remedial components to remain at OU-1 will be determined in conjunction with the property owner to be compatible with the conceptual park redevelopment plans available at the time of the final design. Every effort will be made to ensure that any permanent infrastructure required for implementation of the remedy, such as recovery wells or monitoring wells, will be placed in areas that will be finished as paved pathways and avoid planned main park areas.

This alternative was developed to be protective of public health and the environment while balancing short term and long-term disruptions to the community and allowing for redevelopment of OU-1 as a public park. As noted above, the final park redevelopment plans have not been developed as of the date of this RAAR. This alternative is intended to be compatible with the plans for the final redevelopment of OU-1 that may be under consideration by the property owner.

8.4. Alternative 4 – Shallow Subsurface Soil Removal, Source Material Excavation and/or Stabilization, Capping, Parcel 2 Containment Barrier, DNAPL Recovery and Groundwater Monitoring

8.4.1. Overall Protection of Human Health and the Environment

Alternative 4 will be protective of the public and environment. The QHHEA concluded that under current conditions, potential exposure pathways exist for future utility and construction workers to come into contact with contaminants in subsurface soil and groundwater at Parcel 2 and the adjacent ROWs. Similarly, potential exposure pathways exist for future utility and construction workers, park visitors, and commercial workers to come into contact with contaminants in surface soils, subsurface soil, soil vapor, and groundwater at Parcel 3, Parcel 4, and the adjacent ROWs. The majority of Non-MGP-Impacted Material and MGP-Impacted Material, to the depths of potential future exposure scenarios for utility and construction workers, will be removed from Parcels 3 and 4. Identified Contaminant Source Material will be removed, stabilized, or rendered physically and hydraulically isolated throughout Parcels 2, 3, and 4 which will prevent potential source material exposure in scenarios of deeper utility or construction

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activities at OU-1. The existing composite cover on Parcel 2 and the planned cover for Parcels 3 and 4 will prevent exposure for park patrons and workers. Groundwater from Parcels 2, 3, and 4 will be remediated through removing, stabilizing, and/or hydraulically isolating Contaminant Source Material in subsurface soils. Institutional controls will be developed to ensure the protection of public health to any remaining impacts from soil vapor and groundwater.

8.4.2. Compliance with SCGs

The excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones and installation of the cover system will prevent ingestion/direct contact with the remaining impacted soils and will meet the Site SCGs for subsurface soil to the depths of the proposed excavation. However, soil in exceedance of the SCOs will remain at depth beyond the limits of the excavation. Contaminant Source Material will be excavated or remain on-site, stabilized via ISS at depth beyond the limits of the excavation. ISS containment will be utilized to hydraulically isolate Contaminant Source Material in inaccessible areas of Parcel 2. Contaminant Source Material removal, stabilization, and physical and hydraulic isolation conform with the SCGs by reducing the potential for source material migration and removing source material where practicable. Groundwater from Parcels 2, 3, and 4 will be remediated through Contaminant Source Material removal, stabilization of deeper Contaminant Source Material, installation of the ISS containment wall, DNAPL recovery, and MNA. Institutional controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current use and the planned redevelopment.

8.4.3. Long-Term Effectiveness and Permanence

Removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones at OU-1 and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beyond the limits of the excavation, Contaminant Source Material will be removed via DNAPL recovery or stabilized via ISS on Parcels 2 and 3 and 4, respectively. Additionally, the ISS containment wall along the boundary of Parcels 2 and 3 will isolate, both physically and hydraulically, Contaminant Source Material remaining at depth on Parcel 2.

A combination of Contaminant Source Material removal, stabilization, and containment will be effective at permanently removing or containing potentially mobile source material present within the subsurface. While identified Contaminant Source Material will be removed or stabilized, impacted material exceeding SCOs will remain at OU-1. Groundwater from Parcels 2, 3, and 4 will be remediated through removing, stabilizing, and hydraulically isolating Contaminant Source Material within subsurface soils.

8.4.4. Reduction of Toxicity, Mobility, or Volume Through Treatment

The excavation and removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and saturated zones at OU-1 will permanently reduce the mobility and volume of these impacts through off-site treatment and/or disposal. Contaminant Source Material removal, stabilization, and/or containment will reduce the mobility and the overall volume of Contaminant Source Material at OU-1.

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As noted in Section 3.8, the CSM estimates approximately 135,100 kilograms (297,900 pounds) of contaminant mass within Parcels 3 and 4 based on the defined horizontal and vertical limits of impacted soil. The remediation planned under Alternative 4 represents removal and/or stabilization of approximately 123,300 kilograms (271,800 pounds) of contaminant mass representing 91.23% of the total contaminant mass within Parcels 3 and 4. The remaining 8.77% of contaminant mass will be left at depth below the cover system. While identified Contaminant Source Material will be removed or stabilized, impacted material exceeding SCOs will remain at OU-1.

8.4.5. Short-Term Impact and Effectiveness

The excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones may increase the short-term potential exposure to workers at OU-1. However, controls, such as direct loading of excavated materials for off-site treatment and/or disposal and odor suppressant foam, will be utilized to minimize these exposures. The construction of the ISS containment wall along the boundary of Parcels 2 and 3 will require partial, temporary closure of the Bushwick Inlet Park on Parcel 2 during remedial execution, pending final configuration.

The surrounding community and park patrons of the active park at Parcel 2 will be impacted by construction-related noise, increased vehicle traffic, and potential odors and/or nuisance dust during the excavation, ISS, and backfill operations associated with this alternative. The total estimated duration of remedial construction for Alternative 4 is approximately 27.5 months.

The volume of soil to be excavated and removed from OU-1 is estimated at 40,600 cubic yards (69,020 tons). Imported clean fill material (approximately 22,000 cubic yards/37,400 tons) will also be required to backfill the excavations to the proposed subgrade requirements for the planned park reconstruction. Waste disposal at MGP sites is limited by the locations of available disposal facilities, with the closest facilities located in New Jersey and Pennsylvania. Based on the limitations of local trucking and the available thruput of these facilities, similar sites in this area are typically limited to no more than 20 tri-axle truckloads per day. The weight of these trucks is limited by the NYC bridge restrictions which limit the capacity to between 25 tons per truckload. Therefore, it is anticipated that up to twenty 25-ton truckloads per day (maximum of 500 tons/day) would be transported through the local community for approximately 138 workdays (~7 months). Similarly, an additional 20 trucks per day would be required to transport clean imported materials to OU-1 for 75 workdays (~4 months). The volume of increased truck traffic during this period will have a short-term impact on the community and park patrons during the construction.

8.4.6. Implementability

The implementation issues with the performance of this alternative are similar to Alternative 3. The primary implementation issues will arise from the excavation and ISS activities in proximity to the East River bulkhead wall and the North 12th Street sewer line. PDI activities will be completed to determine current structural and geostructural conditions, additional construction support, and monitoring required during remediation activities. Pending the results of the PDI activities, some of these concerns may be addressed using standard construction techniques.

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In addition to work required in Alternative 3, Alternative 4 includes the installation of an ISS containment barrier constructed to approximately 60 feet bgs along the boundary of Parcels 2 and 3 and along North 11th Street and North 12th Street. Limitations for work adjacent to, and within, the active park on Parcel 2 are anticipated if the park remains active portions of the construction. This may include limitations on the time of year or specific days per week when specific remedial work can occur and additional controls to be required during the work. This could include a phased approach to the remedial work to accommodate future park construction activities and minimize the effects of partial closure of the active park on Parcel 2.

Institutional controls are implementable as they would be consistent with the current and potential future uses of OU-1.

8.4.7. Cost Effectiveness

The estimated cost range for Alternative 4 is between $42.9 and $92 million (Table 5), which is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

As noted in Section 8.2.7 the costs provided in Table 5 are feasibility level costs and the expected range of accuracy of this level of estimate is between –30% and +50%. Alternative 4 provides greater overall reduction of mobility of contaminants and long-term effectiveness than Alternative 3 through hydraulic isolation of Contaminant Source Material remaining at depth on Parcel 2. Although it has a similar estimated cost to Alternative 3, the additional remedial benefits result in a favorable balance of cost and performance.

8.4.8. Land Use

This alternative supports the current and proposed future land use at OU-1. The location and size of remedial components to remain at OU-1 will be determined in conjunction with the property owner to be compatible with the conceptual park redevelopment plans available at the time of the final design. Every effort will be made to ensure that any permanent infrastructure required for implementation of the remedy, such as recovery wells or monitoring wells, will be placed in areas that will be finished as paved pathways and avoid planned main park areas.

This alternative was developed to be protective of public health and the environment while balancing short-term and long-term disruptions to the community and allowing for redevelopment of OU-1 as a public park. As noted above, the final park redevelopment plans have not been developed as of the date of this RAAR. This alternative is intended to be compatible with the plans for the final redevelopment of OU-1 that may be under consideration by the property owner.

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8.5. Alternative 5 – Shallow Subsurface Soil Removal, Protection of Groundwater Source Material Removal and/or Stabilization, Capping, Parcel 2 Containment Barrier, DNAPL Recovery and Groundwater Monitoring

8.5.1. Overall Protection of Human Health and the Environment

Alternative 5 will be protective of the public and environment. The QHHEA concluded that under current conditions, potential exposure pathways exist for future utility and construction workers to come into contact with contaminants in subsurface soil and groundwater at Parcel 2 and the adjacent ROWs. Similarly, potential exposure pathways exist for future utility and construction workers, park visitors, and commercial workers to come into contact with contaminants in surface soils, subsurface soil, soil vapor, and groundwater at Parcel 3, Parcel 4, and the adjacent ROWs. The majority of Non-MGP-Impacted Material and MGP-Impacted Material, to the depths of potential future exposure scenarios for utility and construction workers, will be removed from Parcels 3 and 4. Identified Contaminant Source Material will be removed stabilized, or rendered physically and hydraulically isolated throughout Parcels 2, 3, and 4 which will prevent potential source material exposure in scenarios of deeper utility or construction activities at OU-1. The existing composite cover on Parcel 2 and the planned cover for Parcels 3 and 4 will prevent exposure to park patrons and workers. Groundwater from Parcels 2, 3, and 4 will be remediated through removing and/or hydraulically isolating Contaminant Source Material and soils exceeding POG standards for BTEX compounds and naphthalene in subsurface soils. Institutional controls will be developed to ensure the protection of public health to any remaining impacts from soil vapor and groundwater.

8.5.2. Compliance with SCGs

The excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones and installation of the cover system will prevent ingestion/direct contact with the remaining impacted soils and will meet the Site SCGs for subsurface soil to the depths of the proposed excavation. However, soil in exceedance of the SCOs will remain at depth beyond the limits of the excavation. Contaminant Source Material will be excavated or remain on-site, stabilized via ISS at depth beyond the limits of the excavation. ISS containment will be utilized to hydraulically isolate Contaminant Source Material in inaccessible areas of Parcel 2. Removal, stabilization, and/or hydraulic isolation of Contaminant Source Material and soils exceeding POG standards for BTEX compounds and naphthalene conform with the SCGs by reducing the potential for source material migration and removing source material where practicable. Groundwater from Parcels 2, 3, and 4 will be remediated through Contaminant Source Material removal, stabilization of deeper Contaminant Source Material, installation of the ISS containment wall, DNAPL recovery, and MNA. Institutional controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current use and the planned redevelopment.

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8.5.3. Long-Term Effectiveness and Permanence

Removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones at OU-1 and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beyond the limits of the excavation, Contaminant Source Material and soils exceeding POG standards for BTEX compounds and naphthalene will be removed via DNAPL recovery or stabilized via ISS on Parcels 2 and 3 and 4, respectively. Additionally, the ISS containment wall along the boundary of Parcels 2 and 3 will isolate, both physically and hydraulically, Contaminant Source Material remaining at depth on Parcel 2.

A combination of removal, stabilization, and containment of Contaminant Source Material and soils exceeding POG standards for BTEX compounds and naphthalene will be effective at permanently removing or containing potentially mobile source material present within the subsurface. While identified Contaminant Source Material will be removed or stabilized, impacted material exceeding SCOs will remain at OU-1. Groundwater from Parcels 2, 3, and 4 will be remediated through removing, stabilizing, and hydraulically isolating Contaminant Source Material within subsurface soils.

8.5.4. Reduction of Toxicity, Mobility, or Volume Through Treatment

The excavation and removal of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and saturated zones at OU-1 will permanently reduce the mobility and volume of these impacts through off-site treatment and/or disposal. The removal, stabilization, and/or containment of Contaminant Source Material and soils exceeding POG standards for BTEX compounds and naphthalene will reduce the mobility and the overall volume source material at OU-1.

As noted in Section 3.8, the CSM estimates approximately 135,100 kilograms (297,900 pounds) of contaminant mass within Parcels 3 and 4 based on the defined horizontal and vertical limits of impacted soil. Remediation planned under Alternative 5 represents the maximum practicable removal of approximately 125,400 kilograms (276,500 pounds) of contaminant mass, representing 92.81% of the total contaminant mass within Parcels 3 and 4. The remaining 7.19% of the estimated contaminant mass is anticipated to remain at depth beneath the engineered cover system between the existing bulkhead and the proposed secant pile bulkhead wall, where the excavation is not practicable due to structural and constructability constraints associated with the site's riverfront setting. While identified Contaminant Source Material and soils exceeding POG standards for BTEX compounds and naphthalene will be removed or stabilized, impacted material exceeding SCOs will remain at OU-1.

8.5.5. Short-Term Impact and Effectiveness

The excavation of Non-MGP-Impacted Material and MGP-Impacted Material in the unsaturated and shallow saturated zones may increase the short-term potential exposure to workers at OU-1. However, controls, such as direct loading of excavated materials for off-site treatment and/or disposal and odor suppressant foam, will be utilized to minimize these exposures. The construction of the ISS containment wall along the boundary of Parcels 2 and 3 will require partial, temporary closure of the Bushwick Inlet Park on Parcel 2 during remedial execution, pending final configuration.

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The surrounding community and park patrons of the active park at Parcel 2 will be impacted by construction-related noise, increased vehicle traffic, and potential odors and/or nuisance dust during the excavation, ISS, and backfill operations associated with this alternative. The total estimated duration of remedial construction for Alternative 5 is approximately 28.5 months.

The volume of soil to be excavated and removed from OU-1 is estimated at 42,400 cubic yards (72,080 tons). Imported clean fill material (approximately 23,100 cubic yards/39,270 tons) will also be required to backfill the excavations to the proposed subgrade requirements for the planned park reconstruction. Waste disposal at MGP sites is limited by the locations of available disposal facilities, with the closest facilities located in New Jersey and Pennsylvania. Based on the limitations of local trucking and the available thruput of these facilities, similar sites in this area are typically limited to no more than 20 tri-axle truckloads per day. The weight of these trucks is limited by the NYC bridge restrictions which limit the capacity to between 25 tons per truckload. Therefore, it is anticipated that up to twenty 25-ton truckloads per day (maximum of 500 tons/day) would be transported through the local community for approximately 144 workdays (~7 months). Similarly, an additional 20 trucks per day would be required to transport clean imported materials to OU-1 for 79 workdays (~4 months). The volume of increased truck traffic during this period will have a short-term impact on the community and park patrons during the construction.

8.5.6. Implementability

The implementation issues with the performance of Alternative 5 are similar to Alternatives 3 and 4. The primary implementation issues will arise from the excavation and ISS activities in proximity to the East River bulkhead and surrounding the North 12th Street sewer line. PDI activities will be completed to determine current structural and geostructural conditions, additional construction support, and monitoring required during remediation activities. Pending the results of the PDI activities, some of these concerns may be addressed using standard construction techniques.

Similar to Alternative 4, Alternative 5 includes the installation of an ISS containment barrier constructed to approximately 60 feet bgs along the boundary of Parcels 2 and 3 and along North 11th Street and North 12th Street. Limitations for work adjacent to, and within, the active park on Parcel 2 are anticipated if the park remains active portions of the construction. This may include limitations on the time of year or specific days per week when specific remedial work can occur and additional controls to be required during the work. This could include a phased approach to the remedial work to accommodate future park construction activities and minimize the effects of partial closure of the active park on Parcel 2.

Institutional controls are implementable as they would be consistent with the current and potential future uses of OU-1.

8.5.7. Cost Effectiveness

The estimated cost range for Alternative 5 is between $44.1 and $94.6 million (Table 5), which is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

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As noted in Section 8.2.7 the costs provided in Table 5 are feasibility level costs and the expected range of accuracy of this level of estimate is between –30% and +50%.

Alternative 5 is similarly cost-effective to Alternatives 3 and 4, however requires an approximately 2.8% increase in estimated remedial cost to achieve only an additional 1.5% reduction in contaminant mass. Although Alternative 5 provides the greatest contaminant mass removal, the incremental benefit is disproportionate to the additional cost and implementation complexity.

8.5.8. Land Use

This alternative supports the current and proposed future land use at OU-1. The location and size of remedial components to remain at OU-1 will be determined in conjunction with the property owner to be compatible with the conceptual park redevelopment plans available at the time of the final design. Every effort will be made to ensure that any permanent infrastructure required for implementation of the remedy, such as recovery wells or monitoring wells, will be placed in areas that will be finished as paved pathways and avoid planned main park areas.

This alternative was developed to be protective of public health and the environment while balancing short-term and long-term disruptions to the community and allowing for redevelopment of the OU-1 as a public park. As noted above, the final park redevelopment plans have not been developed as of the date of this RAAR. This alternative is intended to be compatible with the plans for the final redevelopment of OU-1 that may be under consideration by the property owner.

8.6. Comparison of Alternatives

As summarized in Table 5, the evaluated alternatives demonstrate the tradeoff between increasing remedial effectiveness and increasing implementation complexity and cost. While Alternative 2 provides a viable remedial approach with the lowest upfront implementation cost and shortest construction duration, Alternatives 3 through 5 provide enhanced long-term effectiveness by more comprehensively addressing Contaminant Source Material and reducing the potential for continued groundwater contamination. These tradeoffs form the basis for the recommended remedy discussed in the following section.

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9. Conclusion and Recommendations

9.1. Recommended Alternative

Upon consideration of the alternatives and their respective attributes and limitations, Alternative 4 emerged as the recommended alternative. As discussed in previous sections, Alternatives 3, 4, and 5 achieve substantial reductions in Contaminant Source Materials through the combination of direct excavation, ISS, and DNAPL Recovery when compared to Alternative 2, which relies primarily shallow excavation and installation of the cover system. Alternatives 3, 4, and 5 remove or stabilize 91.23%, 91.23%, 92.81% of the total contaminant mass identified in Parcels 3 and 4, respectively.

Compared to Alternative 3, Alternative 4 provides a substantial improvement in the long-term effectiveness of the groundwater remedy by hydraulically isolating the remaining Contaminant Source Material within Parcel 2, thereby reducing groundwater interaction with residual contamination and limiting long-term contaminant migration. While Alternative 5 achieves the greatest degree of contaminant mass removal, the incremental environmental benefit (1.5%) is accompanied by increased cost (2.8%) and implementation complexity, resulting in diminishing returns relative to Alternative 4. Alternative 4 provides an emphasis on balancing effectiveness and cost through the combination of direct excavation, ISS, DNAPL recovery, and enhanced MNA. It is implementable with similar short-term impacts to Alternatives 3 and 5 and meets the RAOs for OU-1, to the extent practicable.

The recommended alternative, Alternative 4, includes the following actions:

9.1.1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the recommended alternative. This will include development of a Remedial Design Work Plan, completion of appropriate pre-design investigations, and preparation of interim design deliverables to develop the final design for the selected alternative and obtain all appropriate permits and approvals from stakeholders.

9.1.2. Demolition of Existing Foundations

Demolition and off-site disposal of all concrete foundation elements currently in place at Parcels 3 and 4. This includes crushing of concrete debris to suitable size for off-site disposal, cutting of reinforcing rebar elements, and appropriate sampling of the materials to ensure proper off-site disposal. Approximately 2,928 cubic yards (5,000 tons) of concrete debris and rebar will be demolished and removed from OU-1 for off-site disposal.

9.1.3. Excavation

Excavation and off-site treatment and/or disposal of MGP-Impacted Material and Non-MGP-Impacted Material in the unsaturated and shallow saturated zones in the identified areas shown on Figure 26 to a maximum depth of 15 feet below grade. Approximately 60,400 cubic yards (102,610 tons) of material

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will be excavated and transported off-site for treatment and/or disposal as applicable. Waste characterization sampling will be completed based on the requirements of the National Grid-approved disposal facility and in conformance with all appliable federal, state, and local laws, rules, and regulations and any facility-specific permits.

9.1.4. Backfill

Clean fill meeting the requirements of the applicable SCOs for proposed final use of OU-1 as a public park will be imported to establish the designed subgrade elevation for Parcels 3 and 4. The final remedy backfill elevation will be coordinated with the property owner during the design phase. Backfill will be placed to a maximum elevation equivalent to the adjacent street grades to accommodate final public park construction.

Enhanced MNA involves combining natural processes with active enhancements in the form of amendments to stimulate indigenous microbes to accelerate the breakdown of contaminants in soil and groundwater. Amendments may be placed at the limits of the excavation or blended with imported backfill materials to enhance the treatment of groundwater impacted by Contaminant Source Material remaining at depth within Parcel 2. The specific amendments and method of deployment will be determined during the design phase of the remedy.

9.1.5. Cover System

A soil cover system will be installed across Parcels 3 and 4. The cover system will consist of a minimum of two feet of imported clean fill placed over a demarcation barrier. If final public park grades are available during remedial design, the top of the remedial cover system will be constructed up to approximately six inches below the final public park surface, provided the resulting restoration elevation does not exceed the adjacent street elevations. If the final public park grades are not available or would require restoration above the adjacent street elevations, the remedial action will restore the site to a maximum elevation equivalent to the adjacent street grades. Topsoil, landscaping, hardscape features, and other park amenities will be installed by others above the cover system as part of the future park construction and will not be considered components of the remedial cover system. This approach separates the remedial elements from the future park infrastructure while allowing park construction to proceed with minimal disturbance to the completed remedy.

9.1.6. In-Situ Stabilization

In-Situ Stabilization will be implemented to stabilize approximately 18,596 cubic yards of Contaminant Source Material throughout Parcels 3 and 4 not addressed via excavation. Bench-scale testing will be completed to establish an ISS mix design to satisfy the desired performance criteria to produce a solidified mass resulting in low permeability monoliths in the areas identified. The depths of the ISS monoliths will extend from the limits of the excavations to depths between 15 to 55 feet below existing grade. Following ISS implementation, the solidified material will be covered by the cover system described above to prevent direct exposure to the solidified mass. The resulting ISS monolith reduces the mobility of Contaminant Source Material and limits its potential to act as a continuing source of groundwater contamination.

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9.1.7. In-Situ Stabilization Containment Wall

A subsurface ISS containment wall will be installed within Parcel 3 and the adjacent N11th Street and N12th Street rights-of-way along the boundary of Parcel 2 to complete a hydraulic containment system for the remaining Contaminant Source Material at depth within Parcel 2 that remains following implementation of previous IRMs. Pending the results of groundwater modeling, the containment wall will extend to the underlying confining layer, approximately 60 feet below existing grade. Together with the existing sheet pile wall within Parcel 2, the containment wall will form a hydraulic barrier that renders the remaining Contaminant Source Material within Parcel 2 both physically and hydraulically isolated and reduces its potential to act as a continuing source of groundwater contamination.

9.1.8. Secant Pile Bulkhead Wall

Construction of a secant pile bulkhead wall inboard of the existing East River bulkhead to provide excavation support and facilitate implementation of the excavation and ISS components of the remedy. Following completion of the landside remedial activities, the existing bulkhead and material located between the existing bulkhead and the secant pile wall will be removed to approximately two feet below the sediment surface. The secant pile wall will remain in place as the permanent riverfront structure.

9.1.9. NAPL Recovery

Operation of the existing NAPL recovery wells will continue to remove DNAPL from the subsurface along the exterior of the Parcel 2 boundary. The benefit of installing additional DNAPL recovery wells and/or the need to relocate recovery wells to accommodate park construction will be evaluated during the design phase of the remedy.

9.1.10. Institutional Controls

Institutional controls in the form of an environmental easement, and a Site Management Plan, as described below, will be required. This will allow the use and development of OU-1 for a public park (restricted residential use as defined by Part 375-1.8(g)) and restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment.

9.2. Closing

The remedial construction work, including the excavation, ISS, and restoration of OU-1 would have a duration of approximately 27.5 months.

This alternative would have a moderate environmental footprint compared to the other remedial alternatives, primarily associated with the transport and disposal of impacted soil. During the design phase, opportunities to incorporate green technologies, energy-efficient materials and equipment, and other sustainable practices will be evaluated to minimize the environmental footprint of the remediation, in accordance with DER 31 Green Remediation guidance.

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The recommended alternative represents an approach appropriate for OU-1's future land use and aligns with the desires of the local community. The remedy will be designed and implemented so that scheduling of the on-site activities, traffic flows, parking areas, equipment staging, and other aspects of the work would minimize impacts to operations of the existing park.

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Tables

Table 2a Remedial Investigation Surface Soil Analytical Results Summary

Table 1b Remedial Investigation Shallow Subsurface Soil Analytical Results Summary – Parcel 2

Table 1c Remedial Investigation Shallow Subsurface Soil Analytical Results Summary – Parcels 3 & 4

Table 1d Remedial Investigation Deep Subsurface Soil Analytical Results Summary – Parcel 2

Table 1e Remedial Investigation Deep Subsurface Soil Analytical Results Summary – Parcels 3 & 4

Table 2a Remedial Investigation Shallow Groundwater Analytical Results Summary

Table 2b Remedial Investigation Intermediate Groundwater Analytical Results Summary

Table 2c Remedial Investigation Deep Groundwater Analytical Results Summary

Table 3 Contaminant Mass Model Summary

Table 4 Remedial Alternative Scoring Comparison Summary

Table 5 Summary of Remedial Alternatives Costs

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Table 1a. Remedial Investigation Surface Soil Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics										
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
BTEX	mg/kg															
No Detects																
Other VOCs	mg/kg															
No Detects																
PAH17	mg/kg															
Acenaphthene		83-32-9	20	98	100	7	3	4	WW-SS-07 (0-0.2)	0.1	0.1575	0.23	WW-SS-06 (0-0.2)	0	0	0
Acenaphthylene		208-96-8	100	365	100	7	3	4	WW-SS-09 (0-0.2)	0.11	0.285	0.79	WW-SS-04 (0-0.2)	0	0	0
Anthracene		120-12-7	100	1000	100	7	0	7	WW-SS-XX-100609	0.071	0.25443	0.58	WW-SS-04 (0-0.2)	0	0	0
Benzo(a)anthracene		56-55-3	1	1	1.4	7	0	7	WW-SS-XX-100609	0.28	0.87286	2.1	WW-SS-04 (0-0.2)	2	2	1
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	7	0	7	WW-SS-XX-100609	0.47	1.25	2.9	WW-SS-04 (0-0.2)	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	7	0	7	WW-SS-XX-100609	0.14	0.50714	1.2	WW-SS-04 (0-0.2)	1	0	0
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	7	0	7	WW-SS-05 (0-0.2)	0.49	1.2214	2.6	WW-SS-04 (0-0.2)	5	0	0
Benzo(a)pyrene		50-32-8	1	22	1	7	0	7	WW-SS-XX-100609	0.37	1.1157	2.9	WW-SS-04 (0-0.2)	3	0	3
Chrysene		218-01-9	1	1	4.9	7	0	7	WW-SS-XX-100609	0.33	1.0329	2.6	WW-SS-04 (0-0.2)	3	3	0
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	7	6	1	WW-SS-04 (0-0.2)	0.73	0.73	0.73	WW-SS-04 (0-0.2)	1	0	1
Fluoranthene		206-44-0	85	1000	100	7	0	7	WW-SS-XX-100609	0.28	1.4286	2.3	WW-SS-04 (0-0.2)	0	0	0
Fluorene		86-73-7	30	386	100	7	5	2	WW-SS-06 (0-0.2)	0.19	0.195	0.2	WW-SS-04 (0-0.2)	0	0	0
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	7	0	7	WW-SS-05 (0-0.2)	0.43	1.2014	2.9	WW-SS-04 (0-0.2)	6	0	2
Phenanthrene		85-01-8	1.1	1000	4.9	7	0	7	WW-SS-XX-100609	0.2	1.2229	2.7	WW-SS-04 (0-0.2)	3	0	0
Pyrene		129-00-0	64	1000	100	7	0	7	WW-SS-XX-100609	0.55	2.1786	4.8	WW-SS-04 (0-0.2)	0	0	0
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	NE	7	0	7	WW-SS-XX-100609	3.951	12.699	29.48	WW-SS-04 (0-0.2)	0	0	0
PAH17 Other SVOCs	mg/kg															
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	7	6	1	WW-SS-04 (0-0.2)	3	3	3	WW-SS-04 (0-0.2)	0	0	0
Butyl benzyl phthalate		85-68-7	NE	NE	NE	7	0	7	WW-SS-05 (0-0.2)	0.24	0.49286	1.1	WW-SS-08 (0-0.2)	0	0	0
Carbazole		86-74-8	NE	NE	NE	7	2	5	WW-SS-05 (0-0.2)	0.08	0.133	0.2	WW-SS-06 (0-0.2)	0	0	0
Dibenzofuran		132-64-9	2.1	110	18	7	5	2	WW-SS-04 (0-0.2)	0.12	0.145	0.17	WW-SS-06 (0-0.2)	0	0	0
Di-n-butyl phthalate		84-74-2	NE	NE	NE	7	4	3	WW-SS-04 (0-0.2)	0.11	0.18	0.23	WW-SS-09 (0-0.2)	0	0	0
Phenol		108-95-2	0.33	0.33	100	7	6	1	WW-SS-06 (0-0.2)	0.15	0.15	0.15	WW-SS-06 (0-0.2)	0	0	0
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	NE	7	0	7	WW-SS-XX-100609	4.431	13.855	33.21	WW-SS-04 (0-0.2)	0	0	0
Alkylated PAHs	mg/kg															
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	7	0	7	WW-SS-XX-100609	0.14	0.50714	1.2	WW-SS-04 (0-0.2)	1	0	0
Chrysene		218-01-9	1	1	4.9	7	0	7	WW-SS-XX-100609	0.33	1.0329	2.6	WW-SS-04 (0-0.2)	3	3	0
PCB Aroclors	mg/kg															
Aroclor 1248		12672-29-6	NE	NE	NE	7	6	1	WW-SS-06 (0-0.2)	0.018	0.018	0.018	WW-SS-06 (0-0.2)	0	0	0
Aroclor 1254		11097-69-1	NE	NE	NE	7	0	7	WW-SS-07 (0-0.2)	0.021	0.062857	0.15	WW-SS-04 (0-0.2)	0	0	0
Aroclor 1260		11096-82-5	NE	NE	NE	7	2	5	WW-SS-07 (0-0.2)	0.017	0.0862	0.2	WW-SS-04 (0-0.2)	0	0	0
Aroclor 1268		11100-14-4	NE	NE	NE	7	0	7	WW-SS-09 (0-0.2)	0.0075	0.045471	0.12	WW-SS-04 (0-0.2)	0	0	0
Total PCB Aroclors (ND=0)		TPCB-AR_ND(	0.1	3.200	1.000	7	0	7	WW-SS-09 (0-0.2)	0.0295	0.17247	0.47	WW-SS-04 (0-0.2)	3	0	0
Pesticides	mg/kg															
Aldrin		309-00-2	0.0048	0.19	0.044	7	6	1	WW-SS-04 (0-0.2)	0.0022	0.0022	0.0022	WW-SS-04 (0-0.2)	0	0	0
beta-BHC (beta-Hexachlorocyclohexane)		319-85-7	0.021	0.09	0.18	7	5	2	WW-SS-XX-100609	0.0025	0.0031	0.0037	WW-SS-04 (0-0.2)	0	0	0
gamma-BHC (gamma-Hexachlorocyclohexane) (Lindane)		58-89-9	NE	NE	NE	7	6	1	WW-SS-04 (0-0.2)	0.0034	0.0034	0.0034	WW-SS-04 (0-0.2)	0	0	0
delta-BHC (delta-Hexachlorocyclohexane)		319-86-8	0.04	0.1	100	7	5	2	WW-SS-XX-100609	0.0019	0.00245	0.003	WW-SS-04 (0-0.2)	0	0	0
alpha-chlordane		5103-71-9	0.014	4.5	0.65	7	6	1	WW-SS-06 (0-0.2)	0.0038	0.0038	0.0038	WW-SS-06 (0-0.2)	0	0	0
gamma-Chlordane		5103-74-2	NE	NE	NE	7	2	5	WW-SS-07 (0-0.2)	0.003	0.0039	0.0051	WW-SS-04 (0-0.2)	0	0	0
4,4'-DDT (p,p'-DDT)		50-29-3	NE	NE	NE	7	1	6	WW-SS-05 (0-0.2)	0.01	0.02	0.042	WW-SS-04 (0-0.2)	0	0	0
4,4'-DDE (p,p'-DDE)		72-55-9	0.0033	9.3	3.4	7	1	6	WW-SS-05 (0-0.2)	0.0024	0.0070333	0.015	WW-SS-04 (0-0.2)	5	0	0
4,4'-DDD (p,p-DDD)		72-54-8	0.0033	14	5	7	2	5	WW-SS-07 (0-0.2)	0.0041	0.00826	0.011	WW-SS-08 (0-0.2)	5	0	0
Dieldrin		60-57-1	0.005	0.1	0.075	7	4	3	WW-SS-05 (0-0.2)	0.0013	0.0033667	0.0046	WW-SS-04 (0-0.2)	0	0	0
alpha-Endosulfan (I)		959-98-8	4.3	65	35	7	5	2	WW-SS-XX-100609	0.0068	0.00715	0.0075	WW-SS-04 (0-0.2)	0	0	0
Endrin		72-20-8	0.014	0.06	5.3	7	4	1	WW-SS-04 (0-0.2)	0.0039	0.0039	0.0039	WW-SS-04 (0-0.2)	0	0	0
Endrin aldehyde		7421-93-4	NE	NE	NE	7	0	7	WW-SS-07 (0-0.2)	0.0056	0.010786	0.029	WW-SS-XX-100609	0	0	0
Heptachlor epoxide		1024-57-3	NE	NE	NE	7	5	2	WW-SS-04 (0-0.2)	0.0036	0.0054	0.0072	WW-SS-XX-100609	0	0	0
Methoxychlor		72-43-5	NE	NE	NE	7	5	2	WW-SS-08 (0-0.2)	0.02	0.0235	0.027	WW-SS-XX-100609	0	0	0
Herbicides	mg/kg															
No Detects																

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Table 1a. Remedial Investigation Surface Soil Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics										
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
Metals	mg/kg															
Aluminum		7429-90-5	NE	NE	NE	7	Ocotber	7	WW-SS-07 (0-0.2)	2440	5545.7	13700	WW-SS-09 (0-0.2)	0	0	0
Arsenic		7440-38-2	13	16	16	7	6	1	WW-SS-09 (0-0.2)	6.1	6.1	6.1	WW-SS-09 (0-0.2)	0	0	0
Barium		7440-39-3	410	820	410	7	0	7	WW-SS-05 (0-0.2)	68.8	154.09	327	WW-SS-06 (0-0.2)	0	0	0
Beryllium		7440-41-7	4.4	47	43	7	0	7	WW-SS-07 (0-0.2)	0.15	0.45714	1.6	WW-SS-09 (0-0.2)	0	0	0
Cadmium		7440-43-9	2.5	7.5	2.5	7	1	6	WW-SS-07 (0-0.2)	0.6	1.3	2.5	WW-SS-XX-100609	0	0	0
Calcium		7440-70-2	NE	NE	NE	7	0	7	WW-SS-05 (0-0.2)	9680	22254	64900	WW-SS-09 (0-0.2)	0	0	0
Chromium		7440-47-3	NE	NE	NE	7	0	7	WW-SS-05 (0-0.2)	20.9	24.929	32.3	WW-SS-09 (0-0.2)	0	0	0
Cobalt		7440-48-4	NE	NE	NE	7	0	7	WW-SS-07 (0-0.2)	4	4.9	7.6	WW-SS-XX-100609	0	0	0
Copper		7440-50-8	50	1720	280	7	0	7	WW-SS-05 (0-0.2)	51.9	119.96	347	WW-SS-06 (0-0.2)	7	0	1
Iron		7439-89-6	NE	NE	NE	7	0	7	WW-SS-05 (0-0.2)	10200	14486	20500	WW-SS-07 (0-0.2)	0	0	0
Lead		7439-92-1	63	450	400	7	0	7	WW-SS-07 (0-0.2)	99.1	167.1	251	WW-SS-06 (0-0.2)	7	0	0
Magnesium		7439-95-4	NE	NE	NE	7	0	7	WW-SS-05 (0-0.2)	5840	8798.6	18400	WW-SS-09 (0-0.2)	0	0	0
Manganese		7439-96-5	1600	2000	2000	7	0	7	WW-SS-04 (0-0.2)	188	328.29	963	WW-SS-09 (0-0.2)	0	0	0
Mercury		7439-97-6	0.18	0.73	0.3	7	0	7	WW-SS-09 (0-0.2)	0.091	0.12986	0.2	WW-SS-XX-100609	2	0	0
Nickel		7440-02-0	30	130	320	7	0	7	WW-SS-05 (0-0.2)	14.6	19.257	24.2	WW-SS-XX-100609	0	0	0
Potassium		7440-09-7	NE	NE	NE	7	0	7	WW-SS-07 (0-0.2)	277	628.86	1710	WW-SS-09 (0-0.2)	0	0	0
Silver		7440-22-4	2	8.3	110	7	4	3	WW-SS-09 (0-0.2)	0.1	0.35333	0.57	WW-SS-XX-100609	0	0	0
Sodium		7440-23-5	NE	NE	NE	7	0	7	WW-SS-05 (0-0.2)	103	279	954	WW-SS-09 (0-0.2)	0	0	0
Tin		7440-31-5	NE	NE	NE	7	1	6	WW-SS-07 (0-0.2)	3.5	6.1167	9.3	WW-SS-08 (0-0.2)	0	0	0
Vanadium		7440-62-2	NE	NE	NE	7	0	7	WW-SS-07 (0-0.2)	13.3	18.8	24.8	WW-SS-09 (0-0.2)	0	0	0
Zinc		7440-66-6	109	2480	6600	7	0	7	WW-SS-09 (0-0.2)	336	585.57	922	WW-SS-XX-100609	7	0	0
Cyanides	mg/kg															
Free Cyanide		FREECN	NE	NE	NE	7	6	1	WW-SS-07 (0-0.2)	0.063	0.063	0.063	WW-SS-07 (0-0.2)	0	0	0
Other																
Percent Solids	%	SOLIDS	NE	NE	NE	7	0	7	WW-SS-04 (0-0.2)	72.8	85.886	94.7	WW-SS-07 (0-0.2)	0	0	0

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Table 1a. Remedial Investigation Surface Soil Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:

Note: results/limits where cells contain qualifier only are unknown

mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAHs are calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

NA = Not Analyzed
ND = Not Detected
NE = Not Established

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Table 1b. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcel 2
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics										
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
BTEX	mg/kg															
No Detects																
Other VOCs	mg/kg															
No Detects																
PAH17	mg/kg															
Acenaphthene		83-32-9	20	98	100	1	0	1	WW-MW-07 (4-5)	0.27	0.27	0.27	WW-MW-07 (4-5)	0	0	0
Acenaphthylene		208-96-8	100	365	100	1	0	1	WW-MW-07 (4-5)	2.9	2.9	2.9	WW-MW-07 (4-5)	0	0	0
Anthracene		120-12-7	100	1000	100	1	0	1	WW-MW-07 (4-5)	0.99	0.99	0.99	WW-MW-07 (4-5)	0	0	0
Benzo(a)anthracene		56-55-3	1	1	1.4	1	0	1	WW-MW-07 (4-5)	6.9	6.9	6.9	WW-MW-07 (4-5)	1	1	1
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	8.1	8.1	8.1	WW-MW-07 (4-5)	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	1	0	1	WW-MW-07 (4-5)	3.3	3.3	3.3	WW-MW-07 (4-5)	1	1	0
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	1	0	1	WW-MW-07 (4-5)	6.1	6.1	6.1	WW-MW-07 (4-5)	1	0	1
Benzo(a)pyrene		50-32-8	1	22	1	1	0	1	WW-MW-07 (4-5)	12	12	12	WW-MW-07 (4-5)	1	0	1
Chrysene		218-01-9	1	1	4.9	1	0	1	WW-MW-07 (4-5)	6	6	6	WW-MW-07 (4-5)	1	1	1
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	1	0	1	WW-MW-07 (4-5)	2.3	2.3	2.3	WW-MW-07 (4-5)	1	0	1
Fluoranthene		206-44-0	85	1000	100	1	0	1	WW-MW-07 (4-5)	5.4	5.4	5.4	WW-MW-07 (4-5)	0	0	0
Fluorene		86-73-7	30	386	100	1	0	1	WW-MW-07 (4-5)	0.37	0.37	0.37	WW-MW-07 (4-5)	0	0	0
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	1	0	1	WW-MW-07 (4-5)	7.6	7.6	7.6	WW-MW-07 (4-5)	1	1	1
2-Methylnaphthalene		91-57-6	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.26	0.26	0.26	WW-MW-07 (4-5)	0	0	0
Naphthalene		91-20-3	12	12	100	1	0	1	WW-MW-07 (4-5)	0.58	0.58	0.58	WW-MW-07 (4-5)	0	0	0
Phenanthrene		85-01-8	1.1	1000	4.9	1	0	1	WW-MW-07 (4-5)	1.9	1.9	1.9	WW-MW-07 (4-5)	1	0	0
Pyrene		129-00-0	64	1000	100	1	0	1	WW-MW-07 (4-5)	5.6	5.6	5.6	WW-MW-07 (4-5)	0	0	0
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	70.57	70.57	70.57	WW-MW-07 (4-5)	0	0	0
PAH17 Other SVOCs	mg/kg															
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.21	0.21	0.21	WW-MW-07 (4-5)	0	0	0
Carbazole		86-74-8	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.45	0.45	0.45	WW-MW-07 (4-5)	0	0	0
Dibenzofuran		132-64-9	2.1	110	18	1	0	1	WW-MW-07 (4-5)	0.18	0.18	0.18	WW-MW-07 (4-5)	0	0	0
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	71.41	71.41	71.41	WW-MW-07 (4-5)	0	0	0
Alkylated PAHs	mg/kg															
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	1	0	1	WW-MW-07 (4-5)	3.3	3.3	3.3	WW-MW-07 (4-5)	1	1	0
Chrysene		218-01-9	1	1	4.9	1	0	1	WW-MW-07 (4-5)	6	6	6	WW-MW-07 (4-5)	1	1	1
PCB Aroclors	mg/kg															
No Detects																
Pesticides	mg/kg															
beta-BHC (beta-Hexachlorocyclohexane)		319-85-7	0.021	0.09	0.18	1	0	1	WW-MW-07 (4-5)	0.0027	0.0027	0.0027	WW-MW-07 (4-5)	0	0	0
gamma-Chlordane		5103-74-2	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.0045	0.0045	0.0045	WW-MW-07 (4-5)	0	0	0
4,4'-DDT (p,p'-DDT)		50-29-3	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.014	0.014	0.014	WW-MW-07 (4-5)	0	0	0
beta-Endosulfan (II)		33213-65-9	4.3	44	35	1	0	1	WW-MW-07 (4-5)	0.0087	0.0087	0.0087	WW-MW-07 (4-5)	0	0	0
Endosulfan sulfate		1031-07-8	4.3	47	35	1	0	1	WW-MW-07 (4-5)	0.017	0.017	0.017	WW-MW-07 (4-5)	0	0	0
Endrin		72-20-8	0.014	0.06	5.3	1	0	1	WW-MW-07 (4-5)	0.0074	0.0074	0.0074	WW-MW-07 (4-5)	0	0	0
Endrin aldehyde		7421-93-4	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.023	0.023	0.023	WW-MW-07 (4-5)	0	0	0
Endrin ketone		53494-70-5	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.019	0.019	0.019	WW-MW-07 (4-5)	0	0	0
Heptachlor		76-44-8	0.013	0.38	0.53	1	0	1	WW-MW-07 (4-5)	0.0043	0.0043	0.0043	WW-MW-07 (4-5)	0	0	0
Methoxychlor		72-43-5	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	0.033	0.033	0.033	WW-MW-07 (4-5)	0	0	0
Herbicides	mg/kg															
No Detects																
Metals	mg/kg															
Aluminum		7429-90-5	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	7330	7330	7330	WW-MW-07 (4-5)	0	0	0
Arsenic		7440-38-2	13	16	16	1	0	1	WW-MW-07 (4-5)	2.3	2.3	2.3	WW-MW-07 (4-5)	0	0	0
Barium		7440-39-3	410	820	410	1	0	1	WW-MW-07 (4-5)	48.5	48.5	48.5	WW-MW-07 (4-5)	0	0	0
Beryllium		7440-41-7	4.4	47	43	1	0	1	WW-MW-07 (4-5)	0.67	0.67	0.67	WW-MW-07 (4-5)	0	0	0
Cadmium		7440-43-9	2.5	7.5	2.5	1	0	1	WW-MW-07 (4-5)	0.33	0.33	0.33	WW-MW-07 (4-5)	0	0	0
Calcium		7440-70-2	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	1150	1150	1150	WW-MW-07 (4-5)	0	0	0
Chromium		7440-47-3	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	15.7	15.7	15.7	WW-MW-07 (4-5)	0	0	0
Cobalt		7440-48-4	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	6.4	6.4	6.4	WW-MW-07 (4-5)	0	0	0
Copper		7440-50-8	50	1720	280	1	0	1	WW-MW-07 (4-5)	24.8	24.8	24.8	WW-MW-07 (4-5)	0	0	0
Iron		7439-89-6	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	15800	15800	15800	WW-MW-07 (4-5)	0	0	0
Lead		7439-92-1	63	450	400	1	0	1	WW-MW-07 (4-5)	45	45	45	WW-MW-07 (4-5)	0	0	0
Magnesium		7439-95-4	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	2010	2010	2010	WW-MW-07 (4-5)	0	0	0
Manganese		7439-96-5	1600	2000	2000	1	0	1	WW-MW-07 (4-5)	269	269	269	WW-MW-07 (4-5)	0	0	0
Mercury		7439-97-6	0.18	0.73	0.3	1	0	1	WW-MW-07 (4-5)	0.037	0.037	0.037	WW-MW-07 (4-5)	0	0	0
Nickel		7440-02-0	30	130	320	1	0	1	WW-MW-07 (4-5)	13.6	13.6	13.6	WW-MW-07 (4-5)	0	0	0
Potassium		7440-09-7	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	806	806	806	WW-MW-07 (4-5)	0	0	0
Sodium		7440-23-5	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	65.1	65.1	65.1	WW-MW-07 (4-5)	0	0	0
Vanadium		7440-62-2	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	25.9	25.9	25.9	WW-MW-07 (4-5)	0	0	0
Zinc		7440-66-6	109	2480	6600	1	0	1	WW-MW-07 (4-5)	91.3	91.3	91.3	WW-MW-07 (4-5)	0	0	0
Cyanides	mg/kg															
No Detects																
Other																
Percent Solids	%	SOLIDS	NE	NE	NE	1	0	1	WW-MW-07 (4-5)	83.1	83.1	83.1	WW-MW-07 (4-5)	0	0	0

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Table 1b. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcel 2
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:
Note: results/limits where cells contain qualifier only are unknown
mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAHs are calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

NA = Not Analyzed
ND = Not Detected
NE = Not Established

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Table 1c. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics											
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
BTEX	mg/kg															
Benzene		71-43-2	0.06	0.06	3.7	77	58	19	WW-MW-14 (3-5)	0.00074	0.099934	1.8	WW-TP-203A-2.5	1	1	0
Toluene		108-88-3	0.7	0.7	100	77	67	10	WW-SB-254 0.6-5ft	0.0008	0.11547	1.14	WW-TP-203A-2.5	1	1	0
Ethylbenzene		100-41-4	1	1	76	77	71	6	WW-SB-242 0-5	0.0026	0.55177	2.57	WW-TP-203A-2.5	1	1	0
o-Xylene		95-47-6	NE	NE	NE	58	56	2	WW-SB-242 0-5	0.001	0.46	0.919	WW-TP-203A-2.5	0	0	0
m/p-Xylene		179601-23-1	NE	NE	NE	58	56	2	WW-SB-242 0-5	0.0041	0.67705	1.35	WW-TP-203A-2.5	0	0	0
Total BTEX (ND=0)		TBTEX_ND0	NE	NE	NE	77	53	24	WW-MW-14 (3-5)	0.00074	0.35992	7.779	WW-TP-203A-2.5	0	0	0
Other VOCs	mg/kg															
Acetone		67-64-1	0.03	0.03	100	77	37	40	SB-241 0.5-3.5ft	0.003	0.066145	0.235	WW-SB-234 0-5ft	28	28	0
n-Butylbenzene		104-51-8	18	18	100	58	56	2	WW-SB-242 0-5	0.0281	2.524	5.02	WW-TP-203A-2.5	0	0	0
sec-Butylbenzene		135-98-8	25	25	100	58	56	2	WW-SB-242 0-5	0.0648	0.9224	1.78	WW-TP-203A-2.5	0	0	0
tert-Butylbenzene		98-06-6	11	11	100	58	56	2	WW-SB-242 0-5	0.0594	0.2017	0.344	WW-TP-203A-2.5	0	0	0
Carbon disulfide		75-15-0	NE	NE	NE	77	63	14	WW-SB-253 0-5ft	0.001	0.00655	0.0171	WW-SB-211 0.5-5	0	0	0
Cyclohexane		110-82-7	NE	NE	NE	58	55	3	WW-MW-202 0-5	0.0014	0.15053	0.448	WW-TP-203A-2.5	0	0	0
p-Cymene (4-Isopropyltoluene)		99-87-6	NE	NE	NE	58	56	2	WW-SB-242 0-5	0.0071	1.7885	3.57	WW-TP-203A-2.5	0	0	0
cis-1,2-Dichloroethene		156-59-2	0.19	0.19	41	77	75	1	WW-SB-204 0-5	0.0027	0.0027	0.0027	WW-SB-204 0-5	0	0	0
Isopropylbenzene		98-82-8	NE	NE	NE	58	56	2	WW-SB-242 0-5	0.0558	0.9779	1.9	WW-TP-203A-2.5	0	0	0
Methyl acetate		79-20-9	NE	NE	NE	58	54	1	WW-SB-254 0.6-5ft	0.0154	0.0154	0.0154	WW-SB-254 0.6-5ft	0	0	0
Methyl ethyl ketone (2-Butanone)		78-93-3	0.1	0.1	100	77	64	13	WW-SB-218 0-5	0.0053	0.0086462	0.0147	WW-SB-224 0.5-5	0	0	0
Methylcyclohexane		108-87-2	NE	NE	NE	58	53	5	WW-SB-231 0-5	0.0013	8.5019	37.1	WW-SB-242 0-5	0	0	0
Naphthalene		91-20-3	12	12	100	58	35	23	WW-SB-254 0.6-5ft	0.0008	1.8429	42.3	WW-TP-203A-2.5	1	1	0
n-Propylbenzene		103-65-1	5	5	100	58	56	2	WW-SB-242 0-5	0.0753	1.5426	3.01	WW-TP-203A-2.5	0	0	0
Styrene		100-42-5	NE	NE	NE	77	73	3	WW-SB-13 (4-5)	0.00051	0.0015033	0.003	WW-SB-XX (2-4)	0	0	0
Tetrahydrofuran		109-99-9	NE	NE	NE	57	55	2	DUP-08032022	0.0015	0.00175	0.002	WW-SB-211 0.5-5	0	0	0
1,1,2-Trichloroethane		79-00-5	NE	NE	NE	77	76	1	WW-SB-16 (0.5-5)	0.074	0.074	0.074	WW-SB-16 (0.5-5)	0	0	0
Trichloroethene (TCE)		79-01-6	0.47	0.47	6.4	77	72	4	WW-SB-201 0.4-5ft	0.0012	0.00225	0.0046	WW-SB-203 0.4-5ft	0	0	0
1,2,4-Trimethylbenzene		95-63-6	5.9	5.9	100	58	54	4	WW-SB-253 0-5ft	0.0009	1.8378	7.34	WW-TP-203A-2.5	1	1	0
1,3,5-Trimethylbenzene		108-67-8	3.1	3.1	100	58	55	3	WW-SB-242 0-5	0.0014	1.0282	3.08	WW-TP-203A-2.5	0	0	0
Vinyl chloride		75-01-4	0.03	0.03	0.48	77	75	1	WW-SB-204 0-5	0.0017	0.0017	0.0017	WW-SB-204 0-5	0	0	0
Total VOCs (ND=0)		TVOC_ND0	NE	NE	NE	77	20	57	WW-SB-13 (4-5)	0.00051	2.1631	81.971	WW-TP-203A-2.5	0	0	0
PAH17	mg/kg															
Acenaphthene		83-32-9	20	98	100	77	16	61	WW-SB-214 0.5-5	0.0297	5.2751	92	WW-SB-XX (2-4)	4	0	0
Acenaphthylene		208-96-8	100	365	100	77	7	70	WW-SB-214 0.5-5	0.0374	2.8042	23	WW-SB-XX (2-4)	0	0	0
Anthracene		120-12-7	100	1000	100	77	1	76	WW-SB-214 0.5-5	0.0455	4.1857	83	WW-SB-XX (2-4)	0	0	0
Benzo(a)anthracene		56-55-3	1	1	1.4	77	1	76	WW-SB-214 0.5-5	0.135	7.2214	76	WW-SB-13 (4-5)	58	58	56
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	77	1	76	WW-SB-214 0.5-5	0.129	8.2574	150	WW-SB-13 (4-5)	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	77	1	76	WW-SB-214 0.5-5	0.103	4.6142	57	WW-SB-13 (4-5)	56	50	21
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	77	1	76	WW-SB-214 0.5-5	0.103	6.2726	78	WW-SB-13 (4-5)	61	0	27
Benzo(a)pyrene		50-32-8	1	22	1	77	1	76	WW-SB-214 0.5-5	0.161	9.7992	130	WW-SB-13 (4-5)	60	7	60
Chrysene		218-01-9	1	1	4.9	77	1	76	WW-SB-214 0.5-5	0.136	7.0458	73	WW-SB-13 (4-5)	59	59	27
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	77	14	63	WW-SB-214 0.5-5	0.03	1.8416	22	WW-SB-13 (4-5)	51	0	51
Fluoranthene		206-44-0	85	1000	100	77	1	76	WW-SB-214 0.5-5	0.216	9.2691	89	WW-SB-XX (2-4)	1	0	0
Fluorene		86-73-7	30	386	100	77	16	61	WW-SB-214 0.5-5	0.0196	4.3268	100	WW-SB-XX (2-4)	2	0	0
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	77	1	76	WW-SB-214 0.5-5	0.111	6.9858	90	WW-SB-13 (4-5)	66	22	55
2-Methylnaphthalene		91-57-6	NE	NE	NE	77	24	53	WW-SB-251 0-5	0.0541	1.7665	25.6	WW-TP-203A-2.5	0	0	0
Naphthalene		91-20-3	12	12	100	77	24	53	WW-SB-242 0-5	0.0547	3.3583	40.2	WW-TP-203A-2.5	3	3	0
Phenanthrene		85-01-8	1.1	1000	4.9	77	1	76	WW-SB-214 0.5-5	0.131	12.404	280	WW-SB-XX (2-4)	58	0	21
Pyrene		129-00-0	64	1000	100	77	0	77	WW-SB-217 0-5	0.0196	12.439	140	WW-SB-XX (2-4)	3	0	1
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	NE	77	0	77	WW-SB-217 0-5	0.0196	102.7	1108.3	WW-SB-XX (2-4)	0	0	0
2.332 MAEPH	mg/kg															
C-10		C-10	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.212	4.5843	13.9	WW-TP-203B (14')	0	0	0
C-11		C-11	NE	NE	NE	6	2	4	WW-SB-253 0-5ft	0.272	3.5652	11.7	WW-TP-203B (14')	0	0	0
C-12		C-12	NE	NE	NE	6	2	4	WW-SB-253 0-5ft	0.71	10.082	37.7	WW-TP-203B (14')	0	0	0
C-13		C-13	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.301	0.562	0.882	DUP-08082022-01	0	0	0
C-14		C-14	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.428	0.856	1.33	DUP-08082022-01	0	0	0
C-15		C-15	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.229	0.86233	1.44	DUP-08082022-01	0	0	0
C-16		C-16	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.992	1.226	1.46	DUP-08082022-01	0	0	0
C-17		C-17	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.306	0.94167	1.52	DUP-08082022-01	0	0	0
C-18		C-18	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.262	0.786	1.27	DUP-08082022-01	0	0	0
C-19		C-19	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.33	0.861	1.36	DUP-08082022-01	0	0	0
C-20		C-20	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.238	0.786	1.21	DUP-08082022-01	0	0	0
C-21		C-21	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.33	0.68067	0.911	DUP-08082022-01	0	0	0
C-22		C-22	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.515	0.6115	0.708	DUP-08082022-01	0	0	0
C-23		C-23	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.534	0.75933	0.892	WW-SB-253 0-5ft	0	0	0
C-24		C-24	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.807	1.0185	1.23	DUP-08082022-01	0	0	0
C-25		C-25	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	1.54	1.815	2.09	DUP-08082022-01	0	0	0
C-26		C-26	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.907	1.2485	1.59	DUP-08082022-01	0	0	0
C-27		C-27	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	1.6	1.79	1.98	DUP-08082022-01	0	0	0

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Table 1c. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics											
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
C-28		C-28	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.992	1.246	1.5	DUP-08082022-01	0	0	0
C-29		C-29	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.811	1.0805	1.35	DUP-08082022-01	0	0	0
C-30		C-30	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.955	1.1625	1.37	DUP-08082022-01	0	0	0
C-31		C-31	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	1.07	1.305	1.54	DUP-08082022-01	0	0	0
C-32		C-32	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.902	1.171	1.44	DUP-08082022-01	0	0	0
C-33		C-33	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.944	1.127	1.31	DUP-08082022-01	0	0	0
C-34		C-34	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	1.05	1.215	1.38	DUP-08082022-01	0	0	0
C-35		C-35	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.992	1.186	1.38	DUP-08082022-01	0	0	0
C-36		C-36	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.643	0.8815	1.12	DUP-08082022-01	0	0	0
C-37		C-37	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.844	0.987	1.13	DUP-08082022-01	0	0	0
C-38		C-38	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.476	0.5805	0.685	DUP-08082022-01	0	0	0
C-39		C-39	NE	NE	NE	6	4	2	WW-SB-253 0-5ft	0.265	0.3385	0.412	DUP-08082022-01	0	0	0
C-40		C-40	NE	NE	NE	6	5	1	DUP-08082022-01	0.549	0.549	0.549	DUP-08082022-01	0	0	0
C-8		C-8	NE	NE	NE	6	3	3	WW-SB-227(0-5)	0.243	15.761	41.6	WW-TP-203B (14')	0	0	0
C-9		C-9	NE	NE	NE	6	3	3	WW-SB-227(0-5)	1.27	6.5467	14.3	WW-TP-203B (14')	0	0	0
PAH17 Other SVOCs	mg/kg															
Acetophenone		98-86-2	NE	NE	NE	58	34	24	WW-SB-214 0.5-5	0.0283	0.1186	0.289	WW-SB-215 0-5ft	0	0	0
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	NE	58	29	29	WW-SB-223 0-5	0.0438	0.26687	2.14	WW-TP-203A-2.5	0	0	0
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	77	41	36	WW-SB-242 0-5	0.0494	1.0109	22.4	WW-SB-213 0-5	0	0	0
Butyl benzyl phthalate		85-68-7	NE	NE	NE	77	60	17	WW-SB-213 0-5	0.0779	0.37204	1.1	WW-SS-08 (0-0.2)	0	0	0
Caprolactam		105-60-2	NE	NE	NE	58	55	3	WW-SB-231 0-5	0.0397	0.082067	0.148	WW-SB-213 0-5	0	0	0
Carbazole		86-74-8	NE	NE	NE	77	18	59	WW-SB-251 0-5	0.0157	0.52335	2.5	WW-SB-XX (2-4)	0	0	0
Dibenzofuran		132-64-9	2.1	110	18	77	23	54	WW-SB-251 0-5	0.0205	0.9637	9.6	WW-SB-XX (2-4)	6	0	0
2,4-Dimethylphenol		105-67-9	NE	NE	NE	77	64	4	WW-SB-231 0-5	0.0288	0.0742	0.166	WW-SB-215 0-5ft	0	0	0
Di-n-butyl phthalate		84-74-2	NE	NE	NE	77	72	5	WW-SS-04 (0-0.2)	0.11	0.166	0.23	WW-SS-09 (0-0.2)	0	0	0
Di-n-octyl phthalate		117-84-0	NE	NE	NE	77	76	1	WW-SB-217 0-5	0.0332	0.0332	0.0332	WW-SB-217 0-5	0	0	0
2-Methylnaphthalene		91-57-6	NE	NE	NE	58	8	50	WW-SB-251 0-5	0.0541	1.1044	25.6	WW-TP-203A-2.5	0	0	0
2-Methylphenol (o-Cresol)		95-48-7	0.33	0.33	100	77	57	12	WW-SB-218 0-5	0.0192	0.044675	0.128	WW-SB-215 0-5ft	0	0	0
3,4-Methylphenol (m,p-Cresol)		108394/106445	NE	NE	NE	58	38	12	WW-SB-221 0-5	0.0449	0.098108	0.275	WW-SB-215 0-5ft	0	0	0
Phenol		108-95-2	0.33	0.33	100	77	65	2	WW-SB-226 0-5	0.0661	0.10805	0.15	WW-SS-06 (0-0.2)	0	0	0
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	NE	77	0	77	WW-SB-217 0-5	0.2557	104.51	1120.4	WW-SB-XX (2-4)	0	0	0
Alkylated PAHs	mg/kg															
Acenaphthene		83-32-9	20	98	100	6	0	6	DUP-08082022-01	0.123	14.252	50	WW-TP-203B (14')	2	0	0
Acenaphthylene		208-96-8	100	365	100	6	0	6	DUP-08082022-01	0.117	10.312	37.2	WW-TP-203B (14')	0	0	0
Anthracene		120-12-7	100	1000	100	6	0	6	DUP-08082022-01	0.277	17.859	72.6	WW-TP-203B (14')	0	0	0
Benzene		71-43-2	0.06	0.06	3.7	6	0	6	DUP-08082022-01	0.0417	2.0289	8.2	WW-TP-203B (14')	5	5	1
C1-Benzene		BENC1	NE	NE	NE	6	2	4	WW-SB-227(0-5)	0.238	4.4478	14.5	WW-TP-203B (14')	0	0	0
C2-Benzenes		BENC2	NE	NE	NE	6	0	6	DUP-08082022-01	0.0595	4.4709	20.2	WW-TP-203B (14')	0	0	0
C3-Benzenes		BENC3	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.102	5.1265	14.5	WW-TP-203B (14')	0	0	0
C4-Benzenes		BENC4	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.145	9.9333	41.9	WW-TP-203A-2.5	0	0	0
C5-Benzenes		BENC5	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.133	8.7662	31.8	WW-TP-203A-2.5	0	0	0
Benzo(a)anthracene		56-55-3	1	1	1.4	6	0	6	DUP-08082022-01	0.623	26.256	119	WW-TP-203B (14')	5	5	5
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	6	0	6	DUP-08082022-01	0.567	30.896	150	WW-TP-203B (14')	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	77	1	76	WW-SB-214 0.5-5	0.103	4.6142	57	WW-SB-13 (4-5)	56	50	21
Benzo(j,k)fluoranthene		205823/207089	NE	NE	NE	6	0	6	DUP-08082022-01	0.481	32.353	162	WW-TP-203B (14')	0	0	0
Benzo(b)fluorene		243-17-4	1	2.1	1.4	6	0	6	DUP-08082022-01	0.0631	3.0342	12.8	WW-TP-203B (14')	2	2	2
Benzo(c)fluorene		205-12-9	NE	NE	NE	6	0	6	DUP-08082022-01	0.0245	1.4759	6.64	WW-TP-203B (14')	0	0	0
Naphthobenzothiophenes (Benzo(b)naphtho(2,1-d)thiophene)		239-35-0	NE	NE	NE	6	0	6	DUP-08082022-01	0.138	2.5895	10.6	WW-TP-203B (14')	0	0	0
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	6	0	6	DUP-08082022-01	0.411	38.802	198	WW-TP-203B (14')	5	0	3
Benzo(a)pyrene		50-32-8	1	22	1	6	0	6	DUP-08082022-01	0.634	54.616	276	WW-TP-203B (14')	5	2	5
Benzo(e)pyrene		192-97-2	NE	NE	NE	6	0	6	DUP-08082022-01	0.443	26.077	127	WW-TP-203B (14')	0	0	0
Benzothiophene (1-Benzothiophene)		11095-43-5	NE	NE	NE	6	0	6	DUP-08082022-01	0.00958	0.45658	1.42	WW-TP-203B (14')	0	0	0
C1-Benzo(b)thiophenes		BENbTHPHC1	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0204	1.2069	3.66	WW-TP-203B (14')	0	0	0
C2-Benzo(b)thiophenes		BENbTHPHC2	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.0277	1.8719	7.04	WW-TP-203B (14')	0	0	0
C3-Benzo(b)thiophenes		BENbTHPHC3	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.0233	1.6851	7.58	WW-TP-203B (14')	0	0	0
C4-Benzo(b)thiophenes		BENbTHPHC4	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.0209	0.74848	3.43	WW-TP-203B (14')	0	0	0
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0342	0.75788	2.13	WW-TP-203B (14')	0	0	0
n-Butylbenzene		104-51-8	18	18	100	6	1	5	WW-SB-253 0-5ft	0.0117	0.55006	2.56	WW-TP-203A-2.5	0	0	0
sec-Butylbenzene		135-98-8	25	25	100	6	1	5	WW-SB-253 0-5ft	0.00664	0.71703	2.21	WW-TP-203B (14')	0	0	0
tert-Butylbenzene		98-06-6	11	11	100	6	3	3	WW-SB-227(0-5)	0.00901	0.22134	0.482	WW-TP-203B (14')	0	0	0
Chrysene		218-01-9	1	1	4.9	77	1	76	WW-SB-214 0.5-5	0.136	7.0458	73	WW-SB-13 (4-5)	59	59	27
C1-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC1	NE	NE	NE	6	0	6	DUP-08082022-01	0.411	19.398	94	WW-TP-203B (14')	0	0	0
C2-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC2	NE	NE	NE	6	0	6	DUP-08082022-01	0.44	11.232	56	WW-TP-203B (14')	0	0	0
C3-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC3	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.368	6.2612	31.7	WW-TP-203B (14')	0	0	0
C4-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC4	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.22	2.9928	15.2	WW-TP-203B (14')	0	0	0
Chrysene/triphenylene		CHRYTRIPHE	NE	NE	NE	6	0	6	DUP-08082022-01	0.623	23.187	104	WW-TP-203B (14')	0	0	0
Coronene		191-07-1	NE	NE	NE	6	0	6	DUP-08082022-01	0.118	11.536	58.4	WW-TP-203B (14')	0	0	0
p-Cymene (4-Isopropyltoluene)		99-87-6	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0171	0.59218	2.8	WW-TP-203A-2.5	0	0	0

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Table 1c. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics											
Analyte	Units	CAS No.	Unrestricted SCO	Protection of GW SCO	Restricted-Residential SCO	Number of Results	Number of Nondetects	Number of Detects	Minimum Detect ID	Minimum Detect	Average Detect	Maximum Detect	Maximum Detect ID	Number of Exceedances Unrestricted SCO	Number of Exceedances Protection of GW SCO	Number of Exceedances Restricted-Residential SCO
cis-Decalin		493-01-6	NE	NE	NE	6	1	5	WW-SB-253 0-5ft	0.00434	0.92121	2.4	WW-TP-203A-2.5	0	0	0
trans-Decalin		493-02-7	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0208	4.2945	14.3	WW-TP-203B (14')	0	0	0
C1-Decalins		DECLC1	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0722	11.195	34.5	WW-TP-203B (14')	0	0	0
C2-Decalins		DECLC2	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.096	9.562	31.6	WW-TP-203B (14')	0	0	0
C3-Decalins		DECLC3	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0772	4.5124	18.5	WW-TP-203B (14')	0	0	0
C4-Decalins		DECLC4	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.148	4.0035	18	WW-TP-203B (14')	0	0	0
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	6	0	6	DUP-08082022-01	0.161	14.162	75.5	WW-TP-203B (14')	4	0	4
Dibenzofuran		132-64-9	2.1	110	18	6	0	6	DUP-08082022-01	0.0762	3.2729	10.1	WW-TP-203B (14')	2	0	0
Dibenzothiophene		132-65-0	NE	NE	NE	6	0	6	DUP-08082022-01	0.0792	4.0762	16.5	WW-TP-203B (14')	0	0	0
C1-Dibenzothiophenes		DIBENTHPHC1	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.114	4.948	21.7	WW-TP-203B (14')	0	0	0
C2-Dibenzothiophenes		DIBENTHPHC2	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.154	4.0747	18.1	WW-TP-203B (14')	0	0	0
C3-Dibenzothiophenes		DIBENTHPHC3	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.121	2.2857	9.87	WW-TP-203B (14')	0	0	0
C4-Dibenzothiophenes		DIBENTHPHC4	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.0844	0.9974	3.95	WW-TP-203B (14')	0	0	0
Ethylbenzene		100-41-4	1	1	76	6	0	6	DUP-08082022-01	0.0181	1.8645	7.22	WW-TP-203B (14')	2	2	0
Fluoranthene		206-44-0	85	1000	100	6	0	6	DUP-08082022-01	1.09	28.338	106	WW-TP-203B (14')	1	0	1
C1-Fluoranthenes/pyrenes		FLUORTHPYRC1	NE	NE	NE	6	0	6	DUP-08082022-01	0.584	27.452	118	WW-TP-203B (14')	0	0	0
C2-Fluoranthenes/pyrenes		FLUORTHPYRC2	NE	NE	NE	6	0	6	DUP-08082022-01	0.46	12.046	53	WW-TP-203B (14')	0	0	0
C3-Fluoranthenes/pyrenes		FLUORTHPYRC3	NE	NE	NE	6	0	6	DUP-08082022-01	0.38	6.6083	30.8	WW-TP-203B (14')	0	0	0
Fluorene		86-73-7	30	386	100	6	0	6	WW-SB-227(0-5)	0.115	5.268	20.9	WW-TP-203A-2.5	0	0	0
C1-Fluorenes		FLUORC1	NE	NE	NE	6	0	6	DUP-08082022-01	0.131	6.8487	31.2	WW-TP-203B (14')	0	0	0
C2-Fluorenes		FLUORC2	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.192	6.0932	29.3	WW-TP-203B (14')	0	0	0
C3-Fluorenes		FLUORC3	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.214	3.6347	17.4	WW-TP-203B (14')	0	0	0
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	6	0	6	DUP-08082022-01	0.531	53.562	278	WW-TP-203B (14')	6	3	4
Isopropylbenzene		98-82-8	NE	NE	NE	6	0	6	DUP-08082022-01	0.00717	0.56725	1.73	WW-TP-203B (14')	0	0	0
Methylcyclohexane		108-87-2	NE	NE	NE	6	0	6	DUP-08082022-01	0.012	1.8799	9.04	WW-TP-203B (14')	0	0	0
1-Methylnaphthalene		90-12-0	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.111	11.988	34.9	WW-TP-203B (14')	0	0	0
2-Methylnaphthalene		91-57-6	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.177	6.9162	25.7	WW-TP-203A-2.5	0	0	0
1-Methylpyrene		2381-21-7	NE	NE	NE	6	0	6	DUP-08082022-01	0.0625	3.0043	12.6	WW-TP-203B (14')	0	0	0
2-Methylpyrene		3442-78-2	NE	NE	NE	6	0	6	DUP-08082022-01	0.085	3.9577	17.3	WW-TP-203B (14')	0	0	0
Naphthalene		91-20-3	12	12	100	6	0	6	DUP-08082022-01	0.171	12.394	38	WW-TP-203A-2.5	2	2	0
C1-Naphthalenes		NAPHC1	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.191	11.394	36.6	WW-TP-203A-2.5	0	0	0
C2-Naphthalenes		NAPHC2	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.174	14.687	46.8	WW-TP-203B (14')	0	0	0
C3-Naphthalenes		NAPHC3	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.223	14.017	64.5	WW-TP-203B (14')	0	0	0
C4-Naphthalenes		NAPHC4	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.204	6.8792	33.7	WW-TP-203B (14')	0	0	0
C1-Naphthobenzothiophenes		NAPHBENTHPHC1	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.261	4.6388	20.7	WW-TP-203B (14')	0	0	0
C2-Naphthobenzothiophenes		NAPHBENTHPHC2	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.254	2.9445	12.6	WW-TP-203B (14')	0	0	0
C3-Naphthobenzothiophenes		NAPHBENTHPHC3	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.234	1.7222	6.65	WW-TP-203B (14')	0	0	0
C4-Naphthobenzothiophenes		NAPHBENTHPHC4	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.109	0.68483	2.52	WW-TP-203B (14')	0	0	0
Perylene		198-55-0	NE	NE	NE	6	0	6	DUP-08082022-01	0.164	11.268	54.6	WW-TP-203B (14')	0	0	0
Phenanthrene		85-01-8	1.1	1000	4.9	6	0	6	WW-SB-227(0-5)	0.471	31.972	118	WW-TP-203B (14')	4	0	3
C1-Phenanthrenes/anthracenes		PHENANTHC1	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.533	28.481	129	WW-TP-203B (14')	0	0	0
C2-Phenanthrenes/anthracenes		PHENANTHC2	NE	NE	NE	6	1	5	WW-SB-227(0-5)	0.596	18.507	72.7	WW-TP-203B (14')	0	0	0
C3-Phenanthrenes/anthracenes		PHENANTHC3	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.354	5.8312	27.2	WW-TP-203B (14')	0	0	0
C4-Phenanthrenes/anthracenes		PHENANTHC4	NE	NE	NE	6	0	6	WW-SB-227(0-5)	0.152	1.9257	8.97	WW-TP-203B (14')	0	0	0
n-Propylbenzene		103-65-1	5	5	100	6	0	6	DUP-08082022-01	0.0172	0.7374	2.22	WW-TP-203A-2.5	0	0	0
Pyrene		129-00-0	64	1000	100	6	0	6	DUP-08082022-01	1.05	36.863	149	WW-TP-203B (14')	1	0	1
Retene		483-65-8	NE	NE	NE	6	1	5	WW-SB-253 0-5ft	0.055	0.14708	0.368	WW-TP-203A-2.5	0	0	0
Styrene		100-42-5	NE	NE	NE	6	0	6	DUP-08082022-01	0.0336	4.9417	18.4	WW-TP-203B (14')	0	0	0
Toluene		108-88-3	0.7	0.7	100	6	2	4	WW-SB-227(0-5)	0.273	5.1208	16.7	WW-TP-203B (14')	3	3	0
1,2,3-Trimethylbenzene		526-73-8	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.021	0.90365	2.89	WW-TP-203A-2.5	0	0	0
1,2,4-Trimethylbenzene		95-63-6	5.9	5.9	100	6	0	6	WW-SB-253 0-5ft	0.0467	2.4192	6.9	WW-TP-203B (14')	2	2	0
1,3,5-Trimethylbenzene		108-67-8	3.1	3.1	100	6	0	6	WW-SB-253 0-5ft	0.0138	0.72817	2.43	WW-TP-203A-2.5	0	0	0
o-Xylene		95-47-6	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	0.0137	1.2377	5.68	WW-TP-203B (14')	0	0	0
m/p-Xylene		179601-23-1	NE	NE	NE	6	0	6	DUP-08082022-01	0.0504	3.5337	16.6	WW-TP-203B (14')	0	0	0
4-methylpyrene		3353-12-6	NE	NE	NE	6	0	6	DUP-08082022-01	0.082	3.829	16.6	WW-TP-203B (14')	0	0	0
PCB Aroclors	mg/kg															
Aroclor 1242		53469-21-9	NE	NE	NE	75	73	2	WW-SB-236 0-5ft	0.6	0.65	0.7	WW-SB-202 0.4-5ft	0	0	0
Aroclor 1248		12672-29-6	NE	NE	NE	75	72	3	WW-SS-06 (0-0.2)	0.018	0.059333	0.09	WW-SB-253 0-5ft	0	0	0
Aroclor 1254		11097-69-1	NE	NE	NE	75	48	27	WW-SS-07 (0-0.2)	0.021	0.69422	3.2	WW-SB-203 0.4-5ft	0	0	0
Aroclor 1260		11096-82-5	NE	NE	NE	75	23	52	WW-SS-07 (0-0.2)	0.017	0.1779	0.9	WW-SB-203 0.4-5ft	0	0	0
Aroclor 1268		11100-14-4	NE	NE	NE	64	57	7	WW-SS-09 (0-0.2)	0.0075	0.045471	0.12	WW-SS-04 (0-0.2)	0	0	0
Total PCB Aroclors (ND=0)		TPCB-AR_ND0	0.1	3.200	1.000	75	20	55	WW-SB-211 0.5-5	0.02	0.54166	4.1	WW-SB-203 0.4-5ft	26	2	9

DRAFT

Table 1c. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics										
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
Pesticides	mg/kg															
Aldrin		309-00-2	0.0048	0.19	0.044	75	73	2	WW-SB-208 0-5ft	0.001	0.0016	0.0022	WW-SS-04 (0-0.2)	0	0	0
beta-BHC (beta-Hexachlorocyclohexane)		319-85-7	0.021	0.09	0.18	75	73	2	WW-SS-XX-100609	0.0025	0.0031	0.0037	WW-SS-04 (0-0.2)	0	0	0
gamma-BHC (gamma-Hexachlorocyclohexane) (Lindane)		58-89-9	NE	NE	NE	75	72	3	WW-MW-11 (3-5)	0.00077	0.00209	0.0034	WW-SS-04 (0-0.2)	0	0	0
delta-BHC (delta-Hexachlorocyclohexane)		319-86-8	0.04	0.1	100	75	71	4	WW-SB-13 (4-5)	0.00089	0.00167	0.003	WW-SS-04 (0-0.2)	0	0	0
Chlordane (Technical)		12789-03-6	NE	NE	NE	57	8	49	DUP-08032022	0.0119	0.10781	0.702	WW-SB-236 0-5ft	0	0	0
alpha-chlordane		5103-71-9	0.014	4.5	0.65	75	25	50	WW-MW-203 0-5ft	0.0014	0.016578	0.134	WW-SB-236 0-5ft	22	0	0
gamma-Chlordane		5103-74-2	NE	NE	NE	75	18	57	WW-MW-203 0-5ft	0.001	0.013275	0.135	WW-SB-236 0-5ft	0	0	0
2,4-D (2,4-Dichlorophenoxyacetic acid)		94-75-7	NE	NE	NE	75	74	1	SB-240 0.5-4.5ft	0.028	0.028	0.028	SB-240 0.5-4.5ft	0	0	0
4,4'-DDT (p,p'-DDT)		50-29-3	NE	NE	NE	75	40	35	WW-SB-251 0-5	0.0015	0.017757	0.0862	SB-200 0.4-3.5ft	0	0	0
4,4'-DDE (p,p'-DDE)		72-55-9	0.0033	9.3	3.4	75	34	41	WW-SB-230 0-5	0.0013	0.0057659	0.017	WW-MW-XX (4-5)	25	0	0
4,4'-DDD (p,p-DDD)		72-54-8	0.0033	14	5	75	62	12	WW-SB-219 0-5ft	0.0029	0.013058	0.081	WW-MW-13 (2-5)	9	0	0
Dieldrin		60-57-1	0.005	0.1	0.075	75	22	53	WW-SS-05 (0-0.2)	0.0013	0.010353	0.0368	WW-SB-254 0.6-5ft	34	0	0
alpha-Endosulfan (I)		959-98-8	4.3	65	35	75	73	2	WW-SS-XX-100609	0.0068	0.00715	0.0075	WW-SS-04 (0-0.2)	0	0	0
beta-Endosulfan (II)		33213-65-9	4.3	44	35	75	59	16	DUP-08032022	0.0014	0.005825	0.0263	WW-SB-204 0-5	0	0	0
Endosulfan sulfate		1031-07-8	4.3	47	35	75	73	2	WW-SB-223 0-5	0.0028	0.00455	0.0063	SB-240 0.5-4.5ft	0	0	0
Endrin		72-20-8	0.014	0.06	5.3	75	69	4	WW-SS-04 (0-0.2)	0.0039	0.006175	0.0087	WW-SB-229 0-5	0	0	0
Endrin aldehyde		7421-93-4	NE	NE	NE	75	63	12	WW-SB-232 0-5ft	0.0034	0.011858	0.03	WW-SB-13 (4-5)	0	0	0
Endrin ketone		53494-70-5	NE	NE	NE	75	69	6	WW-SB-13 (4-5)	0.0016	0.030783	0.099	WW-MW-13 (2-5)	0	0	0
Heptachlor		76-44-8	0.013	0.38	0.53	75	61	14	WW-SB-232 0-5ft	0.001	0.0029714	0.008	WW-SB-236 0-5ft	0	0	0
Heptachlor epoxide		1024-57-3	NE	NE	NE	75	71	3	SB-239 0.5-2ft	0.003	0.0046	0.0072	WW-SS-XX-100609	0	0	0
Hexachlorobenzene		118-74-1	0.33	3.2	0.33	57	54	3	SB-238 0.4-5ft	0.0011	0.0012667	0.0014	WW-SB-203 0.4-5ft	0	0	0
Methoxychlor		72-43-5	NE	NE	NE	75	66	9	WW-SB-254 0.6-5ft	0.0053	0.012722	0.027	WW-SS-XX-100609	0	0	0
2,4,5-TP (Silvex)		93-72-1	NE	NE	NE	75	67	8	SB-237 0.5-5ft	0.001	0.002375	0.006	SB-240 0.5-4.5ft	0	0	0
Herbicides	mg/kg															
2,4-D (2,4-Dichlorophenoxyacetic acid)		94-75-7	NE	NE	NE	75	74	1	SB-240 0.5-4.5ft	0.028	0.028	0.028	SB-240 0.5-4.5ft	0	0	0
Dicamba		1918-00-9	NE	NE	NE	57	55	2	WW-SB-253 0-5ft	0.01	0.0155	0.021	WW-SB-219 0-5ft	0	0	0
Dichloroprop		120-36-5	NE	NE	NE	57	56	1	WW-SB-242 0-5	1.64	1.64	1.64	WW-SB-242 0-5	0	0	0
Mecoprop (MCPP)		93-65-2	NE	NE	NE	57	39	18	WW-SB-207 0.4-5ft	2.1	7.0011	16.1	WW-SB-220 0-5	0	0	0
Methylchlorophenoxyacetic acid		94-74-6	NE	NE	NE	57	50	7	WW-SB-208 0-5ft	1.81	3.7629	9.18	MW-204 0.4-5ft	0	0	0
2,4,5-T (2,4,5-Trichlorophenoxyacetic acid)		93-76-5	NE	NE	NE	75	73	2	WW-SB-202 0.4-5ft	0.002	0.0265	0.051	WW-SB-242 0-5	0	0	0
2,4,5-TP (Silvex)		93-72-1	NE	NE	NE	75	67	8	SB-237 0.5-5ft	0.001	0.002375	0.006	SB-240 0.5-4.5ft	0	0	0
Metals	mg/kg															
Aluminum		7429-90-5	NE	NE	NE	77	0	77	WW-MW-13 (2-5)	1250	5487.9	13700	WW-SS-09 (0-0.2)	0	0	0
Antimony		7440-36-0	NE	NE	NE	77	61	16	WW-MW-200 0-5ft	0.52	2.8969	8.73	WW-SB-229 0-5	0	0	0
Arsenic		7440-38-2	13	16	16	77	9	68	WW-SB-217 0-5	1.1	11.825	159	WW-TP-203A-2.5	17	10	10
Barium		7440-39-3	410	820	410	77	0	77	WW-SB-209 0-5ft	17.5	108.49	431	WW-SB-254 0.6-5ft	1	0	1
Beryllium		7440-41-7	4.4	47	43	77	10	67	WW-SS-07 (0-0.2)	0.15	0.36119	1.6	WW-SS-09 (0-0.2)	0	0	0
Cadmium		7440-43-9	2.5	7.5	2.5	77	46	31	WW-MW-13 (2-5)	0.41	2.1023	8.37	WW-SB-202 0.4-5ft	7	1	7
Calcium		7440-70-2	NE	NE	NE	77	3	74	WW-SB-15 (3-5)	1380	23714	70500	WW-SB-253 0-5ft	0	0	0
Chromium		7440-47-3	NE	NE	NE	77	0	77	WW-SB-13 (4-5)	4.2	21.661	193	SB-200 0.4-3.5ft	0	0	0
Cobalt		7440-48-4	NE	NE	NE	77	1	76	WW-SB-13 (4-5)	1.3	4.6622	10.9	SB-237 0.5-5ft	0	0	0
Copper		7440-50-8	50	1720	280	77	0	77	WW-SB-209 0-5ft	4.74	107.61	1010	WW-SB-203 0.4-5ft	44	0	8
Iron		7439-89-6	NE	NE	NE	77	0	77	WW-SB-235 0-5ft	5000	15265	44600	SB-200 0.4-3.5ft	0	0	0
Lead		7439-92-1	63	450	400	77	0	77	WW-MW-10 (4-5)	11.1	240.04	1030	WW-SB-254 0.6-5ft	62	11	12
Magnesium		7439-95-4	NE	NE	NE	77	0	77	WW-MW-11 (3-5)	493	6034.7	19600	WW-MW-200 0-5ft	0	0	0
Manganese		7439-96-5	1600	2000	2000	77	0	77	WW-MW-13 (2-5)	19.6	213.61	963	WW-SS-09 (0-0.2)	0	0	0
Mercury		7439-97-6	0.18	0.73	0.3	77	0	77	WW-SB-217 0-5	0.014	0.57604	2.6	WW-TP-203A-2.5	53	19	40
Nickel		7440-02-0	30	130	320	77	0	77	WW-SB-13 (4-5)	4.1	22.683	266	SB-200 0.4-3.5ft	10	1	0
Potassium		7440-09-7	NE	NE	NE	77	7	70	WW-MW-13 (2-5)	128	919.61	1750	WW-MW-201 0-5	0	0	0
Selenium		7782-49-2	3.9	4	110	77	44	22	WW-SB-218 0-5	0.46	1.155	2.01	WW-SB-204 0-5	0	0	0
Silver		7440-22-4	2	8.3	110	77	61	16	WW-MW-15 (1-4)	0.083	1.1114	4.54	WW-SB-208 0-5ft	3	0	0
Sodium		7440-23-5	NE	NE	NE	77	26	51	WW-SS-05 (0-0.2)	103	488.08	2000	WW-MW-XX (4-5)	0	0	0
Thallium		7440-28-0	NE	NE	NE	77	70	7	WW-SB-234 0-5ft	0.45	1.0629	2.2	WW-MW-15 (1-4)	0	0	0
Tin		7440-31-5	NE	NE	NE	77	51	26	WW-SS-07 (0-0.2)	3.5	22.923	107	SB-238 0.4-5ft	0	0	0
Vanadium		7440-62-2	NE	NE	NE	77	0	77	WW-MW-13 (2-5)	5	18.881	50.5	SB-237 0.5-5ft	0	0	0
Zinc		7440-66-6	109	2480	6600	77	0	77	WW-SB-15 (3-5)	6.6	357.65	2320	SB-237 0.5-5ft	54	0	0
Cyanides	mg/kg															
Free Cyanide		FREECN	NE	NE	NE	77	76	1	WW-SS-07 (0-0.2)	0.063	0.063	0.063	WW-SS-07 (0-0.2)	0	0	0
Other																
Percent Solids	%	SOLIDS	NE	NE	NE	18	0	18	WW-SS-04 (0-0.2)	72.8	83.089	94.7	WW-SS-07 (0-0.2)	0	0	0
C9-C18 Aliphatics	mg/kg	ALIPH9-18	NE	NE	NE	6	3	3	WW-SB-227(0-5)	99.6	1299.9	2320	WW-TP-203B (14')	0	0	0
C19-C36 Aliphatics	mg/kg	ALIPH19-36	NE	NE	NE	6	0	6	WW-SB-227(0-5)	109	349.17	839	WW-TP-203B (14')	0	0	0
C11-C22 Aromatics	mg/kg	AROM11-22	NE	NE	NE	6	1	5	DUP-08082022-01	117	1435.8	4210	WW-TP-203B (14')	0	0	0
C11-C22 Aromatics (Unadjusted)	mg/kg	AROM11-22UnAdj	NE	NE	NE	6	1	5	DUP-08082022-01	117	1711.6	4940	WW-TP-203B (14')	0	0	0
Total Petroleum Hydrocarbons	mg/kg	TPH	NE	NE	NE	17	0	17	WW-SB-214 0.5-5	83.7	2181.9	17200	WW-TP-203B (14')	0	0	0
TPH-Diesel Range Organics (C10-C28)	mg/kg	TPH-DRO10-28	NE	NE	NE	6	0	6	WW-SB-253 0-5ft	396	3475.5	13300	WW-TP-203B (14')	0	0	0
C9-C40	mg/kg	TEPH9-40	NE	NE	NE	6	0	6	WW-SB-227(0-5)	840	6117	24900	WW-TP-203B (14')	0	0	0

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Table 1c. Remedial Investigation Shallow Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:

Note: results/limits where cells contain qualifier only are unknown
mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAHs are calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

NA = Not Analyzed
ND = Not Detected
NE = Not Established

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Table 1d. Remedial Investigation Deep Subsurface Soils Analytical Results Summary - Parcel 2
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics										
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
BTEX	mg/kg															
Benzene		71-43-2	0.06	0.06	3.7	31	8	23	WW-SB-11 (63-64)	0.0029	109.6	1100	WW-SB-23 (31-33)	18	18	9
Ethylbenzene		100-41-4	1	1	76	31	11	20	WW-MW-05 (63-64)	0.002	83.306	470	WW-MW-08 (7.5-8.5)	13	13	5
Toluene		108-88-3	0.7	0.7	100	31	11	20	WW-SB-38(96.5-97)	0.00019	221.31	1800	WW-SB-23 (31-33)	13	13	6
Total Xylene		1330-20-7	0.26	1.2	100	31	9	22	WW-SB-XX (95-96)	0.00069	242.13	1700	WW-SB-23 (31-33)	13	13	7
Total BTEX (ND=0)		TBTEX_ND0	NE	NE	NE	31	4	27	WW-SB-38(96.5-97)	0.00019	516.29	4800	WW-SB-23 (31-33)	0	0	0
Other VOCs	mg/kg															
Acetone		67-64-1	0.03	0.03	100	31	25	6	WW-SB-XX (95-96)	0.005	0.0327	0.049	WW-MW-XX (0-2)	4	4	0
Carbon disulfide		75-15-0	NE	NE	NE	31	29	2	WW-MW-04 (5-10)	0.0012	0.7506	1.5	WW-MW-04 (31-33)	0	0	0
Chloroform (Trichloromethane)		67-66-3	0.37	0.37	24	31	29	2	WW-SB-40 (95-95.5)	0.0016	0.00165	0.0017	WW-SB-XX (95-96)	0	0	0
cis-1,2-Dichloroethene		156-59-2	0.19	0.19	41	31	30	1	WW-MW-04 (5-10)	0.0015	0.0015	0.0015	WW-MW-04 (5-10)	0	0	0
Methylene chloride		75-09-2	0.05	0.05	81	31	29	2	WW-SB-41 (96-97)	0.0022	0.00265	0.0031	WW-SB-42 (96.5-97)	0	0	0
Styrene		100-42-5	NE	NE	NE	31	17	14	WW-SB-24 (53-55)	0.00019	198.51	1100	WW-SB-23 (31-33)	0	0	0
Trichloroethene (TCE)		79-01-6	0.47	0.47	6.4	31	30	1	WW-MW-04 (5-10)	0.0053	0.0053	0.0053	WW-MW-04 (5-10)	0	0	0
Total VOCs (ND=0)		TVOC_ND0	NE	NE	NE	31	2	29	WW-SB-38(96.5-97)	0.00019	576.58	5900	WW-SB-23 (31-33)	0	0	0
PAH17	mg/kg															
Acenaphthene		83-32-9	20	98	100	31	14	17	WW-MW-07 (59-60)	0.028	58.931	400	WW-SB-23 (31-33)	8	2	2
Acenaphthylene		208-96-8	100	365	100	31	14	17	WW-MW-17 (54-55)	0.033	306.42	3200	WW-SB-23 (31-33)	6	4	6
Anthracene		120-12-7	100	1000	100	31	15	16	WW-MW-07 (59-60)	0.051	130.75	1300	WW-SB-23 (31-33)	5	1	5
Benzo(a)anthracene		56-55-3	1	1	1.4	31	15	16	WW-MW-07 (59-60)	0.04	71.766	710	WW-SB-23 (31-33)	11	11	11
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	31	16	15	WW-MW-06 (58-60)	0.016	42.556	430	WW-SB-23 (31-33)	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	31	22	9	WW-MW-04 (5-10)	0.046	21.078	140	WW-SB-23 (31-33)	7	5	5
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	31	17	14	WW-MW-04 (5-10)	0.3	65.84	620	WW-SB-23 (31-33)	10	0	8
Benzo(a)pyrene		50-32-8	1	22	1	31	14	17	WW-MW-07 (59-60)	0.03	50.643	530	WW-SB-23 (31-33)	11	7	11
Chrysene		218-01-9	1	1	4.9	31	15	16	WW-MW-07 (59-60)	0.028	69.787	700	WW-SB-23 (31-33)	11	11	10
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	31	28	3	WW-MW-04 (5-10)	0.19	10.697	29	WW-MW-17 (7-8)	2	0	2
Fluoranthene		206-44-0	85	1000	100	31	14	17	WW-MW-17 (54-55)	0.032	136.25	1600	WW-SB-23 (31-33)	5	1	4
Fluorene		86-73-7	30	386	100	31	15	16	WW-MW-04 (5-10)	0.042	196.49	2000	WW-SB-23 (31-33)	8	1	7
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	31	20	11	WW-MW-08 (40-45)	0.28	27.839	110	WW-MW-08 (7.5-8.5)	9	6	7
2-Methylnaphthalene		91-57-6	NE	NE	NE	31	9	22	WW-MW-XX (0-2)	0.014	648.7	7800	WW-SB-23 (31-33)	0	0	0
Naphthalene		91-20-3	12	12	100	31	9	22	WW-MW-XX (0-2)	0.038	1473	17000	WW-SB-23 (31-33)	13	13	10
Phenanthrene		85-01-8	1.1	1000	4.9	31	11	20	WW-SB-40 (95-95.5)	0.019	384.03	4800	WW-SB-23 (31-33)	12	1	12
Pyrene		129-00-0	64	1000	100	31	14	17	WW-MW-17 (54-55)	0.03	166.28	1700	WW-SB-23 (31-33)	7	1	7
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	NE	31	7	24	WW-SB-40 (95-95.5)	0.019	3173.4	42930	WW-SB-23 (31-33)	0	0	0
PAH17 Other SVOCs	mg/kg															
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	31	23	8	WW-MW-05 (63-64)	0.031	0.1855	0.73	WW-MW-17 (54-55)	0	0	0
Carbazole		86-74-8	NE	NE	NE	31	30	1	WW-SB-23 (62-63)	0.77	0.77	0.77	WW-SB-23 (62-63)	0	0	0
Dibenzofuran		132-64-9	2.1	110	18	31	21	10	WW-SB-42 (62-62.5)	1.1	53.77	400	WW-SB-23 (31-33)	9	1	4
2,4-Dimethylphenol		105-67-9	NE	NE	NE	31	30	1	WW-SB-10 (51-52)	0.75	0.75	0.75	WW-SB-10 (51-52)	0	0	0
2-Methylphenol (o-Cresol)		95-48-7	0.33	0.33	100	31	30	1	WW-SB-10 (51-52)	0.55	0.55	0.55	WW-SB-10 (51-52)	1	1	0
4-Methylphenol (p-Cresol)		106-44-5	0.33	0.33	100	31	30	1	WW-SB-10 (51-52)	0.52	0.52	0.52	WW-SB-10 (51-52)	1	1	0
Phenol		108-95-2	0.33	0.33	100	31	29	2	WW-SB-11 (50-51)	0.1	0.165	0.23	WW-SB-24 (53-55)	0	0	0
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	NE	31	4	27	WW-SB-40 (95-95.5)	0.019	2840.9	43330	WW-SB-23 (31-33)	0	0	0
Alkylated PAHs	mg/kg															
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	31	22	9	WW-MW-04 (5-10)	0.046	21.078	140	WW-SB-23 (31-33)	7	5	5
Chrysene		218-01-9	1	1	4.9	31	15	16	WW-MW-07 (59-60)	0.028	69.787	700	WW-SB-23 (31-33)	11	11	10
PCB Aroclors	mg/kg															
Aroclor 1260		11096-82-5	NE	NE	NE	1	0	1	WW-MW-04 (5-10)	0.012	0.012	0.012	WW-MW-04 (5-10)	0	0	0
Total PCB Aroclors (ND=0)		TPCB-AR_ND0	0.1	3.200	1.000	1	0	1	WW-MW-04 (5-10)	0.012	0.012	0.012	WW-MW-04 (5-10)	0	0	0
Pesticides	mg/kg															
delta-BHC (delta-Hexachlorocyclohexane)		319-86-8	0.04	0.1	100	1	0	1	WW-MW-04 (5-10)	0.00082	0.00082	0.00082	WW-MW-04 (5-10)	0	0	0
4,4'-DDT (p,p'-DDT)		50-29-3	NE	NE	NE	1	0	1	WW-MW-04 (5-10)	0.0071	0.0071	0.0071	WW-MW-04 (5-10)	0	0	0
Dieldrin		60-57-1	0.005	0.1	0.075	1	0	1	WW-MW-04 (5-10)	0.0021	0.0021	0.0021	WW-MW-04 (5-10)	0	0	0

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Table 1d. Remedial Investigation Deep Subsurface Soils Analytical Results Summary - Parcel 2
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics										
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
Herbicides	mg/kg															
No Detects																
Metals	mg/kg															
Aluminum		7429-90-5	NE	NE	NE	31	0	31	WW-SB-38(96.5-97)	845	6228.7	29700	WW-SB-40 (95-95.5)	0	0	0
Arsenic		7440-38-2	13	16	16	31	20	11	WW-MW-06 (50-52)	1.7	4.0909	14.3	WW-MW-XX (0-2)	1	0	0
Barium		7440-39-3	410	820	410	31	0	31	WW-SB-38(96.5-97)	11.3	73.387	531	WW-SB-40 (95-95.5)	2	0	2
Beryllium		7440-41-7	4.4	47	43	31	0	31	WW-SB-23 (31-33)	0.17	0.66548	1.8	WW-MW-XX (0-2)	0	0	0
Cadmium		7440-43-9	2.5	7.5	2.5	31	30	1	WW-SB-42 (96.5-97)	0.49	0.49	0.49	WW-SB-42 (96.5-97)	0	0	0
Calcium		7440-70-2	NE	NE	NE	31	10	21	WW-SB-38(96.5-97)	268	4911.8	63700	WW-MW-04 (5-10)	0	0	0
Chromium		7440-47-3	NE	NE	NE	31	0	31	WW-SB-38(96.5-97)	4.8	14.919	74	WW-SB-41 (96-97)	0	0	0
Cobalt		7440-48-4	NE	NE	NE	31	0	31	WW-SB-42 (62-62.5)	1.2	20.723	185	WW-SB-42 (96.5-97)	0	0	0
Copper		7440-50-8	50	1720	280	31	0	31	WW-SB-42 (62-62.5)	5.8	31.261	264	WW-SB-42 (96.5-97)	6	0	0
Iron		7439-89-6	NE	NE	NE	31	0	31	WW-SB-37(96-97)	439	28598	247000	WW-SB-42 (62-62.5)	0	0	0
Lead		7439-92-1	63	450	400	31	10	21	WW-SB-XX (95-96)	1.5	37.838	548	WW-MW-17 (7-8)	2	1	1
Magnesium		7439-95-4	NE	NE	NE	31	3	28	WW-SB-37(96-97)	62.9	2678.3	10600	WW-SB-40 (95-95.5)	0	0	0
Manganese		7439-96-5	1600	2000	2000	31	0	31	WW-SB-37(96-97)	4.1	411.55	4820	WW-SB-42 (62-62.5)	1	1	1
Mercury		7439-97-6	0.18	0.73	0.3	31	19	12	WW-SB-09 (53-54)	0.0068	0.12157	1.2	WW-MW-17 (7-8)	1	1	1
Nickel		7440-02-0	30	130	320	31	1	30	WW-SB-42 (62-62.5)	4.3	26.053	231	WW-SB-42 (96.5-97)	4	2	0
Potassium		7440-09-7	NE	NE	NE	31	3	28	WW-SB-38(96.5-97)	32.4	1816.4	13400	WW-SB-40 (95-95.5)	0	0	0
Silver		7440-22-4	2	8.3	110	31	26	5	WW-SB-24 (38-40)	0.12	0.186	0.3	WW-SB-23 (62-63)	0	0	0
Sodium		7440-23-5	NE	NE	NE	31	16	15	WW-SB-42 (96.5-97)	46.3	333.84	1110	WW-SB-39(96-97)	0	0	0
Thallium		7440-28-0	NE	NE	NE	31	28	3	WW-MW-06 (58-60)	1.1	1.5333	1.8	WW-SB-42 (96.5-97)	0	0	0
Tin		7440-31-5	NE	NE	NE	31	29	2	WW-SB-41 (96-97)	5.5	15.15	24.8	WW-MW-04 (5-10)	0	0	0
Vanadium		7440-62-2	NE	NE	NE	31	0	31	WW-SB-37(96-97)	3.5	27.868	94.8	WW-SB-40 (95-95.5)	0	0	0
Zinc		7440-66-6	109	2480	6600	31	1	30	WW-SB-38(96.5-97)	6.8	86.153	1020	WW-MW-04 (5-10)	4	0	0
Cyanides	mg/kg															
No Detects																
Other																
Percent Solids	%	SOLIDS	NE	NE	NE	1	0	1	WW-MW-04 (5-10)	82.7	82.7	82.7	WW-MW-04 (5-10)	0	0	0

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Table 1d. Remedial Investigation Deep Subsurface Soils Analytical Results Summary - Parcel 2
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:
Note: results/limits where cells contain qualifier only are unknown
mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAHs are calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

NA = Not Analyzed
ND = Not Detected
NE = Not Established

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Table 1e. Remedial Investigation Deep Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics													
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Nondetect**	**Average Nondetect**	**Maximum Nondetect**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
BTEX	mg/kg																		
Benzene		71-43-2	0.06	0.06	3.7	170	68	102	0.00089	0.2142	12	WW-SB-234 25-30	0.0008	21.049	1140	WW-SB-231 20-25ft	57	57	26
Toluene		108-88-3	0.7	0.7	100	170	105	65	0.00089	2.7435	155	WW-MW-207D (60-62')	0.00036	38.512	1720	WW-SB-231 20-25ft	21	21	3
Ethylbenzene		100-41-4	1	1	76	170	85	85	0.00089	0.03128	2.4	WW-SB-215 5-10	0.0008	84.255	1440	WW-SB-231 20-25ft	47	47	18
o-Xylene		95-47-6	NE	NE	NE	157	85	72	0.00089	0.0056281	0.263	WW-SB-215 5-10	0.001	40.933	990	WW-SB-231 20-25ft	0	0	0
m/p-Xylene		179601-23-1	NE	NE	NE	157	87	70	0.00089	0.015991	0.526	WW-SB-215 5-10	0.0014	78.166	2220	WW-SB-231 20-25ft	0	0	0
Total Xylene		1330-20-7	0.26	1.2	100	13	11	2	0.0056	3.7805	12	WW-MW-15 (12-13)	0.0085	36.004	72	WW-MW-XX (6-9)	1	1	0
Total BTEX (ND=0)		TBTEX_ND0	NE	NE	NE	168	61	107	-	-	-	WW-MW-207D (60-62')	0.00036	189.75	7510	WW-SB-231 20-25ft	0	0	0
Other VOCs	mg/kg																		
Acetone		67-64-1	0.03	0.03	100	170	125	44	0.0053	68.751	3880	WW-MW-200 33-35ft	0.0039	0.03947	0.18	WW-SB-219 5-10	16	16	0
n-Butylbenzene		104-51-8	18	18	100	140	83	57	0.0015	0.2508	20.1	WW-SB-253 25-30	0.0008	8.5262	80.6	WW-SB-230 15-20	8	8	0
sec-Butylbenzene		135-98-8	25	25	100	140	89	51	0.0015	3.6903	155	WW-SB-214 5-10	0.0007	2.5239	24.3	WW-SB-223 16-20	0	0	0
tert-Butylbenzene		98-06-6	11	11	100	140	107	33	0.0015	3.121	155	DUP-08112022	0.0014	0.49073	4.5	WW-SB-223 16-20	0	0	0
Carbon disulfide		75-15-0	NE	NE	NE	170	125	45	0.00089	3.0832	155	WW-MW-205D (38-40')	0.00039	0.060886	1.81	WW-SB-216 20-25	0	0	0
Chlorobenzene		108-90-7	4.5	4.5	100	170	169	1	0.00089	2.2993	155	WW-SB-204 7-9	0.0233	0.0233	0.0233	WW-SB-204 7-9	0	0	0
Chloroform (Trichloromethane)		67-66-3	0.37	0.37	24	170	163	7	0.00089	2.3838	155	WW-SB-253 25-30	0.0009	0.002	0.0052	WW-SB-215 5-10	0	0	0
Cyclohexane		110-82-7	NE	NE	NE	157	96	61	0.00089	0.3437	18.7	WW-SB-213 5-10	0.0006	17.493	660	WW-SB-230 15-20	0	0	0
p-Cymene (4-Isopropyltoluene)		99-87-6	NE	NE	NE	140	76	64	0.0015	0.27246	20.1	WW-SB-210 7-10	0.001	6.2412	71.3	WW-SB-230 15-20	0	0	0
1,2-Dichlorobenzene (o-DCB)		95-50-1	1.1	1.1	100	157	156	1	0.00089	2.1722	155	WW-SB-204 7-9	0.0402	0.0402	0.0402	WW-SB-204 7-9	0	0	0
1,4-Dichlorobenzene (p-DCB)		106-46-7	1.8	1.8	24	157	156	1	0.00089	2.1722	155	WW-SB-204 7-9	0.0104	0.0104	0.0104	WW-SB-204 7-9	0	0	0
cis-1,2-Dichloroethene		156-59-2	0.19	0.19	41	170	159	11	0.00089	2.4437	155	WW-MW-200 33-35ft	0.0012	0.0053273	0.0145	WW-SB-206 28-30ft	0	0	0
trans-1,2-Dichloroethene		156-60-5	0.19	0.19	100	170	169	1	0.00089	2.2993	155	WW-SB-204 7-9	0.0014	0.0014	0.0014	WW-SB-204 7-9	0	0	0
Isopropylbenzene		98-82-8	NE	NE	NE	157	81	76	0.00089	0.0025381	0.0087	WW-SB-226 35-40ft	0.0009	11.41	146	WW-SB-230 15-20	0	0	0
Methyl acetate		79-20-9	NE	NE	NE	157	143	14	0.0015	23.468	1550	DUP-08112022	0.0119	1.3208	5.63	WW-SB-216 20-25	0	0	0
Methyl ethyl ketone (2-Butanone)		78-93-3	0.1	0.1	100	170	152	18	0.0045	56.031	3880	WW-MW-206D(40-42)	0.0029	12.785	230	WW-MW-XX (6-9)	1	1	1
4-Methyl-2-pentanone (MIBK)		108-10-1	NE	NE	NE	170	169	1	0.0045	20.311	1550	WW-MW-14 (36-37)	7	7	7	WW-MW-14 (36-37)	0	0	0
Methylcyclohexane		108-87-2	NE	NE	NE	157	89	68	0.00089	0.2205	18.7	WW-SB-234 20-25	0.0006	40.785	1610	WW-SB-230 15-20	0	0	0
Methylene chloride		75-09-2	0.05	0.05	81	170	157	13	0.0018	10.428	775	WW-SB-241 39-40ft	0.0013	1.0296	9.53	WW-SB-225 20-25ft	8	8	0
Naphthalene		91-20-3	12	12	100	140	37	103	0.0016	0.0029081	0.0087	WW-SB-214 30-35	0.0005	932.84	24600	WW-SB-231 20-25ft	40	40	31
n-Propylbenzene		103-65-1	5	5	100	140	70	70	0.0016	0.55704	20.1	WW-SB-213 5-10	0.0005	8.3977	133	WW-SB-230 15-20	27	27	1
Styrene		100-42-5	NE	NE	NE	170	138	32	0.00089	2.1575	155	WW-SB-213 5-10	0.0006	25.528	737	WW-SB-231 20-25ft	0	0	0
Tetrachloroethene (PCE)		127-18-4	1.3	1.3	18	170	169	1	0.00089	2.2656	155	WW-MW-14 (36-37)	0.95	0.95	0.95	WW-MW-14 (36-37)	0	0	0
Tetrahydrofuran		109-99-9	NE	NE	NE	98	97	1	0.0015	0.0029629	0.0087	WW-SB-213 35-40	0.0009	0.0009	0.0009	WW-SB-213 35-40	0	0	0
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	157	156	1	0.00089	2.1722	155	WW-SB-251 6-9	0.0148	0.0148	0.0148	WW-SB-251 6-9	0	0	0
1,1,2-Trichloroethane		79-00-5	NE	NE	NE	170	169	1	0.00089	2.2985	155	WW-SB-252 10-15	0.214	0.214	0.214	WW-SB-252 10-15	0	0	0
Trichloroethene (TCE)		79-01-6	0.47	0.47	6.4	170	169	1	0.00089	2.2993	155	WW-SB-204 7-9	0.0015	0.0015	0.0015	WW-SB-204 7-9	0	0	0
1,2,4-Trimethylbenzene		95-63-6	5.9	5.9	100	140	63	77	0.0016	0.0028175	0.0087	WW-SB-217 5-10	0.0012	61.297	868	WW-SB-230 15-20	32	32	12
1,3,5-Trimethylbenzene		108-67-8	3.1	3.1	100	140	73	67	0.0016	0.0082959	0.403	WW-SB-213 5-10	0.0005	21.785	292	WW-SB-231 20-25ft	27	27	3
Vinyl chloride		75-01-4	0.03	0.03	0.48	170	169	1	0.00089	2.301	155	WW-SB-204 7-9	0.0036	0.0036	0.0036	WW-SB-204 7-9	0	0	0
Total VOCs (ND=0)		TVOC_ND0	NE	NE	NE	168	24	144	-	-	-	WW-MW-201D (43-45')	0.00049	902.65	34339	WW-SB-231 20-25ft	0	0	0
PAH17	mg/kg																		
Acenaphthene		83-32-9	20	98	100	170	58	112	0.197	0.36117	1.07	WW-SB-218 35-40	0.0199	87.599	1260	WW-SB-220 5-10	49	26	26
Acenaphthylene		208-96-8	100	365	100	170	60	110	0.191	2.8453	150	WW-MW-202 (40-42')	0.014	48.562	1910	WW-SB-225 20-25ft	7	3	7
Anthracene		120-12-7	100	1000	100	170	64	106	0.191	0.34369	1.07	WW-MW-203D(68-70')	0.012	77.442	1720	WW-SB-225 20-25ft	17	1	17
Benzo(a)anthracene		56-55-3	1	1	1.4	170	64	106	0.033	0.26345	1.07	DUP-08082022-02	0.0238	62.041	1340	WW-SB-225 20-25ft	86	86	84
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	170	68	102	0.034	0.26941	1.07	WW-MW-204D (40-42)	0.03	39.189	703	WW-SB-225 20-25ft	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	170	69	101	0.034	0.26978	1.07	WW-MW-204D (40-42)	0.012	27.398	672	WW-SB-225 20-25ft	84	75	57
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	170	72	98	0.191	3.8527	150	WW-SB-228 40-45	0.0262	23.237	465	WW-SB-225 20-25ft	82	0	57
Benzo(a)pyrene		50-32-8	1	22	1	170	64	106	0.034	0.21613	0.537	WW-MW-204D (40-42)	0.025	56.562	1070	WW-SB-225 20-25ft	86	46	86
Chrysene		218-01-9	1	1	4.9	170	64	106	0.186	0.28775	0.537	WW-MW-200D(40-42)	0.016	54.199	1110	WW-SB-225 20-25ft	86	86	66
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	170	81	89	0.034	4.3565	150	WW-MW-200D(40-42)	0.028	8.8146	172	WW-SB-225 20-25ft	75	0	75
Fluoranthene		206-44-0	85	1000	100	170	60	110	0.191	0.34167	1.07	WW-MW-202 (40-42')	0.021	112.13	2850	WW-SB-225 20-25ft	20	4	19
Fluorene		86-73-7	30	386	100	170	67	103	0.191	0.36576	1.14	WW-SB-220 35-40	0.0187	86.121	1750	WW-SB-225 20-25ft	35	7	19
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	170	71	99	0.034	2.9065	150	WW-MW-203D(68-70')	0.029	28.929	622	WW-SB-225 20-25ft	88	54	78
2-Methylnaphthalene		91-57-6	NE	NE	NE	170	57	113	0.195	0.4933	6.7	WW-MW-202 50-52	0.0201	210.36	3320	WW-SB-225 20-25ft	0	0	0
Naphthalene		91-20-3	12	12	100	170	42	128	0.197	0.37919	1.14	WW-SB-222 48-50	0.0204	470.87	10900	WW-SB-225 20-25ft	52	52	34
Phenanthrene		85-01-8	1.1	1000	4.9	170	52	118	0.191	0.35381	1.07	DUP-07282022	0.0183	223.74	5030	WW-SB-225 20-25ft	83	7	70
Pyrene		129-00-0	64	1000	100	170	56	114	0.191	0.34616	1.07	DUP-01	0.0095	120.59	2450	WW-SB-225 20-25ft	36	4	25
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	NE	169	30	139	-	-	-	DUP-01	0.0095	1437.2	36451	WW-SB-225 20-25ft	0	0	0
2.332 MAEPH	mg/kg																		
C-10		C-10	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	1.7	17.987	95.9	WW-SB-224 15-20	0	0	0
C-11		C-11	NE	NE	NE	14	8	6	0.568	1.6735	5	WW-SB-210(5-10')	0.858	3.7963	7.76	WW-SB-212 10-15	0	0	0
C-12		C-12	NE	NE	NE	14	5	9	0.781	2.2422	5	WW-SB-204(5-10')	1.54	26.943	144	WW-SB-224 15-20	0	0	0
C-13		C-13	NE	NE	NE	14	5	9	0.781	2.2422	5	WW-SB-204(5-10')	0.58	5.4037	13.6	WW-SB-253 10-15	0	0	0
C-14		C-14	NE	NE	NE	14	5	9	0.781	2.2422	5	WW-SB-204(5-10')	0.812	9.3469	23.7	WW-SB-253 10-15	0	0	0
C-15		C-15	NE	NE	NE	14	8	6	0.622	1.7044	5	WW-SB-210 10-15	0.647	5.3262	21.7	WW-SB-253 10-15	0	0	0
C-16		C-16	NE	NE	NE	14	10	4	0.622	1.5947	5	WW-SB-210 10-15	0.72	7.2925	24.8	WW-SB-253 10-15	0	0	0
C-17		C-17	NE	NE	NE	14	9	5	0.622	1.5908	5	WW-SB-210 10-15	1.71	6.808	23.2	WW-SB-253 10-15	0	0	0
C-18		C-18	NE	NE	NE	14	10	4	0.622	1.5947	5	WW-SB-210 10-15	1.41	6.5275	19.4	WW-SB-253 10-15	0	0	0
C-19		C-19	NE	NE	NE	14	10	4	0.622	1.5947	5	WW-SB-210 10-15	1.71	6.6975	18.8	WW-SB-253 10-15	0	0	0
C-20		C-20	NE	NE	NE	14	9	5	0.622	1.6751	5	WW-SB-210 10-15	1.75	6.586	17.2	WW-SB-253 10-15	0	0	0
C-21		C-21	NE	NE	NE	14	10	4	0.622	1.5947	5	WW-SB-210 10-15	1.91	5.9025	12.7	WW-SB-253 10-15	0	0	0
C-22		C-22	NE	NE	NE	14	11	3	0.568	1.5014	5	WW-SB-224 5-10	0.897	3.3557	7.86	WW-SB-253 10-15	0	0	0
C-23		C-23	NE	NE	NE	14	7	7	0.622	1.7879	5	WW-SB-210 10-15	4.38	8.8286	12.4	WW-SB-251 6-9	0	0	0
C-24		C-24	NE	NE	NE	14	9	5	0.622	1.6751	5	WW-SB-210 10-15	1.53	3.35	6.17	WW-SB-253 10-15	0	0	0

Table 1e. Remedial Investigation Deep Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics													
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Nondetect**	**Average Nondetect**	**Maximum Nondetect**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
C-25		C-25	NE	NE	NE	14	8	6	0.622	1.6808	5	WW-SB-210 10-15	1.52	3.725	6.07	WW-SB-224 15-20	0	0	0
C-26		C-26	NE	NE	NE	14	11	3	0.568	1.5014	5	DUP-08112022	0.952	1.3373	1.75	WW-SB-253 10-15	0	0	0
C-27		C-27	NE	NE	NE	14	7	7	0.622	1.7879	5	WW-SB-253 10-15	2.39	6.6371	13.2	WW-SB-224 15-20	0	0	0
C-28		C-28	NE	NE	NE	14	10	4	0.568	1.4885	5	DUP-08112022	1.06	2.015	3.88	WW-SB-224 15-20	0	0	0
C-29		C-29	NE	NE	NE	14	12	2	0.568	1.4328	5	WW-SB-253 10-15	0.981	7.8405	14.7	WW-SB-224 5-10	0	0	0
C-30		C-30	NE	NE	NE	14	12	2	0.568	1.4328	5	WW-SB-253 10-15	0.971	3.9655	6.96	WW-SB-224 5-10	0	0	0
C-31		C-31	NE	NE	NE	14	11	3	0.568	1.4148	5	WW-SB-253 10-15	1.04	4.3067	6.56	WW-SB-224 5-10	0	0	0
C-32		C-32	NE	NE	NE	14	13	1	0.568	1.4579	5	WW-SB-224 5-10	3.52	3.52	3.52	WW-SB-224 5-10	0	0	0
C-34		C-34	NE	NE	NE	14	13	1	0.539	1.374	5	WW-SB-224 15-20	12.5	12.5	12.5	WW-SB-224 15-20	0	0	0
C-35		C-35	NE	NE	NE	14	11	3	0.539	1.5795	5	WW-SB-210 10-15	1.67	2.84	4.33	WW-SB-210(5-10')	0	0	0
C-36		C-36	NE	NE	NE	14	13	1	0.539	1.4557	5	WW-SB-210 10-15	0.433	0.433	0.433	WW-SB-210 10-15	0	0	0
C-37		C-37	NE	NE	NE	14	11	3	0.539	1.5795	5	WW-SB-210 10-15	3.1	5.6433	8.2	WW-SB-210(5-10')	0	0	0
C-38		C-38	NE	NE	NE	14	11	3	0.539	1.5795	5	WW-SB-210 10-15	2.26	6.72	10.7	WW-SB-210(5-10')	0	0	0
C-39		C-39	NE	NE	NE	14	13	1	0.539	1.4557	5	WW-SB-210 10-15	0.559	0.559	0.559	WW-SB-210 10-15	0	0	0
C-40		C-40	NE	NE	NE	14	13	1	0.539	1.4557	5	WW-SB-210 10-15	0.516	0.516	0.516	WW-SB-210 10-15	0	0	0
C-8		C-8	NE	NE	NE	14	3	11	0.568	1.002	1.76	WW-SB-204(5-10')	0.366	11.176	59.6	WW-SB-224 15-20	0	0	0
C-9		C-9	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.83	5.1414	22.7	WW-SB-224 15-20	0	0	0
PAH17 Other SVOCs	mg/kg																		
Acetophenone		98-86-2	NE	NE	NE	157	139	18	0.191	0.93015	6.65	WW-SB-223 7-10	0.0244	0.33318	1.83	WW-SB-224 5-10	0	0	0
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	NE	157	91	66	0.0191	0.20483	1.14	WW-MW-204 30-32	0.0145	32.889	497	WW-SB-225 20-25ft	0	0	0
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	170	156	14	0.191	3.5201	150	WW-SB-213 5-10	0.0492	0.52231	3.05	DUP-08112022	0	0	0
Butyl benzyl phthalate		85-68-7	NE	NE	NE	170	162	8	0.191	3.3473	150	WW-SB-223 7-10	0.0446	3.8781	17.1	WW-MW-202 20-22	0	0	0
Caprolactam		105-60-2	NE	NE	NE	157	145	12	0.191	0.74745	5.75	WW-SB-225 5-10ft	0.0688	3.3181	15	WW-MW-205 10-15	0	0	0
Carbazole		86-74-8	NE	NE	NE	170	86	84	0.191	1.842	66	WW-MW-204 30-32	0.0167	18.287	629	WW-SB-225 20-25ft	0	0	0
2-Chloronaphthalene		91-58-7	NE	NE	NE	170	168	2	0.191	3.2909	150	WW-SB-205 10-12	0.0169	0.41395	0.811	WW-SB-213 20-25	0	0	0
Dibenzofuran		132-64-9	2.1	110	18	170	76	94	0.191	0.38393	2.25	WW-MW-202 (40-42')	0.02	35.922	1130	WW-SB-225 20-25ft	50	7	17
Diethyl phthalate		84-66-2	NE	NE	NE	170	169	1	0.191	3.2752	150	WW-SB-207 7-10	0.0968	0.0968	0.0968	WW-SB-207 7-10	0	0	0
Dimethyl phthalate		131-11-3	NE	NE	NE	170	169	1	0.191	3.274	150	WW-MW-204D (40-42)	0.21	0.21	0.21	WW-MW-204D (40-42)	0	0	0
2,4-Dimethylphenol		105-67-9	NE	NE	NE	170	156	13	0.191	3.406	150	WW-SB-229 5-10ft	0.0358	10.081	64.6	WW-SB-225 20-25ft	0	0	0
Di-n-butyl phthalate		84-74-2	NE	NE	NE	170	161	9	0.191	3.4204	150	WW-MW-205D (38-40')	0.015	0.10691	0.344	WW-SB-207 7-10	0	0	0
2,6-Dinitrotoluene		606-20-2	NE	NE	NE	170	169	1	0.068	3.2389	150	WW-TP-200C-10	0.647	0.647	0.647	WW-TP-200C-10	0	0	0
Di-n-octyl phthalate		117-84-0	NE	NE	NE	170	167	3	0.29	3.8902	150	WW-SB-235 5-10	0.0488	0.12527	0.172	DUP-08112022	0	0	0
2-Methylnaphthalene		91-57-6	NE	NE	NE	157	55	102	0.195	0.3836	1.2	WW-MW-202 50-52	0.0201	208.31	3320	WW-SB-225 20-25ft	0	0	0
2-Methylphenol (o-Cresol)		95-48-7	0.33	0.33	100	170	153	16	0.191	3.453	150	WW-SB-225 5-10ft	0.022	2.6476	26.7	WW-SB-225 20-25ft	6	6	0
3,4-Methylphenol (m,p-Cresol)		108394/106445	NE	NE	NE	140	108	31	0.191	0.89499	6.65	WW-SB-225 5-10ft	0.039	3.3072	59.8	WW-SB-225 20-25ft	0	0	0
4-Methylphenol (p-Cresol)		106-44-5	0.33	0.33	100	30	29	1	0.29	14.914	150	WW-SB-16 (12-13)	1.2	1.2	1.2	WW-SB-16 (12-13)	1	1	0
Phenol		108-95-2	0.33	0.33	100	170	160	9	0.191	3.3364	150	WW-SB-230 5-8ft	0.0782	7.7544	41	WW-SB-225 20-25ft	5	5	0
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	NE	169	26	143	-	-	-	DUP-01	0.0095	1449.5	38899.1	WW-SB-225 20-25ft	0	0	0
Alkylated PAHs	mg/kg																		
Acenaphthene		83-32-9	20	98	100	14	0	14	-	-	-	WW-SB-204(5-10')	0.427	50.369	261	WW-TP-202A-10	8	2	2
Acenaphthylene		208-96-8	100	365	100	14	0	14	-	-	-	WW-SB-204(5-10')	0.816	17.026	38.7	WW-SB-251 6-9	0	0	0
Anthracene		120-12-7	100	1000	100	14	0	14	-	-	-	WW-SB-204(5-10')	1.43	39.311	137	WW-TP-202A-10	2	0	2
Benzene		71-43-2	0.06	0.06	3.7	14	1	13	0.00568	0.00568	0.00568	WW-SB-204(5-10')	0.727	7.5142	25.9	WW-SB-224 15-20	13	13	8
C1-Benzene		BENC1	NE	NE	NE	14	1	13	0.352	0.352	0.352	WW-TP-202B-12	0.42	3.6988	9.47	WW-TP-202A-10	0	0	0
C2-Benzenes		BENC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.944	10.489	35.3	WW-SB-224 15-20	0	0	0
C3-Benzenes		BENC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	1.23	19.414	86.7	WW-SB-224 15-20	0	0	0
C4-Benzenes		BENC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	1.02	42.554	178	WW-TP-202A-10	0	0	0
C5-Benzenes		BENC5	NE	NE	NE	14	1	13	0.31	0.31	0.31	WW-SB-204(5-10')	0.525	37.271	155	WW-TP-201B-10.5	0	0	0
Benzo(a)anthracene		56-55-3	1	1	1.4	14	0	14	-	-	-	WW-SB-204(5-10')	9.2	44.221	145	WW-TP-202C-10	14	14	14
Benzo(b)fluoranthene		205-99-2	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	7.73	45.752	227	WW-TP-202C-10	0	0	0
Benzo(k)fluoranthene		207-08-9	0.8	2	4.9	170	69	101	0.034	0.26978	1.07	WW-MW-204D (40-42)	0.012	27.398	672	WW-SB-225 20-25ft	84	75	57
Benzo(j,k)fluoranthene		205823/207089	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	6.14	41.11	194	WW-TP-202C-10	0	0	0
Benzo(b)fluorene		243-17-4	1	2.1	1.4	14	0	14	-	-	-	WW-SB-204(5-10')	0.638	6.8641	20.2	WW-TP-202A-10	13	11	13
Benzo(c)fluorene		205-12-9	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.255	2.713	8.25	WW-TP-202A-10	0	0	0
Naphthobenzothiophenes (Benzo(b)naphtho(2,1-d)thiophene)		239-35-0	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	1.2	6.9186	23.6	WW-TP-202B-12	0	0	0
Benzo(g,h,i)perylene		191-24-2	0.64	1000	4.9	14	0	14	-	-	-	WW-SB-210 10-15	5.56	39.588	204	WW-TP-202C-10	14	0	14
Benzo(a)pyrene		50-32-8	1	22	1	14	0	14	-	-	-	WW-SB-210 10-15	9.82	68.173	349	WW-TP-202C-10	14	11	14
Benzo(e)pyrene		192-97-2	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	5.99	36.75	178	WW-TP-202C-10	0	0	0
Benzothiophene (1-Benzothiophene)		11095-43-5	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.133	2.4185	8.56	WW-SB-224 15-20	0	0	0
C1-Benzo(b)thiophenes		BENbTHPHC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.0919	9.4761	42	WW-TP-202A-10	0	0	0
C2-Benzo(b)thiophenes		BENbTHPHC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.103	12.423	50.3	WW-TP-202A-10	0	0	0
C3-Benzo(b)thiophenes		BENbTHPHC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.0882	9.5528	28.1	WW-TP-201B-10.5	0	0	0
C4-Benzo(b)thiophenes		BENbTHPHC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.0847	4.9988	16.1	WW-TP-201B-10.5	0	0	0
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.108	2.4836	8.47	WW-SB-224 15-20	0	0	0
n-Butylbenzene		104-51-8	18	18	100	14	0	14	-	-	-	WW-SB-204(5-10')	0.0493	2.4245	7.01	WW-TP-202A-10	0	0	0
sec-Butylbenzene		135-98-8	25	25	100	14	0	14	-	-	-	WW-SB-210 10-15	0.0172	1.4363	5.19	WW-SB-224 15-20	0	0	0
tert-Butylbenzene		98-06-6	11	11	100	14	9	5	0.00568	0.03912	0.0816	WW-SB-212 10-15	0.0687	0.31214	0.798	WW-TP-202C-10	0	0	0
Chrysene		218-01-9	1	1	4.9	170	64	106	0.186	0.28775	0.537	WW-MW-200D(40-42)	0.016	54.199	1110	WW-SB-225 20-25ft	86	86	66
C1-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	6.39	29.856	88.4	WW-TP-202C-10	0	0	0
C2-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	3.26	16.413	50	WW-TP-202A-10	0	0	0
C3-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	1.34	8.3536	27.6	WW-TP-202A-10	0	0	0
C4-Chrysenes/benz(a)anthracenes		CHRYBENaANTHC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.618	4.0784	14.3	WW-TP-202A-10	0	0	0
Chrysene/triphenylene		CHRYTRIPHE	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	8.38	38.456	126	WW-TP-202C-10	0	0	0
Coronene		191-07-1	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	1.67	10.357	44.4	WW-TP-202C-10	0	0	0
p-Cymene (4-Isopropyltoluene)		99-87-6	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.0502	1.4087	7.95	WW-SB-224 15-20	0	0	0

Table 1e. Remedial Investigation Deep Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics													
Analyte	Units	CAS No.	Unrestricted SCO	Protection of GW SCO	Restricted-Residential SCO	Number of Results	Number of Nondetects	Number of Detects	Minimum Nondetect	Average Nondetect	Maximum Nondetect	Minimum Detect ID	Minimum Detect	Average Detect	Maximum Detect	Maximum Detect ID	Number of Exceedances Unrestricted SCO	Number of Exceedances Protection of GW SCO	Number of Exceedances Restricted-Residential SCO
cis-Decalin		493-01-6	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.0454	2.9193	11.8	WW-TP-201B-10.5	0	0	0
trans-Decalin		493-02-7	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.156	8.5772	31.2	WW-TP-201B-10.5	0	0	0
C1-Decalins		DECLC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.73	41.912	157	WW-TP-201B-10.5	0	0	0
C2-Decalins		DECLC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.971	47.593	189	WW-TP-201B-10.5	0	0	0
C3-Decalins		DECLC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.794	30.845	109	WW-TP-201B-10.5	0	0	0
C4-Decalins		DECLC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-224 5-10	1.6	27.613	91.2	WW-TP-201B-10.5	0	0	0
Dibenz(a,h)anthracene		53-70-3	0.33	1000	0.33	14	0	14	-	-	-	WW-SB-210 10-15	2.2	15.789	85	WW-TP-202C-10	14	0	14
Dibenzofuran		132-64-9	2.1	110	18	14	0	14	-	-	-	WW-SB-204(5-10')	0.404	7.6988	37.6	WW-TP-202B-12	10	0	1
Dibenzothiophene		132-65-0	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.458	11.648	42.6	WW-TP-202A-10	0	0	0
C1-Dibenzothiophenes		DIBENTHPHC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.903	16.622	55.8	WW-TP-202A-10	0	0	0
C2-Dibenzothiophenes		DIBENTHPHC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	1.04	15.253	45.1	WW-TP-202A-10	0	0	0
C3-Dibenzothiophenes		DIBENTHPHC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.5	8.5929	23.7	WW-TP-202A-10	0	0	0
C4-Dibenzothiophenes		DIBENTHPHC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.25	3.6299	8.73	WW-TP-202A-10	0	0	0
Ethylbenzene		100-41-4	1	1	76	14	0	14	-	-	-	WW-SB-204(5-10')	0.216	7.5987	33.5	WW-SB-224 15-20	12	12	0
Fluoranthene		206-44-0	85	1000	100	14	0	14	-	-	-	WW-SB-204(5-10')	7.21	51.608	163	WW-TP-202B-12	3	0	2
C1-Fluoranthenes/pyrenes		FLUORTHPYRC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	6.25	54.432	178	WW-TP-202A-10	0	0	0
C2-Fluoranthenes/pyrenes		FLUORTHPYRC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	4.61	23.53	72.6	WW-TP-202A-10	0	0	0
C3-Fluoranthenes/pyrenes		FLUORTHPYRC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	2.44	11.693	35	WW-TP-202A-10	0	0	0
Fluorene		86-73-7	30	386	100	14	0	14	-	-	-	WW-SB-204(5-10')	0.643	26.364	107	WW-TP-202A-10	5	0	1
C1-Fluorenes		FLUORC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.598	18.235	72.1	WW-TP-202A-10	0	0	0
C2-Fluorenes		FLUORC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	1.59	19.2	60.1	WW-TP-202A-10	0	0	0
C3-Fluorenes		FLUORC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	1.84	11.374	29.1	WW-TP-202A-10	0	0	0
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	6.6	1.4	14	0	14	-	-	-	WW-SB-210 10-15	7.35	56.146	312	WW-TP-202C-10	14	14	14
Isopropylbenzene		98-82-8	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.0564	3.3101	15.8	WW-TP-202A-10	0	0	0
Methylcyclohexane		108-87-2	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.0747	13.303	92	WW-SB-224 15-20	0	0	0
1-Methylnaphthalene		90-12-0	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.557	78.385	404	WW-TP-202A-10	0	0	0
2-Methylnaphthalene		91-57-6	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.667	55.894	475	WW-TP-202A-10	0	0	0
1-Methylpyrene		2381-21-7	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.535	5.9954	22	WW-TP-202A-10	0	0	0
2-Methylpyrene		3442-78-2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.944	7.361	23.6	WW-TP-202A-10	0	0	0
Naphthalene		91-20-3	12	12	100	14	0	14	-	-	-	WW-SB-204(5-10')	2.44	47.211	168	WW-TP-202A-10	12	12	3
C1-Naphthalenes		NAPHC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.753	81.628	538	WW-TP-202A-10	0	0	0
C2-Naphthalenes		NAPHC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.735	103.53	444	WW-TP-202A-10	0	0	0
C3-Naphthalenes		NAPHC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	1.23	69.962	212	WW-TP-202A-10	0	0	0
C4-Naphthalenes		NAPHC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	2.69	34.432	108	WW-TP-201B-10.5	0	0	0
C1-Naphthobenzothiophenes		NAPHBENTHPHC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	1.73	9.8093	28.4	WW-TP-202A-10	0	0	0
C2-Naphthobenzothiophenes		NAPHBENTHPHC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.733	6.3231	19.4	WW-TP-202A-10	0	0	0
C3-Naphthobenzothiophenes		NAPHBENTHPHC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.469	3.2421	9.46	WW-TP-202A-10	0	0	0
C4-Naphthobenzothiophenes		NAPHBENTHPHC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.119	1.0362	2.93	WW-TP-202A-10	0	0	0
Perylene		198-55-0	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	1.93	14.678	78.5	WW-TP-202C-10	0	0	0
Phenanthrene		85-01-8	1.1	1000	4.9	14	0	14	-	-	-	WW-SB-204(5-10')	3.92	92.742	364	WW-TP-202A-10	14	0	13
C1-Phenanthrenes/anthracenes		PHENANTHC1	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	2.69	66.556	258	WW-TP-202A-10	0	0	0
C2-Phenanthrenes/anthracenes		PHENANTHC2	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	3.02	36.824	120	WW-TP-202A-10	0	0	0
C3-Phenanthrenes/anthracenes		PHENANTHC3	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	2.93	15.259	45.1	WW-TP-202A-10	0	0	0
C4-Phenanthrenes/anthracenes		PHENANTHC4	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.871	5.9358	17.1	WW-TP-202B-12	0	0	0
n-Propylbenzene		103-65-1	5	5	100	14	0	14	-	-	-	WW-SB-204(5-10')	0.0715	3.5053	12.5	WW-SB-224 15-20	4	4	0
Pyrene		129-00-0	64	1000	100	14	0	14	-	-	-	WW-SB-204(5-10')	7.54	63.546	182	WW-TP-202A-10	4	0	3
Retene		483-65-8	NE	NE	NE	14	3	11	0.027	0.037033	0.05	WW-SB-210 10-15	0.275	3.7494	20.8	WW-TP-202B-12	0	0	0
Styrene		100-42-5	NE	NE	NE	14	0	14	-	-	-	WW-SB-212 10-15	0.251	4.4644	13	WW-TP-202C-10	0	0	0
Toluene		108-88-3	0.7	0.7	100	14	1	13	0.403	0.403	0.403	WW-TP-202B-12	0.48	4.2155	10.6	WW-TP-202C-10	12	12	0
1,2,3-Trimethylbenzene		526-73-8	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	0.17	4.8844	24.9	WW-SB-224 15-20	0	0	0
1,2,4-Trimethylbenzene		95-63-6	5.9	5.9	100	14	0	14	-	-	-	WW-SB-210 10-15	0.591	8.6078	64	WW-SB-224 15-20	3	3	0
1,3,5-Trimethylbenzene		108-67-8	3.1	3.1	100	14	0	14	-	-	-	WW-SB-210 10-15	0.137	2.5179	19.8	WW-TP-202A-10	2	2	0
o-Xylene		95-47-6	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.139	3.1171	14.9	WW-SB-224 15-20	0	0	0
m/p-Xylene		179601-23-1	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	0.403	6.1223	20.1	WW-TP-202C-10	0	0	0
4-methylpyrene		3353-12-6	NE	NE	NE	14	0	14	-	-	-	WW-SB-204(5-10')	0.87	6.7521	22.5	WW-TP-202A-10	0	0	0
PCB Aroclors	mg/kg																		
No Detects																			
Pesticides	mg/kg																		
Chlordane (Technical)		12789-03-6	NE	NE	NE	4	3	1	0.0377	0.068867	0.0977	WW-SB-239 5-7ft	0.0372	0.0372	0.0372	WW-SB-239 5-7ft	0	0	0
gamma-Chlordane		5103-74-2	NE	NE	NE	4	2	2	0.0031	0.0056	0.0081	WW-SB-240 15-16ft	0.0052	0.006	0.0068	WW-SB-239 5-7ft	0	0	0
4,4'-DDT (p,p'-DDT)		50-29-3	NE	NE	NE	4	3	1	0.0031	0.0057333	0.0081	WW-SB-240 15-16ft	0.0179	0.0179	0.0179	WW-SB-240 15-16ft	0	0	0
4,4'-DDE (p,p'-DDE)		72-55-9	0.0033	9.3	3.4	4	3	1	0.0031	0.0057	0.0081	WW-SB-239 5-7ft	0.0055	0.0055	0.0055	WW-SB-239 5-7ft	1	0	0
Endosulfan sulfate		1031-07-8	4.3	47	35	4	3	1	0.0031	0.0057	0.0081	WW-SB-239 5-7ft	0.0062	0.0062	0.0062	WW-SB-239 5-7ft	0	0	0
Endrin		72-20-8	0.014	0.06	5.3	4	3	1	0.0031	0.0057	0.0081	WW-SB-239 5-7ft	0.018	0.018	0.018	WW-SB-239 5-7ft	1	0	0
Endrin ketone		53494-70-5	NE	NE	NE	4	3	1	0.0031	0.0057333	0.0081	WW-SB-240 15-16ft	0.0087	0.0087	0.0087	WW-SB-240 15-16ft	0	0	0
2,4,5-TP (Silvex)		93-72-1	NE	NE	NE	4	2	2	0.011	0.0195	0.028	WW-SB-239 5-7ft	0.001	0.0015	0.002	WW-SB-240 15-16ft	0	0	0

Table 1e. Remedial Investigation Deep Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

						Summary Statistics													
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Protection of GW SCO**	**Restricted-Residential SCO**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Nondetect**	**Average Nondetect**	**Maximum Nondetect**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances Unrestricted SCO**	**Number of Exceedances Protection of GW SCO**	**Number of Exceedances Restricted-Residential SCO**
Herbicides	mg/kg																		
Mecoprop (MCPP)		93-65-2	NE	NE	NE	4	2	2	21.9	22.35	22.8	WW-SB-240 49-50ft	3.85	21.125	38.4	WW-SB-239 54-55ft	0	0	0
2,4,5-TP (Silvex)		93-72-1	NE	NE	NE	4	2	2	0.011	0.0195	0.028	WW-SB-239 5-7ft	0.001	0.0015	0.002	WW-SB-240 15-16ft	0	0	0
Metals	mg/kg																		
Aluminum		7429-90-5	NE	NE	NE	170	0	170	-	-	-	WW-SB-242 25-30ft	306	5563	48300	WW-TP-200C-10	0	0	0
Antimony		7440-36-0	NE	NE	NE	170	160	9	0.8	2.6693	6.94	WW-MW-202 (40-42')	0.15	1.1	2.36	WW-SB-251 13-14	0	0	0
Arsenic		7440-38-2	13	16	16	170	18	152	1.73	3.2039	6.5	WW-SB-240 49-50ft	0.68	15.375	260	WW-SB-216 20-25	36	29	29
Barium		7440-39-3	410	820	410	170	0	170	-	-	-	WW-SB-242 25-30ft	3.17	61.276	769	WW-SB-216 20-25	2	0	2
Beryllium		7440-41-7	4.4	47	43	170	20	150	0.53	1.357	3.06	WW-MW-201D (43-45')	0.12	0.49127	5.66	WW-TP-200C-10	1	0	0
Cadmium		7440-43-9	2.5	7.5	2.5	170	149	21	0.8	1.9485	5.56	WW-MW-14 (36-37)	0.31	0.91095	1.9	WW-MW-XX (6-9)	0	0	0
Calcium		7440-70-2	NE	NE	NE	170	0	170	-	-	-	WW-SB-242 8-14ft	98.8	11400	169000	WW-SB-253 10-15	0	0	0
Chromium		7440-47-3	NE	NE	NE	170	0	170	-	-	-	WW-SB-242 25-30ft	2.38	14.572	162	WW-SB-216 20-25	0	0	0
Cobalt		7440-48-4	NE	NE	NE	170	0	170	-	-	-	WW-SB-242 25-30ft	0.5	6.4696	42.8	WW-TP-200C-10	0	0	0
Copper		7440-50-8	50	1720	280	170	7	163	12	31.457	69.4	WW-MW-201D (43-45')	3.1	38.503	667	WW-SB-215 15-20	32	0	3
Iron		7439-89-6	NE	NE	NE	170	1	169	90.1	90.1	90.1	WW-SB-242 8-14ft	1480	23332	258000	WW-TP-200C-10	0	0	0
Lead		7439-92-1	63	450	400	170	15	155	4.3	50.933	139	WW-SB-208 38-40	2	151.85	3100	WW-SB-213 20-25	57	13	15
Magnesium		7439-95-4	NE	NE	NE	170	0	170	-	-	-	WW-SB-242 25-30ft	159	3734.8	67000	WW-MW-11 (11-14)	0	0	0
Manganese		7439-96-5	1600	2000	2000	170	0	170	-	-	-	WW-SB-242 8-14ft	16.1	351.64	4440	WW-MW-204D (60-62)	4	2	2
Mercury		7439-97-6	0.18	0.73	0.3	170	75	95	0.012	0.028147	0.059	WW-SB-13 (37-38)	0.0065	0.78262	19.1	WW-SB-216 20-25	49	16	39
Nickel		7440-02-0	30	130	320	170	3	167	12	33.533	69.4	WW-SB-253 10-15	2.95	13.271	98.3	WW-TP-200C-10	9	0	0
Potassium		7440-09-7	NE	NE	NE	170	10	160	1200	2470	4500	WW-MW-13 (5-10)	81.7	953.1	7260	WW-SB-234 20-25	0	0	0
Selenium		7782-49-2	3.9	4	110	170	116	50	1.1	3.0839	14.9	WW-MW-202 (40-42')	0.13	1.7716	7.48	WW-SB-251 6-9	4	3	0
Silver		7440-22-4	2	8.3	110	170	163	7	0.32	1.8667	5.56	WW-SB-13 (12-15)	0.11	8.3429	51.8	WW-SB-213 20-25	2	1	0
Sodium		7440-23-5	NE	NE	NE	170	30	140	476	2317.5	4500	WW-SB-13 (37-38)	67.8	792.73	6080	WW-SB-226 20-25ft	0	0	0
Thallium		7440-28-0	NE	NE	NE	170	143	15	0.36	2.6959	6.94	WW-MW-201D (43-45')	0.036	0.27073	1.19	WW-SB-206 5-10ft	0	0	0
Tin		7440-31-5	NE	NE	NE	170	144	26	3.5	44.903	139	WW-MW-203D(68-70')	1.3	250.66	3550	WW-SB-213 20-25	0	0	0
Vanadium		7440-62-2	NE	NE	NE	170	1	169	11.6	11.6	11.6	WW-SB-242 8-14ft	1.95	21.495	193	WW-TP-200C-10	0	0	0
Zinc		7440-66-6	109	2480	6600	170	2	168	12	22.8	33.6	WW-SB-231 20-25ft	9.21	89.503	619	WW-SB-215 15-20	36	0	0
Cyanides	mg/kg																		
Free Cyanide		FREECN	NE	NE	NE	170	164	6	0.216	0.31904	1.4	WW-MW-201D (66-68')	0.97	1.2117	1.5	WW-MW-204D (60-62)	0	0	0
Other	mg/kg																		
C9-C18 Aliphatics		ALIPH9-18	NE	NE	NE	14	0	14	-	-	-	WW-SB-224 5-10	222	2428.6	10200	WW-TP-201B-10.5	0	0	0
C19-C36 Aliphatics		ALIPH19-36	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	250	1070.1	3560	WW-TP-202B-12	0	0	0
C11-C22 Aromatics		AROM11-22	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	438	2405.2	6680	WW-TP-201B-10.5	0	0	0
C11-C22 Aromatics (Unadjusted)		AROM11-22UnAdj	NE	NE	NE	14	0	14	-	-	-	WW-SB-253 10-15	712	2740.9	7100	WW-TP-201B-10.5	0	0	0
Total Petroleum Hydrocarbons		TPH	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	2460	9360.7	27000	WW-TP-202A-10	0	0	0
TPH-Diesel Range Organics (C10-C28)		TPH-DRO10-28	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	1660	11717	29400	WW-TP-201B-10.5	0	0	0
C9-C40		TEPH9-40	NE	NE	NE	14	0	14	-	-	-	WW-SB-210 10-15	2240	14416	31500	WW-TP-201B-10.5	0	0	0

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Table 1e. Remedial Investigation Deep Subsurface Soil Analytical Results Summary - Parcels 3 & 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:
Note: results/limits where cells contain qualifier only are unknown
mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAHs are calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

NA = Not Analyzed
ND = Not Detected
NE = Not Established

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Table 2a. Remedial Investigation Shallow Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

				Summary Statistics								
Analyte	**Units**	**CAS No.**	**NYS AWQS**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances NYS AWQS**
BTEX	ug/L											
Benzene		71-43-2	1	13	3	10	WW-MW-200	0.1	104.58	540	WW-MW-13	9
Toluene		108-88-3	5	13	5	8	WW-MW-207	1.2	8.9	38	WW-MW-11	5
Ethylbenzene		100-41-4	5	13	4	9	WW-MW-200	0.2	261.11	1600	WW-MW-11	8
o-Xylene		95-47-6	5	5	3	2	WW-MW-207	1	13.2	25.4	WW-MW-206	1
m/p-Xylene		179601-23-1	5	5	2	3	WW-MW-200	0.2	19.667	57.3	WW-MW-206	1
Total Xylene		1330-20-7	5	8	2	6	WW-MW-04	21	114	280	WW-MW-11	6
Total BTEX (ND=0)		TBTEX_ND0	NE	13	3	10	WW-MW-200	0.5	423.64	2238	WW-MW-11	0
Other VOCs	ug/L											
Acetone		67-64-1	50*	13	11	2	WW-MW-10	16	46.2	76.4	DUP-09122022	1
Carbon disulfide		75-15-0	60*	13	10	3	WW-MW-200	0.2	0.43333	0.6	WW-MW-207	0
Chloroform (Trichloromethane)		67-66-3	7	13	11	2	DUP-09122022	0.3	0.3	0.3	DUP-09122022	0
Chloromethane		74-87-3	5	13	11	2	WW-MW-204	5.4	6.8	8.2	DUP-09122022	2
Cyclohexane		110-82-7	NE	5	3	2	WW-MW-206	1	1.45	1.9	WW-MW-207	0
cis-1,2-Dichloroethene		156-59-2	5	13	9	4	WW-MW-200	0.2	2.45	4.9	WW-MW-XX	0
trans-1,2-Dichloroethene		156-60-5	5	13	11	2	WW-MW-04	0.91	1.005	1.1	WW-MW-XX	0
Isopropylbenzene		98-82-8	5	5	0	5	WW-MW-200	0.2	6.04	24.4	WW-MW-206	1
Methylcyclohexane		108-87-2	NE	5	2	3	WW-MW-200	0.7	1.3	1.7	WW-MW-206	0
Naphthalene		91-20-3	10*	5	0	5	WW-MW-200	0.4	142.04	698	WW-MW-206	1
Styrene		100-42-5	5	13	8	5	WW-MW-206	0.1	5.26	22	WW-MW-07	1
Trichloroethene (TCE)		79-01-6	5	13	11	2	WW-MW-04	2.6	2.8	3	WW-MW-XX	0
Vinyl chloride		75-01-4	2	13	11	2	WW-MW-XX	1.2	1.2	1.2	WW-MW-XX	0
Total VOCs (ND=0)		TVOC_ND0	NE	13	1	12	WW-MW-15	1.7	428.13	2238	WW-MW-11	0
PAH17	ug/L											
Acenaphthene		83-32-9	20*	13	1	12	WW-MW-07	1.4	41.217	188	WW-MW-206	4
Acenaphthylene		208-96-8	NE	13	7	6	WW-MW-207	2.2	6.65	12	WW-MW-XX	0
Anthracene		120-12-7	50*	13	5	8	WW-MW-15	0.52	3.4775	9.6	WW-MW-206	0
Benzo(a)anthracene		56-55-3	0.002*	13	11	2	WW-MW-200	1.6	1.75	1.9	WW-MW-207	2
Benzo(k)fluoranthene		207-08-9	0.002*	13	12	1	WW-MW-207	1.3	1.3	1.3	WW-MW-207	1
Benzo(g,h,i)perylene		191-24-2	NE	13	11	2	WW-MW-200	1.2	1.3	1.4	WW-MW-207	0
Benzo(a)pyrene		50-32-8	ND	13	11	2	WW-MW-200	1.5	1.7	1.9	WW-MW-207	2
Chrysene		218-01-9	0.002*	13	11	2	WW-MW-200	1.5	1.65	1.8	WW-MW-207	2
Fluoranthene		206-44-0	50*	13	5	8	WW-MW-07	0.71	2.8638	8.4	WW-MW-200	0
Fluorene		86-73-7	50*	13	6	7	WW-MW-15	2.3	11.286	21	WW-MW-13	0
2-Methylnaphthalene		91-57-6	NE	13	5	8	WW-MW-207	1.2	110.49	620	WW-MW-11	0
Naphthalene		91-20-3	10*	13	4	9	WW-MW-15	1.4	884.54	6300	WW-MW-11	7
Phenanthrene		85-01-8	50*	13	5	8	WW-MW-15	3.5	13.463	35	WW-MW-13	0
Pyrene		129-00-0	50*	13	4	9	WW-MW-15	0.56	4.2956	13.8	WW-MW-200	0
Total PAH (17) (ND=0)		TPAH17_ND0	NE	13	1	12	DUP-09122022	2.5	805.79	7060	WW-MW-11	0
PAH17 Other SVOCs	ug/L											
Biphenyl (1,1-Biphenyl)		92-52-4	5	5	4	1	WW-MW-206	3.2	3.2	3.2	WW-MW-206	0
Bis(2-ethylhexyl)phthalate		117-81-7	5	13	11	2	WW-MW-04	1.1	1.5	1.9	WW-MW-XX	0
Butyl benzyl phthalate		85-68-7	50*	13	10	3	WW-MW-200	2	2.4333	3.1	WW-MW-206	0
Carbazole		86-74-8	NE	13	12	1	WW-MW-13	5.8	5.8	5.8	WW-MW-13	0

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Table 2a. Remedial Investigation Shallow Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

				Summary Statistics								
Analyte	**Units**	**CAS No.**	**NYS AWQS**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances NYS AWQS**
Dibenzofuran		132-64-9	NE	13	8	5	WW-MW-XX	1	3.38	7.6	WW-MW-206	0
Diethyl phthalate		84-66-2	50*	13	11	2	WW-MW-204	5.5	5.95	6.4	DUP-09122022	0
2-Methylnaphthalene		91-57-6	NE	5	3	2	WW-MW-207	1.2	16.45	31.7	WW-MW-206	0
Phenol		108-95-2	1	13	12	1	WW-MW-13	3.2	3.2	3.2	WW-MW-13	1
Total SVOCs (ND=0)		TSVOC_ND0	NE	13	1	12	WW-MW-204	8.6	810.07	7060	WW-MW-11	0
PFAS	ng/L											
Perfluorobutanesulfonic acid (PFBS)		375-73-5	NE	5	1	4	DUP-032019	2.02	11.13	20	DUP-09122022	0
Perfluorobutanoic acid (PFBA)		375-22-4	NE	5	0	5	WW-MW-14	3.45	12.584	26	DUP-09122022	0
Perfluorodecanoic acid (PFDA)		335-76-2	NE	5	2	3	WW-MW-14	1.47	3.19	4.1	WW-MW-204	0
Perfluorododecanoic acid (PFDoA)		307-55-1	NE	5	4	1	WW-MW-14	1.23	1.23	1.23	WW-MW-14	0
Perfluoroheptanesulfonic acid (PFHpS)		375-92-8	NE	5	4	1	WW-MW-14	0.83	0.83	0.83	WW-MW-14	0
Perfluoroheptanoic acid (PFHpA)		375-85-9	NE	5	1	4	WW-MW-14	3.12	8.7725	14	DUP-09122022	0
Perfluorohexanoic acid (PFHxA)		307-24-4	NE	5	0	5	WW-MW-14	3.86	11.23	22	WW-MW-204	0
Perfluorooctanesulfonamide (FOSA)		754-91-6	NE	5	4	1	WW-MW-14	0.92	0.92	0.92	WW-MW-14	0
Perfluoropentanoic Acid (PFPeA)		2706-90-3	NE	5	0	5	WW-MW-14	3.98	11.506	22	DUP-09122022	0
Perfluorotetradecanoic acid (PFTA/PFTeDA)		376-06-7	NE	5	4	1	WW-MW-14	1.16	1.16	1.16	WW-MW-14	0
Perfluorotridecanoic acid (PFTriA/PFTrDA)		72629-94-8	NE	5	4	1	WW-MW-14	1.02	1.02	1.02	WW-MW-14	0
Perfluoroundecanoic acid (PFUnA)		2058-94-8	NE	5	3	2	DUP-032019	0.85	1.29	1.73	WW-MW-14	0
Perfluorohexanesulfonic acid (PFHxS)		355-46-4	NE	5	3	2	DUP-032019	1.42	1.695	1.97	WW-MW-14	0
Perfluorononanoic Acid (PFNA)		375-95-1	NE	5	0	5	DUP-032019	1.67	3.764	6.2	DUP-09122022	0
Perfluorooctanesulfonic acid (PFOS)		1763-23-1	0.0027	5	0	5	WW-MW-14	19.5	42.02	100	WW-MW-200	5
Perfluorooctanoic Acid (PFOA)		335-67-1	0.0067	5	0	5	WW-MW-14	9.71	15.72	23	DUP-09122022	5
Total PFAS (ND=0)		TPFAS_ND0	NE	5	0	5	DUP-032019	53.53	116.89	171.2	DUP-09122022	0
PCB Aroclors	ug/L											
No Detects												
Pesticides	ug/L											
alpha-BHC (Hexachlorocyclohexane)		319-84-6	0.01	13	12	1	WW-MW-15	0.02	0.02	0.02	WW-MW-15	1
delta-BHC (delta-Hexachlorocyclohexane)		319-86-8	0.04	13	12	1	WW-MW-11	0.041	0.041	0.041	WW-MW-11	1
alpha-chlordane		5103-71-9	NE	13	12	1	WW-MW-15	0.029	0.029	0.029	WW-MW-15	0
alpha-Endosulfan (I)		959-98-8	NE	13	12	1	WW-MW-07	0.012	0.012	0.012	WW-MW-07	0
Herbicides	ug/L											
No Detects												
Total Metals	ug/L											
Aluminum		7429-90-5	NE	13	10	3	WW-MW-10	297	564.67	856	WW-MW-200	0
Antimony		7440-36-0	3	13	11	2	DUP-09122022	0.9	0.95	1	WW-MW-204	0
Arsenic		7440-38-2	25	13	8	5	DUP-09122022	5.1	18.32	42.8	WW-MW-15	2
Barium		7440-39-3	1000	13	0	13	WW-MW-14	58.9	123.4	195	WW-MW-11	0
Beryllium		7440-41-7	3*	13	12	1	WW-MW-207	0.2	0.2	0.2	WW-MW-207	0
Calcium		7440-70-2	NE	13	0	13	WW-MW-10	56900	151550	371000	WW-MW-207	0
Chromium		7440-47-3	50	13	4	9	WW-MW-07	0.62	9.76	74.2	WW-MW-14	1
Cobalt		7440-48-4	NE	13	11	2	WW-MW-07	2.5	4.45	6.4	WW-MW-14	0
Copper		7440-50-8	200	13	5	8	WW-MW-XX	1.9	21.588	72.4	WW-MW-07	0
Iron		7439-89-6	300	13	0	13	WW-MW-07	161	1759.3	5000	WW-MW-10	12
Lead		7439-92-1	25	13	9	4	WW-MW-204	15.9	20.975	26.1	WW-MW-207	2

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Table 2a. Remedial Investigation Shallow Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

				Summary Statistics								
Analyte	**Units**	**CAS No.**	**NYS AWQS**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances NYS AWQS**
Magnesium		7439-95-4	35000*	13	0	13	WW-MW-04	5730	163780	697000	WW-MW-14	4
Manganese		7439-96-5	300	13	0	13	WW-MW-14	48.7	348.18	638	WW-MW-206	7
Mercury		7439-97-6	0.7	13	11	2	WW-MW-204	0.3	0.35	0.4	WW-MW-07	0
Nickel		7440-02-0	100	13	4	9	WW-MW-10	1.7	29.433	159	WW-MW-14	1
Potassium		7440-09-7	NE	13	0	13	WW-MW-10	13100	92223	379000	WW-MW-14	0
Selenium		7782-49-2	10	13	11	2	DUP-09122022	0.8	1.1	1.4	WW-MW-204	0
Sodium		7440-23-5	20000	13	0	13	WW-MW-204	35600	1439700	5990000	WW-MW-14	13
Tin		7440-31-5	NE	5	0	5	WW-MW-200	21.2	32.78	67.6	WW-MW-207	0
Vanadium		7440-62-2	NE	13	5	8	WW-MW-XX	1.7	10.162	30.7	WW-MW-15	0
Zinc		7440-66-6	2000*	13	7	6	WW-MW-13	10.2	110.23	459	WW-MW-14	0
Cyanides	ug/L											
Total Cyanide		57-12-5	200	8	3	5	WW-MW-07	19.7	60.2	211	WW-MW-11	1

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Table 2a. Remedial Investigation Shallow Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:
Analytes in blue are not detected in any sample
ng/L = nanogram per liter (ppt)
ug/L = micrograms per liter or parts per billion (ppb)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
PFAS = Per- and polyfluoroalkyl substances
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAH17 is calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

NYS AWQS = New York State Ambient Water Quality Standards and Guidance Values for GA groundwater
* indicates the value is a guidance value and not a standard

CAS No. = Chemical Abstracts Service Number
ND = Not Detected
NE = Not Established

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Table 2b. Remedial Investigation Intermediate Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

				Summary Statistics								
Analyte	**Units**	**CAS No.**	**NYS AWQS**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances NYS AWQS**
BTEX	ug/L											
Benzene		71-43-2	1	8	4	4	WW-MW-205I	0.32	1954.7	7800	WW-MW-204I	2
Toluene		108-88-3	5	8	6	2	WW-MW-201I	0.4	5.2	10	WW-MW-204I	1
Ethylbenzene		100-41-4	5	8	4	4	WW-MW-202I	0.42	184.47	730	WW-MW-204I	2
o-Xylene		95-47-6	5	8	5	3	WW-MW-201I	1.8	61.3	180	WW-MW-204I	1
m/p-Xylene		179601-23-1	5	8	5	3	WW-MW-206I	2.1	55	160	WW-MW-204I	1
Total BTEX (ND=0)		TBTEX_ND0	NE	8	3	5	WW-MW-205I	0.32	1783.2	8880	WW-MW-204I	0
Other VOCs	ug/L											
Carbon disulfide		75-15-0	60*	8	7	1	WW-MW-206I	2.6	2.6	2.6	WW-MW-206I	0
Chloroform (Trichloromethane)		67-66-3	7	8	3	5	WW-MW-201I	0.34	7.528	31	WW-MW-204I	1
Chloromethane		74-87-3	5	8	3	5	WW-MW-207I	0.51	0.834	1.4	WW-MW-205I	0
1,1-Dichloroethane		75-34-3	5	8	7	1	WW-MW-205I	0.27	0.27	0.27	WW-MW-205I	0
cis-1,2-Dichloroethene		156-59-2	5	8	6	2	WW-MW-200I	0.33	1.265	2.2	WW-MW-205I	0
Isopropylbenzene		98-82-8	5	8	6	2	WW-MW-206I	2	22	42	WW-MW-204I	1
Methyl tert-butyl ether (MTBE)		1634-04-4	10*	8	6	2	WW-MW-200I	0.44	1.02	1.6	WW-MW-205I	0
Methylene chloride		75-09-2	5	8	4	4	WW-MW-206I	0.49	0.7075	1.1	WW-MW-203I	0
Vinyl chloride		75-01-4	2	8	5	3	WW-MW-206I	0.69	1.73	3.3	WW-MW-205I	1
Total VOCs (ND=0)		TVOC_ND0	NE	8	0	8	WW-MW-207I	0.51	1127.1	8953	WW-MW-204I	0
PAH17	ug/L											
Acenaphthene		83-32-9	20*	8	6	2	WW-MW-206I	2.4	6.7	11	WW-MW-204I	0
Acenaphthylene		208-96-8	NE	8	7	1	WW-MW-201I	1	1	1	WW-MW-201I	0
Fluorene		86-73-7	50*	8	7	1	WW-MW-204I	1.1	1.1	1.1	WW-MW-204I	0
2-Methylnaphthalene		91-57-6	NE	8	6	2	WW-MW-204I	1.4	5.1	8.8	WW-MW-206I	0
Naphthalene		91-20-3	10*	8	5	3	WW-MW-201I	2.6	20.567	56	WW-MW-206I	1
Total PAH (17) (ND=0)		TPAH17_ND0	NE	8	5	3	WW-MW-201I	3.6	29.133	67.2	WW-MW-206I	0
PAH17 Other SVOCs	ug/L											
Biphenyl (1,1-Biphenyl)		92-52-4	5	8	7	1	WW-MW-204I	1.4	1.4	1.4	WW-MW-204I	0
Carbazole		86-74-8	NE	8	7	1	WW-MW-204I	0.99	0.99	0.99	WW-MW-204I	0
2,4-Dimethylphenol		105-67-9	50*	8	7	1	WW-MW-204I	4.6	4.6	4.6	WW-MW-204I	0
2-Methylnaphthalene		91-57-6	NE	8	6	2	WW-MW-204I	1.4	5.1	8.8	WW-MW-206I	0
Phenol		108-95-2	1	8	7	1	WW-MW-204I	20	20	20	WW-MW-204I	1
Total SVOCs (ND=0)		TSVOC_ND0	NE	8	5	3	WW-MW-201I	3.6	38.13	67.2	WW-MW-206I	0
Total Metals	ug/L											
Aluminum		7429-90-5	NE	8	0	8	WW-MW-200I	68.2	111.88	197	WW-MW-202I	0
Arsenic		7440-38-2	25	8	0	8	WW-MW-204I	0.91	1.7138	3.2	WW-MW-200I	0
Barium		7440-39-3	1000	8	0	8	WW-MW-207I	29	88.588	175	WW-MW-203I	0
Calcium		7440-70-2	NE	8	0	8	WW-MW-204I	29900	110180	229000	WW-MW-201I	0
Chromium		7440-47-3	50	8	7	1	WW-MW-204I	5.5	5.5	5.5	WW-MW-204I	0
Cobalt		7440-48-4	NE	8	2	6	WW-MW-206I	0.79	1.1983	1.7	WW-MW-202I	0
Iron		7439-89-6	300	8	0	8	WW-MW-204I	238	2448.4	8920	WW-MW-206I	7
Magnesium		7439-95-4	35000*	8	0	8	WW-MW-204I	11000	136300	400000	WW-MW-201I	7
Manganese		7439-96-5	300	8	0	8	WW-MW-204I	1.5	573.44	1640	WW-MW-200I	4
Nickel		7440-02-0	100	8	1	7	WW-MW-204I	1.1	24.143	115	WW-MW-207I	1
Potassium		7440-09-7	NE	8	0	8	WW-MW-206I	5420	46096	114000	WW-MW-201I	0
Selenium		7782-49-2	10	8	7	1	WW-MW-204I	0.64	0.64	0.64	WW-MW-204I	0
Sodium		7440-23-5	20000	8	0	8	WW-MW-204I	154000	1503500	4130000	WW-MW-201I	8
Vanadium		7440-62-2	NE	8	4	4	WW-MW-201I	0.8	4.975	16.3	WW-MW-204I	0
Cyanides	ug/L											
Total Cyanide		57-12-5	200	8	0	8	WW-MW-205I	19	91.875	160	WW-MW-203I	0

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Table 2b. Remedial Investigation Intermediate Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:
Analytes in blue are not detected in any sample
ng/L = nanogram per liter (ppt)
ug/L = micrograms per liter or parts per billion (ppb)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAH17 is calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

NYS AWQS = New York State Ambient Water Quality Standards and Guidance Values for GA groundwater
* indicates the value is a guidance value and not a standard

CAS No. = Chemical Abstracts Service Number
ND = Not Detected
NE = Not Established

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Table 2c. Remedial Investigation Deep Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

				Summary Statistics								
Analyte	**Units**	**CAS No.**	**NYS AWQS**	**Number of Results**	**Number of Nondetects**	**Number of Detects**	**Minimum Detect ID**	**Minimum Detect**	**Average Detect**	**Maximum Detect**	**Maximum Detect ID**	**Number of Exceedances NYS AWQS**
BTEX	ug/L											
Benzene		71-43-2	1	9	3	6	WW-MW-205D	0.32	2.5533	4.5	WW-MW-206D	5
Toluene		108-88-3	5	9	6	3	WW-MW-206D	0.53	1.71	3.4	WW-MW-201D	0
Ethylbenzene		100-41-4	5	9	5	4	WW-MW-200D	0.34	1.215	2.4	WW-MW-205D	0
o-Xylene		95-47-6	5	9	6	3	WW-MW-205D	0.36	0.42333	0.51	WW-MW-206D	0
m/p-Xylene		179601-23-1	5	9	6	3	WW-MW-204D	0.31	0.51	0.76	WW-MW-206D	0
Total BTEX (ND=0)		TBTEX_ND0	NE	9	3	6	DUP-09122024	2.9	4.685	8	WW-MW-206D	0
Other VOCs	ug/L											
Acetone		67-64-1	50*	9	5	4	WW-MW-204D	5.2	5.95	6.8	WW-MW-206D	0
Bromodichloromethane		75-27-4	50*	9	7	2	WW-MW-205D	1.5	2.25	3	WW-MW-203D	0
Chloroform (Trichloromethane)		67-66-3	7	9	0	9	WW-MW-201D	1.1	18.656	47	WW-MW-203D	6
Chloromethane		74-87-3	5	9	5	4	WW-MW-201D	0.48	0.8125	1.5	WW-MW-200D	0
Methylene chloride		75-09-2	5	9	4	5	WW-MW-207D	0.47	0.936	1.7	WW-MW-201D	0
Total VOCs (ND=0)		TVOC_ND0	NE	9	0	9	WW-MW-202D	4.86	25.804	56.5	WW-MW-203D	0
PAH17	ug/L											
Acenaphthene		83-32-9	20*	9	8	1	WW-MW-206D	1.7	1.7	1.7	WW-MW-206D	0
Naphthalene		91-20-3	10*	9	6	3	WW-MW-200D	1	1.0667	1.1	DUP-09122024	0
Total PAH (17) (ND=0)		TPAH17_ND0	NE	9	5	4	WW-MW-200D	1	1.225	1.7	WW-MW-206D	0
PAH17 Other SVOCs	ug/L											
Total SVOCs (ND=0)		TSVOC_ND0	NE	9	5	4	WW-MW-200D	1	1.225	1.7	WW-MW-206D	0
Total Metals	ug/L											
Aluminum		7429-90-5		9	0	9	WW-MW-205D	23.5	103.71	206	WW-MW-203D	0
Antimony		7440-36-0	3	9	8	1	WW-MW-203D	2.4	2.4	2.4	WW-MW-203D	0
Arsenic		7440-38-2	25	9	4	5	WW-MW-201D	1.3	2.08	2.9	WW-MW-203D	0
Barium		7440-39-3	1000	9	0	9	WW-MW-203D	9.6	102.19	166	WW-MW-200D	0
Calcium		7440-70-2	NE	9	0	9	WW-MW-203D	43200	230470	471000	WW-MW-200D	0
Chromium		7440-47-3	50	9	4	5	WW-MW-203D	5.7	11.18	15	DUP-09122024	0
Cobalt		7440-48-4	NE	9	4	5	WW-MW-207D	1	1.46	1.8	DUP-09122024	0
Copper		7440-50-8	200	9	8	1	WW-MW-203D	3.8	3.8	3.8	WW-MW-203D	0
Iron		7439-89-6	300	9	1	8	WW-MW-203D	116	3657	14300	WW-MW-200D	3
Lead		7439-92-1	25	9	7	2	WW-MW-203D	0.94	1.02	1.1	WW-MW-207D	0
Magnesium		7439-95-4	35000*	9	0	9	WW-MW-204D	986	225770	595000	WW-MW-201D	6
Manganese		7439-96-5	300	9	0	9	WW-MW-206D	1.7	688.27	2070	WW-MW-201D	4
Nickel		7440-02-0	100	9	5	4	WW-MW-201D	1	1.8	3.3	WW-MW-203D	0
Potassium		7440-09-7	NE	9	0	9	WW-MW-206D	9260	52107	118000	WW-MW-202D	0
Selenium		7782-49-2	10	9	6	3	WW-MW-206D	1.8	2.0333	2.2	DUP-09122024	0
Sodium		7440-23-5	20000	9	0	9	WW-MW-206D	108000	2168800	5840000	WW-MW-201D	9
Tin		7440-31-5	NE	9	8	1	WW-MW-203D	3.7	3.7	3.7	WW-MW-203D	0
Vanadium		7440-62-2	NE	9	0	9	DUP-09122024	0.69	1.9778	6.6	WW-MW-203D	0
Zinc		7440-66-6	2000*	9	7	2	WW-MW-200D	15.9	37.15	58.4	WW-MW-203D	0
Cyanides	ug/L											
Total Cyanide		57-12-5	200	9	3	6	WW-MW-205D	4	35.4	63	WW-MW-206D	0

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Table 2c. Remedial Investigation Deep Groundwater Analytical Results Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Notes:
Analytes in blue are not detected in any sample
ng/L = nanogram per liter (ppt)
ug/L = micrograms per liter or parts per billion (ppb)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, Total SVOCs, and Total PCBs are calculated using detects only.
Total PAH17 is calculated using the list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, 2-Methylnaphthalene, Phenanthrene, and Pyrene

NYS AWQS = New York State Ambient Water Quality Standards and Guidance Values for GA groundwater
* indicates the value is a guidance value and not a standard

CAS No. = Chemical Abstracts Service Number
ND = Not Detected
NE = Not Established

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Table 3. Contaminant Mass Model Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Remedial Area	Depth (ft)	Total Remedial Area Volume (cf)	Average BTEX & Naphthalene Concentration (mg/kg)	Estimated Contaminant Mass (kg)	Percentage of Total Contaminant Mass
1	0-10	20,500	403.03	499.69	**0.4%**
2	0-10	15,000	1,982.38	1,798.38	**1.3%**
3	10-20	30,000	2,241.42	4,066.76	**3.0%**
4	10-20	216,000	1,968.94	25,721.21	**19.0%**
5	10-20	21,000	671.26	852.54	**0.6%**
6	10-20	30,000	1,496.96	2,716.05	**2.0%**
7	10-30	34,000	314.21	646.11	**0.5%**
8	0-20	90,000	1,392.81	7,581.23	**5.6%**
9	20-30	32,000	4,767.69	9,227.04	**6.8%**
10	0-20	344,000	586.49	12,201.79	**9.0%**
11	0-30	324,000	3,029.96	59,372.69	**43.9%**
12	0-37	75,600	2,209.04	10,100.19	**7.5%**
13	50-55	3,000	1,982.38	359.68	**0.3%**
14	30-35	5,000	0.31	0.09	**0.0%**
15	25-30	8,000	0.21	0.10	**0.0%**
16	30-45	15,000	3.30	3.00	**0.0%**
			Total Contaminant Mass (kg)	**135,146.54**	
			Total Contaminant Mass (lb)	**297,947.12**	

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Table 4. Remedial Alternative Scoring Comparison Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

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Sample I.D.	Alternative 2 Score	Alternative 2 Comments	Alternative 3 Score	Alternative 3 Comments	Alternative 4 Score	Alternative 4 Comments	Alternative 5 Score	Alternative 5 Comments
Overall Protection of Human Health and the Environment	2	Alternative 2 protects human health by removing the Fill Wedge and shallow impacted material, constructing a clean soil cover, maintaining the soil cover at Parcel 2, and maintaining institutional controls. Deeper source material would remain in place, and groundwater improvement would rely on DNAPL recovery and monitored natural attenuation, resulting in a lower level of environmental protection than more active alternatives.	4	Alternative 3 provides greater protection than Alternative 2 by removing shallow impacted material and stabilizing deeper source material within Parcels 3 and 4. This reduces direct exposure potential, limits contaminant mobility, and provides a more active approach to addressing source material that would otherwise remain in place.	5	Alternative 4 provides greater protection than Alternative 3 by adding an ISS containment wall to hydraulically isolate remaining Parcel 2 source material, while retaining excavation, ISS, DNAPL recovery, enhanced MNA, and capping. This improves source control and reduces groundwater interaction with residual impacts.	5	Alternative 5 provides marginally greater protection than Alternative 4 by removing additional impacted material from Parcels 3 and 4 to meet Protection of Groundwater SCOs, while retaining excavation, ISS, the Parcel 2 containment wall, DNAPL recovery, enhanced MNA, and capping. This further reduces exposure potential and groundwater impacts, but residual source material would remain managed in place.
Compliance with SCGs	3	Alternative 2 supports compliance with soil-related SCGs in the upper portion of the site through excavation, off-site treatment/disposal, and construction of a clean soil cover. Groundwater SCGs may not be achieved in the near term because deeper source material would remain and groundwater remediation would rely primarily on DNAPL recovery and monitored natural attenuation.	4	Alternative 3 improves compliance with soil-related SCGs by removing shallow impacted material and stabilizing deeper source material that may contribute to groundwater impacts. Groundwater SCGs may not be achieved immediately, but ISS, DNAPL recovery, enhanced MNA, and monitoring provide a stronger pathway toward long-term groundwater improvement than Alternative 2.	5	Alternative 4 provides an improved pathway toward soil and groundwater SCGs compared with Alternative 3 by combining excavation, ISS, enhanced MNA, DNAPL recovery, and Parcel 2 hydraulic isolation. Residual source material would remain in place, but the containment wall would reduce groundwater interaction with source material and long-term reliance on MNA alone.	5	Alternative 5 provides a slightly stronger pathway toward soil-related SCG compliance because impacted material in Parcels 3 and 4 would be removed to meet Protection of Groundwater SCOs where practicable. Groundwater SCGs may still require time to achieve, but additional source removal, ISS, Parcel 2 containment, DNAPL recovery, and enhanced MNA provide greater support for long-term groundwater improvement than Alternative 4.
Long-Term Effectiveness and Permanence	2	Alternative 2 provides long-term exposure control through shallow removal, cover construction, institutional controls, and groundwater monitoring. Its permanence is limited because deeper source material beneath Parcels 3 and 4 would remain untreated or unstabilized, requiring continued reliance on long-term management, DNAPL recovery, and monitored natural attenuation to address residual impacts.	4	Alternative 3 provides improved long-term effectiveness by combining excavation of shallow impacted material with ISS of deeper source material beneath Parcels 3 and 4. Stabilization reduces contaminant mobility and dependence on long-term management, although residual impacts would remain and require institutional controls, groundwater monitoring, and continued DNAPL recovery.	5	Alternative 4 improves long-term effectiveness by adding hydraulic isolation of remaining Parcel 2 source material to the excavation, ISS, cover system, DNAPL recovery, and monitoring components included in Alternative 3. Residual impacts would remain, but the containment wall would reduce groundwater interaction with source material and long-term reliance on MNA alone.	5	Alternative 5 slightly improves long-term effectiveness compared with Alternative 4 by removing a greater volume of impacted material from Parcels 3 and 4 before relying on ISS, containment, and long-term monitoring. Residual impacts would remain, including material hydraulically isolated near Parcel 2, but the greater degree of excavation reduces long-term reliance on management controls.
Reduction of Toxicity, Mobility, or Volume Through Treatment	2	Alternative 2 removes approximately **11.73%** of the total contaminant mass within Parcels 3 and 4 through excavation and off-site treatment/disposal of shallow impacted material. Deeper source material would remain in place, and groundwater remediation would rely primarily on DNAPL recovery and monitored natural attenuation rather than active treatment of the principal source areas.	4	Alternative 3 removes or stabilizes approximately **91.23%** of the total contaminant mass within Parcels 3 and 4 through shallow excavation, off-site treatment/disposal, and ISS of deeper source material. This alternative provides substantially greater reduction in contaminant mobility and potential groundwater flux than Alternative 2, while residual impacts would be managed through enhanced MNA.	5	Alternative 4 removes or stabilizes approximately **91.23%** of the total contaminant mass within Parcels 3 and 4 through excavation and ISS, while also reducing mobility of remaining Parcel 2 source material through hydraulic isolation. This provides greater reduction in mobility and groundwater flux than Alternative 3.	5	Alternative 5 removes or stabilizes approximately **92.81%** of the total contaminant mass within Parcels 3 and 4 through expanded excavation to meet Protection of Groundwater SCOs and ISS of remaining deeper material. This provides greater reduction in contaminant volume and mobility than Alternative 4, while remaining less disruptive than full source-material removal.
Short-Term Impact and Effectiveness	5	Shortest alternative to complete with the least impact to the local community during implementation. Alternative 2 would result in short-term impacts associated with excavation, material handling, odor and emission controls, and work near the East River bulkhead. Trucking of impacted soil and import of clean backfill materials will require up to 40 trucks per day for approximately **5** months. Remediation would be completed in approximately **14** months.	3	Alternative 3 would result in greater short-term impacts than Alternative 2 due to excavation, ISS, material handling, odor and emission controls, and work near the East River bulkhead. Trucking of impacted soil and import of clean backfill materials will require up to 40 trucks per day for approximately **11** months. Remediation would be completed in approximately **27** months.	3	Alternative 4 would result in similar short-term impacts compared to Alternative 3 due to excavation, ISS, containment wall installation, material handling, odor and emission controls, and work near the East River bulkhead and Parcel 2. Trucking of impacted soil and import of clean backfill materials will require up to 40 trucks per day for approximately **11** months. Remediation would be completed in approximately **27.5** months.	3	Alternative 5 would result in similar short-term impacts compared to Alternatives 3 and 4. Trucking of impacted soil and import of clean backfill materials will require up to 40 trucks per day for approximately **11** months. Remediation would be completed in approximately **28.5** months.
Implementability	4	Alternative 2 is implementable using conventional excavation, off-site treatment/disposal, cover construction, DNAPL recovery, and groundwater monitoring technologies. Implementation would require careful sequencing, coordination with NYCDPR and regulators, truck traffic management, disposal facility coordination, and design considerations related to the East River bulkhead, adjacent infrastructure, and future park redevelopment.	3	Alternative 3 is implementable using conventional excavation, off-site treatment/disposal, ISS, DNAPL recovery, enhanced MNA, and groundwater monitoring technologies. However, implementation is more complex than Alternative 2 because ISS requires bench-scale testing, hydraulic modeling, specialized equipment, additional staging, and careful coordination around the bulkhead, utilities, and future park redevelopment.	2	Alternative 4 is implementable using conventional excavation, ISS, DNAPL recovery, enhanced MNA, containment wall construction, and monitoring technologies. However, implementation is more complex than Alternative 3 because it requires additional hydraulic modeling, ISS containment wall design, specialized construction, sequencing near Parcel 2, and coordination with existing park features and subsurface constraints.	2	Alternative 5 would be marginally more difficult to implement than Alternative 4 due to the depth and scale of excavation, tidal groundwater influence, dewatering requirements, support-of-excavation needs, and proximity to the East River bulkhead and North 12th Street sewer.
Cost Effectiveness	5	The estimated cost for Alternative 2 ranges from **$19.2-$41.1M.** Alternative 2 has the lowest capital cost but provides limited mass remediation and lower long-term effectiveness, leaving greater reliance on long-term management.	3	The estimated cost for Alternative 3 ranges from **$42.2-$90.5M**. Alternative 3 increases cost and short-term impacts relative to Alternative 2, but provides substantially greater mass removal, stabilization, protectiveness, and long-term effectiveness.	3	The estimated cost for Alternative 4 ranges from **$42.9-$92M**. Alternative 4 provides greater contaminant mobility reduction and long-term effectiveness than Alternative 3 through hydraulic isolation of source material remaining at depth on Parcel 2, with similar estimated cost.	3	The estimated cost for Alternative 5 ranges from **$44.1-$94.6M**. Alternative 5 is generally comparable to Alternative 4 but requires a 2.8% cost increase for only a 1.5% additional mass reduction, making the incremental benefit disproportionate to the added cost and implementation complexity.
Land Use	3	Alternative 2 supports current land use and will allow for redevelopment of the site as a park in the future. Materials remaining beneath the cover system at depth may require additional handling during a future redevelopment depending on the final redevelopment plans.	4	Alternative 3 supports current land use and future redevelopment of Parcels 3 and 4 as parkland while reducing the likelihood that deeper source material will affect future subsurface work. Some residual impacts, institutional controls, cover maintenance requirements, and monitoring infrastructure would remain, but the remedy provides greater compatibility with future redevelopment than Alternative 2.	4	Similar to Alternative 3, Alternative 4 supports current land use and future park redevelopment.Some residual impacts, institutional controls, cover maintenance requirements, and monitoring infrastructure would remain, but the remedy provides greater compatibility with future redevelopment than Alternative 2.	4	Similar to Alternative 3 and 4, Alternative 5 supports current land use and future park redevelopment.Some residual impacts, institutional controls, cover maintenance requirements, and monitoring infrastructure would remain, but the remedy provides greater compatibility with future redevelopment than Alternative 2.
TOTAL SCORE	**26**		**29**		**32**		**32**	

Table 5. Summary of Remedial Alternatives Cost
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Remedial Alternative	Remedial Construction Estimate	Total Long Term Operations, Maintenance, & Monitoring Estimate (Net Present Value)	Alternative Total*	Class 4 High Range Estimate (+50%)**	Class 4 Low Range Estimate (-30%)**
Remedial Alternative 2	$ 24,788,286.00	$ 2,630,000.00	$ 27,418,286.00	$ 41,127,429.00	$ 19,192,800.20
Remedial Alternative 3	$ 57,707,286.00	$ 2,630,000.00	$ 60,337,286.00	$ 90,505,929.00	$ 42,236,100.20
Remedial Alternative 4	$ 58,722,516.00	$ 2,630,000.00	$ 61,352,516.00	$ 92,028,774.00	$ 42,946,761.20
Remedial Alternative 5	$ 60,435,596.00	$ 2,630,000.00	$ 63,065,596.00	$ 94,598,394.00	$ 44,145,917.20

* Alternative Total includes costs associated with Remedial Construction and Total OM&M.
** High and Low Range Estimates are 50 percent above and 30 percent below each Alternative Total, respectively.

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Figures

Figure 1 Site Location Map

Figure 2 Remedial Investigation Parcel Identification Map

Figure 3 March 8, 2023, High Tide Groundwater Surface Elevation Contours

Figure 4 March 8, 2023, Low Tide Groundwater Surface Elevation Contours

Figure 5 1905 Historical Structures

Figure 6 1916 Historical Structures

Figure 7 1978 Historical Structures

Figure 8 Historic Non-MGP Structure and Petroleum Plume Locations

Figure 9 Observed Physical Impacts – Unsaturated Zone

Figure 10 Observed Physical Impacts – Saturated Zone To 30 Feet Below Grade

Figure 11 Observed Physical Impacts – Saturated Zone Below 30 Feet and Above Clay

Figure 12 Observed Physical Impacts – Clay and Deeper

Figure 13 Subsurface Soil Analytical Result SCO Exceedances – Unsaturated Soil

Figure 14 Subsurface Soil Analytical Result SCO Exceedances – Saturated Soil Above 30 Feet BGS

Figure 15 Subsurface Soil Analytical Result SCO Exceedances – Saturated Soil Below 30 Feet BGS

Figure 16 Subsurface Soil Analytical Results SCO Exceedances – Within Clay

Figure 17 Parcel 2 Groundwater Exceedances Above 30 Feet

Figure 18 Parcel 2 Groundwater Exceedances Below 30 Feet

Figure 19 Parcel 3 Groundwater Exceedances Above 30 Feet

Figure 20 Parcel 3 Groundwater Exceedances Below 30 Feet

Figure 21 Parcel 4 Groundwater Exceedances Above 30 Feet

Figure 22 Parcel 4 Groundwater Exceedances Below 30 Feet

Figure 23 Conceptual Contaminant Mass Model and Remedial Area Delineation

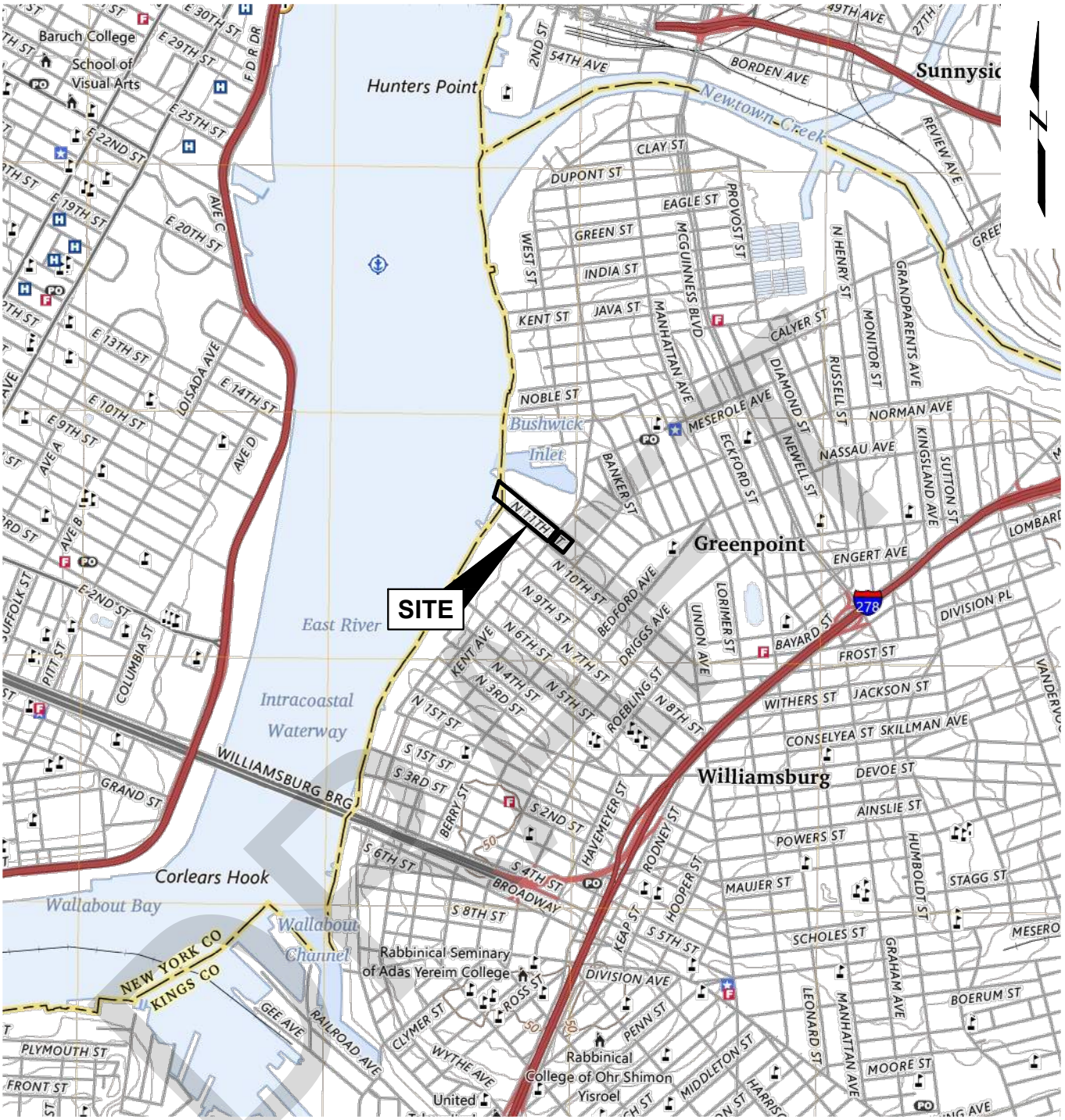
Figure 24 Alternative 2 Conceptual Plan

Figure 25 Alternative 3 Conceptual Plan

Figure 26 Alternative 4 Conceptual Plan

Figure 27 Alternative 5 Conceptual Plan

DRAFT



SOURCE:

USGS TOPOGRAPHIC QUADRANGLE, 7.5 MINUTE SERIES: BROOKLYN, NY 2023
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
10-FOOT CONTOUR INTERVAL

Remedial Alternatives Analysis Report Williamsburg Works Former MGP Site Borough of Brooklyn, New York	GEI Consultants	SITE LOCATION MAP
nationalgrid	Project 093060	October 2026 Fig. 1

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LEGEND:

- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY

SOURCES:

1. AERIAL PHOTOGRAPH NEARMAP ©2024 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 - 1996).
3. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM *HTTP://WWW.OASISNYC.NET* ACCESSED JANUARY 2008.
4. NEW YORK CITY DEPARTMENT OF CITY PLANNING, MAP PLUTO PARCELS.

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SCALE, FEET

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

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REMEDIAL INVESTIGATION
PARCEL IDENTIFICATION
MAP

Project 093060 | October 2026 | Fig. 2



LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY
- HISTORIC MGP STRUCTURES
- WW-MW-02 — MONITORING WELL
- 5 — GROUNDWATER CONTOUR (FEET NAVD88)
- GROUNDWATER FLOW DIRECTION
- 7.56 — GROUNDWATER ELEVATION (FEET NAVD88) MEASURED 3/8/2023
- 3.07* — GROUNDWATER ELEVATION WAS NOT USE TO GENERATE THE GROUNDWATER CONTOURS DUE TO THE PRESENCE OF LIGHT NON-AQUEOUS PHASE LIQUID (LNAPL)

NOTES:

1. CONTOURS MADE BY KRIGING INTERPOLATION.
2. GROUNDWATER CONTOURS AND ELEVATIONS ARE IN FEET ABOVE NORTH AMERICAN VERTICAL DATUM (NAVD88)
3. MONITORING WELLS WERE INSTALLED SPANNING THE GROUNDWATER SURFACE.
4. GROUNDWATER CONTOURS WERE GENERATED USING DATA FROM HIGH TIDE GAUGING ON MARCH 8, 2023.

SOURCES:

1. AERIAL PHOTOGRAPH NEARMAP ©2024 IMAGERY DATE: 07/03/2025.
2. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM *HTTP://WWW.OASISNYC.NET* ACCESSED JANUARY 2008.
3. SURVEY OF WILLIAMSBURG WORKS BOUNDARIES, EXISTING CONDITIONS, AND SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. SURVEYED BY NEW YORK STATE-LICENSED LAND SURVEYOR No. 050146.

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Borough of Brooklyn, New York

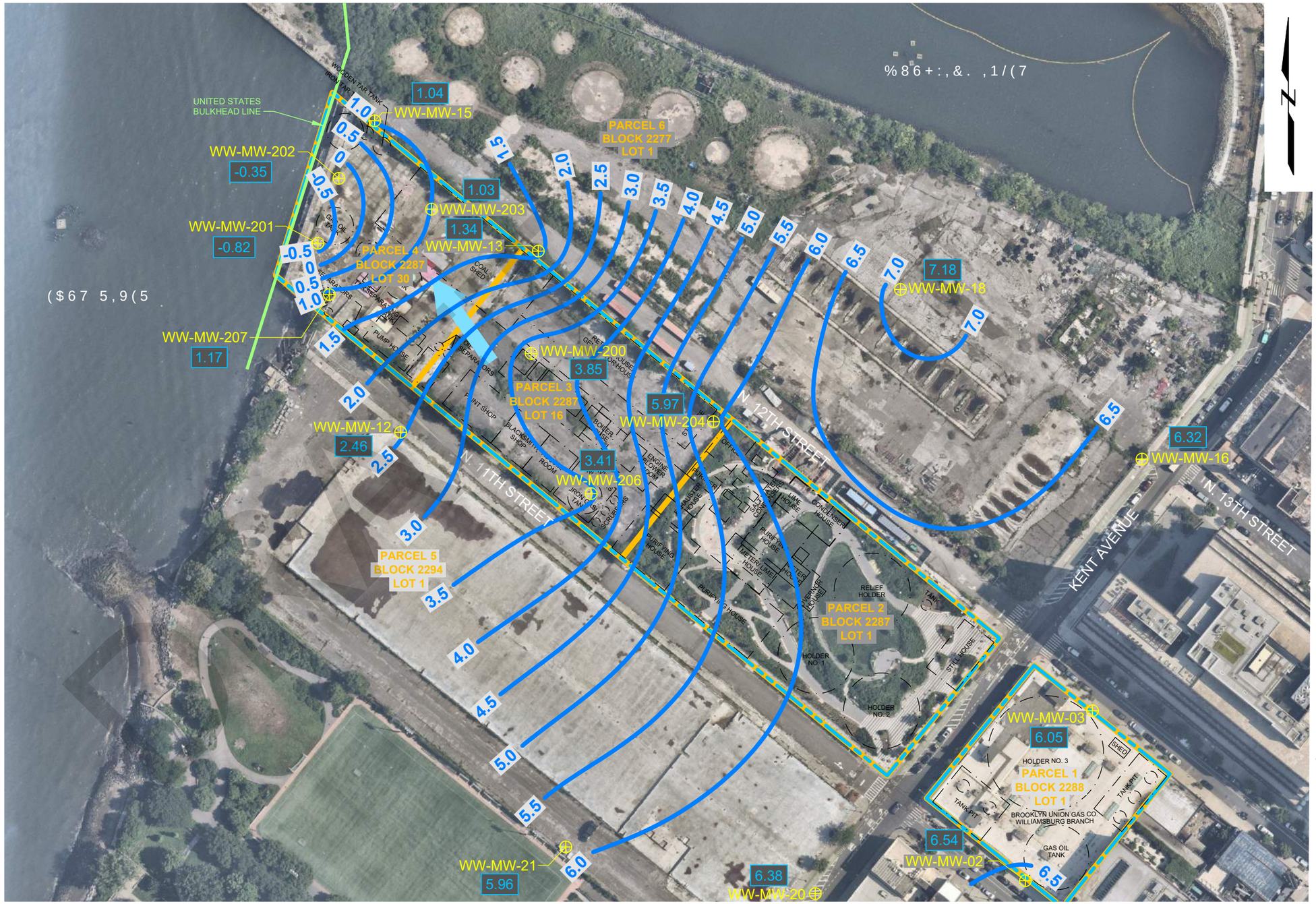
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MARCH 8, 2023 HIGH TIDE GROUNDWATER SURFACE ELEVATION CONTOURS

Project 093060 | October 2026 | Fig. 3

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/(*(1',

- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- WW-MW-02 — MONITORING WELL
- 5.0 — GROUNDWATER CONTOUR (FEET NAVD88)
- GROUNDWATER FLOW DIRECTION
- 7.18 — GROUNDWATER ELEVATION (FEET NAVD88) MEASURED 3/8/2023

127(6

1. CONTOURS MADE BY KRIGING INTERPOLATION.
2. GROUNDWATER CONTOURS AND ELEVATIONS ARE IN FEET ABOVE NORTH AMERICAN VERTICAL DATUM (NAVD88)
3. MONITORING WELLS WERE INSTALLED SPANNING THE GROUNDWATER SURFACE.
4. GROUNDWATER CONTOURS WERE GENERATED USING DATA FROM LOW TIDE GAUGING ON MARCH 8, 2023.

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1. AERIAL PHOTOGRAPH NEARMAP ©2024 IMAGERY DATE: 07/03/2025.
2. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM +773 ::: 2$6,61<& ACCESSED JANUARY 2008.
3. SURVEY OF WILLIAMSBURG WORKS BOUNDARIES, EXISTING CONDITIONS, AND SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. SURVEYED BY NEW YORK STATE-LICENSED LAND SURVEYOR No. 050146.

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SCALE, FEET

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MARCH 8, 2023 LOW TIDE GROUNDWATER SURFACE ELEVATION CONTOURS

Project 093060 | October 2026 | Fig. 4

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LEGEND:

- HISTORIC TANKS
- PARCEL 6 CONDUITS
- OIL CONDUIT
- OIL CONDUIT (INFERRED)

N

SOURCE:

1. PLAN BASED ON 1905 SANBORN MAP.
2. OIL CONDUIT LINE FROM DRAWING TITLED *EXHIBIT 11 - LONG ISLAND PIPE LINE CORP. SCHEMATIC DIAGRAM OF SHIPPERS LINE, LONG ISLAND CITY TERMINAL, 30-25 GREENPOINT AVE., LONG ISLAND CITY,* BUCKEY PARTNERS 104(e) RESPONSE, 8-24-2012.
3. PRATT CONDUIT LINES FROM DRAWING TITLED *1D36: EXCAVATION PLAN FOR PUMP HOUSE, SETTLING TANK AND OIL SEPARATOR,* WILLIAMSBURG WORKS, EXT. NO. 2, THE BROOKLYN UNION GAS CO., BROOKLYN, NY, SCALE: 1/8" = 1 FT, DATE: NOV. 9, 1908.
4. OIL CONDUIT LINE TO NEWTOWN CREEK FROM: LIONEL PINCUS AND PRINCESS FIRYAL MAP DIVISION, THE NEW YORK PUBLIC LIBRARY. "BROOKLYN, VOL. 1, 2ND PART, DOUBLE PAGE PLATE NO. 33; PART OF WARDS 14, 15, 17, SECTION 8-9; [MAP BOUNDED BY MESEROLE AVE., JEWEL ST., NASAU AVE., HUMBOLDT ST., MEEKER AVE., RICHARDSON ST.; INCLUDING UNION AVE., N. 9TH ST., EAST RIVER, GREENPOINT AVE., MANHATTAN AVE.]" THE NEW YORK PUBLIC LIBRARY DIGITAL COLLECTIONS. 1916. *(http://digitalcollections.nypl.org/items/69582cf7-d6cc-ba72-e040-e00a18065eba)*

BLOCK 2277 LOT 1

BLOCK 2287 LOT 30

BLOCK 2287 LOT 16

BLOCK 2294 LOT 1

BLOCK 2287 LOT 1

BLOCK 2294 LOT 5

OIL CONDUIT

PRATT OIL CONDUIT

STANDARD OIL PIPELINE TO NEWTOWN CREEK

OIL CONDUIT TO NEWTOWN CREEK

TUNNEL (1916)

0 60' 120'

SCALE: 1" = 60'

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Borough of Brooklyn, New York

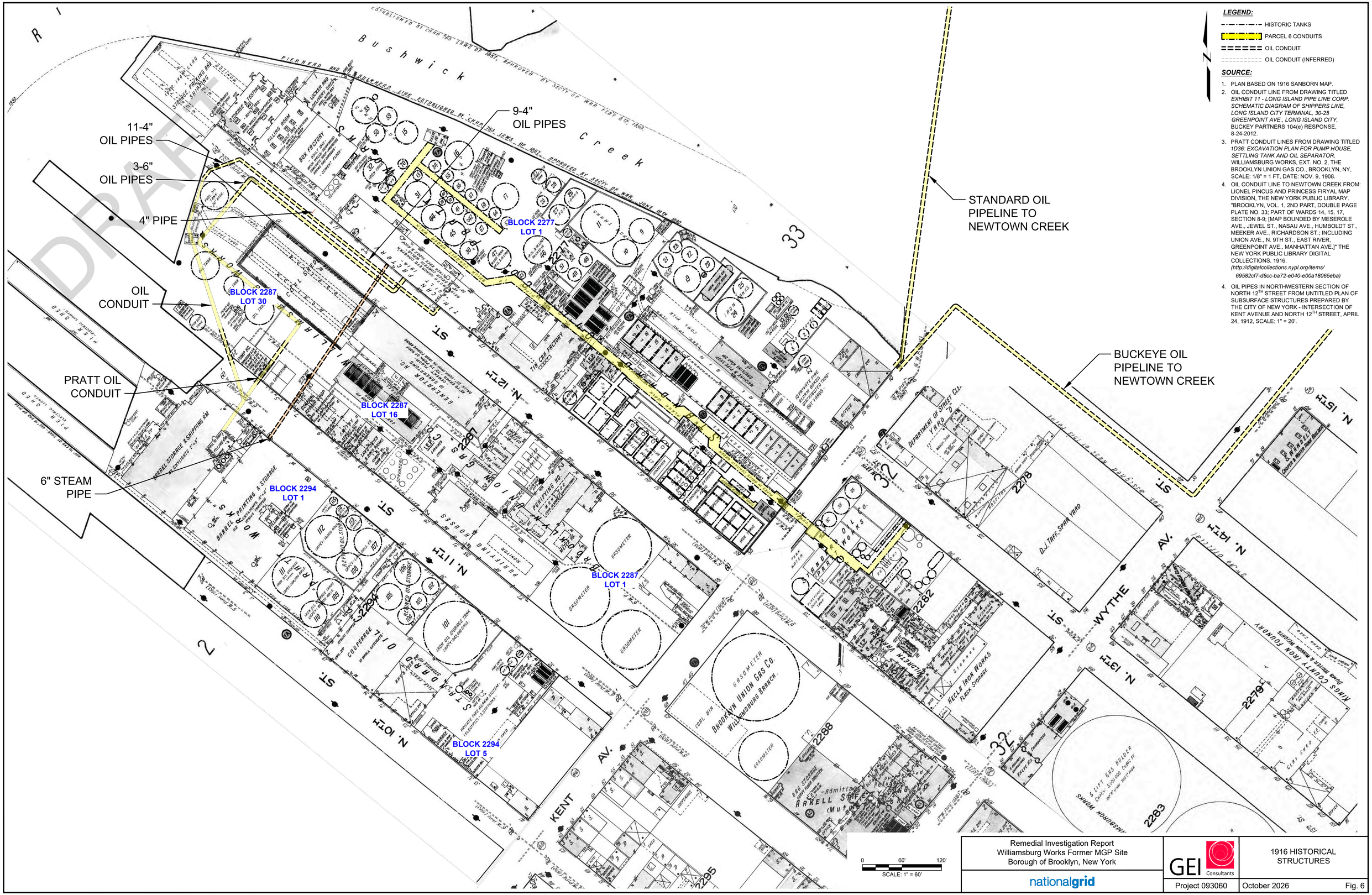
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1905 HISTORICAL STRUCTURES

Project 093060 | October 2026 | Fig. 5

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Borough of Brooklyn, New York

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1916 HISTORICAL STRUCTURES

Project 093060 | October 2026 | Fig. 6

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11-4" OIL PIPES

3-6" OIL PIPES

4" PIPE

OIL CONDUIT

PRATT OIL CONDUIT

6" STEAM PIPE

9-4" OIL PIPES

BLOCK 2277 LOT 1

BLOCK 2287 LOT 30

BLOCK 2287 LOT 16

BLOCK 2294 LOT 1

BLOCK 2287 LOT 1

BLOCK 2294 LOT 5

STANDARD OIL PIPELINE TO NEWTOWN CREEK

BUCKEYE OIL PIPELINE TO NEWTOWN CREEK

TUNNEL (1916)

LEGEND:

- HISTORIC TANKS
- PARCEL 6 CONDUITS
- OIL CONDUIT
- OIL CONDUIT (INFERRED)

SOURCE:

1. PLAN BASED ON 1916 AND 1978 SANBORN MAPS.
2. OIL CONDUIT LINE FROM DRAWING TITLED *EXHIBIT 11 - LONG ISLAND PIPE LINE CORP. SCHEMATIC DIAGRAM OF SHIPPERS LINE, LONG ISLAND CITY TERMINAL, 30-25 GREENPOINT AVE., LONG ISLAND CITY,* BUCKEY PARTNERS 104(e) RESPONSE, 8-24-2012.
3. PRATT CONDUIT LINES FROM DRAWING TITLED *1D36: EXCAVATION PLAN FOR PUMP HOUSE, SETTLING TANK AND OIL SEPARATOR,* WILLIAMSBURG WORKS, EXT. NO. 2, THE BROOKLYN UNION GAS CO., BROOKLYN, NY, SCALE: 1/8" = 1 FT, DATE: NOV. 9, 1908.
4. OIL PIPES IN NORTHWESTERN SECTION OF NORTH 12TH STREET FROM UNTITLED PLAN OF SUBSURFACE STRUCTURES PREPARED BY THE CITY OF NEW YORK - INTERSECTION OF KENT AVENUE AND NORTH 12TH STREET, APRIL 24, 1912, SCALE: 1" = 20'.

0 60' 120'
SCALE: 1" = 60'

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Borough of Brooklyn, New York

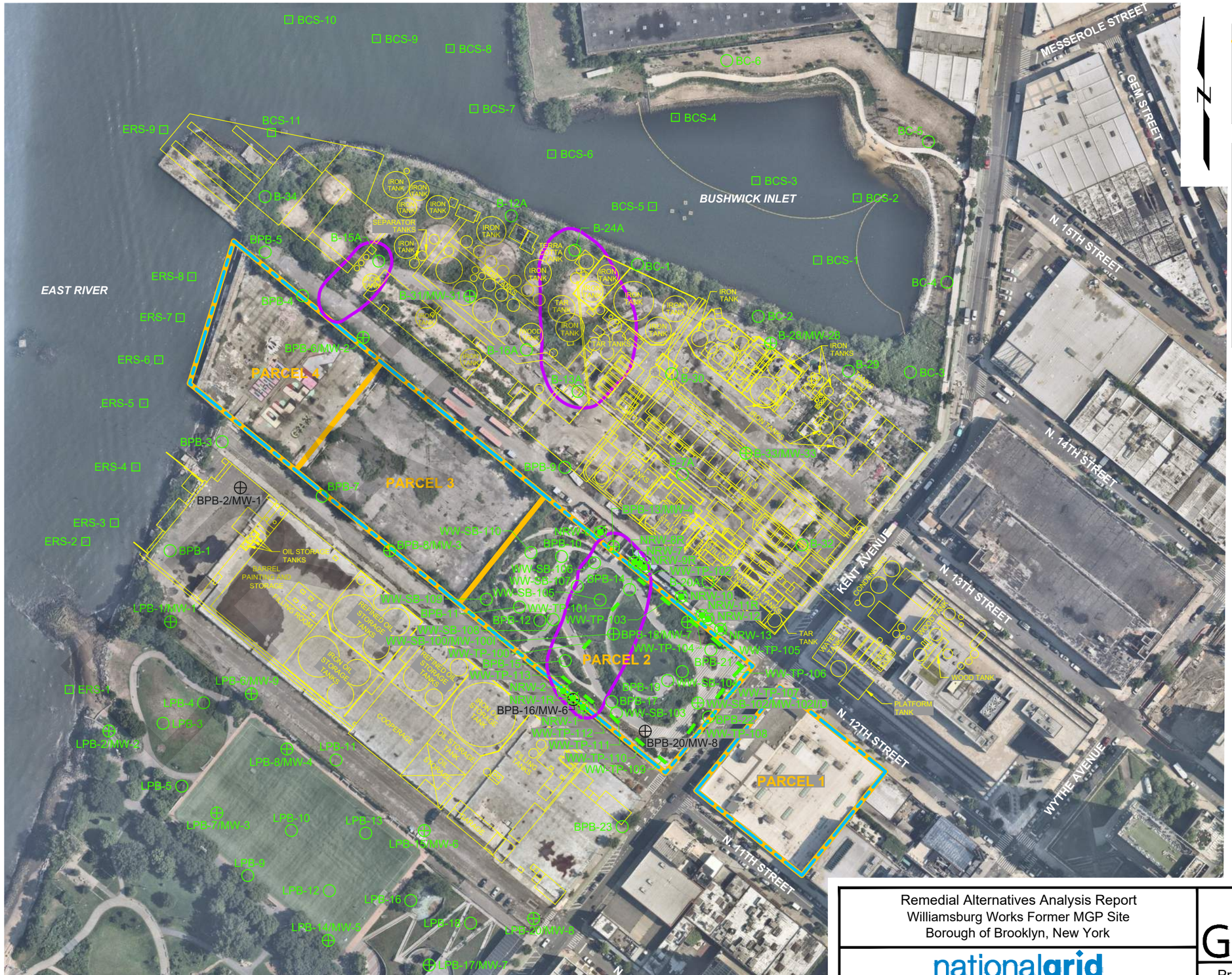
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1978 HISTORICAL STRUCTURES

Project 093060 | October 2026 | Fig. 7

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LEGEND:

- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC NON-MGP STRUCTURES

OTHER INVESTIGATION SAMPLE LOCATIONS

- SOIL BORING [3, 4, 5, 6]
- SEDIMENT CORE [4, 6]
- MONITORING WELL [3, 4, 5]
- ABANDONED / DESTROYED MONITORING WELL
- RECOVERY WELL [7]
- TEST PIT [8]
- PETROLEUM PLUME [5, 6]

SOURCES:

1. AERIAL PHOTOGRAPH NEARMAP ©2024 IMAGERY DATE: 07/03/2025.
2. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM *HTTP://WWW.OASISNYC.NET* ACCESSED JANUARY 2008.
3. SITE INVESTIGATION REPORT BAYSIDE FUEL OIL COMPANY, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC. NOVEMBER 2006.
4. SITE INVESTIGATION REPORT PROPERTY WEST OF KENT AVENUE BETWEEN AND INCLUDING NORTH 10TH AND NORTH 12TH STREETS, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.
5. SITE INVESTIGATION REPORT 9TH STREET EQUITIES, LLC, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., AUGUST 2006.
6. SITE INVESTIGATION REPORT MOTIVA ENTERPRISES, LLC / BUSHWICK CREEK INLET, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.
7. URS CORPORATION, NAPL RECOVERY WELLS, CONSTRUCTION COMPLETION REPORT, NOVEMBER 2014.
8. URS CORPORATION, IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC VIA EMAIL ON FEBRUARY 12, 2013.

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SCALE, FEET

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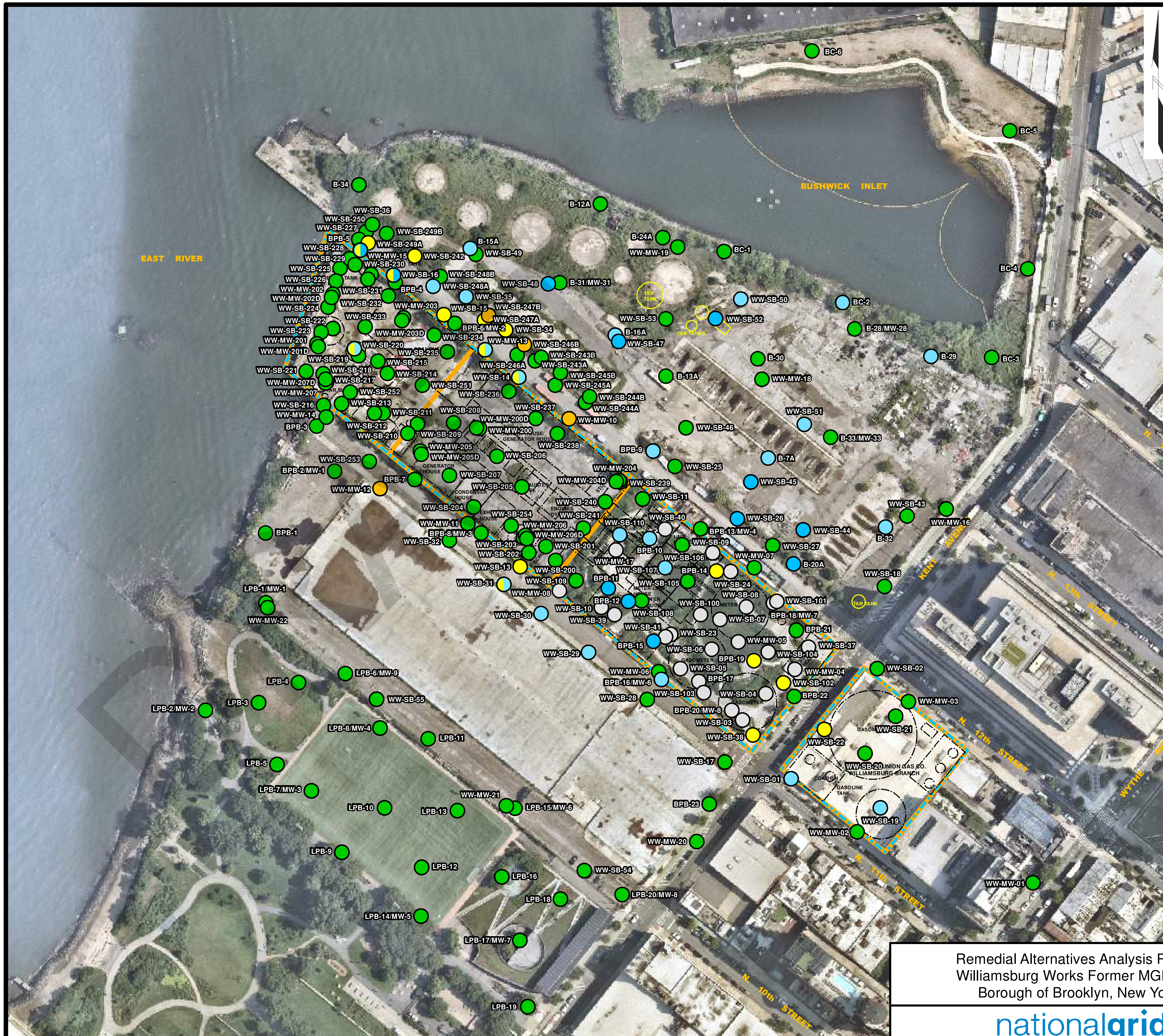
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HISTORIC NON-MGP STRUCTURES AND PETROLEUM PLUME LOCATIONS

Project 093060 | October 2026 | Fig. 8

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LEGEND

- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATION & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED
- REMEDIATED

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
4. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM HTTP://WWW.OASISNYC.NET ACCESSED JANUARY 2008.
5. SURVEY OF WILLIAMSBURG WORKS BOUNDARIES, EXISTING CONDITIONS, AND SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. SURVEYED BY NEW YORK STATE-LICENSED LAND SURVEYOR No. 050146.
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7. SITE INVESTIGATION REPORT PROPERTY WEST OF KENT AVENUE BETWEEN AND INCLUDING NORTH 10TH AND NORTH 12TH STREETS, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.
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9. SITE INVESTIGATION REPORT MOTIVA ENTERPRISES, LLC / BUSHWICK CREEK INLET, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.
10. URS CORPORATION IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC. VIA EMAIL ON FEBRUARY 12, 2013.

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SCALE, FEET

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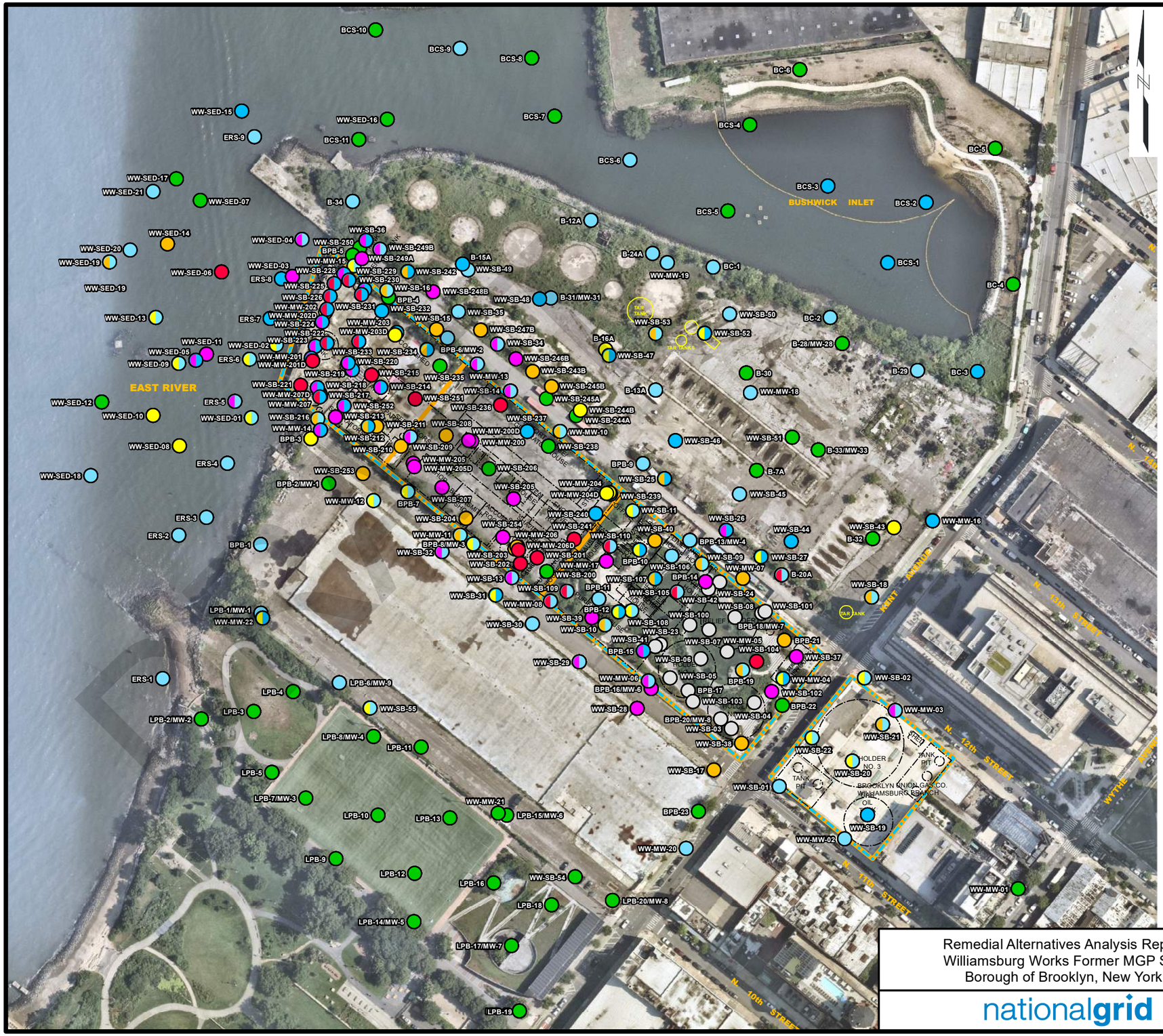
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OBSERVED PHYSICAL IMPACTS UNSATURATED ZONE

October 2026

Fig. 9

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LEGEND

- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATION & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED
- REMEDIATED

NOTE:
IMPACTS SHOWN ON PARCEL 2, N.11TH STREET, AND N. 12TH STREET ARE BASED ON IMPACTS OBSERVED DURING INSTALLATION OF THE SOIL BORING, NOT FOLLOWING THE NAPL RECOVERY IRM.

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
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10. URS CORPORATION IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC. VIA EMAIL ON FEBRUARY 12, 2013.

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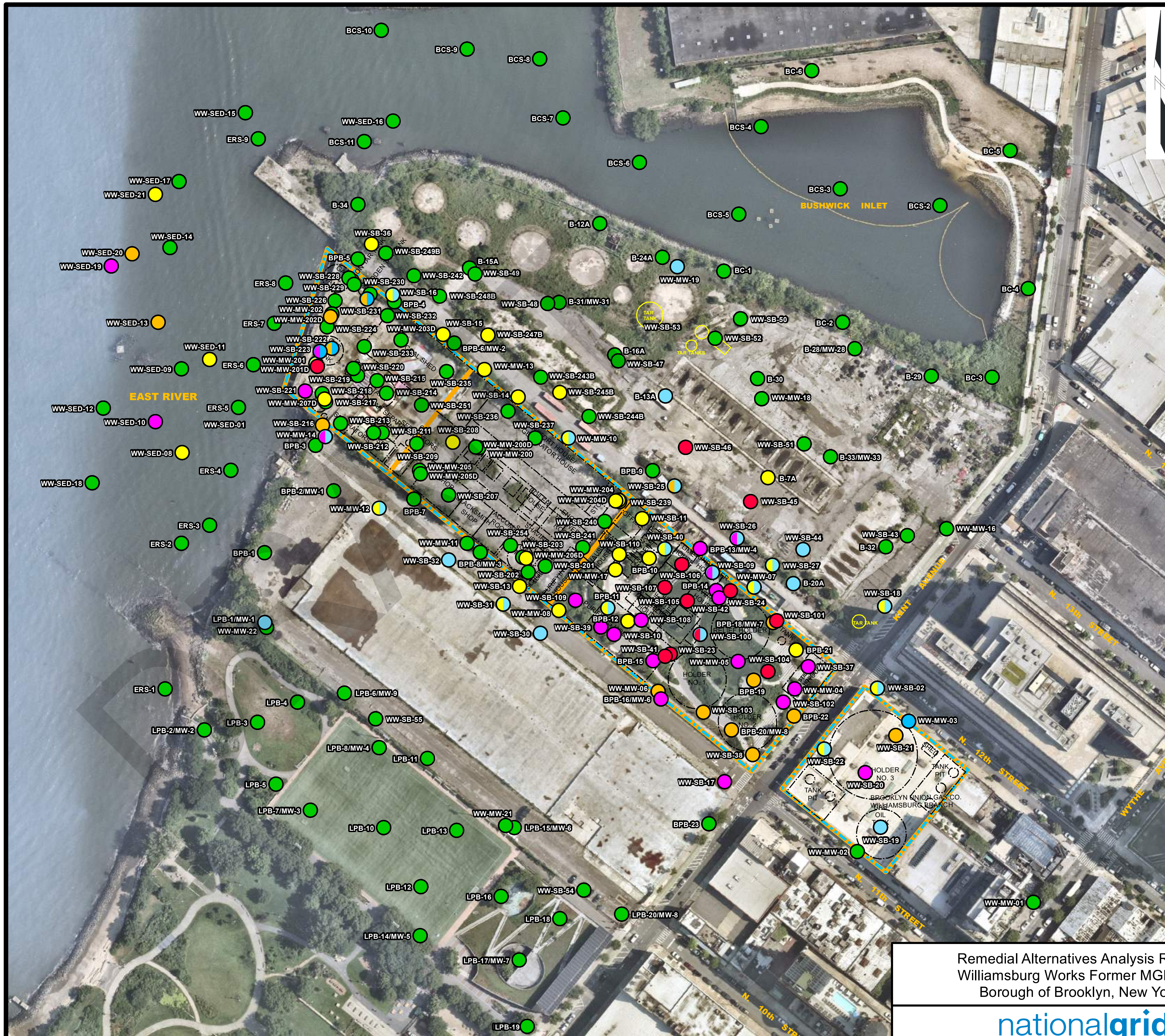
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OBSERVED PHYSICAL IMPACTS SATURATED ZONE TO 30 FEET BELOW GRADE

Project 093060 | October 2026 | Fig. 10

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LEGEND

APPROXIMATE CURRENT PARCEL BOUNDARY

APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY

HISTORIC MGP STRUCTURES

HISTORIC NON-MGP STRUCTURES

NAPL IMPACTS SATURATED

NAPL IMPACTS COATED MATERIAL, LENSES

NAPL IMPACTS BLEBS, GLOBS, SHEEN

NAPL IMPACTS STAINING

PETROLEUM IMPACTS SATURATION & SHEEN

PETROLEUM IMPACTS STAINING

NO IMPACT OBSERVED

REMEDIATED

NOTE:

IMPACTS SHOWN ON PARCEL 2, N.11TH STREET, AND N. 12TH STREET ARE BASED ON IMPACTS OBSERVED DURING INSTALLATION OF THE SOIL BORING, NOT FOLLOWING THE NAPL RECOVERY IRM.

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.

2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).

3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.

4. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM HTTP://WWW.OASISNYC.NET ACCESSED JANUARY 2008.

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9. SITE INVESTIGATION REPORT MOTIVA ENTERPRISES, LLC / BUSHWICK CREEK INLET, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.

10. URS CORPORATION IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC. VIA EMAIL ON FEBRUARY 12, 2013.

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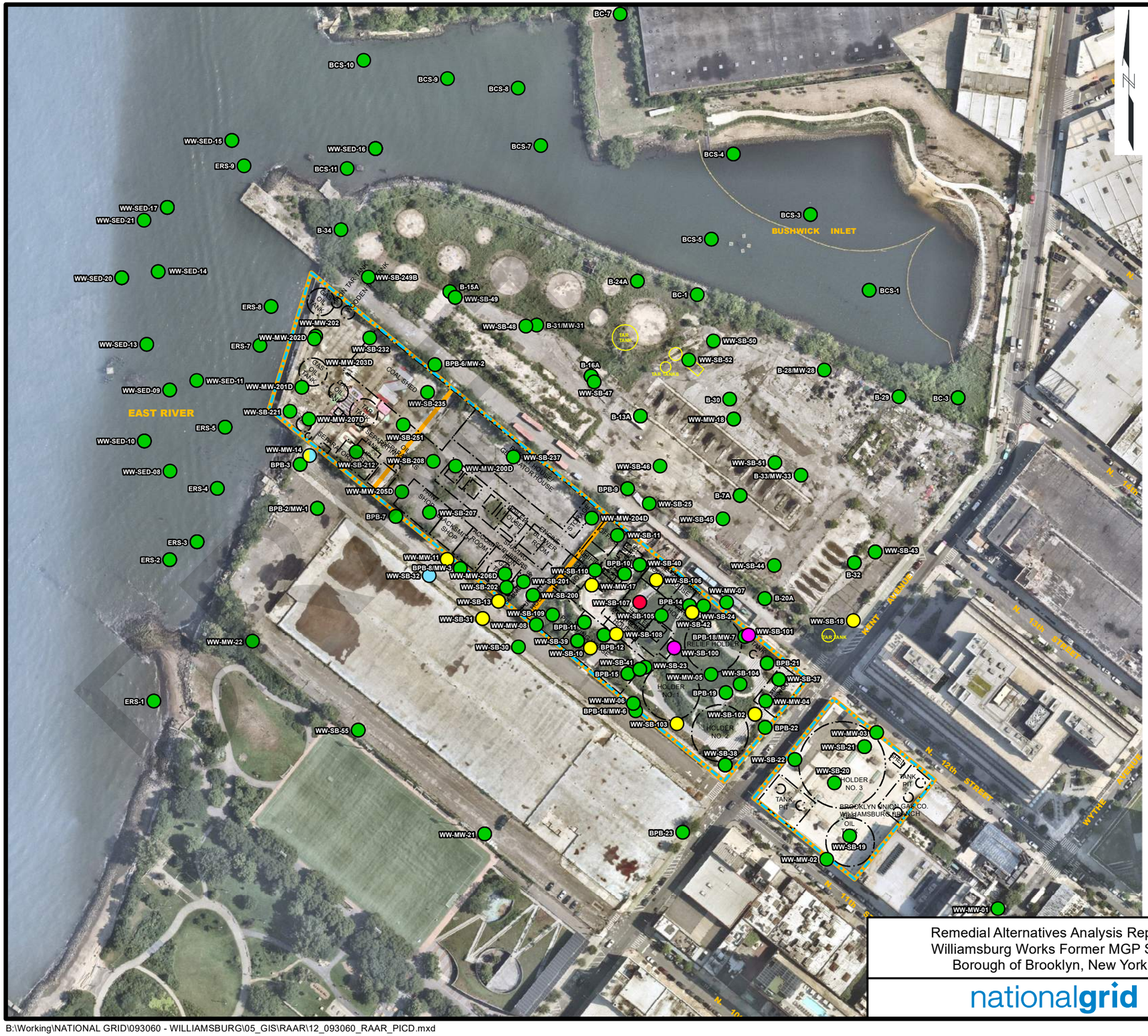
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OBSERVED PHYSICAL IMPACTS SATURATED ZONE BELOW 30 FEET AND ABOVE CLAY

Project 093060 | October 2026 | Fig. 11

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LEGEND

- APPROXIMATE CURRENT PARCEL BOUNDARY
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- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES
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- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATION & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED

NOTE:
WW-SB-100 THROUGH WW-SB-110 WERE INSTALLED BY URS USING HOLLOW STEM AUGER METHODS DURING THE PDI. IMPACTS OBSERVED BELOW THE CLAY ARE ASSUMED TO BE AN ARTIFACT OF HOLLOW STEM AUGER DRILLING METHODS.

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
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SCALE, FEET

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Borough of Brooklyn, New York

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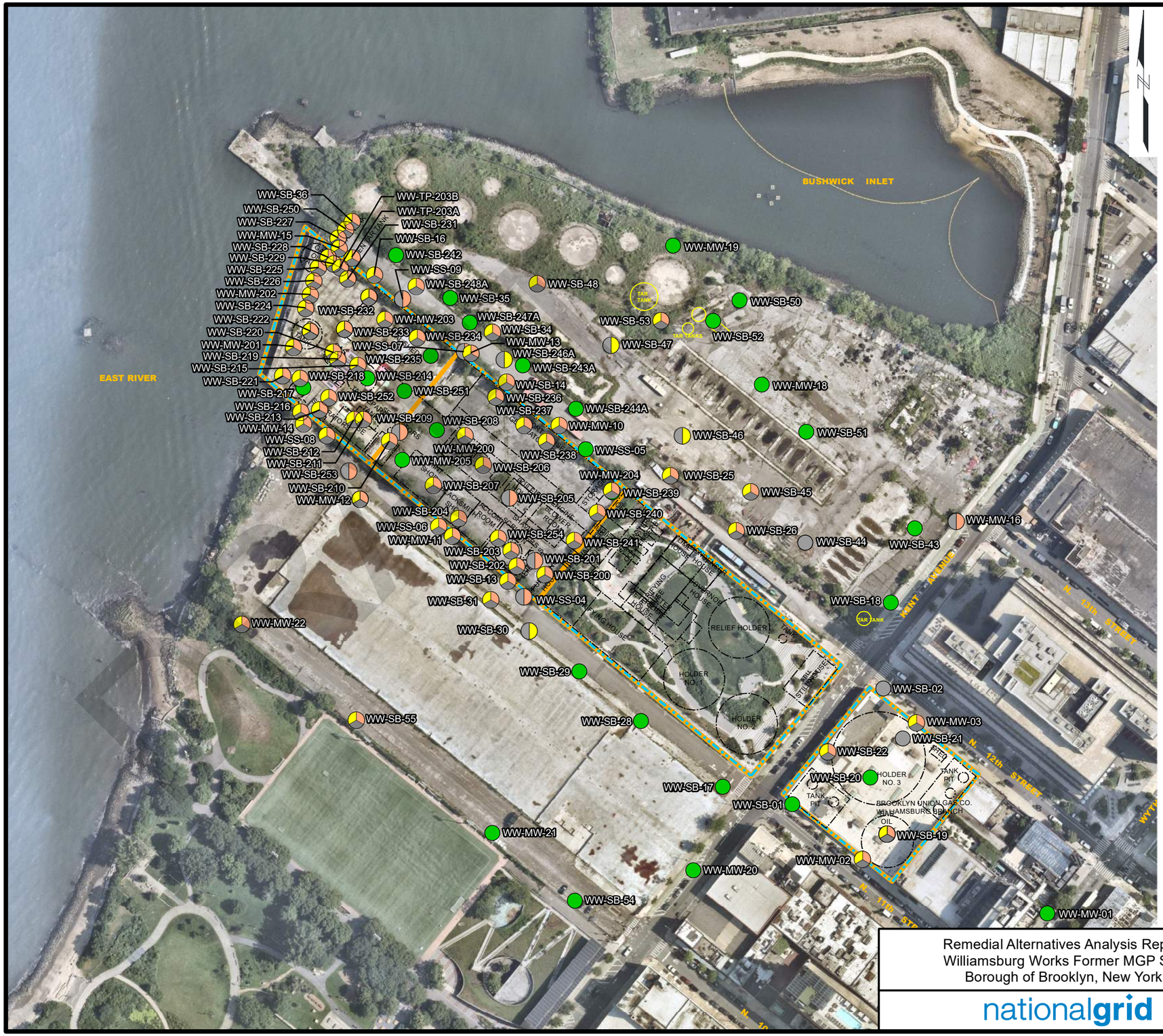
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Project 093060

OBSERVED PHYSICAL IMPACTS CLAY AND DEEPER

October 2026 Fig. 12

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\12_093060_RAAR_PICD.mxd



LEGEND

- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES
- EXCEEDS UNRESTRICTED, PROTECTION OF GROUNDWATER AND RESTRICTED RESIDENTIAL OR INDUSTRIAL SCOs
- EXCEEDS UNRESTRICTED AND RESTRICTED RESIDENTIAL SCOs
- EXCEEDS UNRESTRICTED AND PROTECTION OF GROUNDWATER SCOs
- EXCEEDS UNRESTRICTED SCO
- NO EXCEEDANCE

NOTE:
IMPACTS SHOWN ON PARCEL 2, N.11TH STREET, AND N. 12TH STREET ARE BASED ON IMPACTS OBSERVED DURING INSTALLATION OF THE SOIL BORING, NOT FOLLOWING THE NAPL RECOVERY IRM.

SOURCE:
1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
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0 150 300
SCALE, FEET

Remedial Alternatives Analysis Report
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

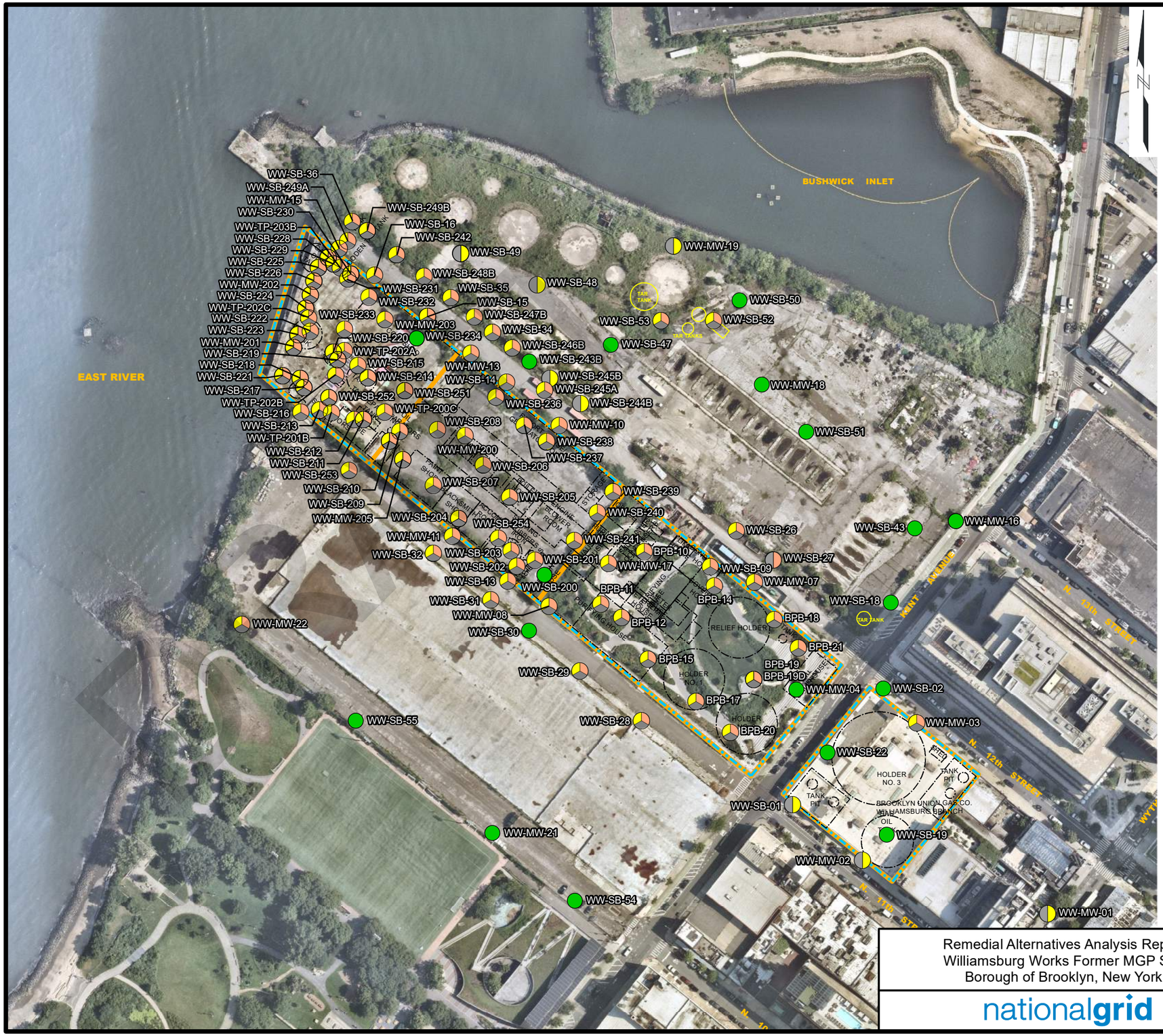
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SUBSURFACE SOIL ANALYTICAL RESULT SCO EXCEEDANCES – UNSATURATED SOIL

Project 093060 | October 2026 | Fig. 13

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\13_093060_RAAR_UNST.mxd



LEGEND

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0 150 300
SCALE, FEET

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Borough of Brooklyn, New York

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SUBSURFACE SOIL ANALYTICAL RESULT SCO EXCEEDANCES – SATURATED SOIL ABOVE 30 FEET BGS

Project 093060 | October 2026 | Fig. 14

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\14_093060_RAAR_SAT_AB30.mxd



LEGEND

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- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
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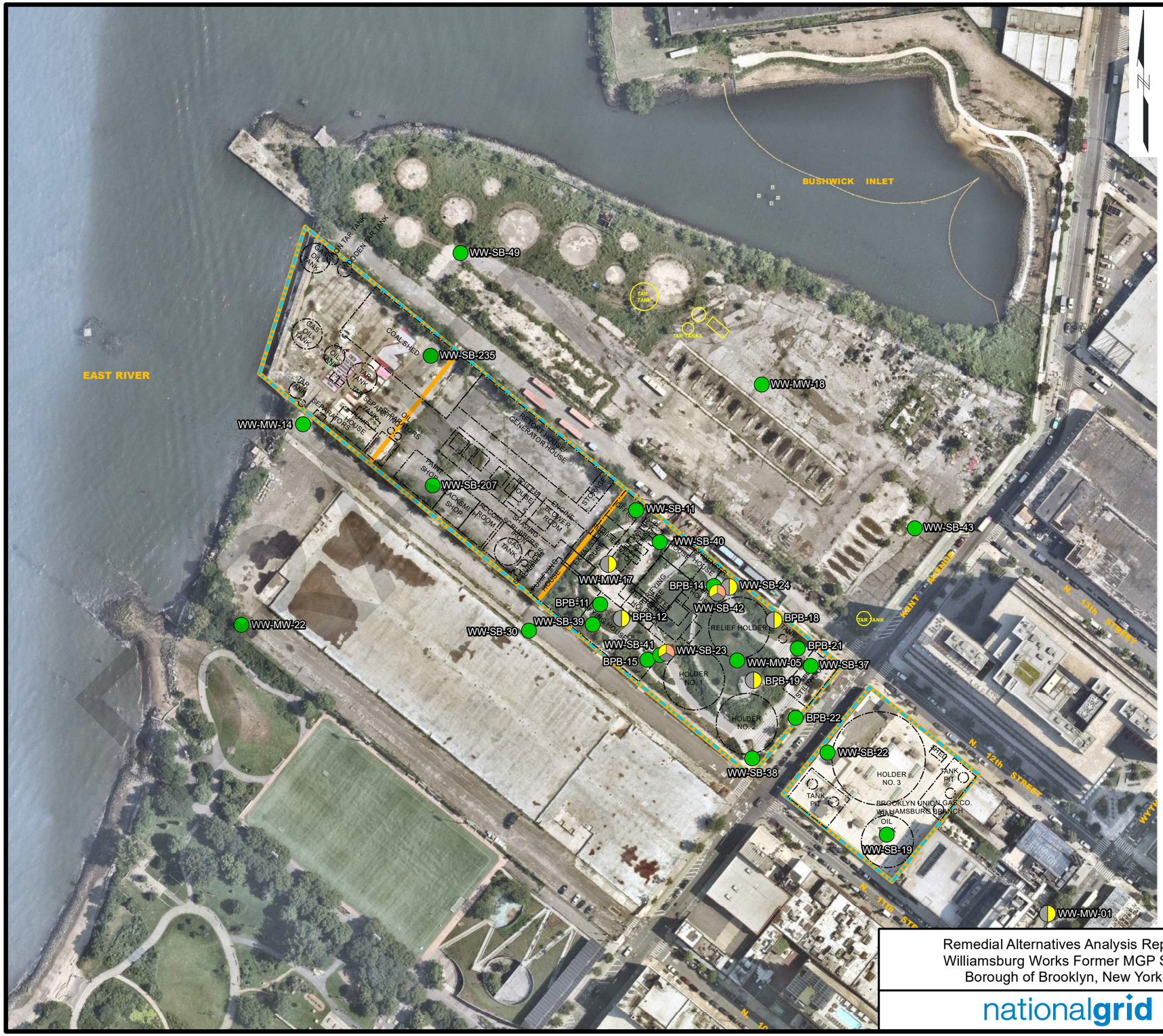
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SUBSURFACE SOIL ANALYTICAL RESULT SCO EXCEEDANCES – SATURATED SOIL BELOW 30 FEET BGS

Project 093060 | October 2026 | Fig. 15

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\15_093060_RAAR_SAT_BL30.mxd



LEGEND

- APPROXIMATE CURRENT PARCEL BOUNDARY
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- NO EXCEEDANCE

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0 150 300
SCALE, FEET

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

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SUBSURFACE SOIL ANALYTICAL RESULT SCO EXCEEDANCES – WITHIN CLAY

Project 093060 | October 2026 | Fig. 16

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\16_093060_RAAR_CLAY.mxd

Sample Name: / Screen Interval (feet bgs): / Sample Date:	NYS AWQS	WW-MW-04 10 - 20 11/4/2009	Duplicate of WWMW-04 10 - 20 11/5/2009	WW-MW-06 0.3 - 10.3 11/4/2009	WW-MW-07 1 - 11 11/5/2009	WW-MW-08 0.3 - 10.3 11/5/2009	WW-MW-17 4 - 14 11/5/2009
BTEX (ug/L)							
Benzene	1	8.7	9.2	270	23	570	5 U
Toluene	5	5.2	5.4	13 J	9	64 J	5 U
Ethylbenzene	5	16	17	940	8.4	2800	5 U
Total Xylene	5	21	23	690	60	3100	5 U
Other VOCs (ug/L)							
Styrene	5	1.9 J	2.1 J	50 U	22	100 U	5 U
PAHs (ug/L)							
Acenaphthene	20*	3 J	3 J	60 J	1.4 J	140 J	2 J
Naphthalene	10*	43	56	2500	120	4000	4.1

LEGEND

- WW-MW-04 — MONITORING WELL WITH ANALYTICAL DATA PRESENTED IN CALLOUT BOX
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- PETROLEUM IMPACTS SATURATION & SHEEN
- NO NAPL OBSERVED
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX AND PAH COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR PAH COMPOUNDS
- INDIVIDUAL BTEX COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- INDIVIDUAL PAH COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION LOW TIDE INTERMEDIATE (9/11/2024)
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES

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SCALE, FEET

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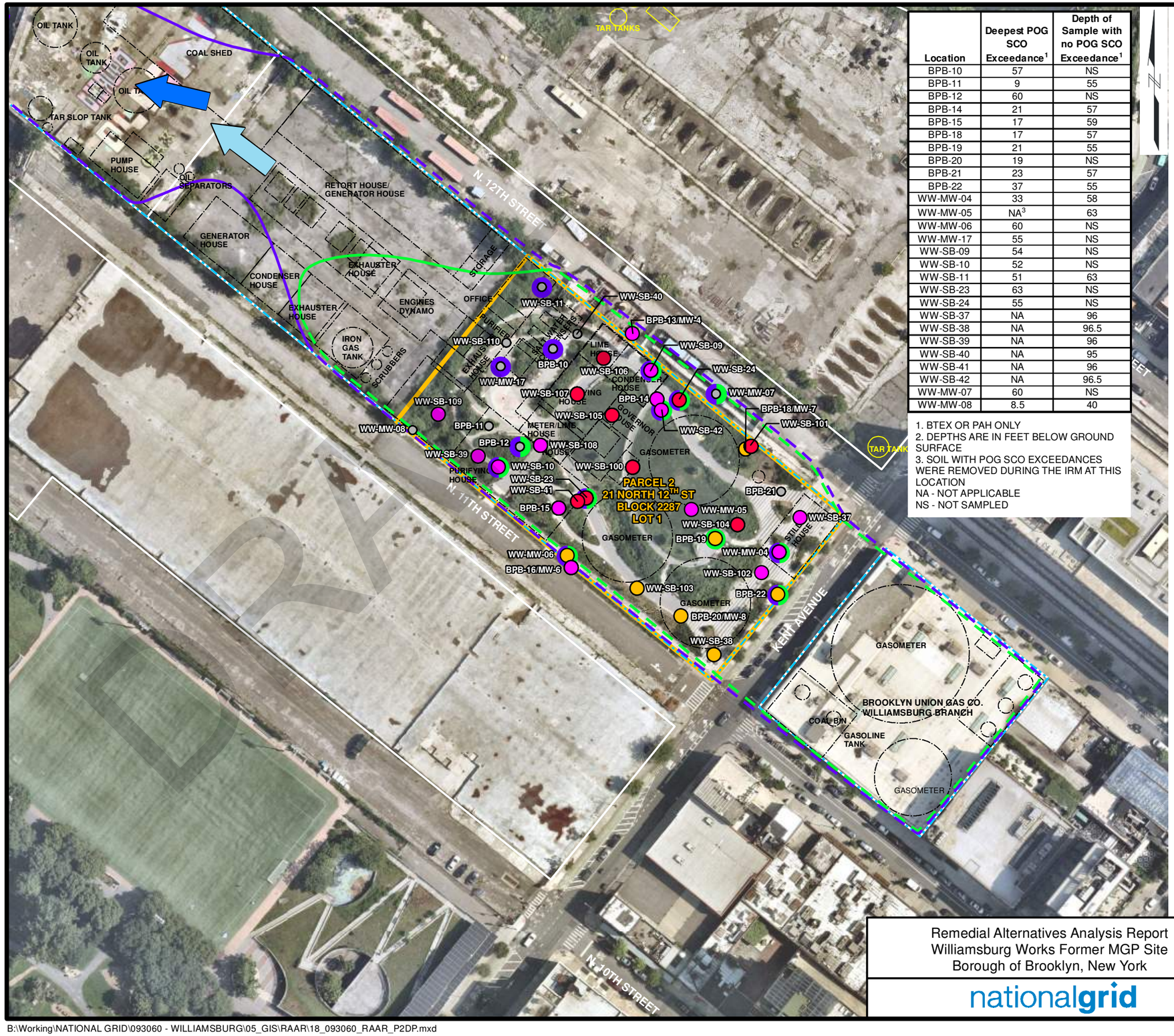
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PARCEL 2 GROUNDWATER EXCEEDANCES ABOVE 30 FEET

Project 093060 | October 2026 | Fig. 17

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\17_093060_RAAR_P2SH.mxd



Location	Deepest POG SCO Exceedance[1]	Depth of Sample with no POG SCO Exceedance[1]
BPB-10	57	NS
BPB-11	9	55
BPB-12	60	NS
BPB-14	21	57
BPB-15	17	59
BPB-18	17	57
BPB-19	21	55
BPB-20	19	NS
BPB-21	23	57
BPB-22	37	55
WW-MW-04	33	58
WW-MW-05	NA[3]	63
WW-MW-06	60	NS
WW-MW-17	55	NS
WW-SB-09	54	NS
WW-SB-10	52	NS
WW-SB-11	51	63
WW-SB-23	63	NS
WW-SB-24	55	NS
WW-SB-37	NA	96
WW-SB-38	NA	96.5
WW-SB-39	NA	96
WW-SB-40	NA	95
WW-SB-41	NA	96
WW-SB-42	NA	96.5
WW-MW-07	60	NS
WW-MW-08	8.5	40

1. BTEX OR PAH ONLY
2. DEPTHS ARE IN FEET BELOW GROUND SURFACE
3. SOIL WITH POG SCO EXCEEDANCES WERE REMOVED DURING THE IRM AT THIS LOCATION
NA - NOT APPLICABLE
NS - NOT SAMPLED

LEGEND

- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- PETROLEUM IMPACTS SATURATION & SHEEN
- NO NAPL OBSERVED
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX AND PAH COMPOUNDS
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- INDIVIDUAL BTEX COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
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- GROUNDWATER FLOW DIRECTION LOW TIDE INTERMEDIATE (9/11/2024)
- GROUNDWATER FLOW DIRECTION LOW TIDE DEEP (9/11/2024)
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
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0 100 200
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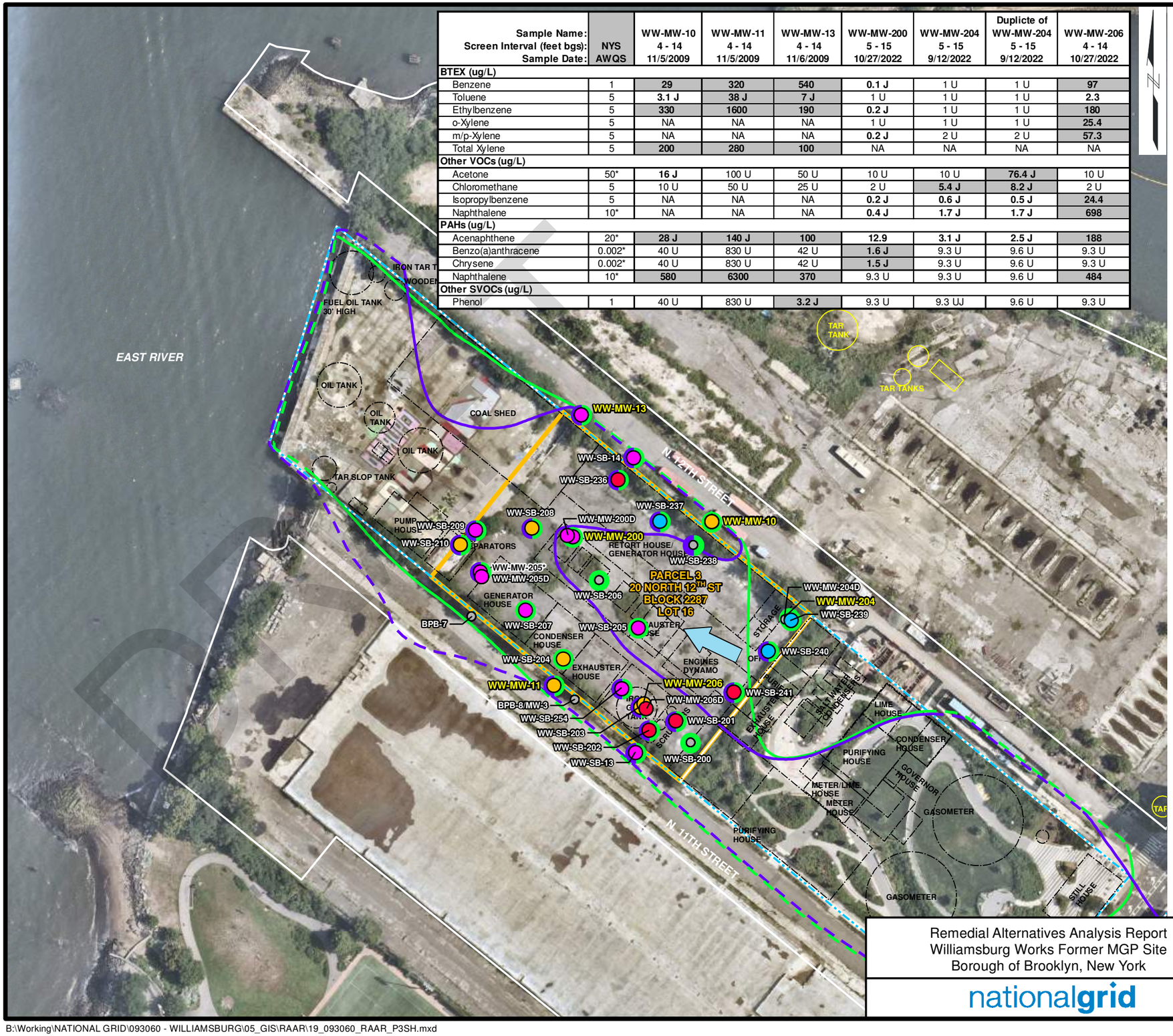
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PARCEL 2 GROUNDWATER EXCEEDANCES BELOW 30 FEET

Project 093060 | October 2026 | Fig. 18

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\18_093060_RAAR_P2DP.mxd

Sample Name: / Screen Interval (feet bgs): / Sample Date:	NYS AWQS	WW-MW-10 4 - 14 11/5/2009	WW-MW-11 4 - 14 11/5/2009	WW-MW-13 4 - 14 11/6/2009	WW-MW-200 5 - 15 10/27/2022	WW-MW-204 5 - 15 9/12/2022	Duplicte of WW-MW-204 5 - 15 9/12/2022	WW-MW-206 4 - 14 10/27/2022
BTEX (ug/L)								
Benzene	1	**29**	**320**	**540**	**0.1 J**	1 U	1 U	**97**
Toluene	5	**3.1 J**	**38 J**	**7 J**	1 U	1 U	1 U	**2.3**
Ethylbenzene	5	**330**	**1600**	**190**	**0.2 J**	1 U	1 U	**180**
o-Xylene	5	NA	NA	NA	1 U	1 U	1 U	**25.4**
m/p-Xylene	5	NA	NA	NA	**0.2 J**	2 U	2 U	**57.3**
Total Xylene	5	**200**	**280**	**100**	NA	NA	NA	NA
Other VOCs (ug/L)								
Acetone	50*	**16 J**	100 U	50 U	10 U	10 U	**76.4 J**	10 U
Chloromethane	5	10 U	50 U	25 U	2 U	**5.4 J**	**8.2 J**	2 U
Isopropylbenzene	5	NA	NA	NA	**0.2 J**	**0.6 J**	**0.5 J**	**24.4**
Naphthalene	10*	NA	NA	NA	**0.4 J**	**1.7 J**	**1.7 J**	**698**
PAHs (ug/L)								
Acenaphthene	20*	**28 J**	**140 J**	**100**	**12.9**	**3.1 J**	**2.5 J**	**188**
Benzo(a)anthracene	0.002*	40 U	830 U	42 U	**1.6 J**	9.3 U	9.6 U	9.3 U
Chrysene	0.002*	40 U	830 U	42 U	**1.5 J**	9.3 U	9.6 U	9.3 U
Naphthalene	10*	**580**	**6300**	**370**	9.3 U	9.3 U	9.6 U	**484**
Other SVOCs (ug/L)								
Phenol	1	40 U	830 U	**3.2 J**	9.3 U	9.3 UJ	9.6 U	9.3 U



LEGEND

- WW-MW-10 — MONITORING WELL WITH ANALYTICAL DATA PRESENTED IN CALLOUT BOX
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- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- PETROLEUM IMPACTS SATURATION & SHEEN
- NO NAPL OBSERVED
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX AND PAH COMPOUNDS
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10. URS CORPORATION IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC. VIA EMAIL ON FEBRUARY 12, 2013.

0 100 200

SCALE, FEET

Remedial Alternatives Analysis Report
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

nationalgrid

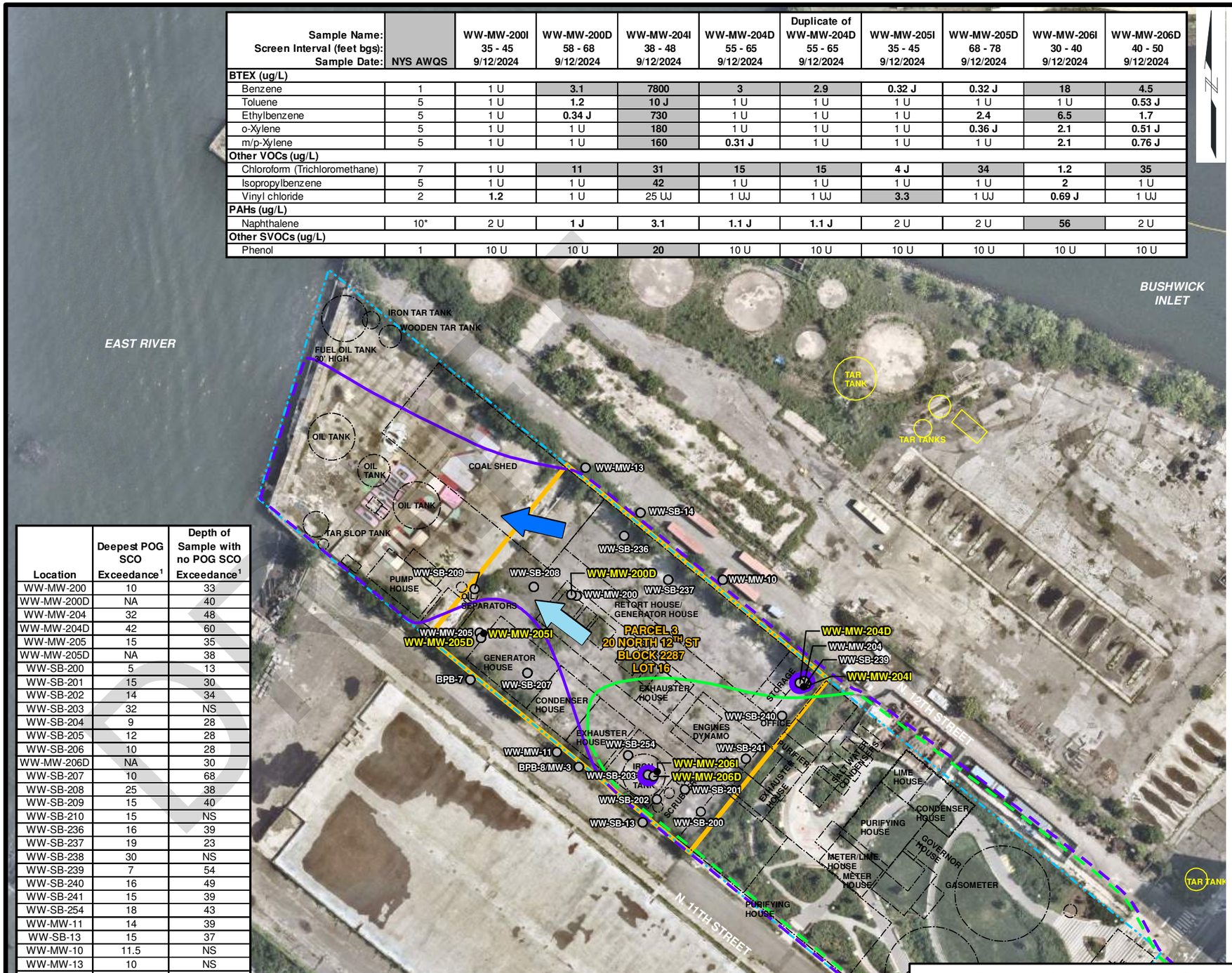
GEI Consultants

PARCEL 3 GROUNDWATER EXCEEDANCES ABOVE 30 FEET

Project 093060 | October 2026 | Fig. 19

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\19_093060_RAAR_P3SH.mxd

Sample Name: / Screen Interval (feet bgs): / Sample Date:	NYS AWQS	WW-MW-200I 35 - 45 9/12/2024	WW-MW-200D 58 - 68 9/12/2024	WW-MW-204I 38 - 48 9/12/2024	WW-MW-204D 55 - 65 9/12/2024	Duplicate of WW-MW-204D 55 - 65 9/12/2024	WW-MW-205I 35 - 45 9/12/2024	WW-MW-205D 68 - 78 9/12/2024	WW-MW-206I 30 - 40 9/12/2024	WW-MW-206D 40 - 50 9/12/2024
BTEX (ug/L)										
Benzene	1	1 U	**3.1**	**7800**	**3**	**2.9**	**0.32 J**	**0.32 J**	**18**	**4.5**
Toluene	5	1 U	**1.2**	**10 J**	1 U	1 U	1 U	1 U	1 U	**0.53 J**
Ethylbenzene	5	1 U	**0.34 J**	**730**	1 U	1 U	1 U	**2.4**	**6.5**	**1.7**
o-Xylene	5	1 U	1 U	**180**	1 U	1 U	1 U	**0.36 J**	**2.1**	**0.51 J**
m/p-Xylene	5	1 U	1 U	**160**	**0.31 J**	1 U	1 U	1 U	**2.1**	**0.76 J**
Other VOCs (ug/L)										
Chloroform (Trichloromethane)	7	1 U	**11**	**31**	**15**	**15**	**4 J**	**34**	**1.2**	**35**
Isopropylbenzene	5	1 U	1 U	**42**	1 U	1 U	1 U	1 U	**2**	1 U
Vinyl chloride	2	**1.2**	1 U	25 UJ	1 UJ	1 UJ	**3.3**	1 UJ	**0.69 J**	1 UJ
PAHs (ug/L)										
Naphthalene	10*	2 U	**1 J**	**3.1**	**1.1 J**	**1.1 J**	2 U	2 U	**56**	2 U
Other SVOCs (ug/L)										
Phenol	1	10 U	10 U	**20**	10 U	10 U	10 U	10 U	10 U	10 U



Location	Deepest POG SCO Exceedance[1]	Depth of Sample with no POG SCO Exceedance[1]
WW-MW-200	10	33
WW-MW-200D	NA	40
WW-MW-204	32	48
WW-MW-204D	42	60
WW-MW-205	15	35
WW-MW-205D	NA	38
WW-SB-200	5	13
WW-SB-201	15	30
WW-SB-202	14	34
WW-SB-203	32	NS
WW-SB-204	9	28
WW-SB-205	12	28
WW-SB-206	10	28
WW-MW-206D	NA	30
WW-SB-207	10	68
WW-SB-208	25	38
WW-SB-209	15	40
WW-SB-210	15	NS
WW-SB-236	16	39
WW-SB-237	19	23
WW-SB-238	30	NS
WW-SB-239	7	54
WW-SB-240	16	49
WW-SB-241	15	39
WW-SB-254	18	43
WW-MW-11	14	39
WW-SB-13	15	37
WW-MW-10	11.5	NS
WW-MW-13	10	NS
WW-SB-14	11	NS

1. BTEX OR PAH ONLY
2. DEPTHS ARE IN FEET BELOW GROUND SURFACE
NA - NOT APPLICABLE
NS - NOT SAMPLED

LEGEND

WW-MW-200D

- MONITORING WELL WITH ANALYTICAL DATA PRESENTED IN CALLOUT BOX
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- PETROLEUM IMPACTS SATURATION & SHEEN
- NO NAPL OBSERVED
- WELL WITH NO DOCUMENTED VISUAL IMPACT INFORMATION
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX AND PAH COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR PAH COMPOUNDS
- INDIVIDUAL BTEX COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- INDIVIDUAL PAH COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION LOW TIDE INTERMEDIATE (9/11/2024)
- GROUNDWATER FLOW DIRECTION LOW TIDE DEEP (9/11/2024)
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
4. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM HTTP://WWW.OASISNYC.NET ACCESSED JANUARY 2008.
5. SURVEY OF WILLIAMSBURG WORKS BOUNDARIES, EXISTING CONDITIONS, AND SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. SURVEYED BY NEW YORK STATE-LICENSED LAND SURVEYOR No. 050146.
6. SITE INVESTIGATION REPORT BAYSIDE FUEL OIL COMPANY, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC. NOVEMBER 2006.
7. SITE INVESTIGATION REPORT PROPERTY WEST OF KENT AVENUE BETWEEN AND INCLUDING NORTH 10TH AND NORTH 12TH STREETS, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.
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10. URS CORPORATION IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC. VIA EMAIL ON FEBRUARY 12, 2013.

0 100 200

SCALE, FEET

Remedial Alternatives Analysis Report
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

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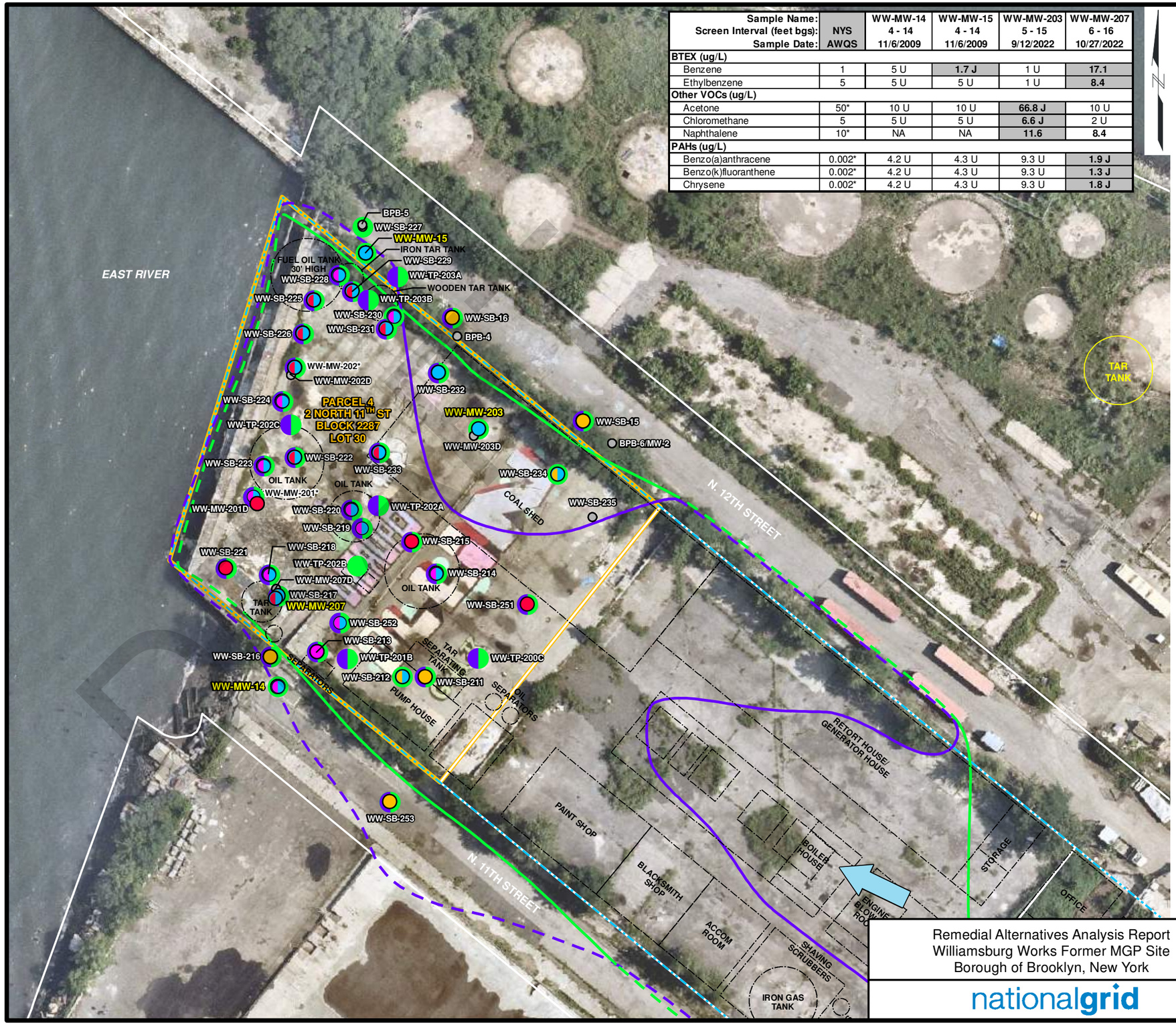
GEI Consultants

PARCEL 3 GROUNDWATER EXCEEDANCES BELOW 30 FEET

Project 093060 | October 2026 | Fig. 20

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\20_093060_RAAR_P3DP.mxd

Sample Name: / Screen Interval (feet bgs): / Sample Date:	NYS AWQS	WW-MW-14 4 - 14 11/6/2009	WW-MW-15 4 - 14 11/6/2009	WW-MW-203 5 - 15 9/12/2022	WW-MW-207 6 - 16 10/27/2022
BTEX (ug/L)					
Benzene	1	5 U	**1.7 J**	1 U	**17.1**
Ethylbenzene	5	5 U	5 U	1 U	**8.4**
Other VOCs (ug/L)					
Acetone	50*	10 U	10 U	**66.8 J**	10 U
Chloromethane	5	5 U	5 U	**6.6 J**	2 U
Naphthalene	10*	NA	NA	**11.6**	**8.4**
PAHs (ug/L)					
Benzo(a)anthracene	0.002*	4.2 U	4.3 U	9.3 U	**1.9 J**
Benzo(k)fluoranthene	0.002*	4.2 U	4.3 U	9.3 U	**1.3 J**
Chrysene	0.002*	4.2 U	4.3 U	9.3 U	**1.8 J**



LEGEND

- WW-MW-14 — MONITORING WELL WITH ANALYTICAL DATA PRESENTED IN CALLOUT BOX
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- PETROLEUM IMPACTS SATURATION & SHEEN
- NO NAPL OBSERVED
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX AND PAH COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR PAH COMPOUNDS
- INDIVIDUAL BTEX COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- INDIVIDUAL PAH COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION LOW TIDE INTERMEDIATE (9/11/2024)
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
4. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM HTTP://WWW.OASISNYC.NET ACCESSED JANUARY 2008.
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7. SITE INVESTIGATION REPORT PROPERTY WEST OF KENT AVENUE BETWEEN AND INCLUDING NORTH 10TH AND NORTH 12TH STREETS, PREPARED BY: METCALF AND EDDY OF NEW YORK, INC., NOVEMBER 2006.
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10. URS CORPORATION IRM DESIGN INVESTIGATION BORING LOGS AND LOCATION MAP PROVIDED TO GEI CONSULTANTS, INC. VIA EMAIL ON FEBRUARY 12, 2013.

0 60 120
SCALE, FEET

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

nationalgrid

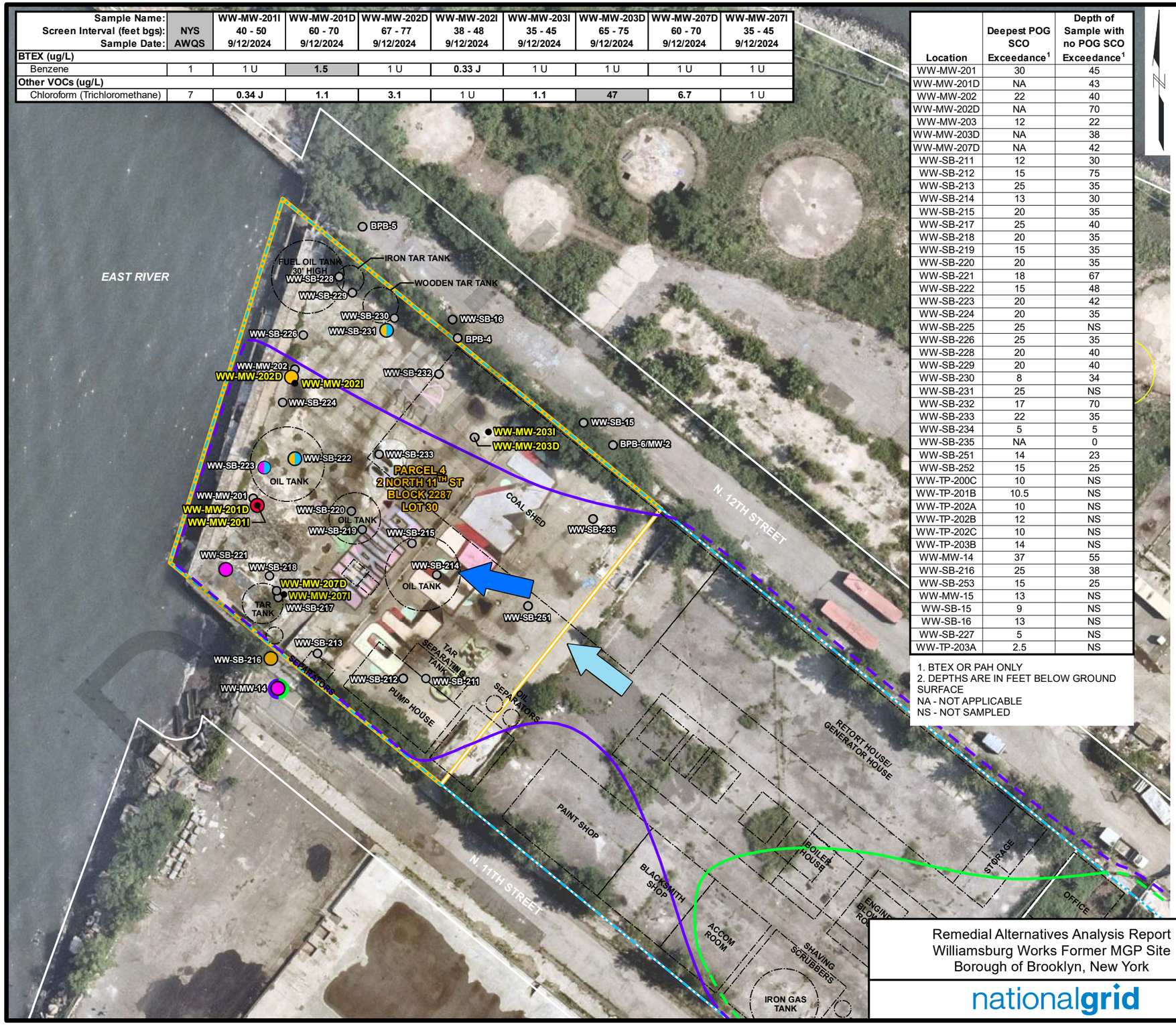
GEI Consultants

PARCEL 4 GROUNDWATER EXCEEDANCES ABOVE 30 FEET

Project 093060 | October 2026 | Fig. 21

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\21_093060_RAAR_P4SH.mxd

Sample Name: / Screen Interval (feet bgs): / Sample Date:	NYS AWQS	WW-MW-201I 40 - 50 9/12/2024	WW-MW-201D 60 - 70 9/12/2024	WW-MW-202D 67 - 77 9/12/2024	WW-MW-202I 38 - 48 9/12/2024	WW-MW-203I 35 - 45 9/12/2024	WW-MW-203D 65 - 75 9/12/2024	WW-MW-207D 60 - 70 9/12/2024	WW-MW-207I 35 - 45 9/12/2024
BTEX (ug/L)									
Benzene	1	1 U	**1.5**	1 U	**0.33 J**	1 U	1 U	1 U	1 U
Other VOCs (ug/L)									
Chloroform (Trichloromethane)	7	**0.34 J**	**1.1**	**3.1**	1 U	**1.1**	**47**	**6.7**	1 U



Location	Deepest POG SCO Exceedance[1]	Depth of Sample with no POG SCO Exceedance[1]
WW-MW-201	30	45
WW-MW-201D	NA	43
WW-MW-202	22	40
WW-MW-202D	NA	70
WW-MW-203	12	22
WW-MW-203D	NA	38
WW-MW-207D	NA	42
WW-SB-211	12	30
WW-SB-212	15	75
WW-SB-213	25	35
WW-SB-214	13	30
WW-SB-215	20	35
WW-SB-217	25	40
WW-SB-218	20	35
WW-SB-219	15	35
WW-SB-220	20	35
WW-SB-221	18	67
WW-SB-222	15	48
WW-SB-223	20	42
WW-SB-224	20	35
WW-SB-225	25	NS
WW-SB-226	25	35
WW-SB-228	20	40
WW-SB-229	20	40
WW-SB-230	8	34
WW-SB-231	25	NS
WW-SB-232	17	70
WW-SB-233	22	35
WW-SB-234	5	5
WW-SB-235	NA	0
WW-SB-251	14	23
WW-SB-252	15	25
WW-TP-200C	10	NS
WW-TP-201B	10.5	NS
WW-TP-202A	10	NS
WW-TP-202B	12	NS
WW-TP-202C	10	NS
WW-TP-203B	14	NS
WW-MW-14	37	55
WW-SB-216	25	38
WW-SB-253	15	25
WW-MW-15	13	NS
WW-SB-15	9	NS
WW-SB-16	13	NS
WW-SB-227	5	NS
WW-TP-203A	2.5	NS

1. BTEX OR PAH ONLY
2. DEPTHS ARE IN FEET BELOW GROUND SURFACE
NA - NOT APPLICABLE
NS - NOT SAMPLED

LEGEND

WW-MW-201D

- MONITORING WELL WITH ANALYTICAL DATA PRESENTED IN CALLOUT BOX
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- PETROLEUM IMPACTS SATURATION & SHEEN
- NO NAPL OBSERVED
- WELL WITH NO DOCUMENTED VISUAL IMPACT INFORMATION
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX AND PAH COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR BTEX COMPOUNDS
- SOIL EXCEEDANCE OF POG SCOs FOR PAH COMPOUNDS
- INDIVIDUAL BTEX COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- INDIVIDUAL PAH COMPOUNDS THAT EXCEED AWQS (DASHED WHERE INFERRED)
- GROUNDWATER FLOW DIRECTION LOW TIDE INTERMEDIATE (9/11/2024)
- GROUNDWATER FLOW DIRECTION LOW TIDE DEEP (9/11/2024)
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- HISTORIC MGP STRUCTURES
- HISTORIC NON-MGP STRUCTURES

SOURCE:

1. AERIAL PHOTOGRAPH NEARMAP ©2025 IMAGERY DATE: 07/03/2025.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
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0 60 120

SCALE, FEET

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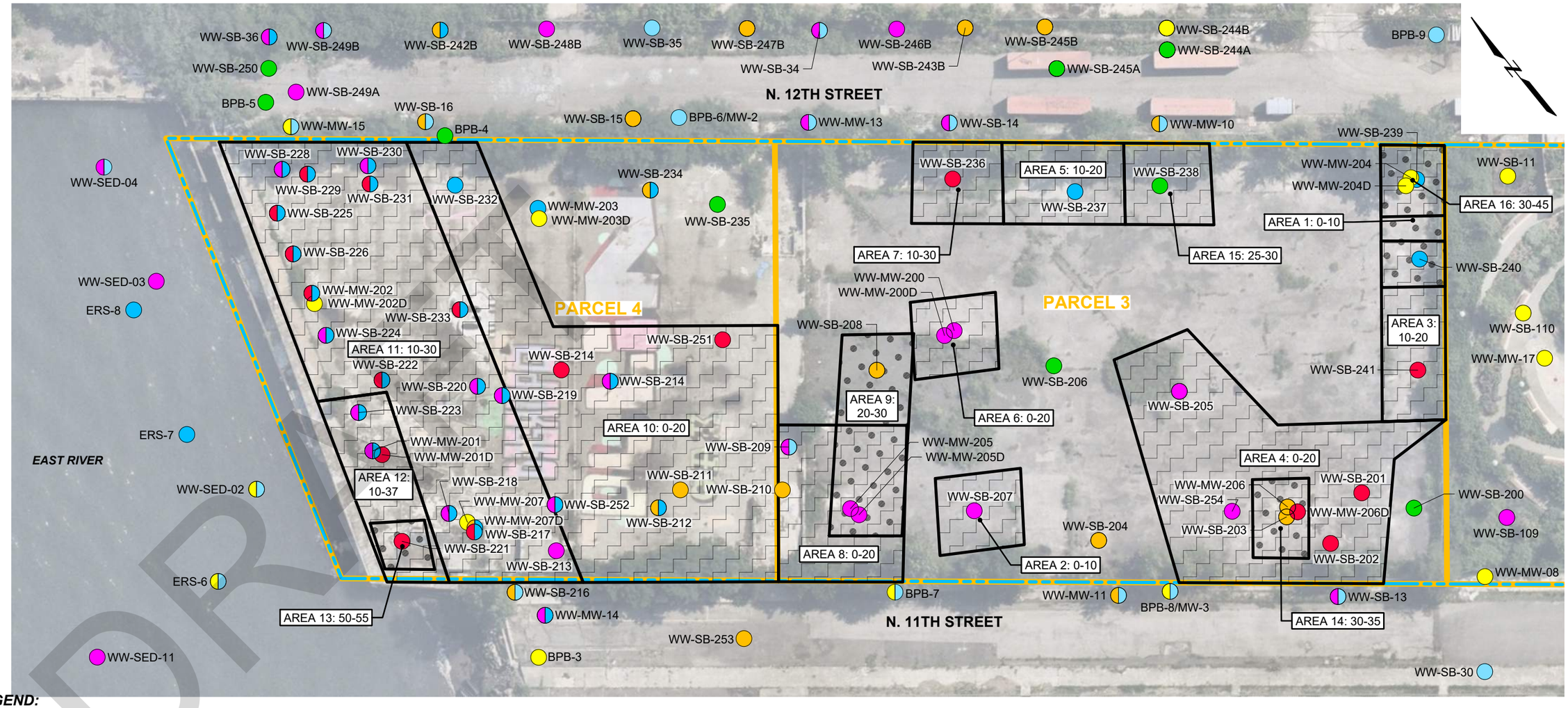
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PARCEL 4 GROUNDWATER EXCEEDANCES BELOW 30 FEET

Project 093060 | October 2026 | Fig. 22

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\22_093060_RAAR_P4DP.mxd



LEGEND:

- AREA 1: 1-10 — REMEDIAL AREA ID WITH REMEDIATION DEPTH INTERVAL (FT BGS)
- CONTAMINANT SOURCE MATERIAL REMEDIATION AREA
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED

SOURCES:

1. AERIAL PHOTOGRAPH NEARMAP ©2024 IMAGERY DATE: 07/03/2025.
2. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM *HTTP://WWW.OASISNYC.NET* ACCESSED JANUARY 2008.
3. SURVEY OF WILLIAMSBURG WORKS BOUNDARIES, EXISTING CONDITIONS, AND SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. SURVEYED BY NEW YORK STATE-LICENSED LAND SURVEYOR No. 050146.

0 50 100

SCALE, FEET

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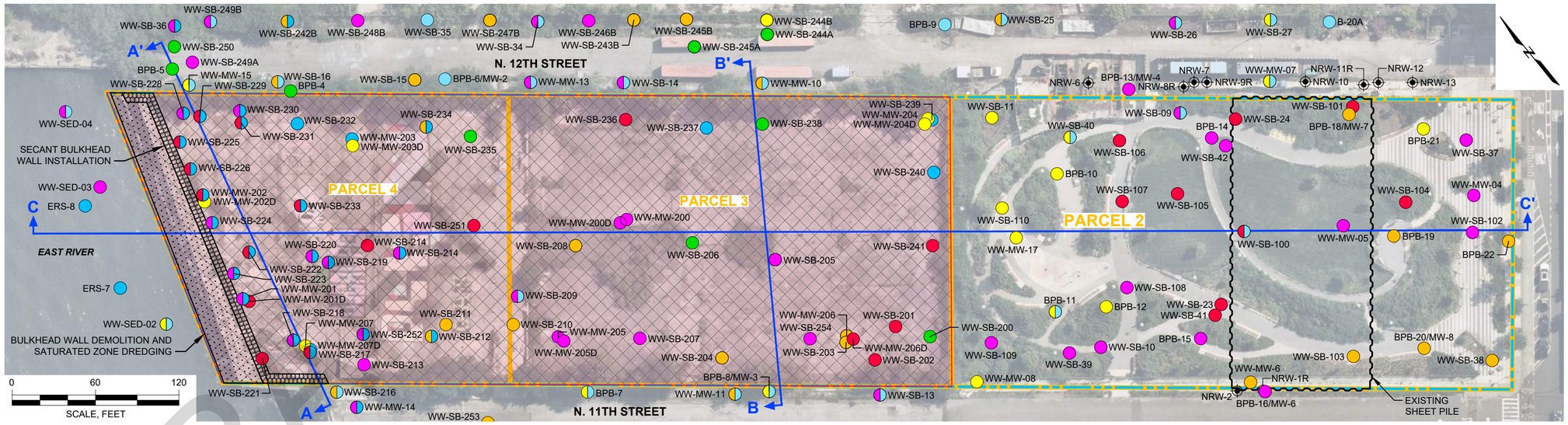
GEI Consultants

CONCEPTUAL CONTAMINANT MASS MODEL AND REMEDIAL AREA DELINEATION

Project 093060 | October 2026 | Fig. 23

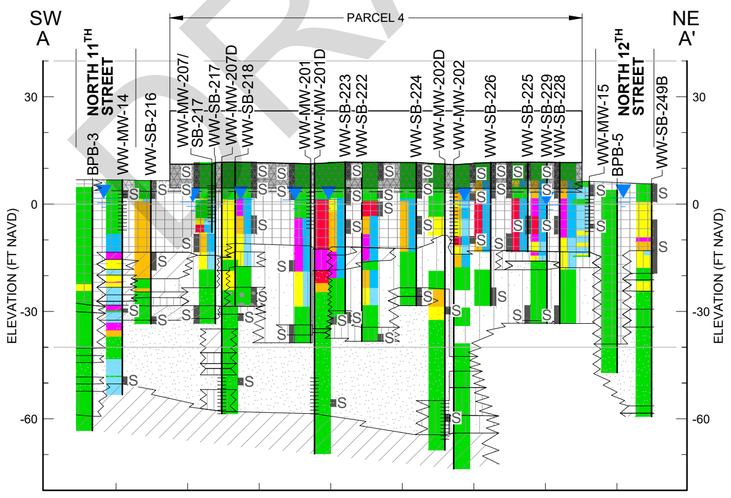
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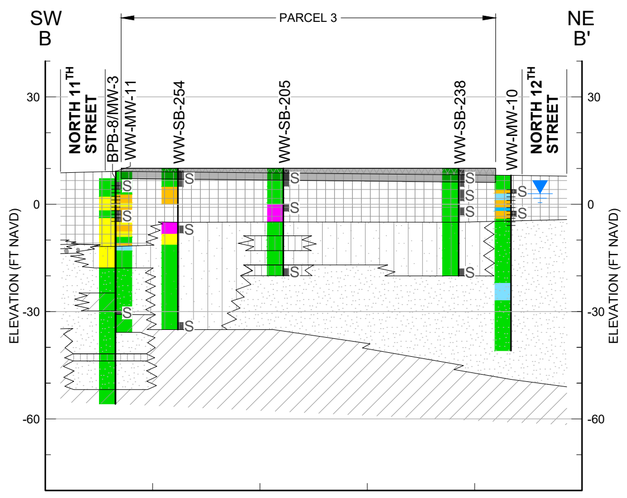
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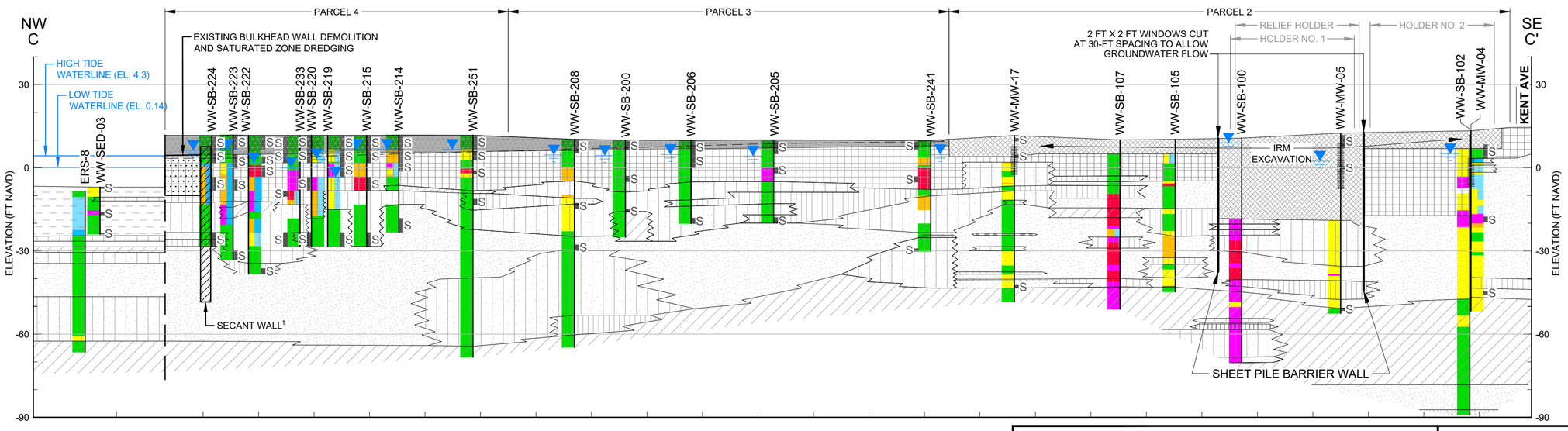
- UNSATURATED EXCAVATION AREA
- COMPOSITE COVER/CLEAN SOIL CAP
- BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- EXISTING SHEETPILE
- GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- RECOVERY WELL
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED





SITEWIDE EXCAVATION			
AREA [sf]	IMPACT DEPTH [ft bgs]	EXCAVATION DEPTH [ft]	VOLUME [cyd]
117,918	VARIES	VARIES	19,800

NOTES:
SITEWIDE EXCAVATION INCLUDES MATERIAL REMOVAL TO FACILITATE CAP PLACEMENT AND LOWERING SITE TO THE SURROUNDING STREET GRADE.



CROSS SECTION LEGEND

- UNSATURATED EXCAVATION EXTENT
- EXISTING BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION

GEOLOGIC UNIT

- POST-MGP FILL / FILL WEDGE
- FILL
- IRM EXCAVATION
- BEDROCK

ALLUVIAL DEPOSITS

- ORGANIC SOIL
- SILT (SHALLOW)

GLACIAL DEPOSITS

- SAND
- SILTY SAND
- SILT (DEEP)
- ELASTIC SILT
- GRAVEL
- CLAYEY SAND
- CLAY (DEEP)
- CONTACT
- BOUNDARY IS APPROXIMATED
- OBSERVED APPARENT GROUNDWATER TABLE
- WW-MW-14 — SOIL BORING, MONITORING WELL OR SEDIMENT CORING IDENTIFICATION
- S — SAMPLE LOCATION
- WELL SCREEN INTERVAL

SOURCES:

1. *REMEDIAL INVESTIGATION REPORT,* PLATE 5: *GEOLOGIC CROSS SECTIONS G-G' AND H-H',* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
2. *REMEDIAL INVESTIGATION REPORT,* FIGURE 19: *OBSERVED PHYSICAL IMPACTS SATURATED ZONE TO 30 FEET BELOW GRADE,* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
3. 7/3/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com).*

NOTES:

1. DEPICTED LATERAL AND VERTICAL EXTENTS OF THE PROPOSED SECANT PILE WALL ARE CONCEPTUAL. FINAL WALL ALIGNMENT, DEPTH, AND CONFIGURATION WILL BE DETERMINED DURING FINAL DESIGN BASED ON SITE-SPECIFIC SUBSURFACE CONDITIONS AND STRUCTURAL DESIGN REQUIREMENTS.

HORIZONTAL SCALE, FEET
0 60 120
VERTICAL SCALE, FEET
0 30 60
NOTE: 2x VERTICAL EXAGGERATION

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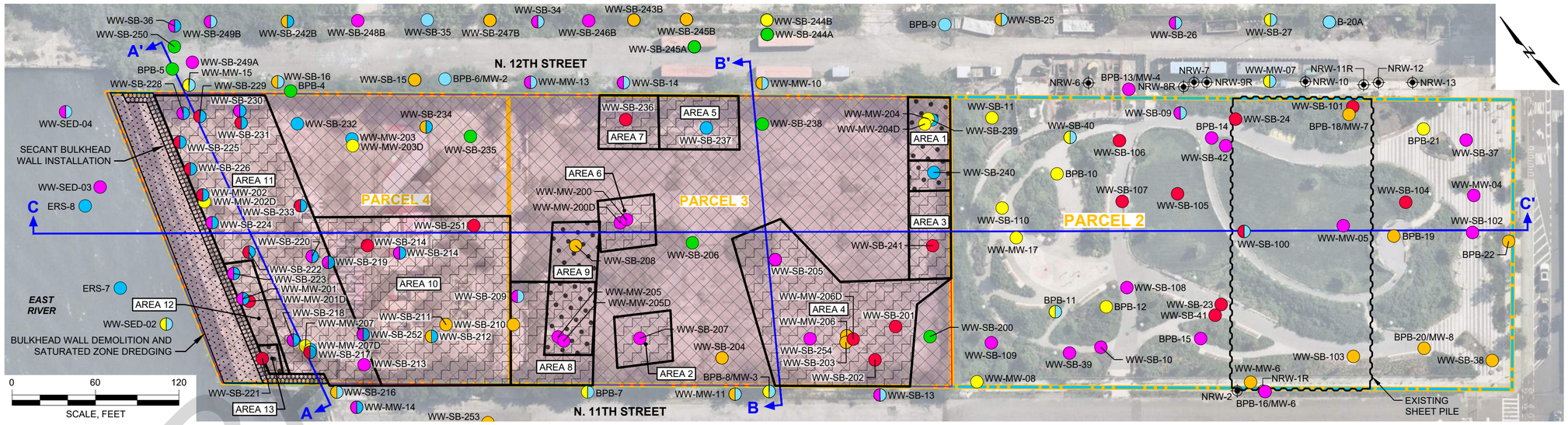
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Project 093060

ALTERNATIVE 2
CONCEPTUAL PLAN

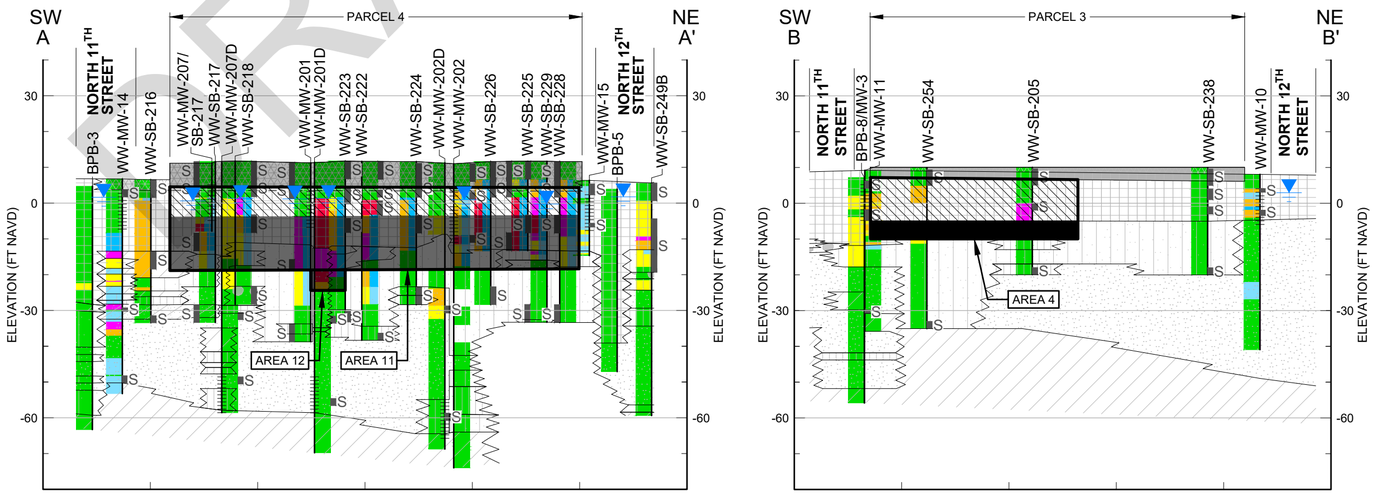
October 2026 Fig. 24

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LEGEND:

- AREA 1 — REMEDIAL AREA ID
- CONTAMINANT SOURCE MATERIAL REMEDIATION AREA
- UNSATURATED EXCAVATION AREA
- COMPOSITE COVER/CLEAN SOIL CAP
- BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- EXISTING SHEETPILE
- A — A' — GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- RECOVERY WELL
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED



SITEWIDE EXCAVATION

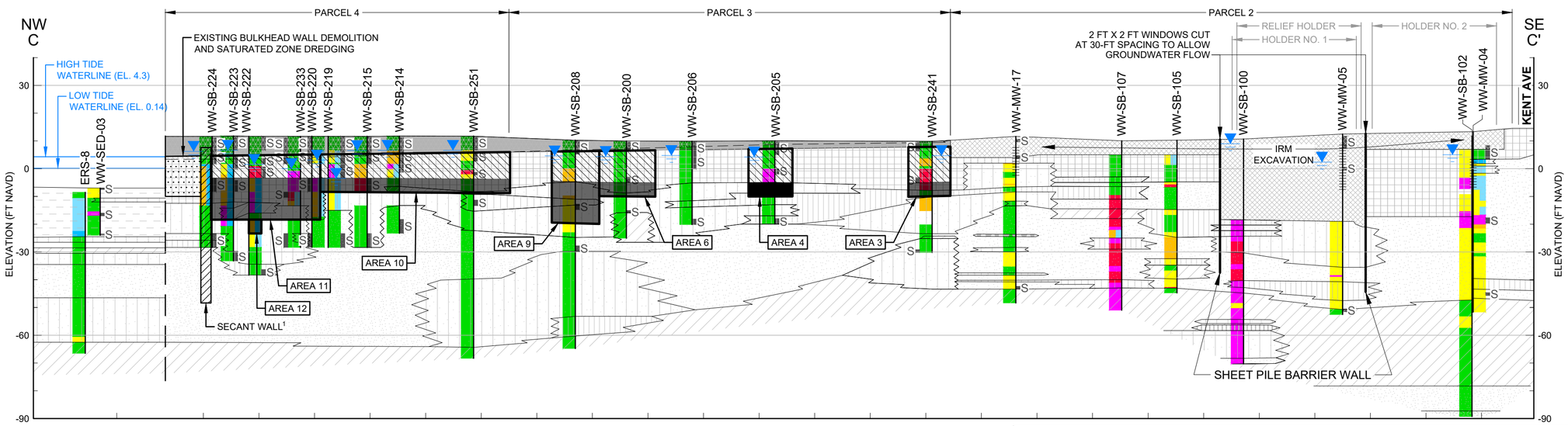
AREA [sf]	IMPACT DEPTH [ft bgs]	EXCAVATION DEPTH [ft]	VOLUME [cyd]
117,918	VARIES	VARIES	19,800

NOTES:
SITEWIDE EXCAVATION INCLUDES MATERIAL REMOVAL TO FACILITATE CAP PLACEMENT AND LOWERING SITE TO THE SURROUNDING STREET GRADE.

ALTERNATIVE 3 REMEDIAL EXTENTS

REMEDIAL AREA	AREA (sf)	TOTAL DEPTH (ft bgs)	DEPTH BENEATH SOIL COVER EXCAVATION (ft)*	TOTAL EXCAVATION VOLUME (CY)	TOTAL ISS VOLUME (CY)
1	1570	10	9	523.3	0
2	1500	10	5.8	322.2	0
3	3000	20	19	1555.6	555.6
4	10800	20	17.4	4960	2000
5	2100	20	16.6	902.2	388.9
6	1500	20	15.4	577.8	277.8
7	1700	30	25.4	654.8	944.4
8	2710	20	15	1003.7	501.9
9	3200	30	25	1185.2	1777.8
10	14200	20	13.6	4523	2629.6
11	14633	30	21	3251.9	8129.7
12	1182	37	28.8	297.6	962.8
13	288	55	47.2	76.8	426.7

*ASSUMES EXCAVATION WILL BE IMPLEMENTED TO A MAXIMUM DEPTH OF 15 FEET.



CROSS SECTION LEGEND

- UNSATURATED EXCAVATION EXTENT
- EXISTING BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- REMEDIAL EXCAVATION
- ISS
- GEOLOGIC UNIT
- POST-MGP FILL / FILL WEDGE
- FILL
- IRM EXCAVATION
- BEDROCK
- ALLUVIAL DEPOSITS
- ORGANIC SOIL
- SILT (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- SILT (DEEP)
- ELASTIC SILT
- GRAVEL
- CLAYEY SAND
- CLAY (DEEP)
- CONTACT
- BOUNDARY IS APPROXIMATED
- OBSERVED APPARENT GROUNDWATER TABLE
- WW-MW-14 — SOIL BORING, MONITORING WELL OR SEDIMENT CORING IDENTIFICATION
- S — SAMPLE LOCATION
- WELL SCREEN INTERVAL

SOURCES:

1. *REMEDIAL INVESTIGATION REPORT*, PLATE 5: *GEOLOGIC CROSS SECTIONS G-G' AND H-H'*, PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
2. *REMEDIAL INVESTIGATION REPORT*, FIGURE 19: *OBSERVED PHYSICAL IMPACTS SATURATED ZONE TO 30 FEET BELOW GRADE*, PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
3. 7/3/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com)*.

NOTES:

1. DEPICTED LATERAL AND VERTICAL EXTENTS OF THE PROPOSED SECANT PILE WALL ARE CONCEPTUAL. FINAL WALL ALIGNMENT, DEPTH, AND CONFIGURATION WILL BE DETERMINED DURING FINAL DESIGN BASED ON SITE-SPECIFIC SUBSURFACE CONDITIONS AND STRUCTURAL DESIGN REQUIREMENTS.

HORIZONTAL SCALE, FEET
0 60 120
0 30 60
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

Remedial Alternatives Analysis Report
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

nationalgrid

GEI Consultants

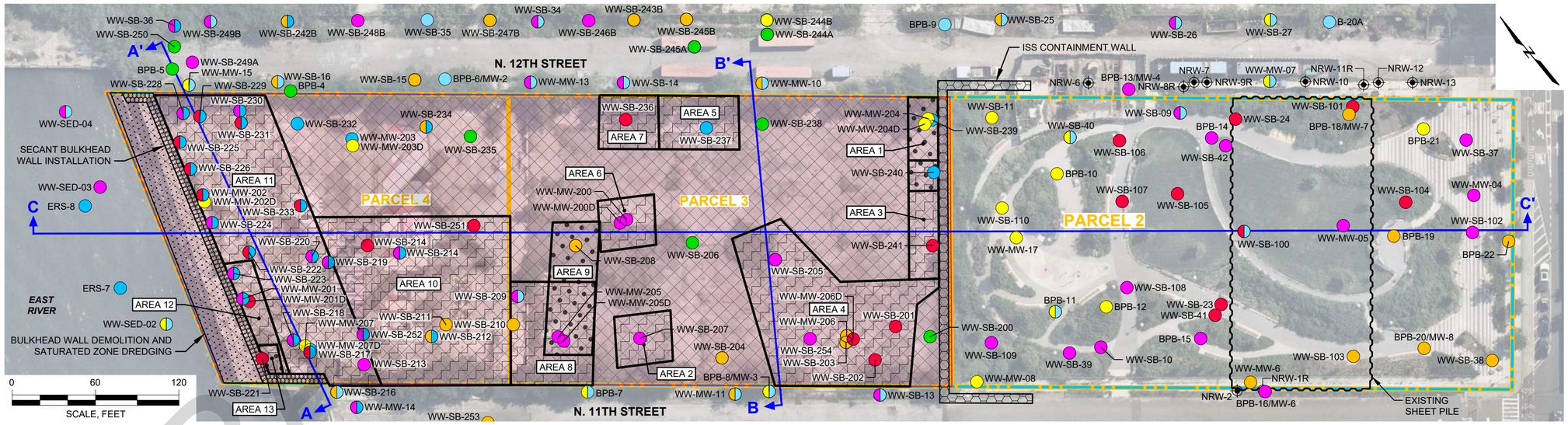
Project 093060

ALTERNATIVE 3
CONCEPTUAL PLAN

October 2026 Fig. 25

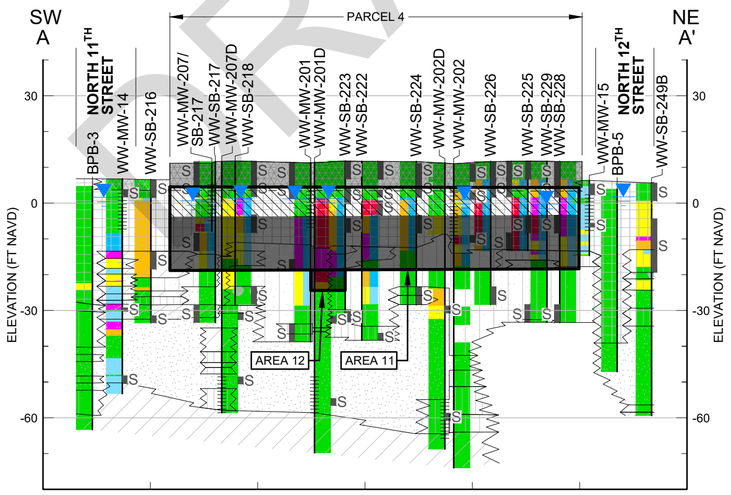
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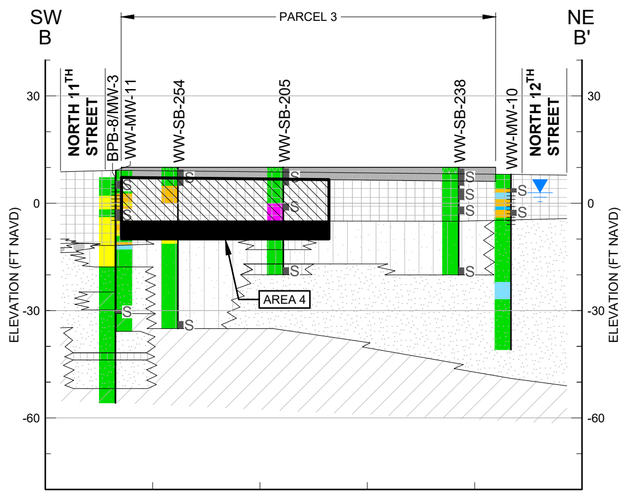
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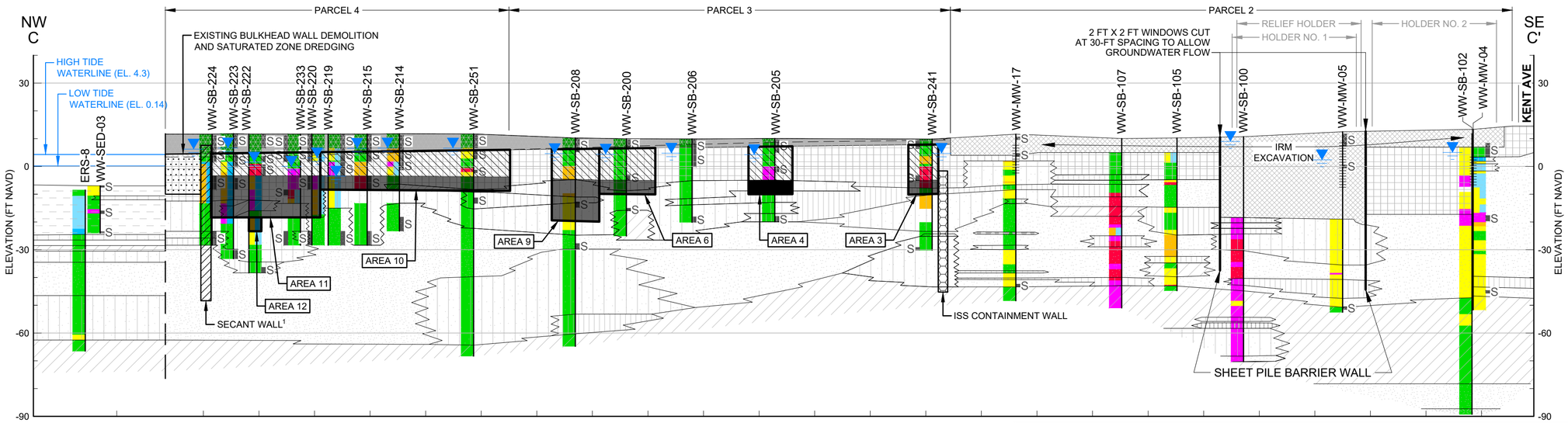


LEGEND:

- AREA 1 — REMEDIAL AREA ID
- CONTAMINANT SOURCE MATERIAL REMEDIATION AREA
- UNSATURATED EXCAVATION AREA
- COMPOSITE COVER/CLEAN SOIL CAP
- BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- ISS CONTAINMENT WALL
- EXISTING SHEETPILE
- A — A' — GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- RECOVERY WELL
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED







SITEWIDE EXCAVATION			
AREA [sf]	IMPACT DEPTH [ft bgs]	EXCAVATION DEPTH [ft]	VOLUME [cyd]
117,918	VARIES	VARIES	19,800

NOTES:
SITEWIDE EXCAVATION INCLUDES MATERIAL REMOVAL TO FACILITATE CAP PLACEMENT AND LOWERING SITE TO THE SURROUNDING STREET GRADE.

ALTERNATIVE 4 REMEDIAL EXTENTS

REMEDIAL AREA	AREA (sf)	TOTAL DEPTH (ft bgs)	DEPTH BENEATH SOIL COVER EXCAVATION (ft)*	TOTAL EXCAVATION VOLUME (CY)	TOTAL ISS VOLUME (CY)
1	983	10	9	327.7	0
2	1500	10	5.8	322.2	0
3	2257	20	19	1170.5	418
4	10768	20	17.4	4945.4	1994.1
5	2100	20	16.6	902.2	388.9
6	1500	20	15.4	577.8	277.8
7	1700	30	25.4	654.8	944.4
8	2710	20	15	1003.7	501.9
9	3200	30	25	1185.2	1777.8
10	14200	20	13.6	4523	2629.6
11	14633	30	21	3251.9	8129.7
12	1182	37	28.8	297.6	962.8
13	288	55	47.2	76.8	426.7

*ASSUMES EXCAVATION WILL BE IMPLEMENTED TO A MAXIMUM DEPTH OF 15 FEET.

CROSS SECTION LEGEND

- UNSATURATED EXCAVATION EXTENT
- EXISTING BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- ISS CONTAINMENT WALL
- REMEDIAL EXCAVATION
- ISS
- GEOLOGIC UNIT
- POST-MGP FILL / FILL WEDGE
- FILL
- IRM EXCAVATION
- BEDROCK
- ALLUVIAL DEPOSITS
- ORGANIC SOIL
- SILT (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- SILT (DEEP)
- ELASTIC SILT
- GRAVEL
- CLAYEY SAND
- CLAY (DEEP)
- CONTACT
- BOUNDARY IS APPROXIMATED
- OBSERVED APPARENT GROUNDWATER TABLE
- WW-MW-14 — SOIL BORING, MONITORING WELL OR SEDIMENT CORING IDENTIFICATION
- S — SAMPLE LOCATION
- WELL SCREEN INTERVAL

SOURCES:

1. *REMEDIAL INVESTIGATION REPORT,* PLATE 5: *GEOLOGIC CROSS SECTIONS G-G' AND H-H',* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
2. *REMEDIAL INVESTIGATION REPORT,* FIGURE 19: *OBSERVED PHYSICAL IMPACTS SATURATED ZONE TO 30 FEET BELOW GRADE,* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
3. 7/3/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com).*

NOTES:

1. DEPICTED LATERAL AND VERTICAL EXTENTS OF THE PROPOSED SECANT PILE WALL ARE CONCEPTUAL. FINAL WALL ALIGNMENT, DEPTH, AND CONFIGURATION WILL BE DETERMINED DURING FINAL DESIGN BASED ON SITE-SPECIFIC SUBSURFACE CONDITIONS AND STRUCTURAL DESIGN REQUIREMENTS.

HORIZONTAL SCALE, FEET
0 60 120
0 30 60
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

Remedial Alternatives Analysis Report
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

nationalgrid

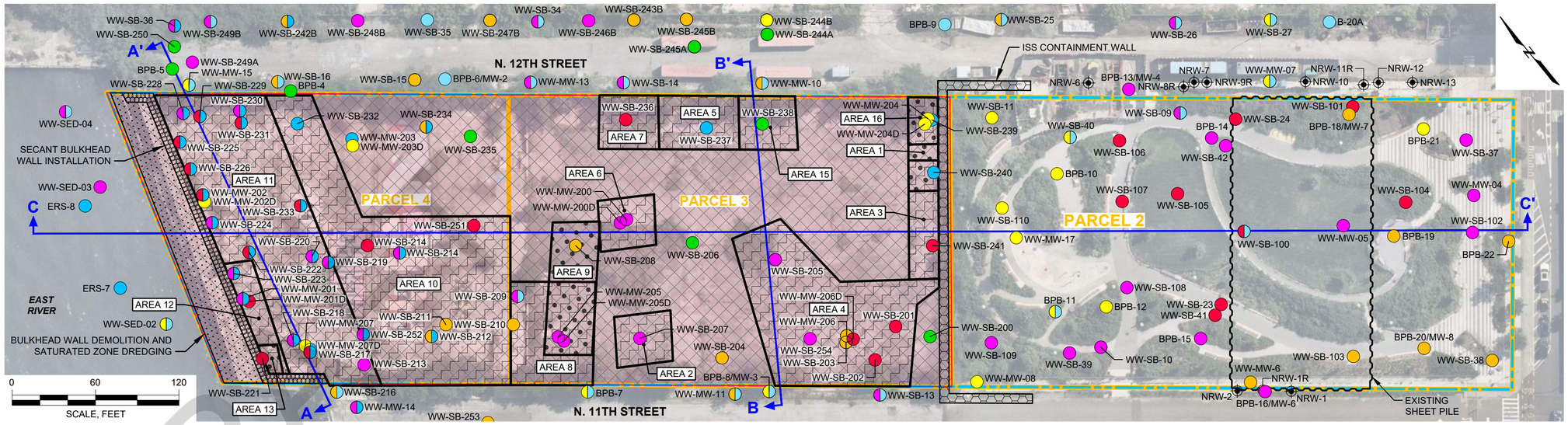
GEI Consultants

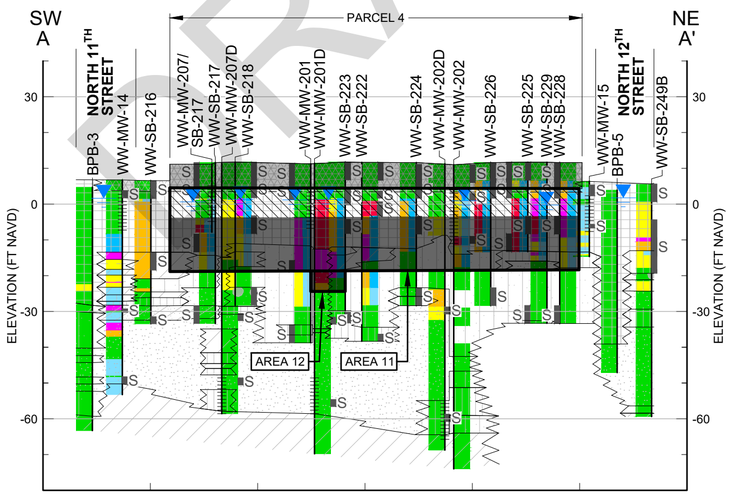
Project 093060

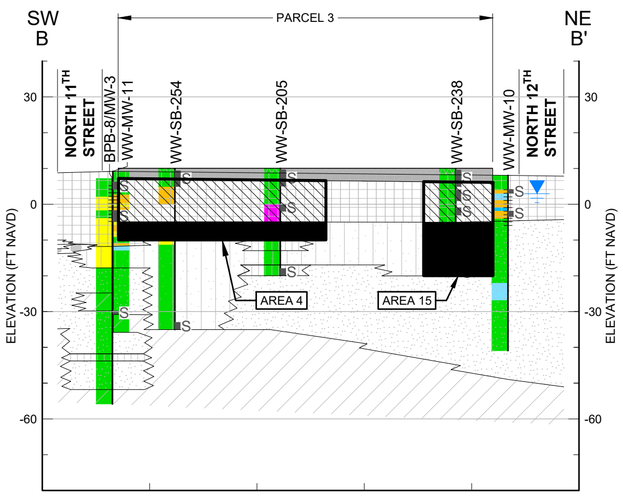
ALTERNATIVE 4
CONCEPTUAL PLAN

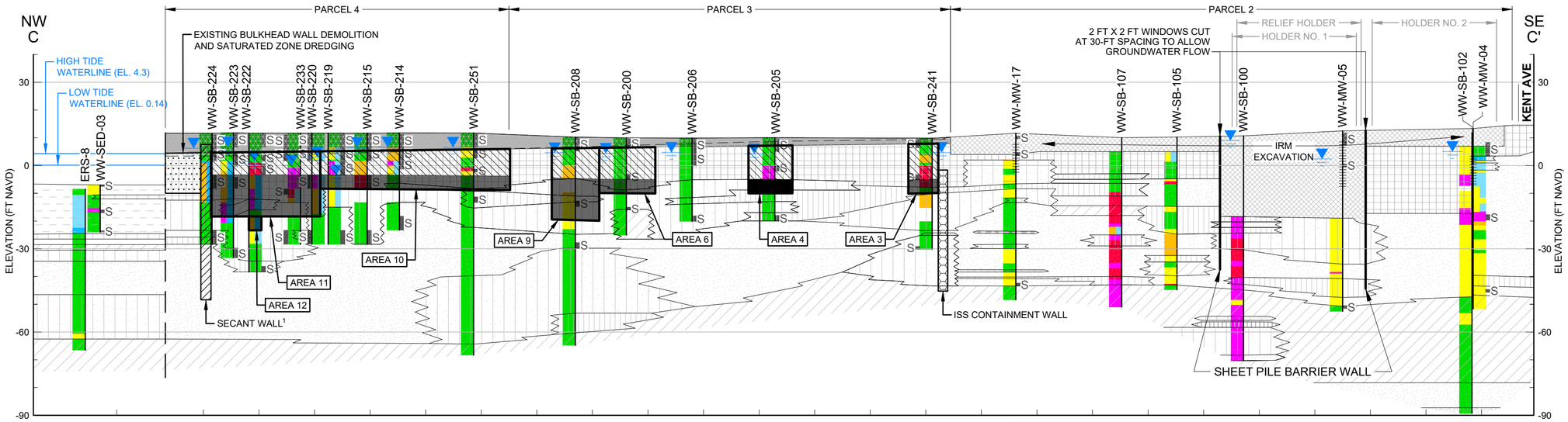
October 2026 Fig. 26

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LEGEND:

- AREA 1 — REMEDIAL AREA ID
- CONTAMINANT SOURCE MATERIAL REMEDIATION AREA
- UNSATURATED EXCAVATION AREA
- COMPOSITE COVER/CLEAN SOIL CAP
- BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- ISS CONTAINMENT WALL
- EXISTING SHEETPILE
- A — A' — GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- RECOVERY WELL
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED

SITEWIDE EXCAVATION			
AREA [sf]	IMPACT DEPTH [ft bgs]	EXCAVATION DEPTH [ft]	VOLUME [cyd]
117,918	VARIES	VARIES	19,800

NOTES:
SITEWIDE EXCAVATION INCLUDES MATERIAL REMOVAL TO FACILITATE CAP PLACEMENT AND LOWERING SITE TO THE SURROUNDING STREET GRADE.

ALTERNATIVE 5 REMEDIAL EXTENTS

REMEDIAL AREA	AREA (sf)	TOTAL DEPTH (ft bgs)	DEPTH BENEATH SOIL COVER EXCAVATION (ft)*	TOTAL EXCAVATION VOLUME (CY)	TOTAL ISS VOLUME (CY)
1	256	10	9	85.4	0
2	1500	10	5.8	322.2	0
3	2257	20	19	1170.5	418
4	9768	20	17.4	4486.2	1808.9
5	2100	20	16.6	902.2	388.9
6	1500	20	15.4	577.8	277.8
7	1700	30	25.4	654.8	944.4
8	2710	20	15	1003.7	501.9
9	3200	30	25	1185.2	1777.8
10	14200	20	13.6	4523	2629.6
11	14633	30	21	3251.9	8129.7
12	1182	37	28.8	297.6	962.8
13	288	55	47.2	76.8	426.7
14	1000	35	32.8	474.1	740.7
15	1600	30	27	711.1	888.9
16	704	45	44	364.8	781.8

*ASSUMES EXCAVATION WILL BE IMPLEMENTED TO A MAXIMUM DEPTH OF 15 FEET.

CROSS SECTION LEGEND

- UNSATURATED EXCAVATION EXTENT
- EXISTING BULKHEAD WALL DEMOLITION AND SATURATED ZONE DREDGING
- SECANT BULKHEAD WALL INSTALLATION
- ISS CONTAINMENT WALL
- REMEDIAL EXCAVATION
- ISS
- GEOLOGIC UNIT
- POST-MGP FILL / FILL WEDGE
- FILL
- IRM EXCAVATION
- BEDROCK
- ALLUVIAL DEPOSITS
- ORGANIC SOIL
- SILT (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- SILT (DEEP)
- ELASTIC SILT
- GRAVEL
- CLAYEY SAND
- CLAY (DEEP)
- CONTACT
- BOUNDARY IS APPROXIMATED
- OBSERVED APPARENT GROUNDWATER TABLE
- WW-MW-14 — SOIL BORING, MONITORING WELL OR SEDIMENT CORING IDENTIFICATION
- S — SAMPLE LOCATION
- WELL SCREEN INTERVAL

SOURCES:

1. *REMEDIAL INVESTIGATION REPORT,* PLATE 5: *GEOLOGIC CROSS SECTIONS G-G' AND H-H',* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
2. *REMEDIAL INVESTIGATION REPORT,* FIGURE 19: *OBSERVED PHYSICAL IMPACTS SATURATED ZONE TO 30 FEET BELOW GRADE,* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
3. 7/3/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com).*

NOTES:

1. DEPICTED LATERAL AND VERTICAL EXTENTS OF THE PROPOSED SECANT PILE WALL ARE CONCEPTUAL. FINAL WALL ALIGNMENT, DEPTH, AND CONFIGURATION WILL BE DETERMINED DURING FINAL DESIGN BASED ON SITE-SPECIFIC SUBSURFACE CONDITIONS AND STRUCTURAL DESIGN REQUIREMENTS.

HORIZONTAL SCALE, FEET
0 60 120
0 30 60
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

Remedial Alternatives Analysis Report
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

nationalgrid

GEI Consultants

Project 093060

ALTERNATIVE 5
CONCEPTUAL PLAN

October 2026 Fig. 27

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Appendix A Remedial Alternative Cost Estimates

A.1. Remedial Alternatives Cost Estimate - Alternative 2

A.2. Remedial Alternatives Cost Estimate - Alternative 3

A.3. Remedial Alternatives Cost Estimate - Alternative 4

A.4. Remedial Alternatives Cost Estimate - Alternative 5

DRAFT

A.1. Remedial Alternatives Cost Estimate - Alternative 2

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Appendix A-1. Remedial Alternatives Cost Estimate - Alternative 2
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

GEI Consultants, Inc. (GEI) has prepared this engineer's estimate of cost to complete the construction of a the proposed remedial alternative. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by a design engineer, the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors. An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions. This estimate was prepared as an AACE International Class 4 estimate with an expected range of accuracy of -30% to +50%.

	Task	Approximate Quantity	Unit of Measurement	Unit or Lump Sum Price ($)	Extended Total ($)
	Site Remediation				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 1,235,000.00	$ 1,235,000.00
B	Construction Activities				$ 20,572,286.00
i)	Mobilization/Demobilization	1	Lump Sum	$ 2,684,000.00	$ 2,684,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$ 3,087,000.00	$ 3,087,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	0	Lump Sum	$ -	$ -
iv)	Fence Removal	1340	Linear Feet	$ 51.00	$ 68,340.00
v)	Concrete Slab Demolition (Post-MGP)	118000	Square Foot	$ 1.32	$ 155,760.00
vi)	Bulkhead Wall Demolition, Secant Wall Installation, Outboard Saturated Soil Excavation and Restoration	1	Lump Sum	$ 6,930,000.00	$ 6,930,000.00
vii)	Unsaturated Zone Excavation (Post-MGP Fill)	19100	Cubic Yard	$ 83.00	$ 1,585,300.00
viii)	Unsaturated Zone Excavation (Source Material)	2200	Cubic Yard	$ 83.00	$ 182,600.00
ix)	Installation of Excavation Support System	0	Lump Sum	$ -	$ -
x)	Saturated Zone Excavation (Source Material)	0	Cubic Yard	$ -	$ -
xi)	ISS Mobilization	0	Lump Sum	$ -	$ -
xii)	ISS Implementation	0	Cubic Yard	$ -	$ -
xiii)	T&D Soil - Thermal Desorption (Source Material)	8300	Ton	$ 115.00	$ 954,500.00
xiv)	T&D Impacted Debris	1200	Ton	$ 185.00	$ 222,000.00
xv)	T&D Soil - NonHaz Landfill (Post-MGP Fill)	32400	Ton	$ 90.00	$ 2,916,000.00
xvi)	T&D Construction Debris (Concrete Slab)	5400	Ton	$ 124.00	$ 669,600.00
xvii)	T&D Wastewater	0	Lump Sum	$ -	$ -
xviii)	Backfill (Clean Import Fill)	7300	Cubic Yard	$ 142.00	$ 1,036,600.00
xix)	Topsoil	1500	Cubic Yard	$ 49.00	$ 73,500.00
xx)	Seeding	118100	Square Foot	$ 0.06	$ 7,086.00
C	CAMP	1	Lump Sum	$ 718,000.00	$ 718,000.00
D	Construction Management, Project Management	1	Lump Sum	$ 2,263,000.00	$ 2,263,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$ 2,630,000.00	$ 2,630,000.00
				Total Construction Cost	$ 24,788,286.00
				Total OM&M Cost	$ 2,630,000.00
				Total Project Cost	$ 27,418,286.00
				Class 4 High Range Estimate (+50%)	$ 41,127,429.00
				Class 4 Low Range Estimate (-30%)	$ 19,192,800.20

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A.2. Remedial Alternatives Cost Estimate - Alternative 3

DRAFT

Appendix A-2. Remedial Alternatives Cost Estimate - Alternative 3
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

GEI Consultants, Inc. (GEI) has prepared this engineer's estimate of cost to complete the construction of a the proposed remedial alternative. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by a design engineer, the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors. An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions. This estimate was prepared as an AACE International Class 4 estimate with an expected range of accuracy of -30% to +50%.

	Task	Approximate Quantity	Unit of Measurement	Unit or Lump Sum Price ($)	Extended Total ($)
	Site Remediation				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 2,888,000.00	$ 2,888,000.00
B	Construction Activities				$ 48,119,286.00
i)	Mobilization/Demobilization	1	Lump Sum	$ 6,277,000.00	$ 6,277,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$ 5,983,000.00	$ 5,983,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	1	Lump Sum	$ 7,650,000.00	$ 7,650,000.00
iv)	Fence Removal	1340	Linear Feet	$ 51.00	$ 68,340.00
v)	Concrete Slab Demolition (Post-MGP)	118000	Square Foot	$ 1.32	$ 155,760.00
vi)	Bulkhead Wall Demolition, Secant Wall Installation, Outboard Saturated Soil Excavation and Restoration	1	Lump Sum	$ 6,930,000.00	$ 6,930,000.00
vii)	Unsaturated Zone Excavation (Post-MGP Fill)	19100	Cubic Yard	$ 83.00	$ 1,585,300.00
viii)	Unsaturated Zone Excavation (Source Material)	7700	Cubic Yard	$ 83.00	$ 639,100.00
ix)	Installation of Excavation Support System	1	Lump Sum	$ 2,773,000.00	$ 2,773,000.00
x)	Saturated Zone Excavation (Source Material)	14500	Cubic Yard	$ 83.00	$ 1,203,500.00
xi)	ISS Mobilization	1	Lump Sum	$ 194,000.00	$ 194,000.00
xii)	ISS Implementation	18600	Cubic Yard	$ 91.00	$ 1,692,600.00
xiii)	T&D Soil - Thermal Desportion (Source Material)	43300	Ton	$ 115.00	$ 4,979,500.00
xiv)	T&D Impacted Debris	3000	Ton	$ 185.00	$ 555,000.00
xv)	T&D Soil - NonHaz Landfill (Post-MGP Fill)	32400	Ton	$ 90.00	$ 2,916,000.00
xvi)	T&D Construction Debris (Concrete Slab)	5400	Ton	$ 124.00	$ 669,600.00
xvii)	T&D Wastewater	1	Lump Sum	$ 572,000.00	$ 572,000.00
xviii)	Backfill (Clean Import Fill)	22500	Cubic Yard	$ 142.00	$ 3,195,000.00
xix)	Topsoil	1500	Cubic Yard	$ 49.00	$ 73,500.00
xx)	Seeding	118100	Square Foot	$ 0.06	$ 7,086.00
C	CAMP	1	Lump Sum	$ 1,406,000.00	$ 1,406,000.00
D	Construction Management, Project Management	1	Lump Sum	$ 5,294,000.00	$ 5,294,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$ 2,630,000.00	$ 2,630,000.00

Total Construction Cost	$ 57,707,286.00
Total OM&M Cost	$ 2,630,000.00
Total Project Cost	$ 60,337,286.00
Class 4 High Range Estimate (+50%)	$ 90,505,929.00
Class 4 Low Range Estimate (-30%)	$ 42,236,100.20

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A.3. Remedial Alternatives Cost Estimate - Alternative 4

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Appendix A-3. Remedial Alternatives Cost Estimate - Alternative 4
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

GEI Consultants, Inc. (GEI) has prepared this engineer's estimate of cost to complete the construction of a the proposed remedial alternative. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by a design engineer, the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors. An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions. This estimate was prepared as an AACE International Class 4 estimate with an expected range of accuracy of -30% to +50%.

	Task	Approximate Quantity	Unit of Measurement	Unit or Lump Sum Price ($)	Extended Total ($)
	Site Remediation				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 2,938,000.00	$ 2,938,000.00
B	Construction Activities				$ 48,965,516.00
i)	Mobilization/Demobilization	1	Lump Sum	$ 6,387,000.00	$ 6,387,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$ 6,093,000.00	$ 6,093,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	1	Lump Sum	$ 7,650,000.00	$ 7,650,000.00
iv)	Fence Removal	1340	Linear Feet	$ 51.00	$ 68,340.00
v)	Concrete Slab Demolition (Post-MGP)	118000	Square Foot	$ 1.32	$ 155,760.00
vi)	Bulkhead Wall Demolition, Secant Wall Installation, Outboard Saturated Soil Excavation and Restoration	1	Lump Sum	$ 6,930,000.00	$ 6,930,000.00
vii)	Unsaturated Zone Excavation (Post-MGP Fill)	19100	Cubic Yard	$ 83.00	$ 1,585,300.00
viii)	Unsaturated Zone Excavation (Source Material)	7400	Cubic Yard	$ 83.00	$ 614,200.00
ix)	Installation of Excavation Support System	1	Lump Sum	$ 2,773,000.00	$ 2,773,000.00
x)	Saturated Zone Excavation (Source Material)	14100	Cubic Yard	$ 83.00	$ 1,170,300.00
xi)	ISS Mobilization	1	Lump Sum	$ 194,000.00	$ 194,000.00
xii)	ISS Implementation	22730	Cubic Yard	$ 91.00	$ 2,068,430.00
xiii)	T&D Soil - Thermal Desorption (Source Material)	46600	Ton	$ 115.00	$ 5,359,000.00
xiv)	T&D Soil - NonHaz Landfill (Post-MGP Fill)	32400	Ton	$ 90.00	$ 2,916,000.00
xv)	T&D Impacted Debris	3000	Ton	$ 185.00	$ 555,000.00
xvi)	T&D Construction Debris (Concrete Slab)	5400	Ton	$ 124.00	$ 669,600.00
xvii)	T&D Wastewater	1	Lump Sum	$ 572,000.00	$ 572,000.00
xviii)	Backfill (Clean Import Fill)	22000	Cubic Yard	$ 142.00	$ 3,124,000.00
xix)	Topsoil	1500	Cubic Yard	$ 49.00	$ 73,500.00
xx)	Seeding	118100	Square Foot	$ 0.06	$ 7,086.00
C	CAMP	1	Lump Sum	$ 1,432,000.00	$ 1,432,000.00
D	Construction Management, Project Management	1	Lump Sum	$ 5,387,000.00	$ 5,387,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$ 2,630,000.00	$ 2,630,000.00

Total Construction Cost	$ 58,722,516.00
Total OM&M Cost	$ 2,630,000.00
Total Project Cost	$ 61,352,516.00
Class 4 High Range Estimate (+50%)	$ 92,028,774.00
Class 4 Low Range Estimate (-30%)	$ 42,946,761.20

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A.4. Remedial Alternatives Cost Estimate - Alternative 5

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Appendix A-4. Remedial Alternatives Cost Estimate - Alternative 5
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

GEI Consultants, Inc. (GEI) has prepared this engineer's estimate of cost to complete the construction of a the proposed remedial alternative. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by a design engineer, the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors. An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions. This estimate was prepared as an AACE International Class 4 estimate with an expected range of accuracy of -30% to +50%.

	Task	Approximate Quantity	Unit of Measurement	Unit or Lump Sum Price ($)	Extended Total ($)
Site Remediation					
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 3,024,000.00	$ 3,024,000.00
B	Construction Activities				$ 50,396,596.00
i)	Mobilization/Demobilization	1	Lump Sum	$ 6,574,000.00	$ 6,574,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$ 6,258,000.00	$ 6,258,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	1	Lump Sum	$ 7,650,000.00	$ 7,650,000.00
iv)	Fence Removal	1340	Linear Feet	$ 51.00	$ 68,340.00
v)	Concrete Slab Demolition (Post-MGP)	118000	Square Foot	$ 1.32	$ 155,760.00
vi)	Bulkhead Wall Demolition, Secant Wall Installation, Outboard Saturated Soil Excavation and Restoration	1	Lump Sum	$ 6,930,000.00	$ 6,930,000.00
vii)	Unsaturated Zone Excavation (Post-MGP Fill)	19100	Cubic Yard	$ 83.00	$ 1,585,300.00
viii)	Unsaturated Zone Excavation (Source Material)	8000	Cubic Yard	$ 83.00	$ 664,000.00
ix)	Installation of Excavation Support System	1	Lump Sum	$ 2,900,000.00	$ 2,900,000.00
x)	Saturated Zone Excavation (Source Material)	15300	Cubic Yard	$ 83.00	$ 1,269,900.00
xi)	ISS Mobilization	1	Lump Sum	$ 194,000.00	$ 194,000.00
xii)	ISS Implementation	25510	Cubic Yard	$ 91.00	$ 2,321,410.00
xiii)	T&D Soil - Thermal Desorption (Source Material)	49700	Ton	$ 115.00	$ 5,715,500.00
xiv)	T&D Soil - NonHaz Landfill (Post-MGP Fill)	32400	Ton	$ 90.00	$ 2,916,000.00
xv)	T&D Impacted Debris	3200	Ton	$ 185.00	$ 592,000.00
xvi)	T&D Construction Debris (Concrete Slab)	5400	Ton	$ 124.00	$ 669,600.00
xvii)	T&D Wastewater	1	Lump Sum	$ 572,000.00	$ 572,000.00
xviii)	Backfill (Clean Import Fill)	23100	Cubic Yard	$ 142.00	$ 3,280,200.00
xix)	Topsoil	1500	Cubic Yard	$ 49.00	$ 73,500.00
xx)	Seeding	118100	Square Foot	$ 0.06	$ 7,086.00
C	CAMP	1	Lump Sum	$ 1,471,000.00	$ 1,471,000.00
D	Construction Management, Project Management	1	Lump Sum	$ 5,544,000.00	$ 5,544,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$ 2,630,000.00	$ 2,630,000.00

Total Construction Cost	$ 60,435,596.00
Total OM&M Cost	$ 2,630,000.00
Total Project Cost	$ 63,065,596.00
Class 4 High Range Estimate (+50%)	$ 94,598,394.00
Class 4 Low Range Estimate (-30%)	$ 44,145,917.20

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