

GEI Consultants

Remedial Alternatives Analysis Report

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

Brooklyn, New York

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November 2025
Project No. 093060-2.1201



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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).

_____ _____

Date

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

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	NYC Industrial Development Agency and 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
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

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 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 on 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). OU-1 is hereinafter referred to as "the Site".

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*.

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 two parcels (Parcels 3 and 4) will be redeveloped, following remediation, as part of the New York City Department of Parks and Recreation (NYCDPR) Bushwick Inlet Park (the Park) complex. A conceptual redevelopment plan for the Park, including Parcels 3 and 4, has been developed by NYCDPR and can be found at this website: https://bushwickinletpark.org/the-park/. Parcel 2 was previously subject to an interim remedial measure (IRM) addressing limited 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. The Site is bounded to the north by North 12th Street, to the east by Kent Avenue, to the south by North 11th Street, to the west by the East River and a bulkhead along it (the East River bulkhead). Photographs of the East River bulkhead conditions in 2009 are available in the RI Report (GEI, 2025). Significant utilities adjacent to the Site include an active twin 78-inch-wide brick combined stormwater and sanitary sewer that discharges local wastewater during heavy rainfall and extends the entire length of North 12th Street.

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

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

Fill is defined as soil or rock used to raise the surface of the ground (Lauber, 2014). Fill, dating from early as the mid-1800s, has been reworked to the current grades. The fill at the Site 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. There is also a surficial post-MGP placed wedge of soil/fill (hereafter referred to as the "Fill Wedge") above the historic industrial surface of Parcels 3 and 4 and adjacent streets. The Fill Wedge was placed on Parcels 2, 3, and 4 to level the Site for construction following MGP operation. The Fill Wedge is thin at the eastern side of Parcel 3 and becomes thicker (at least 9 feet thick) towards the East River. The origin of the Fill Wedge is likely off-site and does not contain, nor is it commingled/intermingled, with impacts related to the former MGP. As such, it is not MGP contamination for which National Grid is responsible under the AOC.

The groundwater aquifer present at the Site 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 the Site. Groundwater at the Site flows to the northwest toward the East River during both high and low tides. Based on June 2025 gauging data, 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 on Figures 3 and 4, respectively.

2.2.1. Regional Water Use

Potable water is currently provided to the Site and 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 the Site 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 the Site. The well is located to the south-southeast, up gradient of the Site, near the intersection of Metropolitan Avenue and N. 6th Street in Brooklyn. A search of the United States Geological Survey (USGS) National Water Inventory System listed twenty-one wells within a 1-mile radius of the Site. None of the identified wells are within ¼ mile of the Site.

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 is provided in the RI Report (GEI, 2025). While remedial alternatives presented in this RAAR are limited to addressing OU-1 impacts, additional information related to OU-2 is provided in subsequent sections to provide context to the entire Williamsburg Works Site.

2.3.1. Pre-MGP Operational History

Pre-MGP operations, historical maps depict a former marsh and shorelines surrounding the Site 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 Williamsburg Works MGP first appeared on the 1887 Sanborn 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. Gasholders 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. Following BUG acquisition, as depicted on a 1905 Sanborn map, gas production facilities at Parcel 4 remained relatively unchanged 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 was shown on Parcel 1. Based on BUG drawing(s) and Sanborn maps, additional MGP infrastructure was, or was planned to be, constructed on Site documented until 1916. Additional infrastructure included, but was 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 the Site, to each other. Pratt Works became affiliated with Standard Oil Company of New York (SOCONY), which later became Mobil, now ExxonMobil.

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 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 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 Ken 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 structures likely associated with the toluol plant.

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
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 of 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. The use and activity at the former Williamsburg Works MGP site, if any, by the United States Navy is unknown. 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 and Abe Weiner, aka, Abraham 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 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 remediated by National Grid as an IRM between 2015 and 2017. The Parcel has 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 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. 004. In 2017, New York City acquired the property for its incorporation into Bushwick Inlet Park.

  A warehouse building had been 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 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. 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.

2.4. 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 manufacturing and oil operations, and is considered a potential additional non-aqueous phase liquid (NAPL) source area. 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 the date of this RAAR. 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.
- 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 Nos. 224402 and 224055A), 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 currently contains multiple tenants and is used for truck parking and rental studios.

- 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. The tunnel was used to contain pipes for the conveyance of oil, steam, water, foam, etc. between the properties (City of New York, 1921). Pipelines connected Parcel 5 and Parcel 6, transecting 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 depicts the property that continued to be used by SOCONY Pratt Works; 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 appeared to have been removed as well as all former tanks.
- 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 through 2011, until 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, and the responsibility to close the MOSF, for its incorporation into Bushwick Inlet Park. 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 the 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, refinery, and 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 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 Site 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.

3. Summary of Remedial Investigation

The RI evaluated the nature and extent of impacts at the former Williamsburg Works MGP 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. As stated in Section 1, the remedial alternatives developed in this RAAR are intended to address impacts identified within OU-1 only. Therefore, the following discussion is limited to findings within OU-1. Details related to parcels outside OU-1 are provided 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 the 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 be compared to Protection of Groundwater SCOs.

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 this Site.

3.2. NAPL Migration

The overall vertical extent of NAPL migration 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 (NAPL saturation and coating, sheens, staining, and odors) to soil are present at the Site which is further described 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 on Figures 13 through 16. While background metal concentrations are referenced in the discussion below to provide context, Site remedial decisions are determined based on 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), pesticides, PCBs, metals, and free cyanide were detected in surface soils. Due to the post-MGP disposition of the Fill Wedge described in Section 2.3.3, the presence of these compounds is not associated with former MGP operations and likely represent impacts associated with fill and land uses post-dating MGP operation.

3.3.2. Shallow Subsurface Soil

For the purpose of this RAAR, shallow subsurface soil is defined as the top five feet of soil that may be excavated during utility or construction activities.

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 and within former Holder No. 1 and the former Relief Holder were excavated to 30 feet bgs. One shallow sample had analytical concentrations exceeding Protection of Groundwater SCOs.

3.3.2.2. Parcels 3 and 4

As described in Sections 2.2 and 2.3.3, a wedge-shaped layer of non-MGP related materials is present at the surface of Parcels 3 and 4. The Fill Wedge, likely placed during building construction following operation of the former MGP Site, is composed of concrete and rebar at the surface underlain with soil and gravel. The thickness of the Fill Wedge ranges from one foot near the boundary of Parcel 2 to at least 9 feet near the boundary with the East River.

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

The following bullets summarize 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 of 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.

Fifty-seven shallow samples had concentrations present above the Protection of Groundwater SCOs.

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.

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]) which is 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 the gas holders and at the center of Parcel 2 was excavated and removed up to 30-ft bgs as part of the IRM.

- Total BTEX concentrations ranged from non-detect to 3,460 mg/kg in WW-SB-24 (38 to 40 feet), which was collected from a NAPL saturated stratum northeast of Holder No. 1.
- Total PAH concentrations ranged from non-detect to 6,416 mg/kg in WW-MW-07 (48.5 to 49.5 feet), which was a stained stratum adjacent to Parcel 2 on North 12th Street. Samples from both fill and native physically impacted strata showed total and individual PAH concentrations that exceeded the Restricted Residential SCOs. Concentrations of other SVOCs did not exceed the Restricted Residential SCOs in deep subsurface soil.
- Concentrations of metals including arsenic, barium, lead, manganese, and mercury were detected exceeding Restricted Residential SCOs primarily within fill. Exponent 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.

Twenty samples deep samples had analytical concentrations exceeding Protection of Groundwater SCOs.

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 17,465.3 mg/kg in sample WW-SB-230 (15-20 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 Residential SCO (59 mg/kg) at eight sampling locations, ranging from 82 mg/kg in WW-SB-233 (20-25 feet) to 1,130 mg/kg in WW-SB-225 (20-25 feet). Alkylated PAH concentrations exceeded Restricted Residential SCOs in 64 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 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.

Seventy-nine deep samples had analytical concentrations exceeding Protection of Groundwater SCOs.

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 former Williamsburg Works MGP 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 former Williamsburg Works MGP site within the East River due to equipment limitations. However, the depth of impacts observed to the west of the former MGP Site are deeper than sediment dredging, or remediation would address, therefore further delineation is not required.

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

3.5. Groundwater

Analysis of dissolved phase groundwater samples identified concentrations above NYSAWQSs that are likely related to MGP and petroleum impacts. Groundwater at the Site also contained elevated concentrations of naturally occurring metals (iron, magnesium, manganese, and/or sodium) indicative of the natural groundwater conditions in the area.

- Total BTEX ranged from non-detect to 31,100 micrograms per liter (µg/L) in groundwater samples collected from WW-MW-05. WW-MW-05 is 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 exceeded the NYSAWQSs. Generally, groundwater samples with the highest levels of BTEX were collected from wells located in Parcels 1 and 2, or on either side of Parcel 3. Other VOCs, including styrene, isopropylbenzene, chloroform, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, trichloroethene, and vinyl chloride, exceeded the NYSAWQS standards in at least one sample. Chlorinated VOCs are not related to former MGP operations. MTBE, a gasoline additive, was detected in groundwater samples collected from Parcel 2 (Metcalf and Eddy, 2007) and likely the result of post-MGP operations on Parcels 1 or 2.

- Total PAHs ranged from non-detect to 7,627 µg/L in the groundwater sample collected from WW-MW-05. Concentrations of individual PAHs were present at levels above the NYSAWQS. Other SVOCs (2-methylphenol, 4-methylphenol, and phenol) were also detected in samples collected from three wells exceeding the NYSAWQS.
- Total PFAS ranged from non-detect to 222.35 nanograms per liter (ng/L) in the groundwater sample collected from WW-MW-12, which is located on the northwestern corner of Parcel 5. Concentrations of individual PFAS were present at levels above the NYSAWQS. PFOS exceeded NYAWQS in five samples ranging from 19 µg/L (WW-MW-203) to 100 µg/L (WW-MW-12 and WW-MW-200). PFOA exceeded the NYAWQS in five samples ranging from 9.71 µg/L (WW-MW-14) to 57.5 µg/L (WW-MW-12).
- PCBs and herbicides were not detected. Concentrations of pesticides exceeded the NYSAWQS in six samples. Pesticides are not associated with former MGP operations.
- Metals (including arsenic, barium, chromium, iron, lead, magnesium, manganese, nickel, potassium, selenium, and sodium) were detected above the NYSAWQS in groundwater samples collected from all monitoring wells.
- Total cyanide ranged from non-detect to 3,900 µg/L in the groundwater sample collected from WW-SB-21. Concentrations of total cyanide exceeded the NYSAWQS in nine samples.
- Ammonia analysis was performed on groundwater samples collected from temporary wells within Parcel 1. Ammonia was detected in all samples, but only at concentrations exceeding the NYSAWQS standard in the groundwater samples collected from WW-SB-21 and WW-SB-22, within deep screened intervals (35 feet and deeper).

3.6. Soil Vapor and Ambient Air (Outdoor)

An SVI investigation, including the collection of sub-slab vapor, indoor air, and ambient (outdoor air) samples, was completed within the occupied building at Parcel 1 and within Parcels 3 and 4.

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 both samples.

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 the Site for their elimination or mitigation:

- Ingestion, dermal contact, and particulate/inhalation of subsurface soil

Potential risk associated with surface soil impacts remaining on Parcels 3 and 4 are similar to any urban area and are not related to former MGP operations due to the presence of the Fill Wedge. Further, surface soils are currently inaccessible due to the overlaying concrete foundations. Exposure to subsurface soil and groundwater would be expected to occur only during potential future ground-intrusive activities at the Site. 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 contaminants of potential concern (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.
- A complete indoor air exposure pathway for chlorinated and other non-MGP volatile organic compounds (VOCs) within indoor air at Parcel 1 was identified during the RI. These compounds are not related to MGP operations but are related to recent use activities at Parcel 1. TCE, carbon tetrachloride, and PCE concentrations in the indoor air may require reasonable and practical actions be taken to identify source(s) and reduce exposures by others according to New York State Department of Health (NYSDOH) soil vapor guidance. A complete exposure pathway for MGP-related VOCs was not identified within indoor air.

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 of the Site 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 the Site, and may present considerable risks to workers and the community during construction. This lack of feasibility is primarily attributable to the depths to which some contaminants (up to 80 ft bgs) have migrated and the lateral proximity of the impacts to the East River. Risk to construction workers is attributed to the unknown construction of existing structures on-site, primarily the bulkhead wall, which would require immediately adjacent deep (>50 ft bgs) material removal to achieve pre-disposal/pre-release restoration. The risk to the community is primarily related to potential releases during management of impacted materials and risks due to settlement or failure of adjacent aging structures and infrastructure (i.e. the North 12th Street sewer and the existing bulkhead wall) during excavations. Failure of the existing bulkhead wall could result in a release of impacted materials within Parcel 4, requiring emergency action to repair or replace the wall. Removal of impacted materials from the Site by truck requires transportation through approximately 1 mile of densely populated and heavily trafficked neighborhoods to reach the nearest expressway. In addition to the risk of a potential release during transportation of impacted materials, the volume of trucking associated with transport of materials will have a substantial impact on local traffic during the remedy.

Based on this analysis, the Site remedial goal is to eliminate or mitigate all significant threats to public health and the environment. This goal establishes the Site-specific SCGs for determining the success of the final remedy, in accordance with 6 NYCRR Part 375.

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 DNAPL and soils containing concentrations of contaminants of concern (COCs) which exceed the 6 NYCRR Subpart 375-6.8 Unrestricted Use SCOs. For the purposes of this RAAR, MGP-impacted material may also contain comingled concentrations of COCs which exceed the Unrestricted Use SCOs which are unrelated to the operations of the former MGP.

- ***MGP-related NAPL source material*** includes all MGP-related DNAPL present in the subsurface of the Site which may provide an ongoing source of groundwater impacts at the Site. Visual impacts that do not include substantial quantities of mobile contamination in the form of NAPL including blebs, globs, sheen, and staining alone are not considered indicators of MGP-related NAPL source material as they do not meet the definition of grossly contaminated media per 6 NYCRR 375-1.2(u). For the purposes of this RAAR, MGP-related NAPL source material may also contain comingled concentrations of COCs which exceed the Unrestricted Use SCOs which are unrelated to the operations of the former MGP.
- ***Non-MGP impacts*** include 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.

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 the Site 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.
- Remove the source of ground or surface water contamination.

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.

5. General Response Actions

The following general response actions are being considered as a means of achieving the RAOs for the Site. 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 MGP-related NAPL source materials and non-MGP-related impacts.
- **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 (*i.e.*, chemical oxidation, stabilization).
- **Containment (soil and groundwater):** isolation of contaminant source areas by constructing and maintaining physical barriers that prevent continued migration of contamination (*i.e.*, in-situ geochemical 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 (*i.e.*, surface cap, fencing, bulkhead).
- **Institutional controls (soil, groundwater, soil vapor):** controlling the type and nature of potential exposures through legal or administrative procedures or programs (*i.e.*, deed notice, 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 as a means of ensuring that potential, but currently incomplete, exposure pathways are not completed (*i.e.*, groundwater monitoring, indoor air sampling, sediment sampling).

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

	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
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	

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 MGP-related impacts at the Site. This preliminary screening focused on alternatives to address Parcel 2 groundwater impacts and remedial activities required to prepare Parcels 3 and 4 for the NYCDPR conceptual redevelopment plan. 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 may be a necessary component 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. While the revised letter and this RAAR provide for the removal of the Fill Wedge, per the Consent Order, removal and the associated costs related to the Fill Wedge do not fall under the responsibility of National Grid.

General response actions considered as a means of achieving the Site RAOs included: excavation/source removal, treatment, containment, engineering controls, institutional controls, and monitoring. Following analysis, technologies retained for analysis were utilized to develop preliminary alternatives for the remediation of Parcels 3 and 4 and the remediation of groundwater impacts at Parcel 2 as discussed further in subsequent sections.

Further details pertaining to the remedial technology screening performed are provided in GEI's Preliminary Remedial Technology Screening – Parcels 2, 3, and 4 letter (2024; Appendix A).

7. Development and Analysis of Alternatives

7.1. Assembly of Remedial Alternatives

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 no action alternative would not include the combination of additional remedial technologies. This alternative would not meet the property owner's minimum requirements for the planned redevelopment of the property. In addition, a No Action alternative will not meet the RAOs for Parcels 2, 3, and 4 and therefore will not be further evaluated in the RAAR.

7.1.2. Alternative 2 – Capping, NAPL Containment, and Groundwater Monitoring

Alternative 2 will include containment of MGP-related NAPL source material via in-situ geochemical stabilization (ISGS) within Parcels 2, 3, and 4. ISGS will be performed using direct push methods to inject a chemical-based solution (typically permanganate or equivalent) under low pressure conditions. MGP-related impacts to groundwater will be addressed by containing MGP-related NAPL source material in subsurface soils, thus reducing hydraulic conductivity and preventing groundwater flow through MGP-related NAPL source materials. Groundwater sampling following ISGS completion will confirm effective MGP-related source material containment and groundwater remediation. Approximate horizontal and vertical ISGS limits for Parcel 2 and Parcels 3 and 4 are identified on Figures 17 and 18 (respectively). The existing Fill Wedge and concrete slab will remain on Parcels 3 and 4 functioning as a composite cover system.

This alternative will utilize ISGS to target MGP-related NAPL source material across an approximately 56,300 square foot area within Parcel 2. Limited excavation and ISS has previously been performed within Parcel 2 during the Parcel 2 IRM, which removed/contained MGP-impacted soils to a maximum 30-foot depth in select areas. Approximate limits of the sheet pile left in-place, installed to facilitate the Parcel 2 IRM, is shown on Figure 17. Alternative 2 will address the remaining MGP-related NAPL source material throughout the parcel with depths generally between 5 and 60 feet bgs using in-situ containment technologies. Approximately 47,650 cubic yards of MGP-impacted soil will be contained within Parcel 2.

Additionally, under this alternative, MGP-related NAPL source material will be addressed with ISGS within Parcels 3 and 4 across an approximately 42,500 square foot area. Parcel 3 and 4 MGP-related NAPL source material is generally located at shallower intervals compared to Parcel 2, between 5 and 35 feet bgs with exception of the southwestern corner of Parcel 4 (WW-WB-221). MGP-related NAPL source material is located at approximately 54 feet bgs in this location. Approximately 19,200 cubic yards of MGP-impacted soil will be targeted with ISGS within Parcels 3 and 4.

A pre-design investigation (PDI) and pilot test will be required to assess feasibility of ISGS implementation to support remedial design. A PDI with hydraulic modelling will be required to evaluate groundwater flow in relation to the proposed ISGS-amended soils and establish an ISGS mix design to satisfy the desired performance criteria. The pilot test may include leachability and permeability testing to determine the degree ISGS application reduces mass flux and mobility of MGP-related NAPL source material, estimate hydraulic conductivity of amended soil, and determine the site-specific ISGS injection radius of influence (ROI). This may include evaluation and testing of various ISGS mix designs. ISGS performance criteria will be determined during the design phase.

Additional PDIs will be required to identify the condition of the existing bulkhead and determine safe setbacks and equipment limitations prior to completion of the remedial design.

A Community Air Monitoring Plan (CAMP) with perimeter monitoring stations will be implemented at the Site as part of this alternative. The objective of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors and on-site workers not involved with Site remedial activities) from potential airborne contaminant releases as a direct result of remedial activities. The CAMP will include air monitoring stations at the perimeter of the work area to monitor potential emissions from the Site. If emission levels approach guidance levels or a nuisance odor is detected during remedial activities, appropriate additional controls will be implemented to control/manage emissions.

Because this alternative will not remove all soils for which laboratory sample analytical results have detected concentrations above Unrestricted Use SCOs, institutional controls would also be required. The proposed institutional controls may include the following:

- An environmental easement (EE) or deed restriction on the property dictating future use and development constraints for the Site.
- Worker notification if utility or other excavation work is planned on the Site.
- Notification to the NYSDEC prior to any action that could jeopardize the integrity of the remedy.
- Development and approval of a Site Management Plan (SMP) for post remediation activities to take place at the Site (including provisions for groundwater monitoring, soil management and worker health and safety).
- A prohibition on the development of water supply or irrigation wells on the Site.
- Annual inspection and certification to confirm appropriate use of the Site, and to ensure that institutional controls included in this remedy are in place and remain effective to control the identified potential exposures.

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.** Under this alternative, containment technologies will be implemented across approximately 98,800 square feet of the on-site area within Parcels 2, 3, and 4. Containment of remaining MGP-related NAPL source material at Parcel 2 (currently operating as

part of Bushwick Inlet Park); may require limited access and disturbance to the parcel space to complete remedial action. Figures 17 and 18 illustrate the conceptual plans of this alternative.

This alternative will not conflict with the existing sewer line and will likely produce minimal potential disturbance to the East River bulkhead.

No above ground or permanent structures will be constructed under this alternative. However, additional groundwater monitoring wells may be determined necessary for long-term monitoring. Locations of monitoring wells will be determined in conjunction with the property owner, if necessary.

- **Time for Remediation***.* Assuming an average ISGS treatment rate of 220 CY per day, the expected duration of the work would be approximately 20 months of continuous on-site activities.

  The rate of ISGS is based on the anticipated time for the installation of vertical and horizontal injection points, injection rates, injection schedules, and the assumption that the ISGS work will be completed in a single mobilization across all three Parcels. Since portions of the injections will occur on the active park, the schedule will be largely dependent on access and a schedule determined in conjunction with the property owner. For the purposes of this RAAR, we have assumed that the work on the other two parcels will be scheduled to minimize disruptions in the overall construction schedule. As portions of the work will be adjacent to the East River bulkhead and the adjacent park, it is possible that the actual rates may vary due to the physical operation constraints from working around the East River bulkhead and any administrative constraints from working adjacent to the park. Additional considerations that may impact the rate of injection productivity include availability of water supply, injection chemical availability, and ease of mixing during implementation.

  Following completion of the remedial construction, long term groundwater monitoring will be required to track groundwater quality trends post-injection to confirm effective MGP-related source material containment and groundwater remediation. Monitoring frequency and duration will be determined in coordination with the property owner and NYSDEC.

- **Spatial Requirements**. Spatial requirements including space for equipment and material storage, access, logistics, and operation for this alternative will generally be satisfied utilizing the area available within the Parcel 2, 3, and 4 boundaries. Parcel 2, currently operating as part of Bushwick Inlet Park, may require partial closure during portions of the execution of this alternative. Staging and sequencing of the work will be coordinated with the property owner and NYSDEC.

  Further, access to all residential roads and highways will be necessary to facilitate equipment and material movement and for off-site transport of impacted materials. During the construction phase, impacted materials generated will be containerized in Department of Transportation (DOT)-approved 55-gallon drums or roll-off containers and temporarily staged on-site until transported for disposal at a properly licensed, National Grid-approved facility.

- **Options for Disposal.** Options for disposal of MGP-impacted materials are readily available off site at a properly permitted, National Grid approved facility. Spoils generating from drilling activities will be handled and disposed in accordance with requirements determined following

pre-construction waste disposal characterization. Waste will be temporarily staged on-site until transported for off-site disposal.

Ongoing waste disposal may be required from long-term groundwater monitoring activities.

Permit Requirements. Road and/or sidewalk permits may be required during construction activities if street closures are required during construction. Drilling activities to facilitate ISGS injection are not expected to pose risk to the adjacent East River bulkhead's integrity; however, an Army Corps of Engineers (ACOE) permit may be required so that, in the event of damage, emergency repairs to the East River bulkhead can be performed.

Additionally, in the state of New York, an EPA Underground Injection Control (UIC) permit will be required prior to injection activities.

- **Limitations.** The ability to complete ISGS may be limited pending results of the PDI and pilot test. Site conditions which may pose potential challenges for ISGS include subsurface porosity for injectate distribution, soil geochemical characteristics, nature of site-specific MGP-related NAPL source material, and tidal influence from the adjacent East River. Site-specific conditions will be assessed during PDI and pilot test efforts to evaluate ISGS feasibility.

  Additionally, limitations associated with the East River bulkhead may be present. Further evaluation will be required in the design phase to confirm safe setbacks and machine limitations.

- **Ecological Impacts.** This alternative is not anticipated to have either significant benefits to or adverse impacts on fish and wildlife resources.

7.1.3. Alternative 3 – Fill Wedge Removal, NAPL Containment and/or Excavation, Capping, and Groundwater Monitoring

Alternative 3 will include removal of the Fill Wedge, excavation of MGP-related impacted soil in the unsaturated zone, targeted excavation and/or containment of MGP-source material in the saturated subsurface soils and immediately landside of the East River bulkhead, off-site treatment and/or disposal of spoils, and construction of a composite cover/clean soil cap across Parcels 3 and 4. Similar to Alternative 2, Alternative 3 will also include an evaluation of containment technologies to address remaining MGP-related NAPL source material at depth within Parcel 2. Approximate excavation, ISS, and ISGS limits are identified on Figures 17 and 19. Based on discussions with the property owner, it is GEI's understanding that the final redevelopment plans for Bushwick Inlet Park have not been prepared. The final elevation of the Parcels' 3 and 4 cap for this alternative will be established to support the final redevelopment plans, to a maximum elevation matching current levels of adjacent streets, by the property owner for the Site if they are available during the remedial design. For the purposes of this RAAR evaluation only, GEI has assumed that the final restored elevation of the Site will match the existing elevations of North 11th Street and North 12th Street adjacent to Parcels 3 and 4. This alternative does not preclude other final redevelopment options, such as a potential hard/soft shoreline, that may be in consideration by the property owner. Groundwater from Parcels 2, 3, and 4 will be remediated through removal and/or containment of MGP-related source material within subsurface soils. Following the soil remediation, groundwater monitoring will confirm effective MGP-related source material removal/containment and groundwater remediation.

Alternative 3 includes MGP-source material removal in the unsaturated zone and a combination of excavation and containment in the saturated subsurface soils within Parcels 3 and 4. Pending evaluation of Site-specific efficacy of applicable technologies, MGP-related NAPL source material within Parcel 2, immediately landside of the existing East River bulkhead, and at selected locations and depths will be contained via ISGS or other containment technologies. The use of ISGS along the existing East River bulkhead wall minimizes the intrusive activities performed adjacent to it and limits the risk of structural failure and a release of impacted materials behind the wall during construction. Approximate vertical and horizontal limits for excavation, ISS, and ISGS are identified on Figures 17 and 19.

Alternative 3 includes the following common elements from Alternative 2: Parcel 2 MGP-related NAPL source material containment, odor/emission control, PDI related to the East River bulkhead condition, ISGS PDI and pilot testing, post-construction groundwater monitoring, and institutional controls, which are likely to include an SMP, EE, and restriction on the use of groundwater underlying the Site. In addition to these common elements, the following remedial elements would be included in Alternative 3.

Pending evaluation of effectiveness at the Site, containment technologies under this alternative will target MGP-related NAPL source material across an approximately 56,300 square foot area within Parcel 2 with depths generally between 5 and 60 feet bgs. Approximately 47,650 cubic yards of MGP-impacted soil will be addressed within Parcel 2. ISGS would be utilized to contain NAPL source material across an approximately 3,000 square foot area within Parcel 4 immediately landside of the East River bulkhead, with depths generally between 10 and 25 feet bgs.

Alternative 3 includes removal of the Fill Wedge and targeted excavation within the shallow saturated zone, the latter to remove MGP-related NAPL source material to a depth of approximately 16 feet below existing grade. 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. 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. Construction of the composite cover/soil cap will be consistent with the current levels of the adjacent streets but can be modified to a lower elevation to meet the final redevelopment plans for the park, if known in a timeframe allowing incorporation into the remedial design. This alternative does not preclude other final redevelopment options, post-remediation, such as a potential hard/soft shoreline that may be under consideration by the property owner.

The Fill Wedge at the surface of Parcels 3 and 4 will be excavated and removed from the Site, where present, to the target excavation depths. Removal of the Fill Wedge includes the non-MGP-related 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 19,100 cubic yards (32,400 tons) of non-MGP impacted fill material.

Excavation beneath the Fill Wedge in the unsaturated and shallow saturated zones will remove approximately 5,000 cubic yards of MGP-impacted soils. Excavated materials will be transported off-site for treatment and/or disposal as applicable. Excavations in areas where ISS is not planned will be

backfilled to the final redevelopment elevation, or a maximum elevation matching current levels of adjacent streets, with a minimum of two feet of imported clean fill.

MGP-related NAPL source material throughout Parcels 3 and 4 not addressed via excavation or ISGS will be contained via ISS to the approximate limits on Figure 19. Installation of temporary subsurface earth support structures may be required in Parcel 4 to facilitate ISS activities near the East River bulkhead. Approximately 15,300 cubic yards of ISS will be implemented under this alternative to depths generally 20 to 35 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.

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.** Figures 17 and 19 illustrate the conceptual plans 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 MGP-related NAPL source material will be required on Parcels 3 and 4, introducing potentially required excavation support and dewatering. Approximately 56,050 square feet of excavation would be at or below the water table with a maximum estimated saturated thickness of 12 feet. Approximately 27,730 and 3100 square feet of ISS and ISGS, respectively, will be performed to contain MGP-related NAPL source material deeper than the planned excavations.

  Containment of remaining MGP-related NAPL source material at depth within Parcel 2 (currently operating as part of Bushwick Inlet Park) may require limited access and disturbance to the parcel space to complete remedial action. Additional groundwater monitoring wells may be determined necessary for long-term monitoring. Locations of monitoring wells, if necessary, will be determined in conjunction with the property owner.

- **Time for Remediation.** Assuming excavation, ISS, and ISGS injection rates of 250 tons, 410 cubic yards and 220 cubic yards per day, respectively, the expected duration of the construction work, including disposal characterization sampling, would be approximately 25 months of continuous on-site activities.

  The excavation and ISS rates above are based on conventional activity rates. Since portions of the excavation and ISS will be within proximity to the East River bulkhead and the adjacent park, it is possible that the actual performance rates may be less than conventional rates due to the physical operation constraints of construction around the East River bulkhead and administrative constraints of working near the park. Physical operation constraints posed by the North 12th Street sewer line may also reduce ISS performance rates.

  To maintain the proposed excavation rate, approximately 20 trucks will be required daily during excavation to transport impacted materials from the Site. In addition, approximately 20 truckloads of clean fill material will be transported to the Site daily. The facility accepting the impacted soils is not the same as the facility providing clean fill. The same trucks cannot be used; therefore, a total of approximately 40 trucks will be transporting materials to and from the Site

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.

ISS and ISGS rates can be similarly limited by subsurface obstructions and limitations on material transportation to the Site. As discussed under Alternative 2 the availability of water supply, injection chemical availability, and ease of mixing during implementation may affect the rate of treatment.

Following completion of the soil remedy, groundwater monitoring will be utilized to confirm effective MGP-related source material removal/containment and groundwater remediation. Monitoring frequency and duration will be determined in coordination with the property owner and NYSDEC.

- **Spatial Requirements.** This alternative will require substantial room for equipment and material storage, access, logistics, and operation. Site 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 and ISGS scopes of work including mobilization, equipment and material storage, and operation. Spatially, due to the largely shallow nature of the excavations, the Site can accommodate these needs, but careful staging and sequencing of the work will be required.

  Further, access to all 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 the Site for the disposal facility. No staging of trucks filled with impacted material will occur off-site.

  Parcel 2, currently operating as part of Bushwick Inlet Park, may require partial closure during portions of this alternative. Staging and sequencing of the work will be coordinated with the property owner and NYSDEC.

- **Options for Disposal.** Options for treatment and disposal of MGP-impacted materials are readily available off-site at a properly permitted facility approved for use by National Grid . However, the volume of material excavated daily may exceed the availability of trucks for transport of impacted materials or disposal facility capabilities during the excavation phase and could result in project delays.

  Approximately 80% of the total remedial alternative excavation volume is associated with the non-MGP impacted materials in the Fill Wedge. Non-MGP impacted soils in the Fill Wedge have PCB impacts unrelated to the former MGP. With acceptable laboratory analytical results and approval by the NYSDEC, excavated non-MGP impacted materials from the Fill Wedge may be reused on-site as backfill material in the deeper MGP-related NAPL 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.

Concrete and rebar materials will 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.

Ongoing waste disposal may be required from long-term groundwater monitoring activities.

- **Permit Requirements.** Permits required for Alternative 3 will be similar to those required for Alternative 2 (i.e., road and/or sidewalk permits, ACOE, and EPA UIC). 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. A NYSDEC General Permit for Stormwater Discharges from Construction Activity will additionally be required for the work as the total disturbance area is greater than one acre, which will include the preparation and implementation of a Stormwater Pollution Prevention Plan (SWPPP).
- **Limitations.** The ability to complete ISS and excavation to the required depths in proximity to the East River bulkhead and/or 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 limit the daily production rate and project schedule. Based on preliminary volumes, approximately 200 truckloads will be required to transport MGP-impacted excavated materials offsite for off-site treatment and/or disposal in addition to 1,300 trucks to transport non-MGP impacted materials from the Fill Wedge and 220 trucks for the concrete and rebar produced during slab demolition. This estimate does not account for the potential debris (boulder, etc.), spoils generated from Parcel 2 ISGS activities, or other miscellaneous spoils that would have to be transported from the Site during construction.

  To mitigate potential transportation and disposal challenges (truck availability, landfill acceptance limits, etc.), transporting excavated material via barge from the Site 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.

  The ability to complete ISGS may be limited pending results of the PDI and pilot test. Site conditions which may pose potential challenges for ISGS include subsurface porosity for injectate distribution, soil geochemical characteristics, nature of site-specific MGP-related NAPL source

material, and tidal influence from the adjacent East River. Site-specific conditions will be assessed during PDI and pilot test efforts to evaluate ISGS feasibility.

Significant hydraulic modelling will be required for the ISS monolith construction and ISGS containment.

- **Ecological Impacts.** This alternative will remove and/or contain identified MGP-related NAPL source material located at the Site. Due to the more extensive remedial activities planned near the East River bulkhead and East River, contaminant precautions will be necessary throughout the construction phase to monitor for potential releases. 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 – Fill Wedge Removal, Hot Spot Excavation, NAPL Removal and/or Containment, Capping, and Groundwater Monitoring

Alternative 4 will include removal of the Fill Wedge, MGP-source material excavation and containment in the saturated subsurface soils within Parcels 3 and 4, containment of MGP-source material within Parcel 2, off-site treatment and/or disposal of spoils, and construction of a composite cover/clean soil cap across Parcels 3 and 4. Approximate vertical and horizontal limits for excavation, ISS, and ISGS are identified on Figures 17 and 20. Based on discussions with the property owner, it is GEI's understanding that the final redevelopment plans for Bushwick Inlet Park have not been prepared. The final elevation of the Parcels 3 and 4 cap for this alternative will be established, to a maximum elevation matching current levels of adjacent streets, to support the final redevelopment plans by the property owner for the Site if they are available during the remedial design. For the purposes of this RAAR evaluation only, GEI has assumed that the restoration of the Site will be even with the existing elevations of North 11th Street and North 12th Street adjacent to Parcels 3 and 4. This alternative does not preclude other final redevelopment options, such as a potential hard/soft shoreline, that may be under consideration by the property owner. Groundwater from Parcels 2, 3, and 4 will be remediated through removal and/or containment of MGP-related source material within subsurface soils. Following the soil remediation, groundwater monitoring will confirm effective MGP-related source material containment and groundwater remediation.

Similar to Alternative 3, Alternative 4 includes MGP-source material removal in the unsaturated zone and a combination of excavation and containment in the saturated subsurface soils within Parcels 3 and 4. MGP-related NAPL source material within Parcel 2, immediately landside of the East River bulkhead, and at selected locations of depth, will be contained via ISGS. Approximate vertical and horizontal limits for excavation, ISS, and ISGS are identified on Figures 17 and 20.

Alternative 4 includes the following common elements from Alternatives 2 and/or 3: Parcel 2 MGP-related NAPL source material containment, Parcel 3 and 4 unsaturated zone excavation, ISGS along the East River bulkhead wall, odor/emission control, PDIs related to the bulkhead condition, waste characterization and ISGS feasibility, ISGS pilot testing, post-construction groundwater monitoring, and institutional controls, which are likely to include an SMP, EE, and restriction on the use of groundwater underlying the Site. In addition to these common elements, the following remedial elements would be included in Alternative 4.

Pending evaluation of effectiveness at the Site, containment technologies would be utilized to the same horizonal and vertical extents as under Alternative 3. Within Parcel 2 MGP-related NAPL source material will be targeted with ISGS across an approximately 56,300 square foot area with depths generally between 5 and 60 feet bgs. Approximately 47,650 cubic yards of MGP-impacted soil will be addressed within Parcel 2. ISGS would be utilized to contain NAPL source material across an approximately 3,000 square foot area within Parcel 4 immediately landside of the East River bulkhead, with depths generally between 10 and 25 feet bgs.

In addition to the unsaturated zone excavation as described in Section 7.1.3, Alternative 4 includes targeted excavations in the saturated zone to remove MGP-related NAPL source material to depths of approximately 25-30 feet below existing grade. Installation of temporary subsurface earth support structures will be required in Parcels 3 and 4 to facilitate source material excavations depending on the excavations' depths and proximity to adjacent surface roads or structures, target depth, and available surroundings to perform the excavation via sloping. Further excavation will be required to compensate for material swell (estimated as 25%) in ISS locations discussed below to maintain the two foot minimum depth below the final redevelopment elevation for construction of the composite cover/soil cap, which for the purposes of this RAAR is assumed to be consistent with the adjacent street current levels but can be modified to a lower elevation to meet the final redevelopment plans for the park, if known in a timeframe allowing incorporation into the remedial design. This alternative does not preclude redevelopment, post-remediation, such as a potential hard/soft shoreline that may be under consideration by the property owner.

The non-MGP Fill Wedge, including the concrete foundation, present at the surface of Parcels 3 and 4 will be demolished and/or removed from the Site as described in Section 7.1.3. Removal of the Fill Wedge represents approximately 2,900 cubic yards (5,400 tons) of concrete slab and rebar and 19,100 cubic yards (32,400 tons) of non-MGP impacted fill material.

Excavation for Alternative 4 in the saturated zone below the Fill Wedge will remove approximately 21,400 cubic yards of MGP-impacted soils. Including the unsaturated zone excavation described in Section 7.1.3, the total volume of material removed in this Alternative is approximately 23,500 cubic yards of MGP-impacted soil from the unsaturated or saturated zones. Excavated materials will be transported off-site for treatment and/or disposal as applicable. Excavations in areas where ISS is not planned will be backfilled to the final redevelopment elevation with a minimum of two feet of imported clean fill.

Deep non-excavated MGP-related NAPL source material within Parcels 3 and 4 will be contained via ISS to the approximate limits identified on Figure 20. Installation of temporary subsurface earth support structures may be required to facilitate ISS activities in proximity to the East River bulkhead . Approximately 800 cubic yards of ISS will be implemented under this alternative to a maximum depth of approximately 33.5 feet below existing grade. A PDI and potential hydraulic modelling will be required to evaluate groundwater flow in relation to the proposed ISS monoliths and establish an ISS mix design to satisfy the desired performance criteria. ISS performance criteria will be determined during the design phase.

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.** Figures 17 and 20 illustrate the conceptual plans of this alternative. Similar to Alternative 3, the entirety of Parcels 3 and 4 will be disturbed during the implementation of the remedy and limited access and disturbance will be required within Parcel 2.

  Additional excavation to remove MGP-related NAPL source material will be required on Parcels 3 and 4, introducing excavation support and increasing dewatering required. Approximately 55,800 square feet of excavation would be at or below the water table with a maximum estimated saturated thickness of 20 feet. Approximately 800 and 3,100 square feet of ISS and ISGS, respectively, will be performed on Parcels 3 and 4 to contain MGP-related NAPL source material.

- **Time for Remediation.** Assuming excavation, ISS, and ISGS treatment rates of 250 tons, 410 cubic yards, and 220 cubic yards per day, respectively, the expected duration of the construction work would be approximately 31 months of continuous on-site activities. As described under Alternatives 3, in the event that sufficient trucks cannot be mobilized or local constraints restrict the number of trucks that can be loaded daily, the time to complete the excavation would be increased.

  Similar to Alternative 3 additional physical constraints (i.e., physical operation constraints of construction around the East River bulkhead and sewer line, administrative constraints of working near the park,) may alter the estimated schedule.

- **Spatial Requirements.** Alternative 4 will require substantial room for equipment and material storage, access, logistics, and operation similar to those described for Alternative 3 (i.e., room for equipment and material storage, access, logistics, and operation; residential roads and highways for material disposal, surface street staging; and sidewalk closure). Additional area will be required to facilitate the extensive excavation to be performed in Parcels 3 and 4 including further groundwater controls including facilities to handle groundwater storage, treatment, and discharge during the construction phase. Spatially, the Site can accommodate these needs, but careful staging and sequencing of the work will be required particularly for the deeper source material excavations in proximity to the East River bulkhead.

  Parcel 2, currently operating as part of Bushwick Inlet Park, may require partial closure during portions of the execution of this alternative. Staging and sequencing of the work will be coordinated with the property owner and NYSDEC.

- **Options for Disposal.** Options for treatment and disposal of MGP-impacted materials are readily available off-site at a properly permitted facility approved for use by National Grid. Options for potential concrete removal and/or reuse, potential reuse of non-MGP Fill Wedge material, on-going waste disposal related to groundwater monitoring are the same as Alternative 3.

  Approximately 45% of the excavation is associated with the non-MGP impacted materials in the Fill Wedge. With approval of the NYSDEC, excavated non-MGP impacted materials from the Fill Wedge may be analyzed and reused on-site as backfill material in the MGP impact driven

excavation areas. On-site material reuse would reduce the volume requirements for material disposal and import.

- **Permit Requirements.** Permits required for Alternative 4 will be similar to those required for Alternative 3 (i.e., road and/or sidewalk permits, discharge permit, ACOE, EPA UIC, local NYC permits for remedial activities, and SWPPP preparation).
- **Limitations.** Limitations for Alternative 4 are similar to Alternative 3 (i.e., excavations and ISS adjacent to East River bulkhead and street, adjacent park and infrastructure, and restrictions on trucking)
- The ability to complete ISGS may be limited pending results of the PDI and pilot test. Site conditions which may pose potential challenges for ISGS include subsurface porosity for injectate distribution, soil geochemical characteristics, nature of site-specific MGP-related NAPL source material, and tidal influence from the adjacent East River. Site-specific conditions will be assessed during PDI and pilot test efforts to evaluate ISGS feasibility.
- Less significant hydraulic modelling will be required for ISS monolith construction, compared to Alternative 3, due to the decreased planned volume of ISS. However, the proposed ISGS within Parcels 2 and 4 and limited ISS within Parcel 4 will affect groundwater flow and still require hydraulic modeling during the design phase.

  Restrictions on trucking, waste disposal facility acceptance rates, and bridge weight limits may limit the daily production rate and project schedule. Based on preliminary volumes, 2,750 truckloads will be required to transport MGP-impacted excavated materials offsite for treatment and/or disposal. An additional 1,300 trucks will be required to transport non-MGP impact materials from the Fill Wedge and 220 trucks for the concrete and rebar produced during slab demolition. As discussed under Alternative 3, material transport and disposal may be facilitated via barge.
- **Ecological Impacts.** Alternative 4 will remove and/or contain identified MGP-related NAPL source material located at the Site. Due to the more extensive remedial activities planned near the East River bulkhead and East River, contaminant precautions will be necessary throughout the construction phase to monitor for potential releases. Overall, neither significant benefits to nor adverse impacts on fish and wildlife resources are expected to result from this alternative.

7.1.5. Alternative 5 – Restore to Pre-Release Conditions

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

Additionally, as noted in the August 2024 Remedial Technology Screening Memo, the preliminary alternative to complete 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 retained as the excavation adjacent to the river to this depth is technically infeasible at Parcel 4. On Parcel 2, demolition of the newly constructed

park and further excavation to approximately 81 ft bgs beneath the park would be required to remove all MGP-related NAPL source material from Parcel 2. Therefore, this alternative is not further evaluated within this RAAR.

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 evaluation for each alternative includes the assignment of a qualitative grade for each criterion on a scale of 1 to 5. The unweighted sum of the grades for each criterion creates the total score for its respective alternative, which is subsequently used to select the preferred remedy for the Site. The nine criteria are:

- **Overall Protection of Public Health and the Environment:** This criterion is an evaluation of the remedy'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.
- **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, provide a discussion and evaluation of the impacts of each, and whether waivers are necessary.
- **Long-term Effectiveness and Permanence:** This criterion evaluates the long-term effectiveness of the remedy after implementation. If wastes or treated residuals remain on-site after the selected remedy 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 remedy to continue to meet RAOs in the future.
- **Reduction of Toxicity, Mobility or Volume with Treatment:** The remedy'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 remedy 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 at the Site will be controlled, and the effectiveness of the controls should be presented. Provide a discussion of engineering controls that will be used to mitigate short-term impacts (i.e., dust control measures). The length of time needed to achieve the remedial objectives is also estimated.

- **Implementability:** The technical and administrative feasibility of implementing the remedy is evaluated. Technical feasibility includes the difficulties associated with the 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:** Capital, operation, maintenance, and monitoring costs are estimated for the remedy and presented on a present worth basis.
- **Land Use:** The NYSDEC may consider 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.

8.2. Alternative 2 – Capping, NAPL Containment, and Groundwater Monitoring

8.2.1. Overall Protection of Human Health and the Environment

This alternative will be protective of the public 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, Parcel 4, and the adjacent ROWs. Subsurface MGP-related NAPL source material will remain in place at the Site, contained within Parcel 2 and ISGS within Parcels 3 and 4 under this alternative. The existing composite cover on Parcel 2 and concrete 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.

8.2.2. Compliance with SCGs

The containment of MGP-related impacted soils will contain subsurface MGP-related NAPL source material at the Site; however, soil in exceedance of the SCOs and residual MGP-related NAPL source material will remain. Containment of MGP-related NAPL source material conforms with SCGs by reducing the potential for MGP-related NAPL source material migration. Groundwater from Parcels 2, 3, and 4 will be remediated through containment of MGP-related source material within subsurface soils. Institutional controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current Site use and the planned redevelopment.

8.2.3. Long-Term Effectiveness and Permanence

Maintenance of the existing cover system and containment of MGP-related NAPL source materials and implementation of institutional controls will provide a long-term solution to prevent exposure to contained potentially mobile source material within the subsurface. Impacted material exceeding SCOs including MGP-related NAPL source material will remain at the Site. Groundwater from Parcels 2, 3, and 4 will be remediated through containment of MGP-related source material in subsurface soils.

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

The containment of MGP-related NAPL source material zone will permanently reduce the mobility of these impacts at the Site. While identified source material will be contained, impacted material exceeding SCOs will remain at the Site.

8.2.5. Short-Term Impact and Effectiveness

The short-term impacts during ISGS activities are anticipated to be negligible with exception of potentially requiring partial, temporary closure of the Bushwick Inlet Park on Parcel 2 during remedial execution.

8.2.6. Implementability

There are minimal implementation issues associated with the containment of MGP-related NAPL source material within Parcels 2, 3, and 4. The primary implementation issue will be performing ISGS activities near the East River bulkhead structure. A PDI will be performed to determine the existing construction and stability of the East River bulkhead structure.

Limitations for work adjacent to the active park on Parcel 2 are anticipated if the park remains active during 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 implemented during the work. This could include a phased approach to the remedial work to accommodate future park construction activities and minimize the effects of potential partial closure of the active park on Parcel 2.

Institutional controls are implementable as they would be consistent with the current and potential future Site use.

8.2.7. Cost

The estimated cost range for this remedial alternative is between $31.7 and $68 Million (Table 1). This cost is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

The costs provided in Table 1 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

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.

8.2.8. Land Use

This alternative supports the current land use and supports the future land use at the Site. 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 the Site as a public park. As noted above, the final park redevelopment plans have not been developed as of the date of this RAAR. Parcels 3 and 4 may require additional remediation and removal of the non-MGP-related Fill Wedge, which is not related to the former MGP operations and is not comingled or intermingled with any MGP-related materials, based on the final park redevelopment plans.

8.3. Alternative 3 – Fill Wedge Removal, NAPL Containment and/or Excavation, Capping, and Groundwater Monitoring

8.3.1. Overall Protection of Human Health and the Environment

This alternative 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. 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. The majority of subsurface soil impacts, to the depths of potential future exposure scenarios for utility and construction workers, will be removed from Parcels 3 and 4. Identified MGP-related NAPL source material will be removed and/or contained throughout Parcels 2, 3, and 4 which will prevent potential source material exposure in scenarios of deeper utility or construction activities at the Site. 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 MGP-related NAPL 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 and MGP-related impacted soils in the unsaturated and shallow saturated zones 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. Residual MGP-related NAPL source material will be excavated or remain on-site, contained during remedial ISS and ISGS, at depth beyond the limits of the excavation. MGP-related NAPL source material removal and containment conforms with the SCGs by reducing the potential for MGP-related NAPL source material migration and removing source material where practicable. Groundwater from Parcels 2, 3, and 4 will be remediated through removing and/or containing MGP-related impacts to subsurface soils. Institutional

controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current site use and the planned redevelopment.

8.3.3. Long-Term Effectiveness and Permanence

Removal of non-MGP and MGP-related impacted soils in the unsaturated and shallow saturated zones at the Site and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beyond the limits of the excavation, MGP-related NAPL source material will be removed or contained throughout Parcels 2, 3, and 4. A combination of MGP-related NAPL source material removal and containment will be effective at permanently removing or containing potentially mobile MGP-related NAPL source material from the subsurface. While identified source material will be removed or contained, impacted material exceeding SCOs will remain at the Site. Groundwater from Parcels 2, 3, and 4 will be remediated through removing and containing MGP-related impacts to subsurface soils without further treatment prior to exiting the Site boundary.

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

The excavation and removal of non-MGP and MGP-related impacted soils in the unsaturated zone at the Site will permanently reduce the mobility and volume of these impacts through off-site treatment and/or disposal. MGP-related NAPL source material removal and/or containment will reduce the mobility and the overall volume of MGP-related NAPL source material at the Site. While identified source material will be removed or contained, impacted material exceeding SCOs will remain at the Site.

8.3.5. Short-Term Impact and Effectiveness

The excavation of non-MGP and MGP-related impacted soils in the unsaturated and shallow saturated zones may increase the short-term potential exposure to workers at the Site. 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 short-term impacts during ISS and ISGS activities are additionally anticipated to include requiring partial, temporary closure of the Bushwick Inlet Park on Parcel 2 during remedial execution.

The surrounding community and park patrons of the active park at Parcel 2 will be impacted during the excavation, ISS, ISGS, and backfill operations associated with this alternative. The volume of material to be excavated and removed from the Site is estimated at 24,100 cubic yards (41,200 tons). Imported clean fill material (approximately 7,300 cubic yards/12,500 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 between 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 82 workdays (~4 months). Similarly, an additional 20 trucks per day would be required to transport clean

imported materials to the Site for 40 workdays (~2 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.

To reduce the short-term impacts resulting from trucking excavated material for disposal, material removal via barge will be considered as a hauling alternative. Material could be loaded directly from the Site to the barge using the river access on the western side of Parcel 4. Clean imported material for backfilling would still require trucking to the Site.

8.3.6. Implementability

There are implementation issues associated with the excavation of soil to meet SCOs and remove residual MGP-impacted soil. The primary implementation issues will include the ISS activities adjacent to the East River bulkhead and the North 12th Street sewer line which will require PDI activities to determine current structural and geostructural conditions, additional construction support, and monitoring during remediation activities. Pending evaluation of the Site-specific effectiveness of the technology, ISGS will be performed directly adjacent to the East River bulkhead extending approximately 15 feet inland within Parcel 4 to address MGP impacted material and reduce construction risks. Further issues can be addressed using standard construction techniques following the PDI to determine the stability of existing structures.

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 implemented 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.

Specific limitations for the location and size of remedial components to remain at the Site will be determined in conjunction with the property owner to be consistent with the final park redevelopment plans if available during the final design.

Institutional controls are implementable as they would be consistent with the current and potential futures Site use.

8.3.7. Cost

The estimated cost range for Alternative 3 is between $32.7 and $70.1 Million (Table 1). Approximately $5 to $11 Million is associated with the removal of the non-MGP-related Fill Wedge as removal is a necessary component to implement this alternative. In accordance with the Consent Order between National Grid and NYSDEC, contamination other than the MGP Wastes is not required to be addressed unless it is commingled or intermingled with MGP-Site Contamination that alone would require remedial action. Therefore, per the Consent Order, the costs associated with the removal of the Fill Wedge does not fall under the responsibility of National Grid. Excluding the non-MGP Fill Wedge, the estimated cost range for Alternative 3 is between $21.7 and $65.1 Million which is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

The costs provided in Table 1 are feasibility level costs. Feasibility level costs are considered an Order of Magnitude estimate under the ANSI classification system or a Class 4 estimate under the AACE classification system. This is an estimate completed when the project definition is between 1-15%. The expected range 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.

8.3.8. Land Use

This alternative supports the current and proposed future land use at the Site. 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 Site 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 does not preclude other final redevelopment options, such as a soft shoreline, that may be under consideration by the property owner.

8.4. Alternative 4 – Fill Wedge Removal, Hot Spot Excavation, NAPL Removal and/or Containment, Capping, 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 subsurface soil impacts, to the depths of potential future exposure scenarios for utility and construction workers, will be removed from Parcels 3 and 4. Identified MGP-related NAPL source material will be removed or contained throughout Parcels 2, 3, and 4 which will prevent potential source material exposure in scenarios of deeper utility or construction activities at the Site. 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 and/or containing MGP-related impacted 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 and MGP-related impacted soils in the unsaturated and shallow saturated zones 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. Residual MGP-related NAPL source material will be excavated or remain on-site, contained during remedial ISS and

ISGS, at depth beyond the limits of the excavation. MGP-related NAPL source material removal and containment conforms with the SCGs by reducing the potential for MGP-related NAPL source material migration and removing source material where practicable. Groundwater from Parcels 2, 3, and 4 will be remediated through removing and containing MGP-related impacts to subsurface soils. Institutional controls will be implemented to prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current Site use and the planned redevelopment.

8.4.3. Long-Term Effectiveness and Permanence

Removal of non-MGP and MGP-related impacted soils in the unsaturated and shallow saturated zones at the Site and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beyond the limits of the excavation, MGP-related NAPL source material will be removed or contained throughout Parcels 2, 3, and 4. A combination of MGP-related NAPL source material removal and containment will be effective at permanently removing or containing potentially mobile MGP-related NAPL source material from the subsurface. While identified source material will be removed or contained, impacted material exceeding SCOs will remain at the Site. Groundwater from Parcels 2, 3, and 4 will be remediated through removing and containing MGP-related impacted subsurface soils.

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

The excavation and removal of non-MGP and MGP-related impacted soils in the unsaturated and saturated zones at the Site will permanently reduce the mobility and volume of these impacts through off-site treatment and/or disposal. MGP-related NAPL source material removal and/or containment will reduce the mobility and the overall volume of MGP-related NAPL source material at the Site. While identified source material will be removed or contained, impacted material exceeding SCOs will remain at the Site.

8.4.5. Short-Term Impact and Effectiveness

The excavation of non-MGP and MGP-related impacted soils in the unsaturated and saturated zones may increase the short-term potential exposure to workers at the Site. 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 short-term impacts during ISS and ISGS activities are anticipated to include likely requiring partial, temporary closure of the Bushwick Inlet Park on Parcel 2 during remedial execution.

The surrounding community and park patrons of the active park at Parcel 2 will be impacted during the excavation, ISS, ISGS, and backfill operations associated with this alternative. The volume of material to be excavated and removed from the Site is estimated at 42,700 cubic yards (75,900 tons). Imported clean fill material (approximately 28,500 cubic yards/48,450 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 20 25-ton truckloads per day (maximum of 500 tons/day) would be transported through the local community for approximately 145 workdays (~7.3 months). Similarly, an additional 20 trucks per day would be required to transport clean imported materials to the Site for 100 workdays (~5 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.

To reduce the short-term impacts resulting from trucking excavated material for disposal, material removal via barge will be considered as a hauling alternative. Material would be loaded directly from the Site to the barge using the river access on the western side of Parcel 4. Clean imported material for backfilling would still require trucking to the Site.

8.4.6. Implementability

Similar to Alternative 3, there are implementation issues associated with the excavation of soil to meet SCOs and remove residual MGP-impacted soil. The primary implementation issues will include the excavation and ISS activities in proximity to the East River bulkhead and surrounding the North 12th Street sewer line which will require PDI activities to determine current structural and geostructural conditions, additional construction support, and monitoring during remediation activities. To reduce risk to the East River bulkhead structure, ISGS will be performed directly adjacent to the East River bulkhead extending approximately 15 feet inland within Parcel 4 to address MGP impacted material and reduce construction risks. Further issues can be addressed using standard construction techniques following a PDI to determine the stability of the existing structures.

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 implemented 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.

Specific limitations for the location and size of remedial components to remain at the Site will be determined in conjunction with the property owner to be consistent with the final park redevelopment plans if available during the final design.

Institutional controls are implementable as they would be consistent with the current and potential futures Site use.

8.4.7. Cost

The estimated cost range for this remedial alternative is between $42.6 and $91.4 Million (Table 1). Similar to Alternative 3, approximately $5 to $11 Million is associated with the removal of the non-MGP-related Fill Wedge which, per the Consent Order, does not fall under the responsibility of National Grid. Excluding the non-MGP Fill Wedge, the estimated cost range for Alternative 4 is between $31.6 and

$86.4 Million which is within the range of industry costs typically associated with the remediation of similarly sized former MGP sites.

The costs provided in Table 1 are feasibility level costs. Feasibility level costs are considered an Order of Magnitude estimate under the ANSI classification system or a Class 4 estimate under the AACE classification system. This is an estimate completed when the project definition is between 1-15%. The expected range 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.

8.4.8. Land Use

This alternative supports the current and proposed future land use at the Site. 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 Site 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 does not preclude other final redevelopment options, such as a soft shoreline, that may be under consideration by the property owner.

8.5. Comparison of Alternatives

Table 1 summarizes estimated remedial costs for the alternatives. Table 2 presents a comparative matrix of the alternatives with the evaluation criteria. A qualitative scoring system has been used to give a general sense of how the alternatives differ in meeting each of the criteria. Each of the alternatives satisfies the criteria to some degree. The primary differences are found in long-term effectiveness, short-term effectiveness, implementability, and cost.

9. Conclusion and Recommendations

9.1. Recommended Alternative

Upon consideration of the alternatives and their respective attributes and limitations, Alternative 3 emerged as the recommended alternative. As summarized in the comparative analysis, both Alternative 3 and Alternative 4 achieve a substantial reduction in impacts through the combination of direct excavation, ISS, and ISGS when compared to Alternative 2, which relies primarily on the maintenance of the existing cover system and containment of MGP-related source material with ISGS. Alternative 3 achieves the equivalent remedial effectiveness as Alternative 4, with significantly less cost, a shorter duration, decreased risk to workers during construction, and much less negative impact to the community during construction. Alternative 3 provides an emphasis on balancing effectiveness and cost though the combination of direct excavation, ISS, and ISGS. This alternative is implementable with moderate short-term impacts and meets the RAOs for the Site, to the extent practicable.

The recommended alternative, Alternative 3, includes the following actions:

9.1.1. Remediation Not Under the ACO

- Demolition and removal of the non-MGP related concrete foundation elements.
- Excavation of the non-MGP commingled nor intermingled Fill Wedge materials, with off-site treatment and/or disposal.

9.1.2. Remediation Under the ACO

- Containment of MGP-related source material located at depth below Parcel 2 and inboard the East River bulkhead wall at Parcel 4 with ISGS.
- Excavation of shallow MGP-related NAPL source material in the unsaturated zone, with off-site treatment and/or disposal.
- MGP-related NAPL source material will be removed and/or contained in the shallow saturated zone.
- Below the shallow saturated zone, MGP-related NAPL source material will be largely contained via iSS with excavation limited to shallower identified impacts.
- Placement of clean fill to a maximum elevation of adjacent streets to support future redevelopment as a part of Bushwick Inlet Park.
- Establishment of an Environmental Easement including a prohibition on the use of groundwater from the Site.
- Establishment of a SMP providing for IC/ECs.

The active Site work, including the excavation, ISGS, ISS, and restoration of the property would have a duration of approximately 25 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.

The recommended alternative represents a consistent approach appropriate for the Site's future land use and which fits 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 1 Summary of Remedial Alternatives Cost

Table 2 Remedial Alternative Scoring Comparison Summary

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

Remedial Alternative	Non-MGP Fill Wedge Removal Estimate	MGP 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	$0	$44,527,880	$820,000	$45,347,880	$68,021,820	$31,743,516
Remedial Alternative 3	$7,342,420	$38,600,130	$820,000	$46,762,550	$70,143,825	$32,733,785
Remedial Alternative 4	$7,342,420	$52,795,850	$820,000	$60,958,270	$91,437,405	$42,670,789

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

Table 2. Remedial Alternative Scoring Comparison Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Sample I.D.	Alternative 2 Score	Alternative 2 Comments	Alternative 3 Score	Alternative 3 Comments	Alternative 4 Score	Alternative 4 Comments
Overall Protection of Human Health and the Environment	4	The existing composite cover on Parcel 2 and the planned cover for Parcels 3 and 4 will prevent exposure for park patrons and workers. Subsurface source material will remain in place, contained by ISGS. Engineering and institutional controls will ensure the protection of public health to any remaining impacts from soil vapor and groundwater. Non-MGP fill wedge and ISGS material at depth may require additional handling during a future redevelopment depending on the final redevelopment plans.	5	The existing composite cover on Parcel 2, ISGS containmnet of source material on Parcel 2, and the excavation and ISS planned for Parcels 3 and 4 will prevent exposure for park patrons and workers. Source material will be removed, stabilized, or contained throughout Parcels 2, 3, and 4 to prevent potential source material exposure during deeper utility or construction activities. Engineering and institutional controls will ensure the protection of public health to any remaining impacts from soil vapor and groundwater.	5	The existing composite cover on Parcel 2, and the excavation and ISS planned for Parcels 3 and 4 will prevent exposure for park patrons and workers. Source material will be removed, stabilized, or contained throughout Parcels 2, 3, and 4 to prevent potential source material exposure during deeper utility or construction activities Engineering and institutional controls will ensure the protection of public health to any remaining impacts from soil vapor and groundwater.
Compliance with SCGs	3	Containment of MGP-related source material conforms with the SCGs by reducing the potential for MGP-related source material migration. Groundwater will be remediated through containment of source material within subsurface soils. Institutional controls will prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current site use and the planned redevelopment.	4	Excavation will remove shallow soils in exceedance of SCOs. ISS will immobilize soil in exceedance of the SCOs and residual MGP-related NAPL source material beneath the limits of the excavation. ISGS will immobilize remant MGP-related impacts from Parcel 2 and adjacent the bulkhead. Institutional controls will prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current site use and the planned redevelopment.	5	Excavation will remove shallow and deeper soils in exceedance of SCOs. ISS will immobilize soil targeted area of NAPL source material beneath the limits of the excavation. ISGS will immobilize remant MGP-related impacts from Parcel 2 and adjacent the bulkhead. Institutional controls will prevent potential exposures to soil and groundwater impacts that exceed the SCGs under current site use and the planned redevelopment.
Long-Term Effectiveness and Permanence	3	Maintenance of a cap, containment of MGP-related source material, and institutional controls will provide a long-term solution to prevent exposure remaining impacts.	4	Removal of non-MGP and MGP-related impacted soils and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beneath the limits of the excavation, NAPL source material will be removed, stabilized, or contained throughout Parcels 2, 3, and 4. MGP-related source material treatment will address impacted groundwater prior to the Site boundary.	5	Removal of non-MGP and MGP-related impacted soils and implementation of institutional controls will provide a long-term solution to prevent exposure to these impacts. Beneath the limits of the excavation, NAPL source material will be removed, stabilized, or contained throughout Parcels 2, 3, and 4. MGP-related source material treatment will address impacted groundwater prior to the Site boundary.
Reduction of Toxicity, Mobility, or Volume Through Treatment	2	Containment of NAPL source material recovery with ISGS will reduce the mobility of remaining MGP-related NAPL source material at the site. Non-MGP fill wedge would remain in place at the site below the existing composite cover.	4	Removal of non-MGP and MGP-related impacted soils in the unsaturated zone will permanently reduce the mobility and volume. NAPL source material removal, containment, and/or solidification will reduce the mobility and the overall volume of source material at the site. While identified source material will be removed or stabilized, impacted material exceeding SCOs will remain at the Site	5	Removal of non-MGP and MGP-related impacted soils in the unsaturated and saturated zones will permanently reduce the mobility and volume. NAPL source material removal, containment, and/or solidification will reduce the mobility and the overall volume of source material at the site. While identified source material will be removed or stabilized, impacted material exceeding SCOs will remain at the Site

Table 2. Remedial Alternative Scoring Comparison Summary
Remedial Alternatives Analysis Report
K - Williamsburg Works - Operable Unit 1
Brooklyn, New York

Sample I.D.	Alternative 2 Score	Alternative 2 Comments	Alternative 3 Score	Alternative 3 Comments	Alternative 4 Score	Alternative 4 Comments
Short-Term Impact and Effectiveness	4	Shortest alternative to complete with the least impact to the local community during implementation. These impacts are primarily associated with construction related noise and temporary closures of portions of the existing park areas. Limited transportation and disposal of drilling spoils will be required following the completion of the work. Remediation would be completed in approximately 20 months. Full or partial closure of the existing park will be necessary during portions of the work.	3	Alternative will have greater impacts to the local community during implementation than Alternative 2. These impacts are associated with construction related noise, traffic, and potential exposures during demolition, excavation, transport, and off-site disposal. Impacts from ISS and ISGS activities are anticipated to be negligible other than temporary closures of portions of the existing park areas. Trucking of impacted soil, import of clean backfill materials will require up to 40 trucks per day for approximately 5 months. Remediation would be completed in approximately 25 months. Full or partial closure of the existing park will be necessary during portions of the work.	2	Alternative will have more significant impacts to the local community during implementation when compared to other Alternatives due to the greater volume of excavation and required backfill. These impacts are associated with construction related noise, traffic, and potential exposures during demolition, excavation, transport, and off-site disposal. Impacts from ISS and ISGS activities are anticipated to be negligible other than temporary closures of portions of the existing park areas. Trucking of impacted soil, import of clean backfill materials will require up to 40 trucks per day for approximately 12 months. Remediation would be completed in approximately 31 months. Full or partial closure of the existing park will be necessary during portions of the work.
Implementability	4	Primary implementation issues include work adjacent to existing bulkhead which may require monitoring of the existing structure and existing sewer in N. 12th Street. Significant PDI studies will be required to determine current structural and geostructural conditions and the Site-specific efficacy of ISGS. Limitations anticipated for work adjacent to the active park on Parcel 2 may include schedule disruptions and full or partial park closures.	3	Implementation issues include excavation of soil and ISS to depths identified adjacent to roadways, bulkhead structure, and the North 12th Street sewer line. Significant PDI studies will be required to determine current structural and geostructural conditions and the Site-specific efficacy of ISGS, additional construction support, and monitoring during remediation activities. Limitations anticipated for work adjacent to the active park on Parcel 2 may include schedule disruptions and full or partial park closures.	2	Implementation issues include deep excavation of soil and ISS to depths identified adjacent to roadways, bulkhead structure, and the North 12th Street sewer line. Significant PDI studies will be required to determine current structural and geostructural conditions and the Site-specific efficacy of ISGS, additional construction support, and monitoring during remediation activities. Limitations anticipated for work adjacent to the active park on Parcel 2 may include schedule disruptions and full or partial park closures.
Costs	4	Alternative estimate ranges from $31.7-$68M	3	Alternative estimate ranges from $32.7-$70.1M	1	Alternative estimate ranges from $42.7-$91.4M
Land Use	3	Alternative supports current land use and will allow for redevelopment of the site as a park in the future. Non-MGP fill wedge and ISGS materail at depth may require additional handling during a future redevelopment depending on the final redevelopment plans.	5	Alternative will support the proposed future land use as a park at the completion of the remedy	5	Alternative will support the proposed future land use as a park at the completion of the remedy
TOTAL SCORE	**27**		**31**		**30**	

Figures

Figure 1 Site Location Map

Figure 2 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 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 30Feet BGS

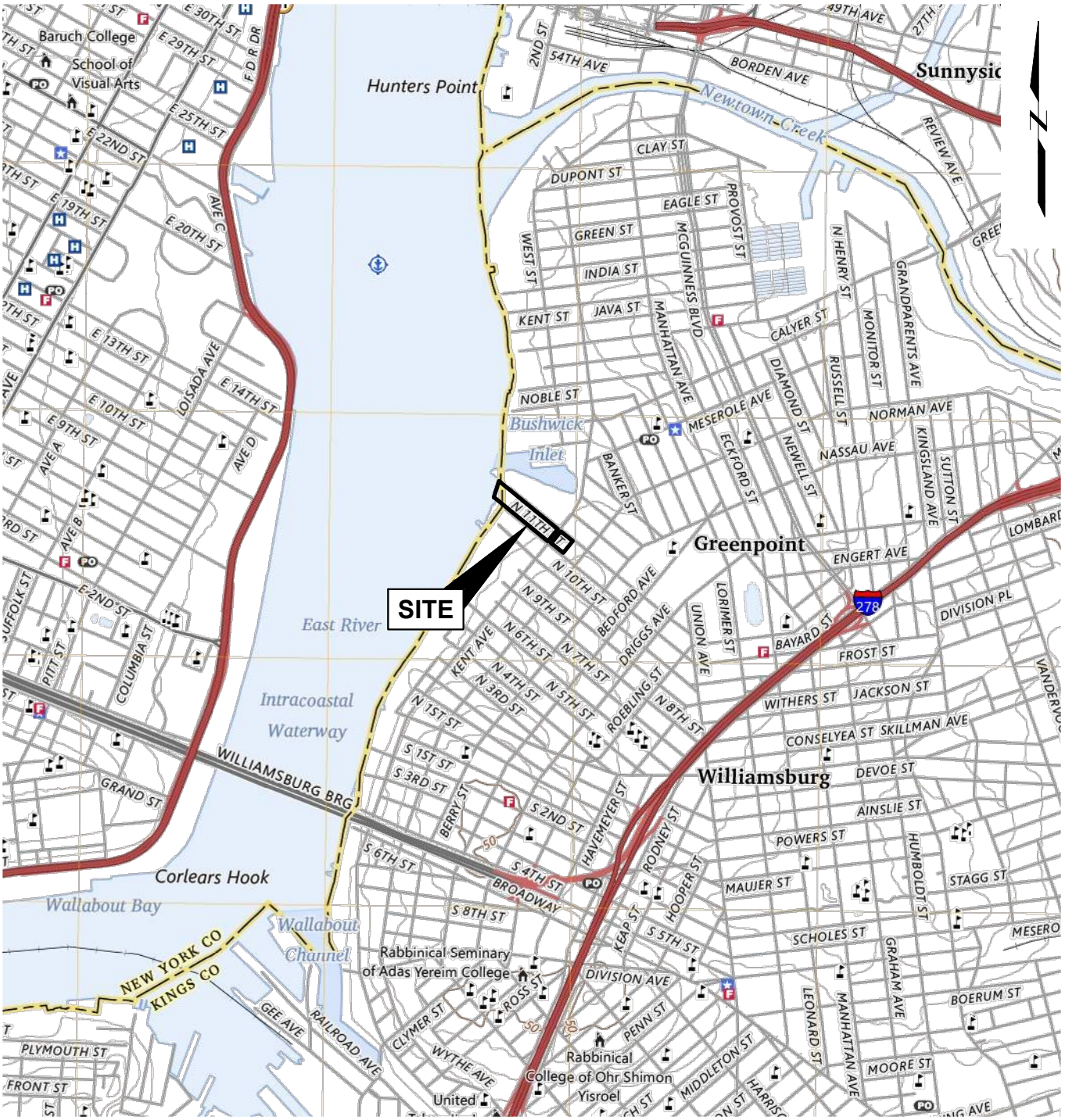
Figure 16 Subsurface Soil Analytical Results SCO Exceedances – Within Clay

Figure 17 Parcel 2 Conceptual Plan – Alternatives 2, 3, and 4

Figure 18 Parcel 3 and 4 Conceptual Plan - Alternative 2

Figure 19 Parcel 3 and 4 Conceptual Plan - Alternative 3

Figure 20 Parcel 3 and 4 Conceptual Plan - Alternative 4



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	November 2025 Fig. 1

HERIOT, PAULA B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\1_093060_RAAR_SLM.dwg - 10/20/2025



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.

0 150 300

SCALE, FEET

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

nationalgrid

GEI Consultants

REMEDIAL INVESTIGATION
PARCEL IDENTIFICATION
MAP

Project 093060 | November 2025 | Fig. 2

HERIOT, PAULA B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\2_093060_RAAR_PRCL.dwg - 10/20/2025



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 OBTAINED FROM MICROSOFT BING VIA CIVIL 3D, ©2023 MICROSOFT CORPORATION ©2022 MAXAR ©CNES (2022) DISTRIBUTION AIRBUS DS, ACCESSED ON 2/7/2023.
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.

0 120 240

SCALE, FEET

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

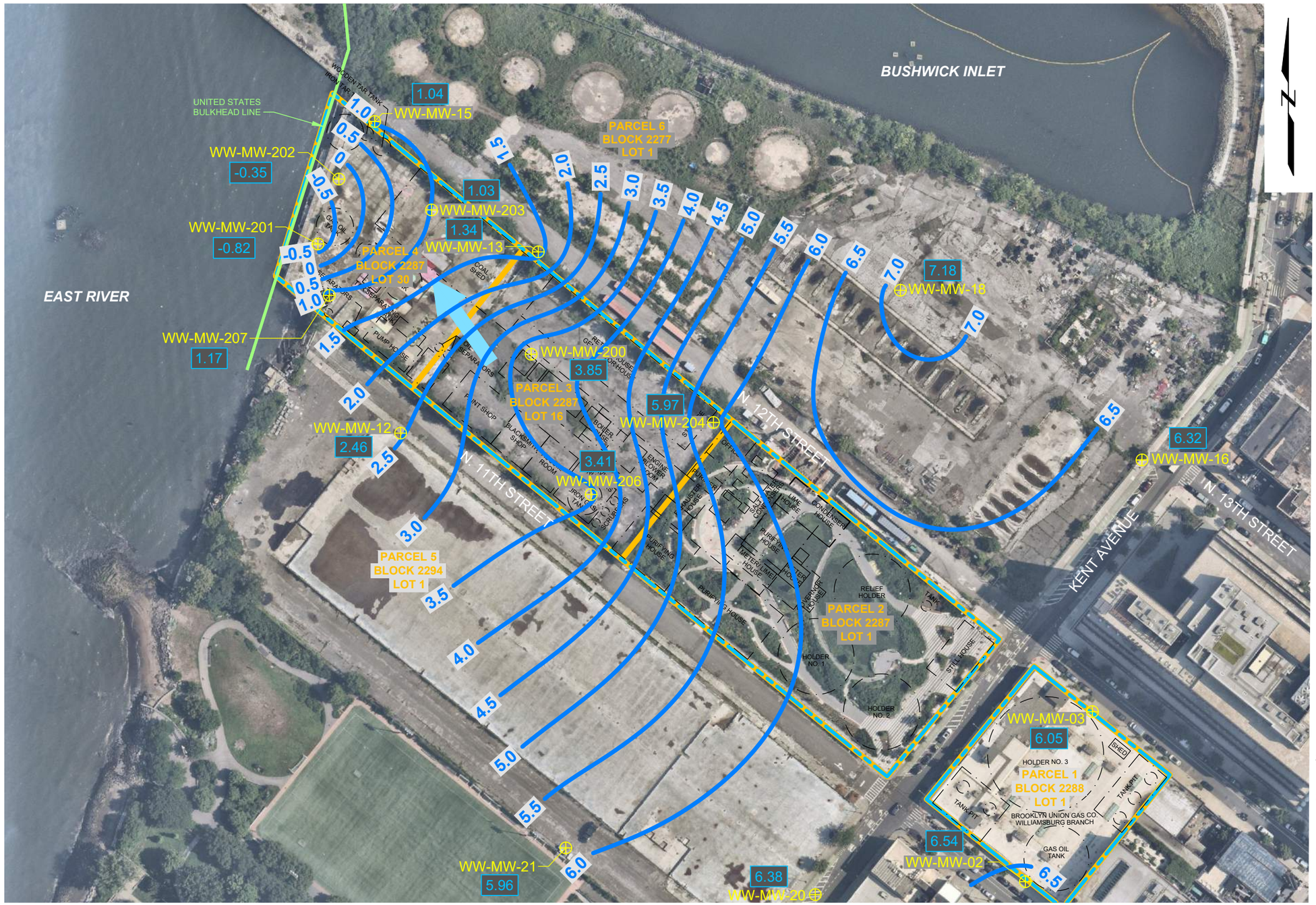
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MARCH 8, 2023 HIGH TIDE GROUNDWATER SURFACE ELEVATION CONTOURS

Project 093060 | November 2025 | Fig. 3

HERIOT, PAULA B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\3_093060_RAAR_GWCH_0323.dwg - 10/20/2025



LEGEND:

- 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

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 LOW TIDE GAUGING ON MARCH 8, 2023.

SOURCES:

1. AERIAL PHOTOGRAPH NEARMAP ©2024 IMAGERY DATE: 06/18/2024.
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.

0 120 240

SCALE, FEET

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

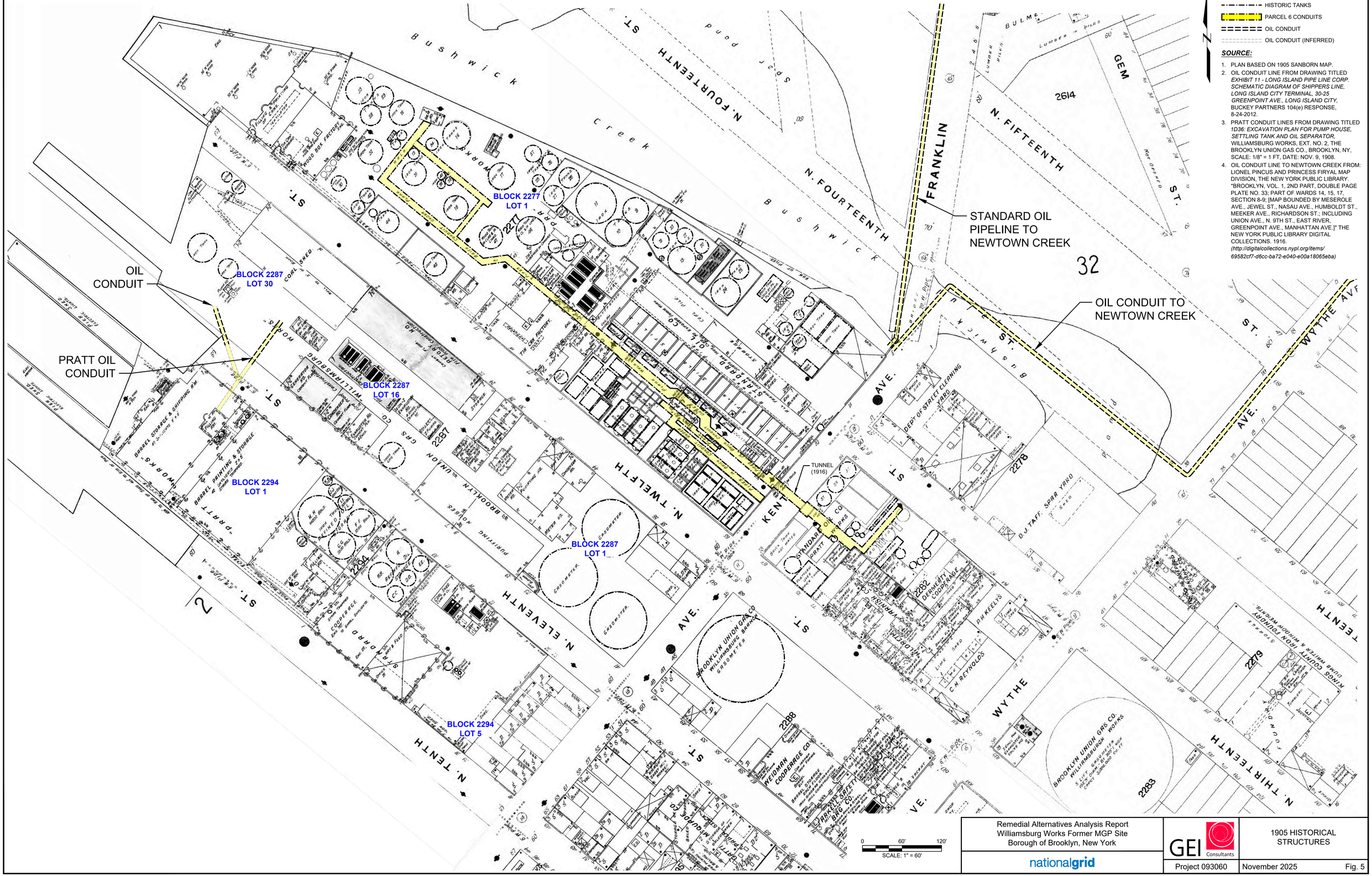
nationalgrid

GEI Consultants

MARCH 8, 2023 LOW TIDE GROUNDWATER SURFACE ELEVATION CONTOURS

Project 093060 | November 2025 | Fig. 4

HERIOT, PAULA B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\4_093060_RAAR_GWCL_0323.dwg - 10/20/2025



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

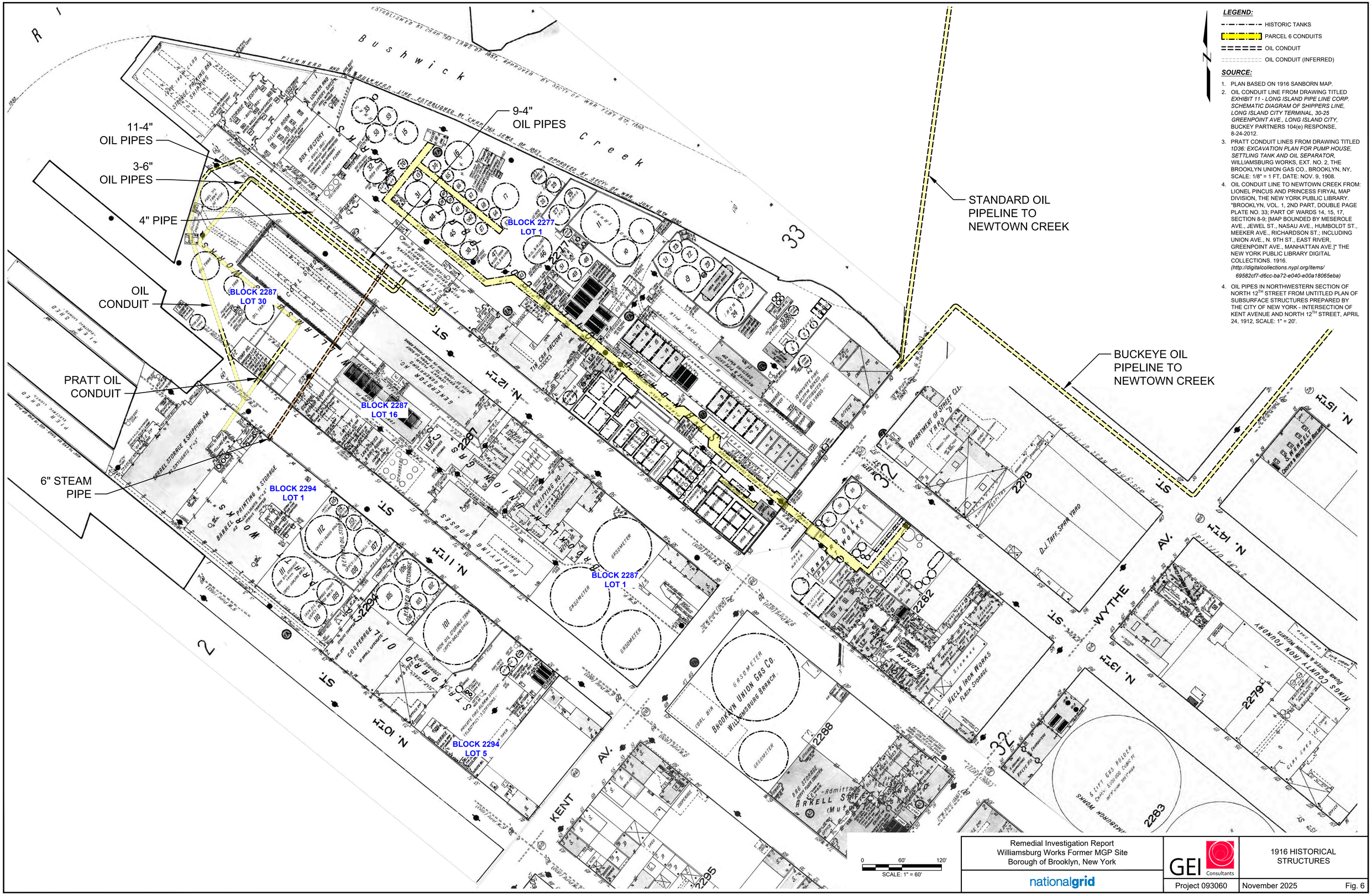
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GEI Consultants

1905 HISTORICAL STRUCTURES

Project 093060 | November 2025 | Fig. 5

---- B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\5_093060_RAAR_1905.dwg - 7/15/2025



LEGEND:

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

N

SOURCE:

1. PLAN BASED ON 1916 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)*
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'.

Remedial Investigation Report
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Borough of Brooklyn, New York

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1916 HISTORICAL STRUCTURES

Project 093060 | November 2025 | Fig. 6

---- B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\6_093060_RAAR_1916.dwg - 10/20/2025

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.
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11-4" OIL PIPES

3-6" OIL PIPES

4" PIPE

9-4" OIL PIPES

BLOCK 2277 LOT 1

BLOCK 2287 LOT 30

OIL CONDUIT

PRATT OIL CONDUIT

6" STEAM PIPE

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)

Bushwick Creek

N. 12TH ST.

N. 11TH ST.

N. 10TH ST.

KENT AV.

BROOKLYN EASTERN DISTRICT TERMINAL

W.Y. CITY SANITATION GARAGE NO. 36

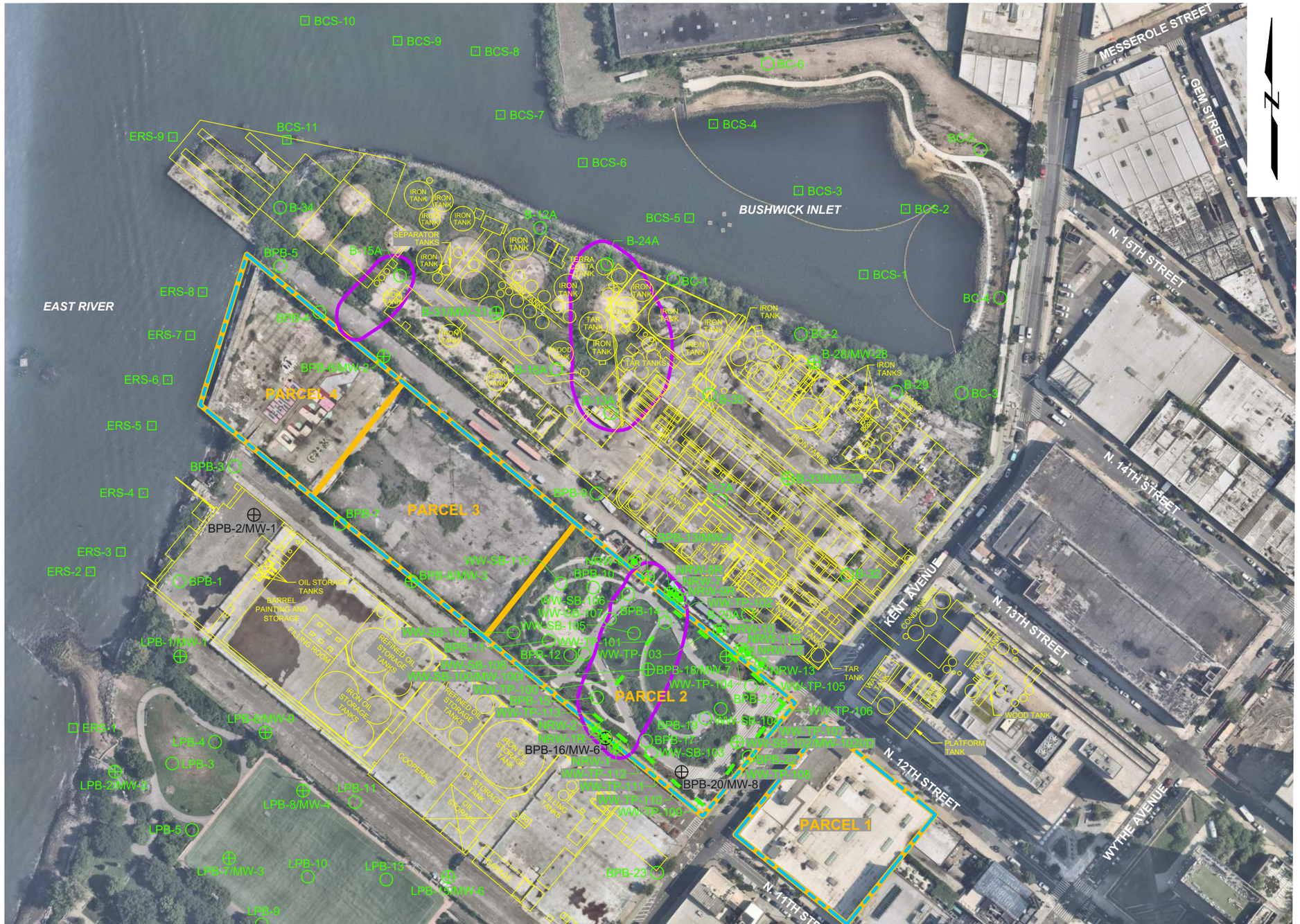
PARAGON OIL CO DIVN. OF TEXACO INC.

STEEL PRODUCTS INC.

SCALE: 1" = 60'

Remedial Investigation Report Williamsburg Works Former MGP Site Borough of Brooklyn, New York	GEI Consultants	1978 HISTORICAL STRUCTURES
nationalgrid	Project 093060	November 2025 Fig. 7

---- B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\7_093060_RAAR_1978.dwg - 10/20/2025



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.
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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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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

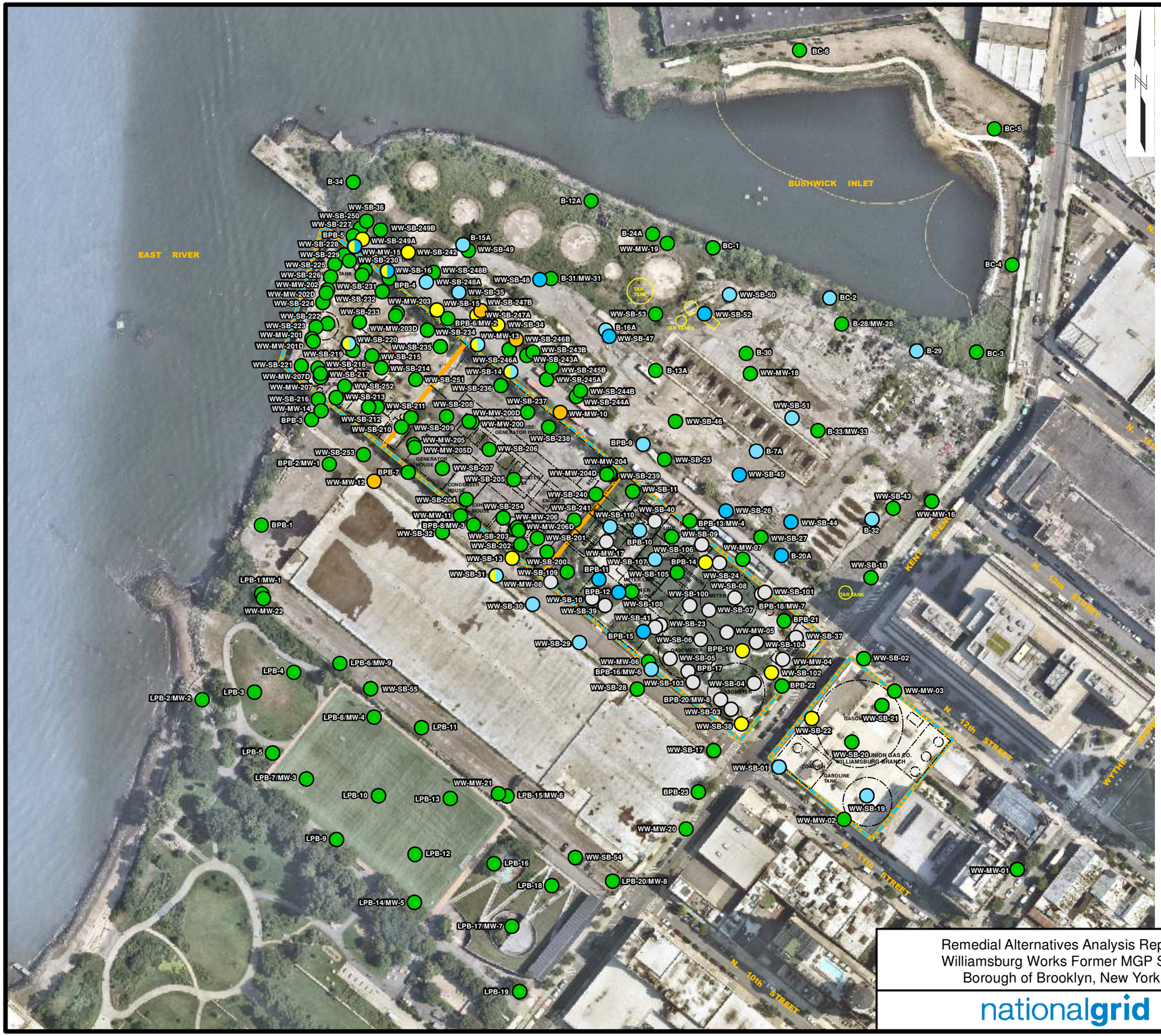
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HISTORIC NON-MGP STRUCTURES AND PETROLEUM PLUME LOCATIONS

Project 093060 | November 2025 | Fig. 8

HERIOT, PAULA B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\8_093060_RAAR_HSPP.dwg - 10/20/2025



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.
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SCALE, FEET

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

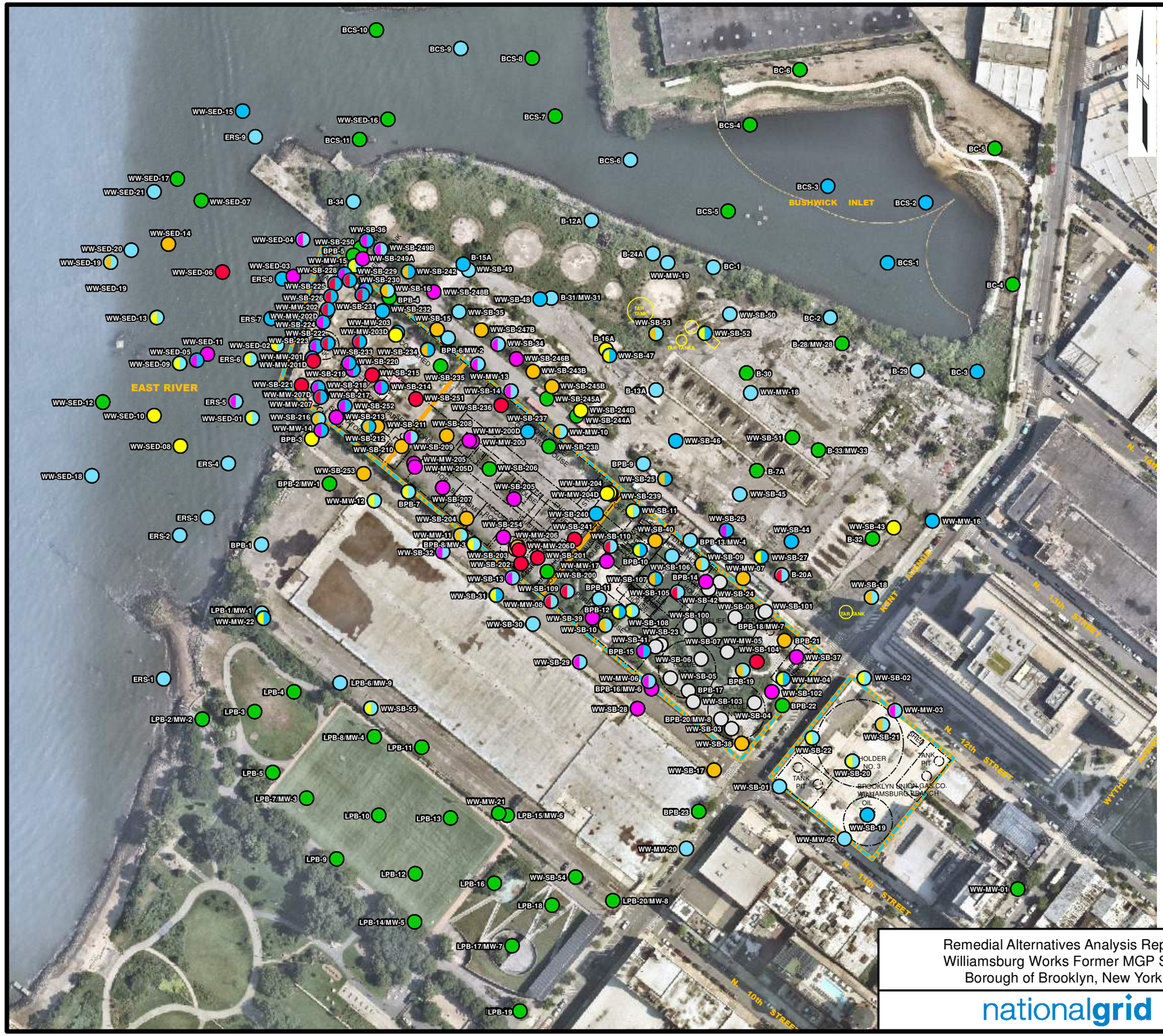
nationalgrid

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OBSERVED PHYSICAL IMPACTS UNSATURATED ZONE

Project 093060 | November 2025 | 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.

0 160 320
SCALE, FEET

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Borough of Brooklyn, New York

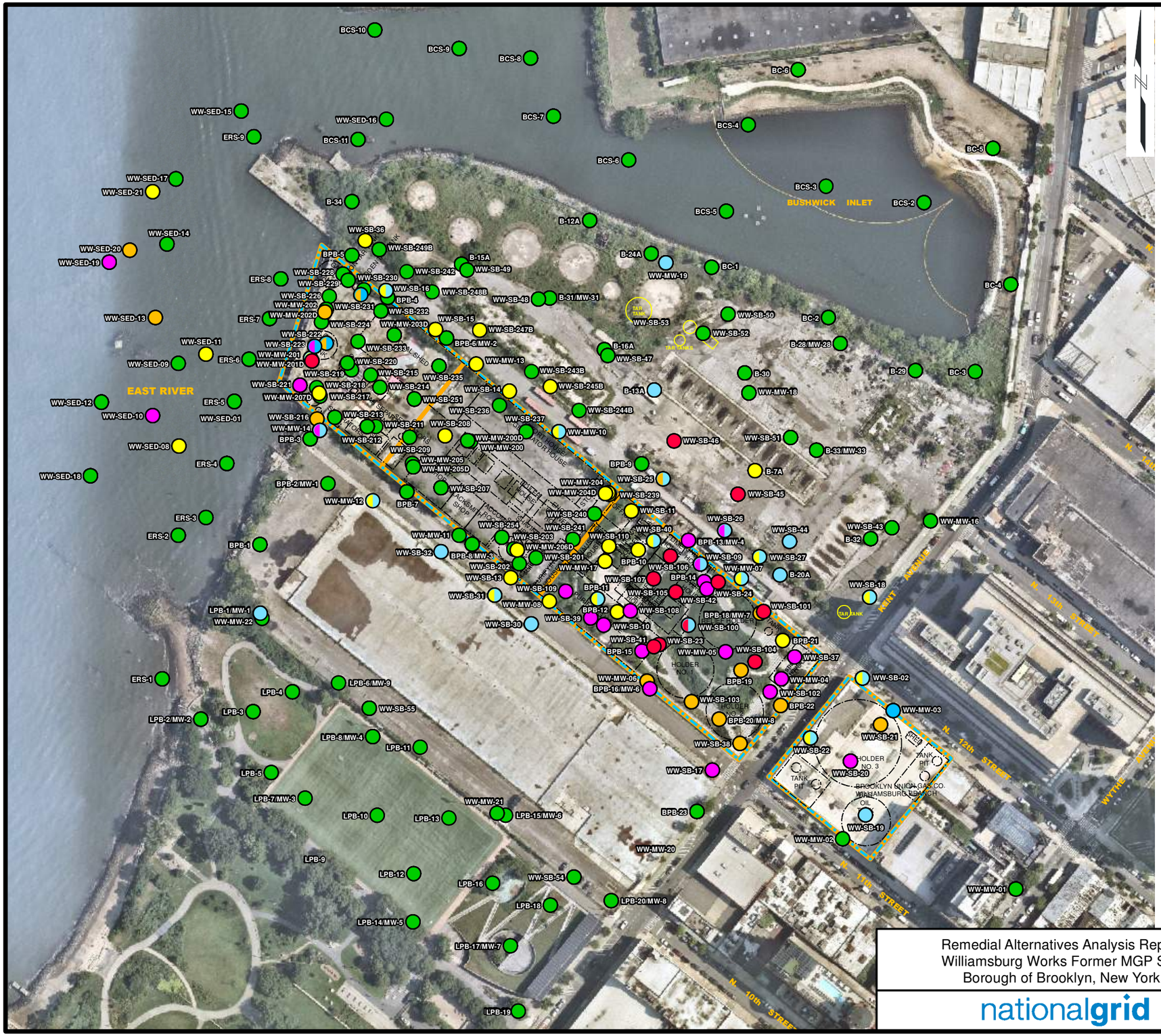
nationalgrid

GEI Consultants

OBSERVED PHYSICAL IMPACTS SATURATED ZONE TO 30 FEET BELOW GRADE

Project 093060 | November 2025 | 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.
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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.

0 160 320
SCALE, FEET

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Borough of Brooklyn, New York

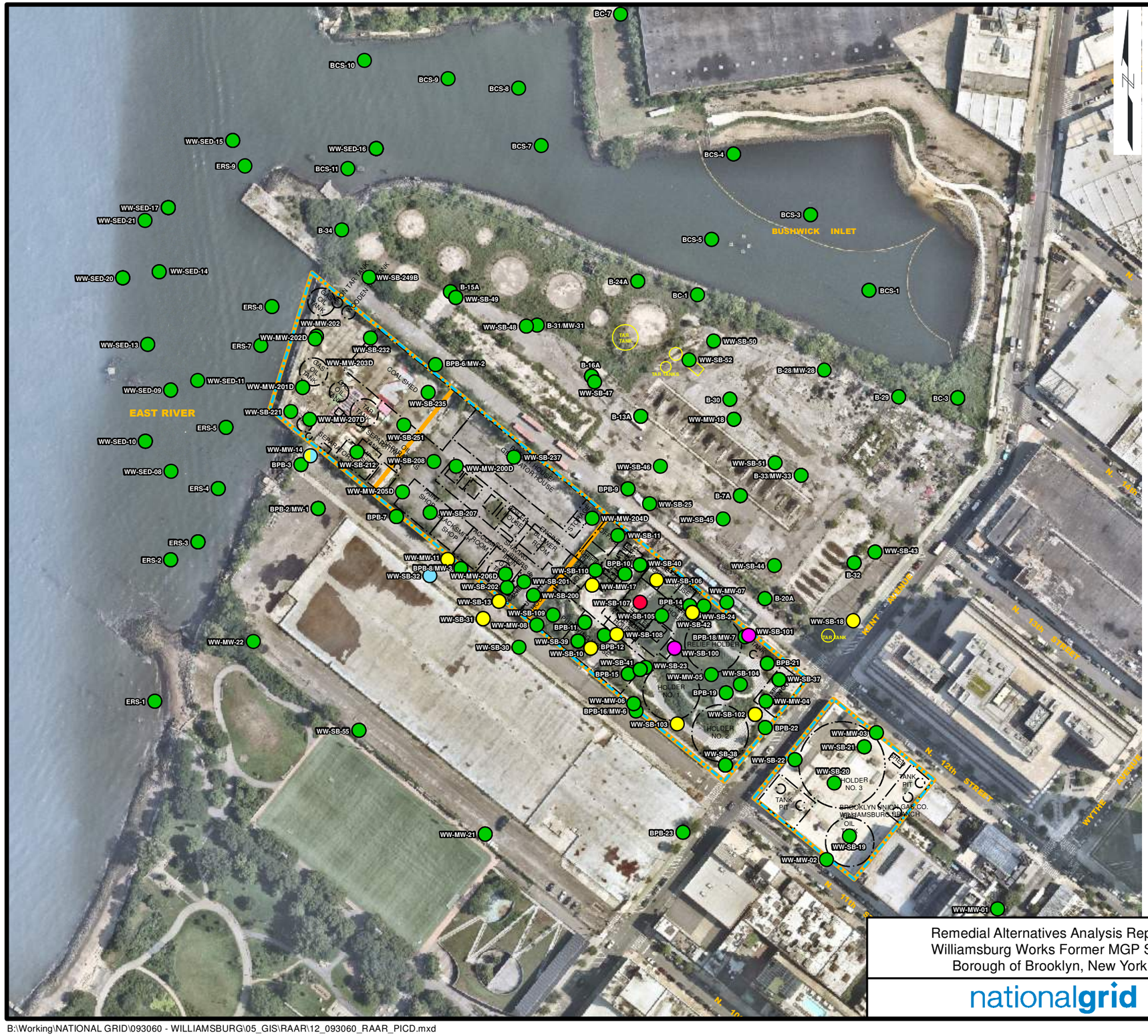
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GEI Consultants

OBSERVED PHYSICAL IMPACTS SATURATED ZONE BELOW 30 FEET AND ABOVE CLAY

Project 093060 | November 2025 | Fig. 11

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\11_093060_RAAR_PISB.mxd



LEGEND

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

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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0 160 320
SCALE, FEET

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Borough of Brooklyn, New York

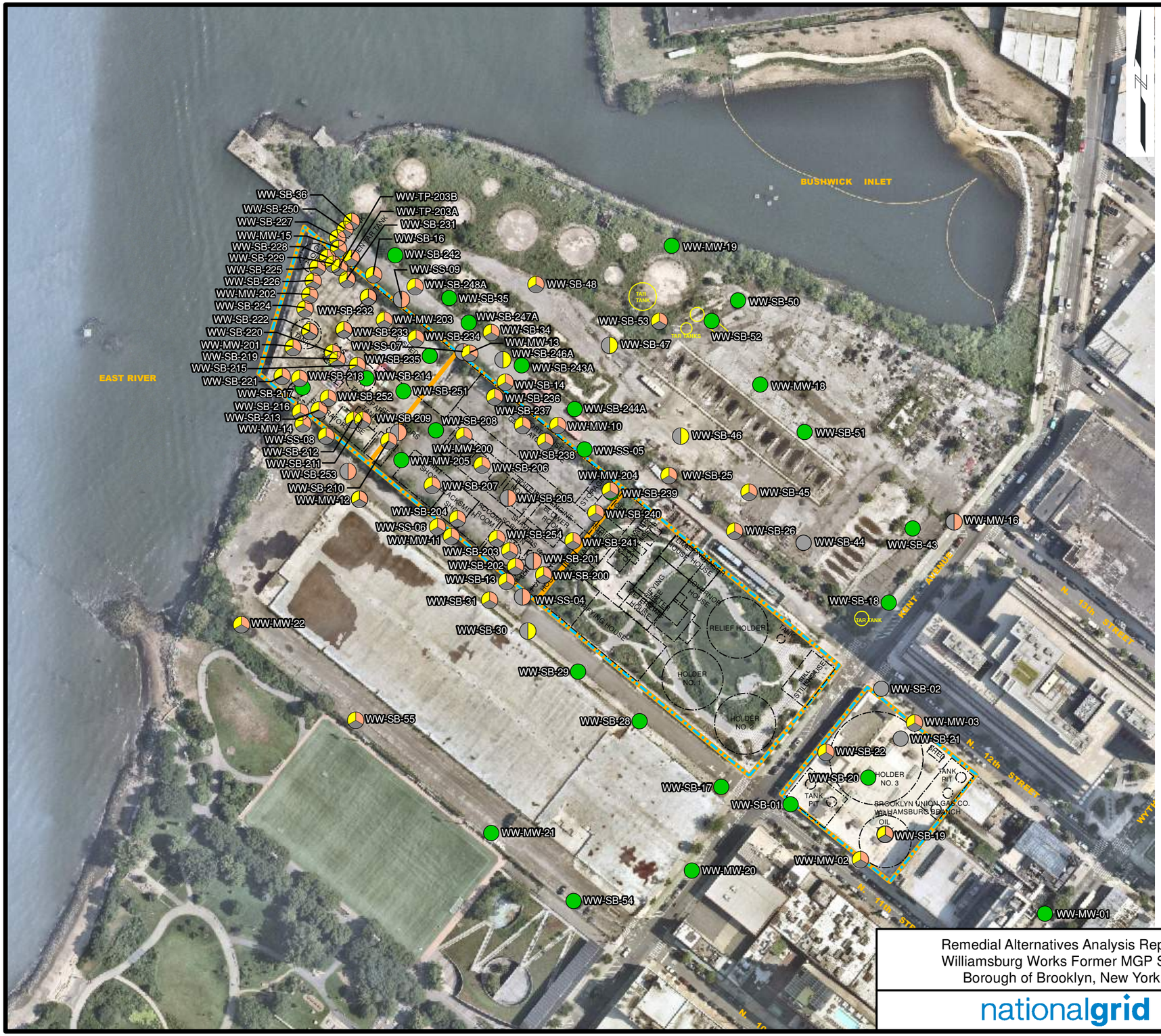
nationalgrid

GEI Consultants

OBSERVED PHYSICAL IMPACTS CLAY AND DEEPER

Project 093060 | November 2025 | 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.

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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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.

0 150 300
SCALE, FEET

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

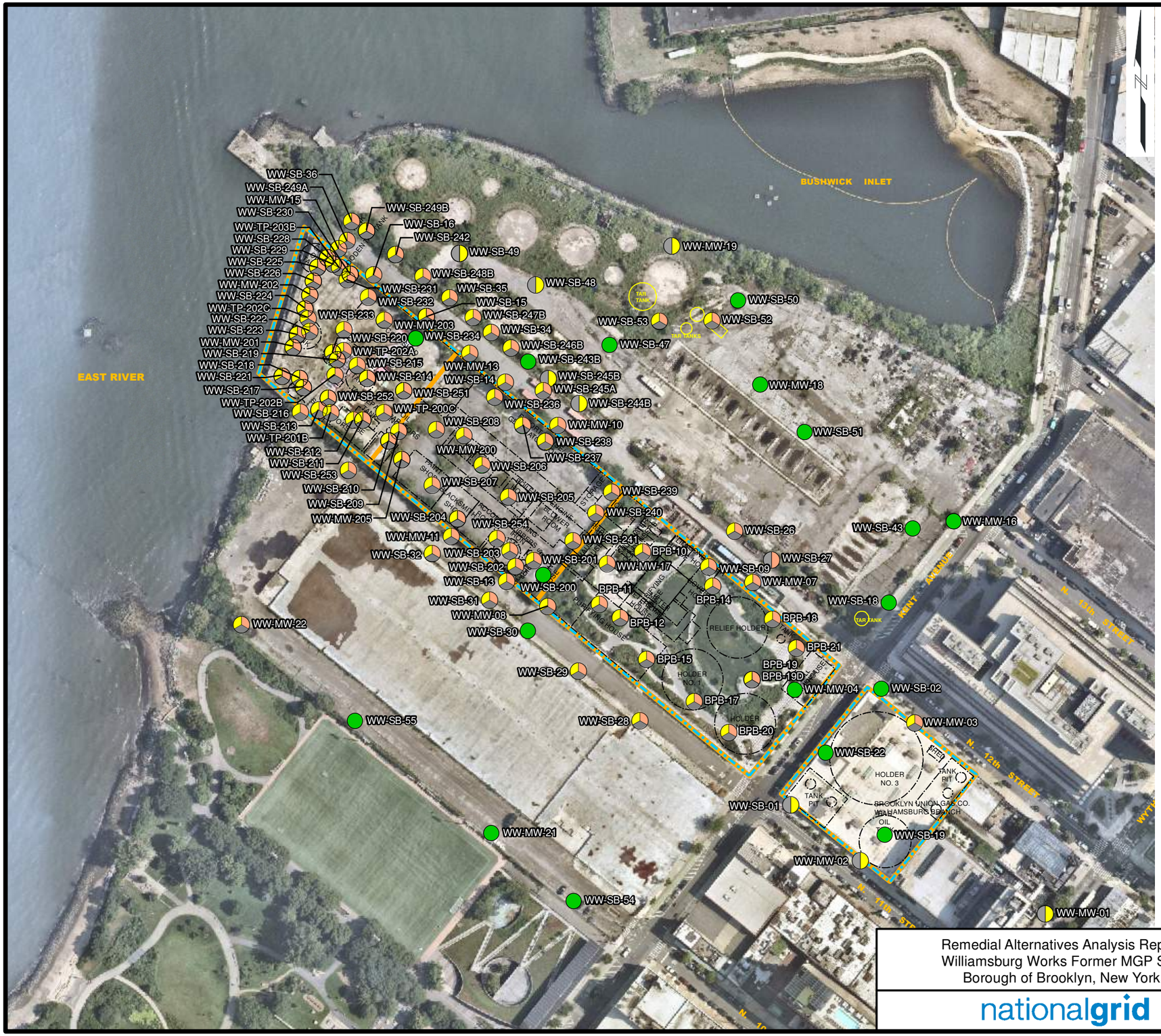
nationalgrid

GEI Consultants

SUBSURFACE SOIL ANALYTICAL RESULT SCO EXCEEDANCES – UNSATURATED SOIL

Project 093060 | November 2025 | Fig. 13

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\13_093060_RAAR_UNST.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.
4. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM HTTP://WWW.OASISNYC.NET ACCESSED JANUARY 2008.
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0 150 300
SCALE, FEET

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

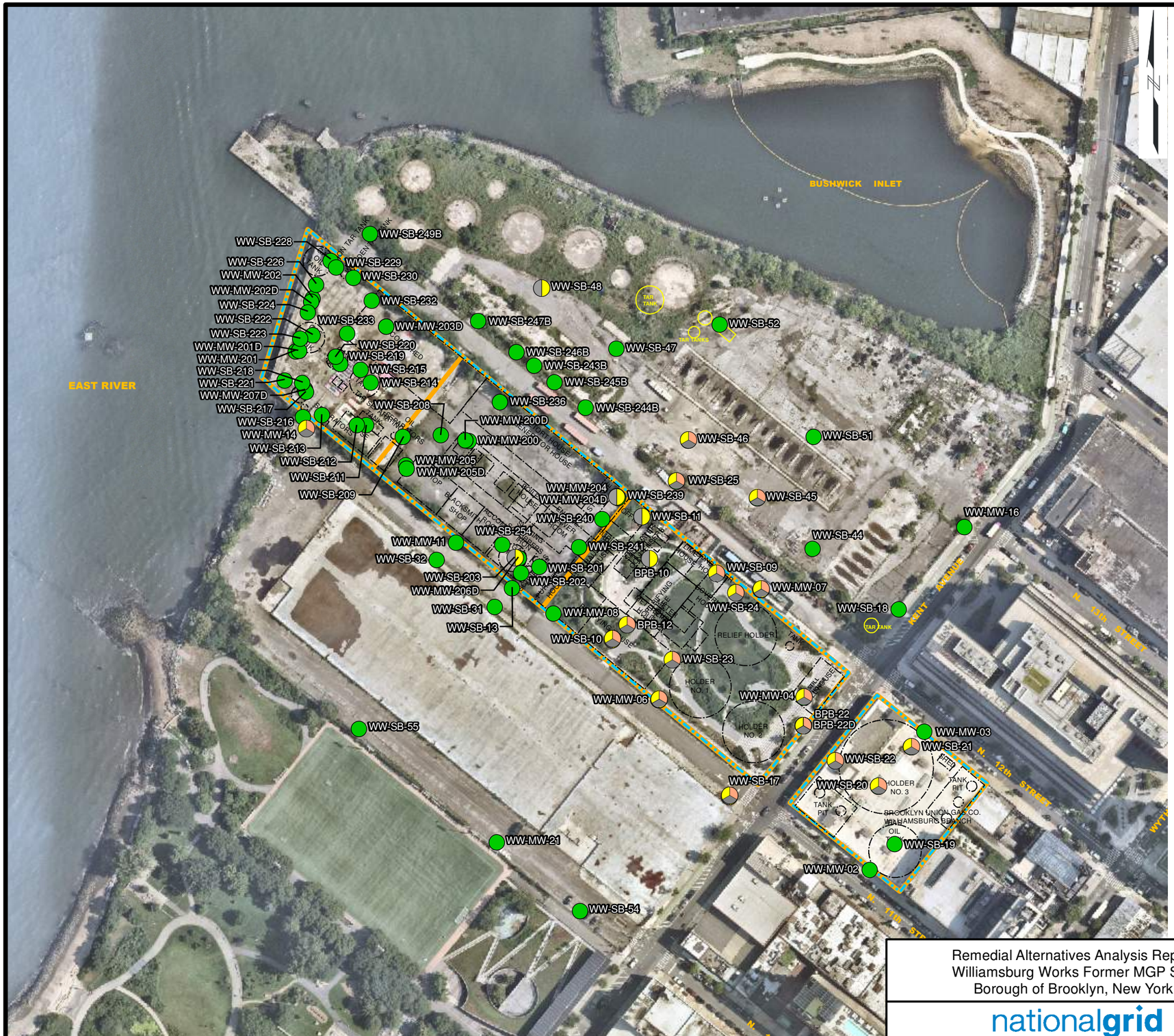
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GEI Consultants

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

Project 093060 | November 2025 | Fig. 14

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\14_093060_RAAR_SAT_AB30.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:
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3. HISTORIC MAP OF BROOKLYN UNION GAS, DATED JULY 27, 1921.
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0 150 300
SCALE, FEET

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

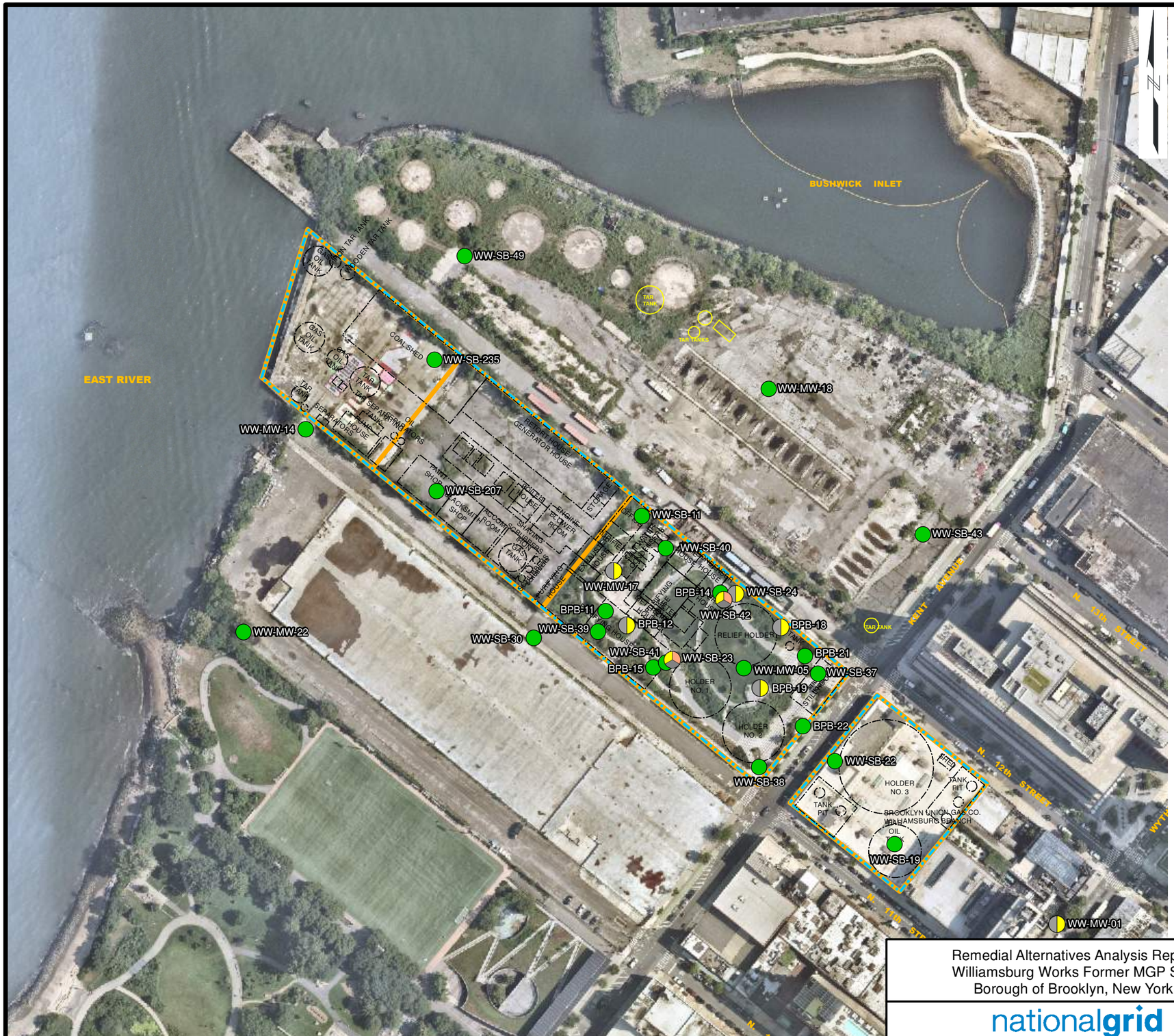
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GEI Consultants

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

Project 093060 | November 2025 | Fig. 15

B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\05_GIS\RAAR\15_093060_RAAR_SAT_BL30.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:
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0 150 300
SCALE, FEET

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

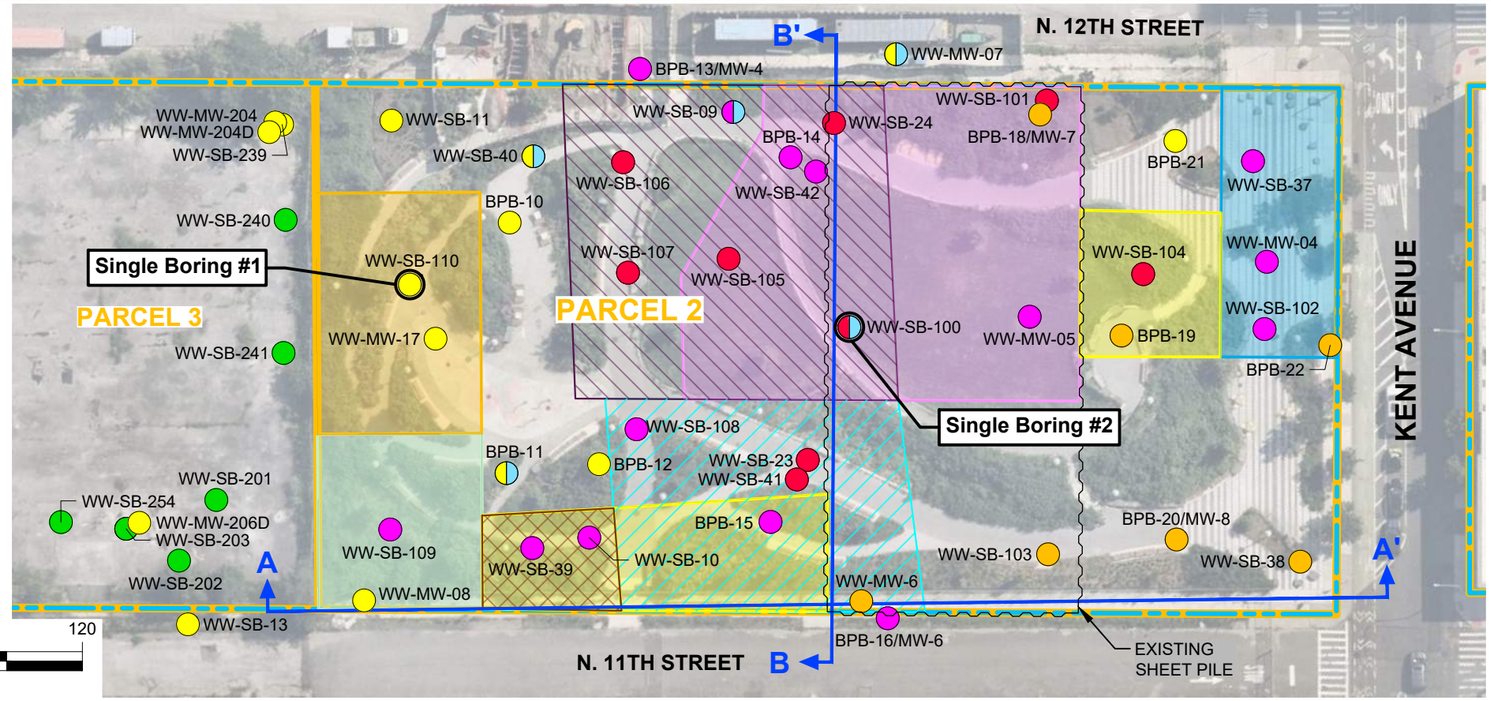
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GEI Consultants

SUBSURFACE SOIL ANALYTICAL RESULT SCO EXCEEDANCES – WITHIN CLAY

Project 093060 | November 2025 | Fig. 16

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



LEGEND:

- GEOLOGIC CROSS-SECTION LOCATION (A – A')
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- EXISTING SHEET PILE
- 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

NOTES:

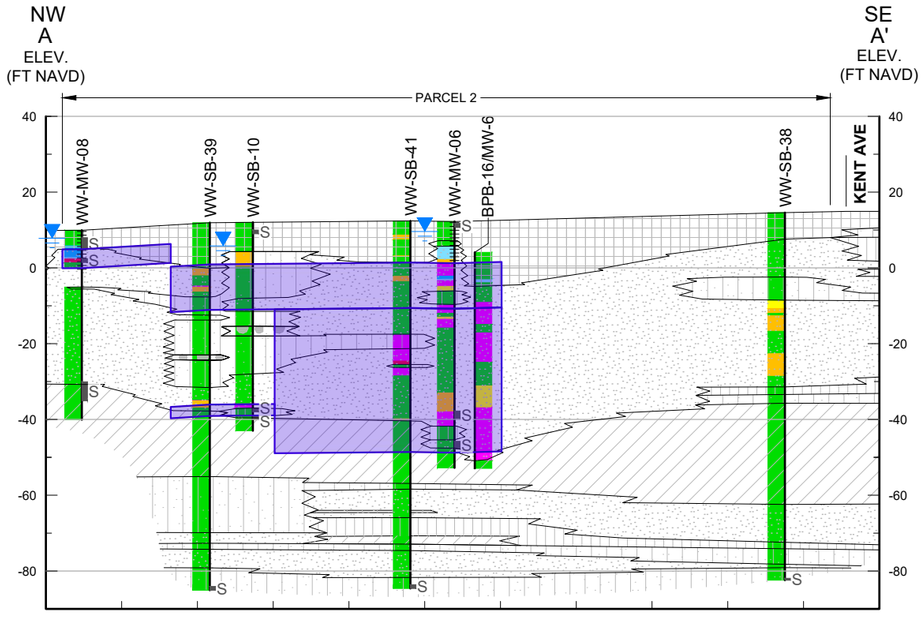
1. ISGS EXTENTS ARE APPROXIMATE.
2. VOLUMES PRESENTED IN TABLE REPRESENT TARGETED SOIL VOLUMES.
3. EXISTING SHEET PILE INSTALLED AND LEFT IN-PLACE DURING INTERIM REMEDIAL MEASURE (IRM). EXTENTS ARE APPROXIMATE.
4. SINGLE BORING ISGS LOCATIONS ASSUMED TO REQUIRE TREATMENT AREAS OF 10 FT BY 10 FT TO THE TARGET DEPTH.

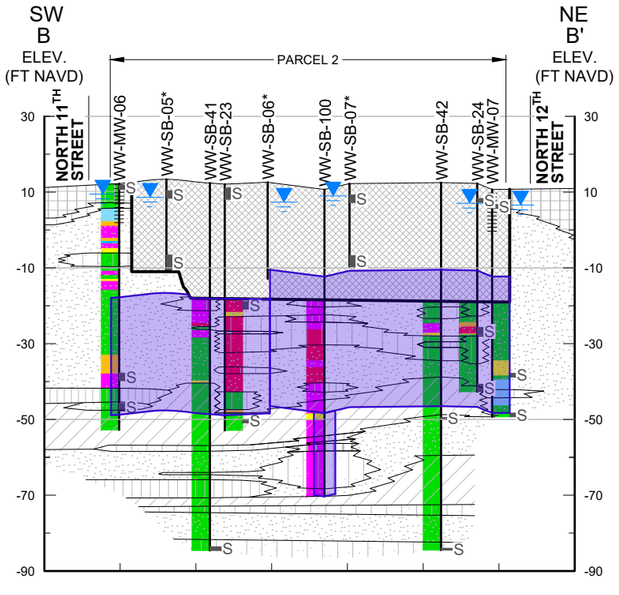
IN-SITU CONTAINMENT LOCATIONS

Shading	ISGS Interval (ft bgs)	ISGS Thickness (ft)	Area [SF]	Volume [CYD]
	5-10	5	4500	833
	5-18	13	6200	2985
	11-23	12	8600	3822
West of sheetpile	11-47	36	5700	7600
Within limits of sheetpile	30-52	22	12500	10185
West of sheetpile	23-61	38	7100	9993
Within limits of sheetpile	30-61	31	2800	3215
	28-35	7	8200	2126
West of sheetpile	47-59	12	13000	5778
Within limits of sheet pile	52-59	7	3000	778
	46-49	3	2100	233
Single Boring #1	24-26.5	2.5	100	9
Single Boring #2	59-81	22	100	81

CROSS SECTION LEGEND

- IN-SITU CONTAINMENT ZONE
- GEOLOGIC UNIT
- FILL
- IRM EXCAVATION
- ALLUVIAL DEPOSITS
- SILT (SHALLOW)
- CLAY (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- GRAVEL
- 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





HORIZONTAL SCALE, FEET
0 80 160
0 40 80
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

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. 3/11/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com).*

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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

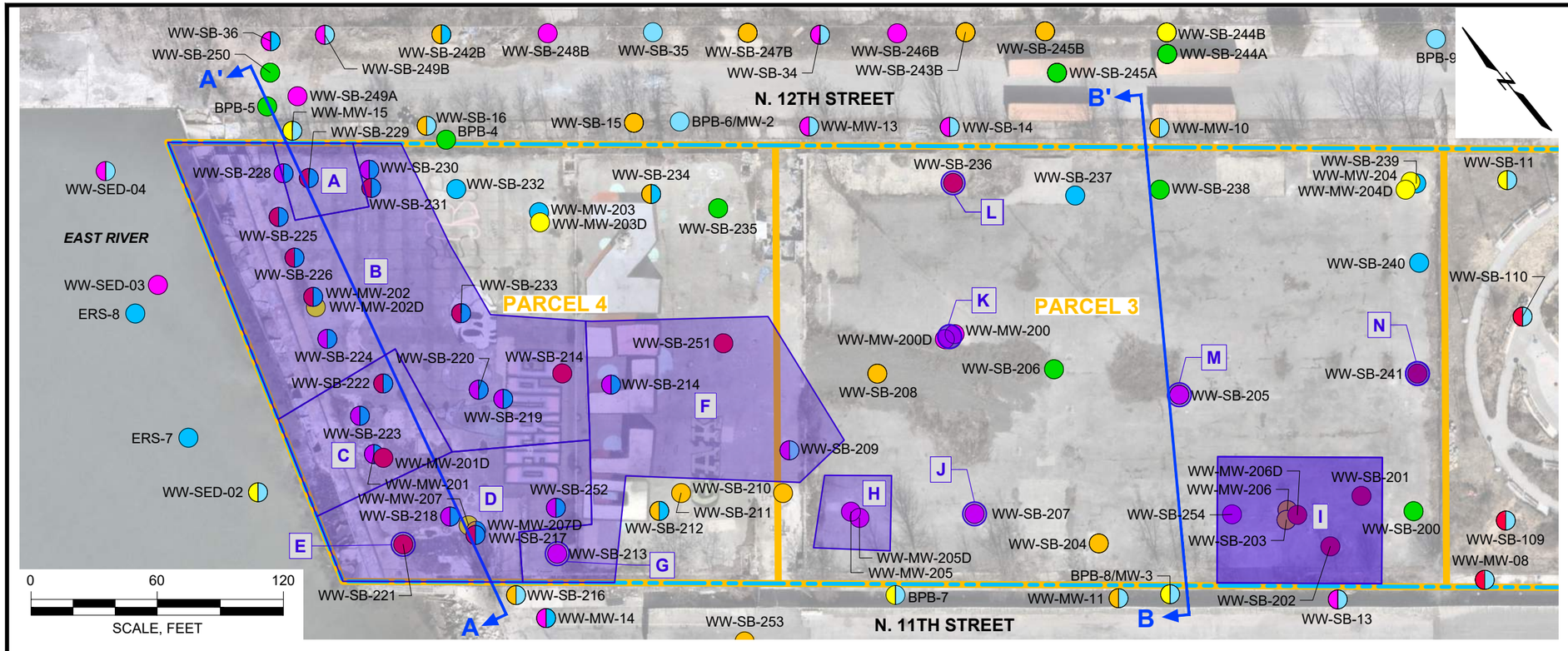
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PARCEL 2 CONCEPTUAL PLAN ALTERNATIVES 2, 3 AND 4

Project 093060 | November 2025 | Fig. 17

HERIOT, PAULA B:\Working\NATIONAL GRID\093060 - WILLIAMSBURG\00_CAD\Figures\RAAR\17_093060_RAAR_ALTS.dwg - 11/12/2025



LEGEND:

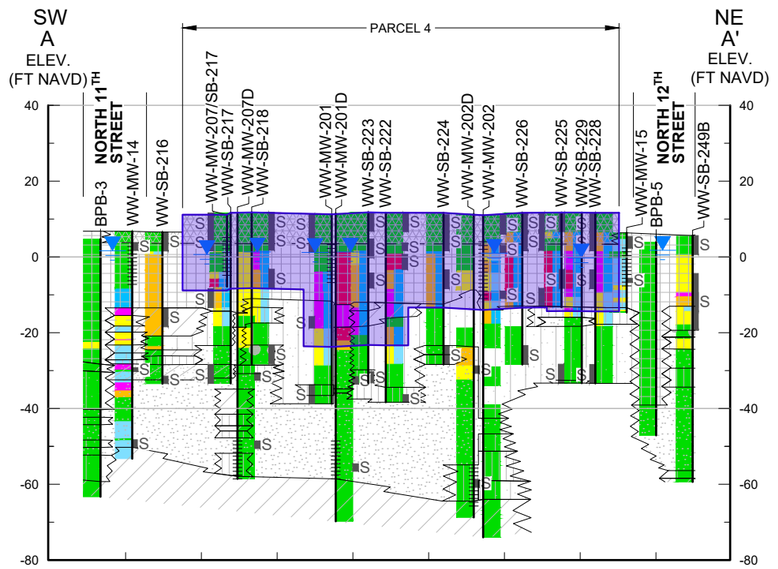
- ISGS EXTENT
- GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED

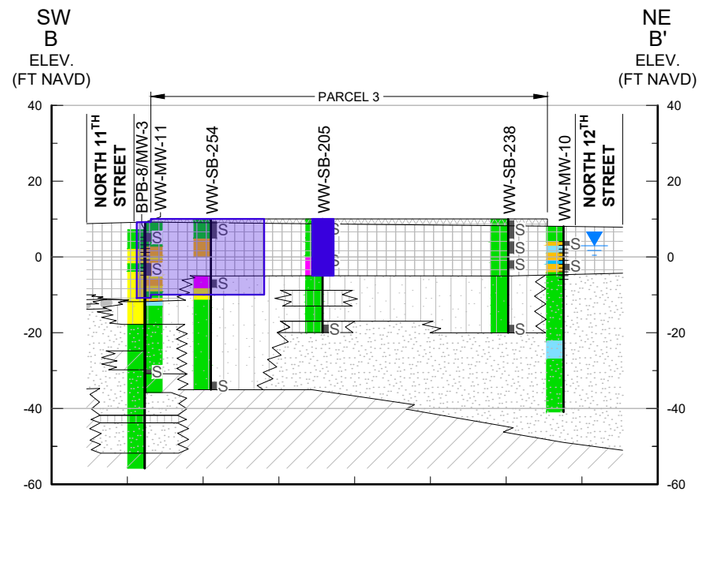
NOTES:

1. ISGS LOCATIONS BASED ON SINGLE BORING ASSUMED TO REQUIRE TREATMENT AREAS OF 10 FT BY 10 FT TO THE TARGET DEPTH.
2. ISGS EXTENTS ARE APPROXIMATE.
3. ISGS VOLUMES PRESENTED IN TABLE REPRESENT TARGETED SOIL VOLUMES.

In-Situ Geochemical Stabilization (ISGS) Locations

Location	Area [sf]	Top of ISGS [ft bgs]	Bottom of ISGS [ft bgs]	Volume [cyd]
A	1250	10	26	741
B	15600	10	25	8667
C	3600	10	35	3333
D	6100	10	20	2259
E	100	53	55	7
F	9300	10	15	1722
G	100	15	30	56
H	1200	10	22.5	556
I	4700	10	20	1741
J	100	6	9	11
K	100	5	20	56
L	100	15	16	4
M	100	10	15	19
N	100	10	18	30





CROSS SECTION LEGEND

- ISGS EXTENT
- GEOLOGIC UNIT
- POST-MGP FILL / FILL WEDGE
- FILL
- ALLUVIAL DEPOSITS
- ORGANIC SOIL
- SILT (SHALLOW)
- CLAY (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- 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. 3/11/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com).*

HORIZONTAL SCALE, FEET
0 80 160
0 40 80
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

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Borough of Brooklyn, New York

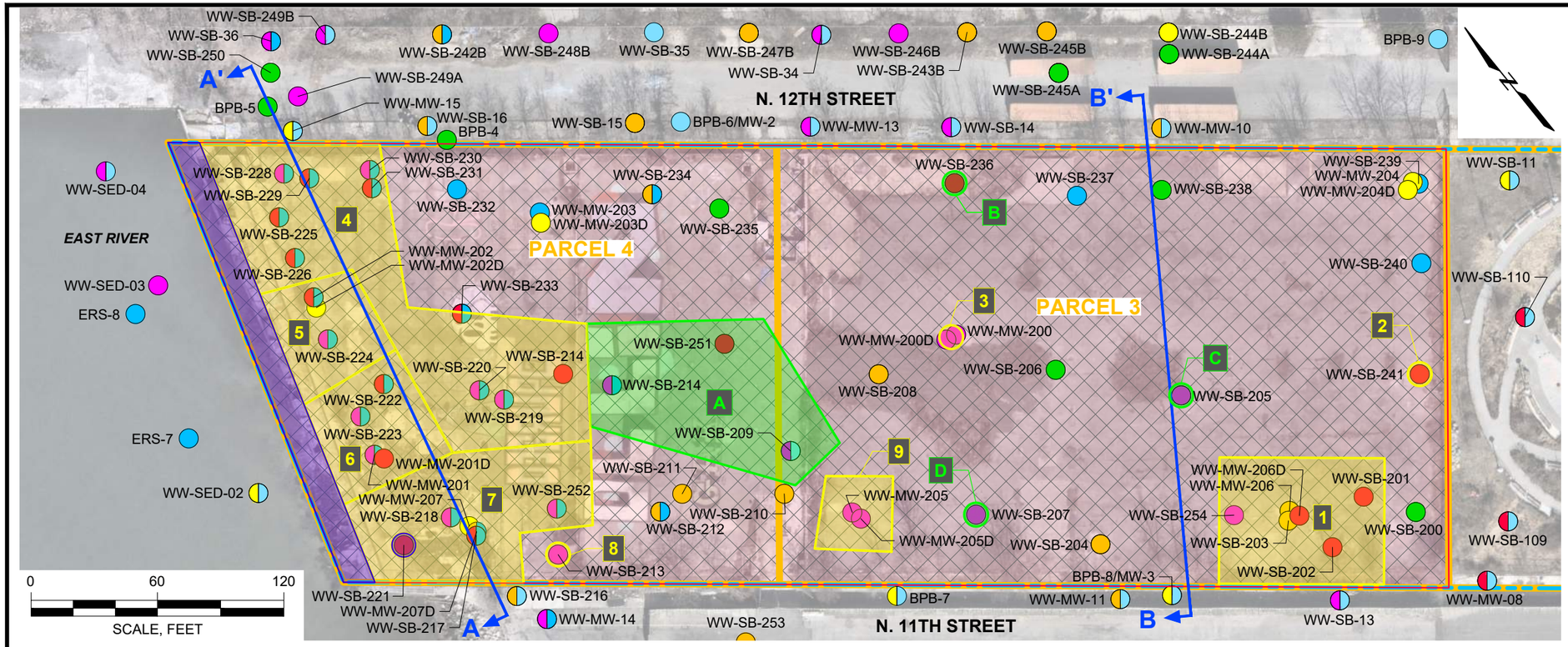
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PARCEL 3 AND 4
CONCEPTUAL PLAN
ALTERNATIVE 2

Project 093060 | November 2025 | Fig. 18

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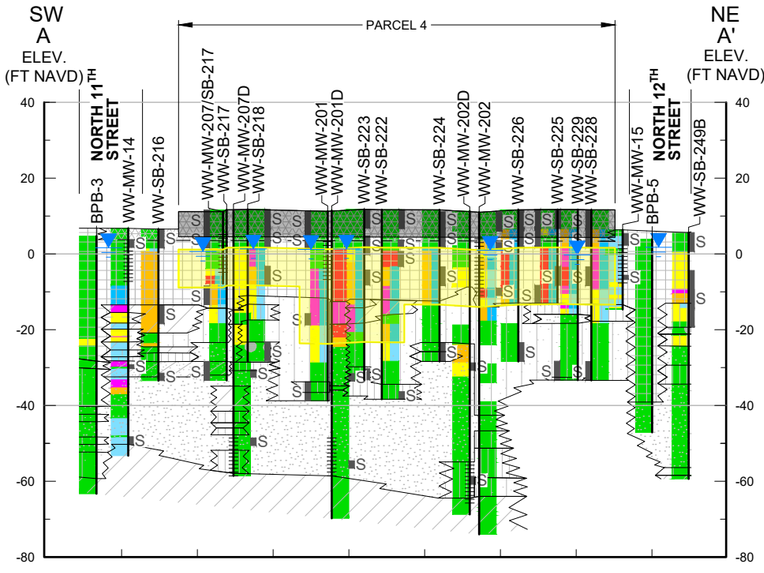
- UNSATURATED EXCAVATION AREA
- COMPOSITE COVER/CLEAN SOIL CAP
- ISGS EXTENT
- ISS EXTENT
- EXCAVATION EXTENT
- A — A' GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED

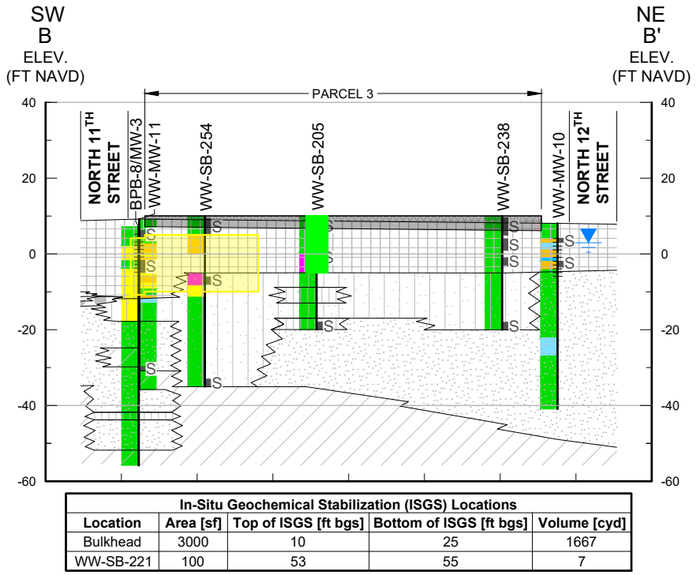
NOTES:

1. EXCAVATION, ISS AND ISGS LOCATIONS BASED ON SINGLE BORING ASSUMED TO REQUIRE TREATMENT AREAS OF 10 FT BY 10 FT TO THE TARGET DEPTH.
2. EXCAVATION, ISS AND ISGS EXTENTS ARE APPROXIMATE.
3. ISGS VOLUMES PRESENTED IN TABLE REPRESENT TARGETED SOIL VOLUMES.
4. ISGS ALONG EXISTING BULKHEAD ASSUMED TO EXTEND INLAND APPROXIMATELY 15 FEET.
5. FURTHER EXCAVATION THAN DEPICTED ON CROSS-SECTIONS REQUIRED IN SELECT LOCATIONS TO COMPENSATE FOR ISS SWELL MATERIAL.

CROSS SECTION LEGEND

- UNSATURATED EXCAVATION EXTENT
- ISS EXCAVATION EXTENT
- EXCAVATION EXTENT
- GEOLOGIC UNIT
- POST-MGP FILL / FILL WEDGE
- FILL
- ALLUVIAL DEPOSITS
- ORGANIC SOIL
- SILT (SHALLOW)
- CLAY (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- 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





HORIZONTAL SCALE, FEET
0 80 160
0 40 80
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

In-Situ Solidification (ISS) Locations				
Label	Area [sf]	Top of ISS [ft bgs]	Bottom of ISS [ft bgs]	ISS Volume [cyd]
1	4700	5	20	2,611
2	100	10	18	30
3	100	5.5	20	54
4	10745	10	25	5,969
5	2285	10	25	1,269
6	2830	10	35	2,620
7	5670	10	20	2,100
8	100	10	30	74
9	1200	10	22.5	556

Excavation Locations				
Label	Area [sf]	Impact Depth [ft bgs]	Excavation Depth [ft]	Volume [cyd]
Sitewide	117918	Varies	Varies	19800
A	6650	15	10.7	2635
B	100	16	12.5	46
C	100	15	12.4	46
D	100	9	5.5	20

In-Situ Geochemical Stabilization (ISGS) Locations				
Location	Area [sf]	Top of ISGS [ft bgs]	Bottom of ISGS [ft bgs]	Volume [cyd]
Bulkhead	3000	10	25	1667
WW-SB-221	100	53	55	7

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

SOURCES:

1. *REMEDIAL INVESTIGATION REPORT,* PLATE 5: *GEOLOGIC CROSS SECTIONS G-G' AND H-H',* PREPARED BY GEI CONSULTANTS, INC., DATE: DECEMBER 2024.
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Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

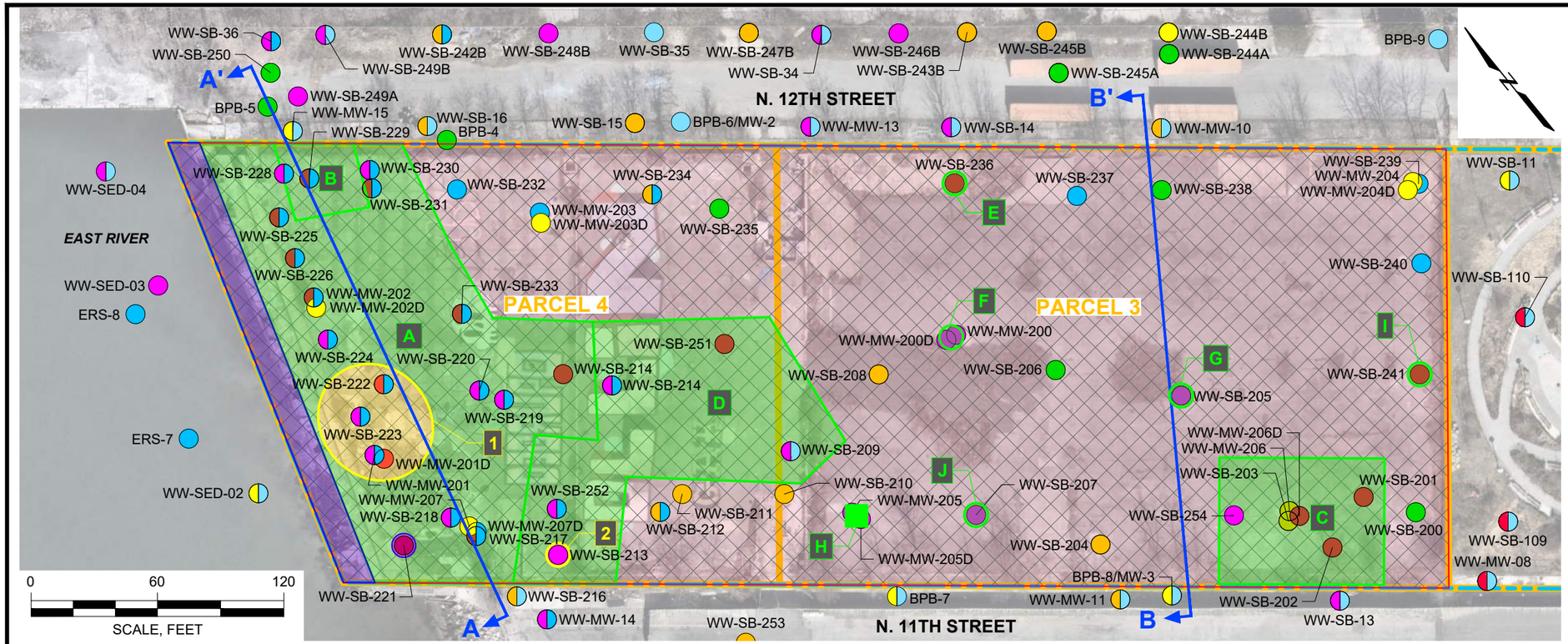
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GEI Consultants

PARCEL 3 AND 4
CONCEPTUAL PLAN
ALTERNATIVE 3

Project 093060 | November 2025 | Fig. 19

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LEGEND:

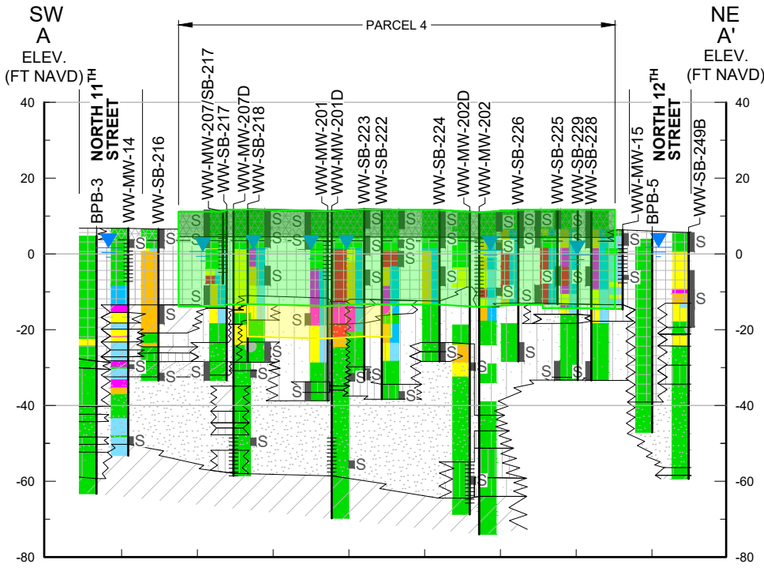
- UNSATURATED EXCAVATION AREA
- COMPOSITE COVER/CLEAN SOIL CAP
- ISGS EXTENT
- ISS EXTENT
- EXCAVATION EXTENT
- A — A' GEOLOGIC CROSS-SECTION LOCATION
- APPROXIMATE CURRENT PARCEL BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY / SITE BOUNDARY
- NAPL IMPACTS SATURATED
- NAPL IMPACTS COATED MATERIAL, LENSES
- NAPL IMPACTS BLEBS, GLOBS, SHEEN
- NAPL IMPACTS STAINING
- PETROLEUM IMPACTS SATURATED & SHEEN
- PETROLEUM IMPACTS STAINING
- NO IMPACT OBSERVED

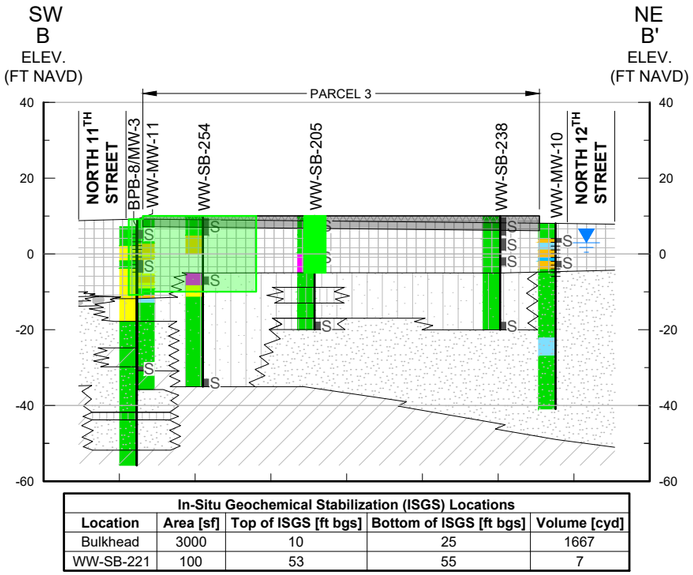
NOTES:

1. EXCAVATION, ISS AND ISGS LOCATIONS BASED ON SINGLE BORING ASSUMED TO REQUIRE TREATMENT AREAS OF 10 FT BY 10 FT TO THE TARGET DEPTH.
2. EXCAVATION, ISS AND ISGS EXTENTS ARE APPROXIMATE.
3. FURTHER EXCAVATION THAN DEPICTED ON CROSS-SECTIONS REQUIRED IN SELECT LOCATIONS TO COMPENSATE FOR ISS SWELL MATERIAL.
4. ISGS VOLUMES PRESENTED IN TABLE REPRESENT TARGETED SOIL VOLUMES.
5. ISGS ALONG EXISTING BULKHEAD ASSUMED TO EXTEND INLAND APPROXIMATELY 15 FEET.
6. FURTHER EXCAVATION THAN DEPICTED ON CROSS-SECTIONS REQUIRED IN SELECT LOCATIONS TO COMPENSATE FOR ISS SWELL MATERIAL.

CROSS SECTION LEGEND

- UNSATURATED EXCAVATION EXTENT
- ISS EXCAVATION EXTENT
- EXCAVATION EXTENT
- GEOLOGIC UNIT
- POST-MGP FILL / FILL WEDGE
- FILL
- ALLUVIAL DEPOSITS
- ORGANIC SOIL
- SILT (SHALLOW)
- CLAY (SHALLOW)
- GLACIAL DEPOSITS
- SAND
- SILTY SAND
- 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





HORIZONTAL SCALE, FEET
0 80 160
0 40 80
VERTICAL SCALE, FEET
NOTE: 2x VERTICAL EXAGGERATION

In-Situ Geochemical Stabilization (ISGS) Locations				
Location	Area [sf]	Top of ISGS [ft bgs]	Bottom of ISGS [ft bgs]	Volume [cyd]
Bulkhead	3000	10	25	1667
WW-SB-221	100	53	55	7

In-Situ Solidification (ISS) Locations				
Label	Area [sf]	Top of ISS [ft bgs]	Bottom of ISS [ft bgs]	ISS Volume [cyd]
1	2350	25	33.56	745
2	100	15	30	56

Excavation Locations				
Label	Area [sf]	Impact Depth [ft bgs]	Excavation Depth [ft]	Volume [cyd]
Sitewide	117918	Varies	Varies	19800
A	19650	25	20.3	14774
B	1250	26	20.5	949
C	4700	20	18	3133
D	10800	15	10.7	4280
E	100	16	12.5	46
F	100	20	16.5	61
G	100	15	12.8	47
H	100	22.5	18.5	69
I	100	18	17	63
J	100	9	5.5	20

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

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. 3/11/2025 AERIAL IMAGE FROM NEARMAP *(www.nearmap.com).*

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

nationalgrid

GEI Consultants

PARCEL 3 AND 4
CONCEPTUAL PLAN
ALTERNATIVE 4

Project 093060 | November 2025 | Fig. 20

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Appendix A Preliminary Remedial Technology Screening – Parcels 2, 3, and 4

Consulting Engineers and Scientists

August 26, 2024
Project 093060-2

Via email: richard.mustico1@dec.ny.gov

Mr. Richard Mustico
Assistant Engineer (Environmental), Division of Environmental Remediation
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233

Dear Mr. Mustico:

Re: Preliminary Remedial Technology Screening – Parcels 2, 3, and 4
K – Williamsburg Works MGP Site, Site No. 224055
20 N. 12th Street & 2 N. 11th Street
Brooklyn, Kings County, New York

On behalf of National Grid, this letter discusses the preliminary screening of potential remedial technologies considered for implementation of a remediation at Parcels 2, 3, and 4 of the former Williamsburg Works Manufactured Gas Plant (MGP; the Site). The Site is subject to a September 2021 Order on Consent and Administrative Settlement (the Consent Order) Index No. CO 2-20200910-300 (the Consent Order) between Brooklyn Union Gas, now d/b/a National Grid NY, and New York State Department of Environmental Conservation (NYSDEC). The intent of this letter is to provide NYSDEC the opportunity to review this preliminary screening of remedial technologies to facilitate and expedite development of the final Alternatives Analysis Report (AAR) for Parcels 2, 3, and 4. Following the completion of initial Remedial Investigation (RI) activities and the submission of the Draft RI Report, National Grid has performed this technology screening to address MGP-related impacts, and non-MGP (*e.g.*, oil refining impacts and impacts found in fill that was placed after MGP operations at the Site ceased) impacts identified at Parcels 2, 3, and 4 in preparation for the development of an AAR.

The Site is located in the Williamsburg neighborhood of Brooklyn, New York (Figure 1) and consists of four tax parcels (identified as Parcels 1 through 4, for convenience) located along North 12th and North 11th Streets, Kent Avenue and the East River (Figure 2). It is National Grid's understanding that two parcels (Parcels 3 and 4) will be redeveloped, following remediation, as part of the New York City Department of Parks and Recreation (NYCDPR) Bushwick Inlet Park (the Park) complex. A conceptual redevelopment plan for the Park, including Parcels 3 and 4, has been developed by NYCDPR and can be found at this website https://bushwickinletpark.org/the-park/. Parcel 1 is currently occupied, and National Grid is not aware of an immediate plan for demolition of the existing structure Therefore, Parcel 1 is not included in this preliminary screening. Parcel 2 was previously subject to remediation efforts addressing impacted soil and NAPL source material and has already been redeveloped as part of the Park complex. In accordance with the NYSDEC comment letter dated July 11, 2024, this

AAR will be applicable to Parcels 2, 3,and 4. Therefore, the preliminary screening of potential remedial alternatives in this letter focuses on alternatives to address Parcel 2 groundwater contamination and remedial activities required to prepare Parcels 3 and 4 for the conceptual redevelopment plan.

Draft Remedial Investigation Findings

A Draft RI Report for the Site was submitted by GEI Consultants in October 2023. Comments on the Draft RI report were received on March 4 and March 21, 2024 from the NYSDEC and New York State Department of Health (NYSDOH), respectively. National Grid will complete Supplemental Remedial Investigations, as requested by the NYSDEC, to address some of these comments, and a revised RI Report will be submitted to the NYSDEC after completion of Supplemental Remedial Investigation activities. The following summary of findings is adapted from the Executive Summary of the Draft RI Report. The Site conditions described in that report were used in the preparation of this Preliminary Remedial Technology Screening. While we do not anticipate that the results of the Supplemental Remedial Investigation will significantly alter this screening evaluation, technologies and alternatives may be revised in the AAR to reflect the results of the RI Report once it is submitted to and approved by the NYSDEC.

The former Williamsburg Works MGP (Figure 1) produced gas for use by local businesses and the nearby community from roughly the 1860s until the 1930s. Following decommissioning, the property was subdivided into four properties (Parcels 1 through 4; Figure 2) and sold in the mid-1940s. Between decommissioning of the MGP and sale of the Site real estate, the United States Navy leased the property for a period of time. After it was sold, the properties were used for lumber storage, sheet metal manufacturing, document storage, and city sanitation operations, including bulk petroleum storage, Brooklyn Eastern Terminal District railroad spurs, and by various oil companies.

Two additional parcels not associated with the former MGP, located to the south (Parcel 5) and to the north (Parcel 6), as well as 25 Kent Avenue to the northeast, had relevance in the RI, because of their historic use for petroleum refining and storage and the extent of contamination associated with local industry.

There is a wedge of soil/fill (the “fill wedge”) which was placed above the historical MGP surface elevation of Parcels 3 and 4 and adjacent streets after MGP operations ceased. Prior to the IRM that has been completed on Parcel 2, the fill wedge extended over Parcel 2 as well. This fill wedge was imported to the Site and placed on Parcels 2, 3 and 4 to level them for construction of post-MGP structures including warehouses that were built on Parcel 3 circa 1985 and on Parcel 4 between 1996 and 2001 and that were demolished in 2015. The concrete foundations from the warehouses remain at the surface of Parcels 3 and 4.

The fill wedge is thin at the eastern side of Parcel 3 and becomes thicker (at least 9 feet thick) towards the East River based on the depth of post-MGP railroad ties observed at a test pit on N. 11th Street. It represents approximately 22,000 cubic yards of material that is on top of the historical MGP surface elevation of Parcels 3 and 4 and that is not commingled or intermingled with MGP-Site contamination. In accordance with the Consent Order between National Grid and NYSDEC, contamination other than MGP Wastes is not required to be addressed under the Order unless it is commingled or intermingled with MGP-Site Contamination that alone would independently require the implementation of remedial action. Soil within the fill wedge contains polycyclic aromatic hydrocarbon (PAH), polychlorinated biphenyls (PCB), and metals concentrations exceeding Restricted-Residential soil cleanup objectives (SCOs) and are not commingled with any of the MGP-impacts observed at the Site.

Non-aqueous phase liquid (NAPL) sources include gas production, tar handling areas, tar tanks, and refinery-related oil lines crossing Parcels 3 and 4. NAPL-saturated soils identified on Parcel 2 in proximity to the former gas holders were removed during an Interim Remedial Measure (IRM) between 2015 and 2017, which is fully described in the Construction Completion Report for the portion of the Site, prepared by AECOM.

Most NAPL saturated soils identified on Parcels 3 and 4 were observed in proximity of the former gas and oil tanks and along the bulkhead within Parcel 4, and near the oil separators on Parcel 3. The majority of NAPL-related impacts were observed within the top twelve feet below ground surface (bgs) and beneath the fill wedge. The deepest observed NAPL-related impacts on Parcels 3 and 4 were observed along the bulkhead within Parcel 4 at a depth of approximately forty-two feet bgs.

The lateral extent of NAPL migration from the 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, and to the south, extending to North 11th Street and towards the northern property boundary of Parcel 5. The vertical extent of NAPL migration appears to be limited by an underlying glacial lacustrine clay layer, which has been generally observed at depths of sixty-five feet bgs. Cross-sections displaying extents of impacts are shown in Plates 1 and 2.

Exclusive of Parcel 2 which has undergone soil remediation, the top five feet of subsurface soils below the fill wedge contain PAH concentrations exceeding restricted SCO (Restricted-Residential SCO for Parcels 3 and 4) and elevated levels of perfluorooctane sulfonic acid (PFOS), PCBs, pesticides, and metals.

Subsurface soils beyond five feet below the historic MGP surface elevation and above 30 feet bgs contain benzene, toluene, ethylbenzene, xylene (BTEX) and PAH concentrations exceeding restricted SCOs (Restricted-Residential SCOs for Parcels 2, 3 and 4) within all Site parcels, and elevated levels of non-MGP impacts at these depths include dibenzofuran and metals. The exception is areas within Parcel 2 where remediation was conducted, and clean fill was placed to depths beyond five feet bgs.

- Subsurface soils below the fill wedge and beyond 30 feet below the historic MGP surface elevation contain BTEX, PAH, and metal concentrations exceeding restricted SCOs within Parcel 2 (Restricted-Residential SCOs) and BTEX concentrations exceeding restricted SCOs within Parcels 3 and 4 (Restricted-Residential SCOs).

NAPL impacts deeper than 30 feet bgs were not frequently observed, except within Parcel 2. Non-MGP chemicals in soils confirm the presence and commingling of multiple impact sources.

Throughout the Site, groundwater flows generally to the northwest toward the East River, during both high and low tides. Groundwater moving through MGP and non-MGP impacted soils may result in the migration of dissolved-phase BTEX and PAHs between Parcels 2, 3, and 4 and in discharge into the East River.

Qualitative Human Exposure Assessment – Human Exposure Pathway Overview

A qualitative human exposure assessment was completed and discussed in the October 2023 RI Report. Based on the assessment, the following existing or potential exposure pathways are significant and require remedial action at the Site for their elimination or mitigation:

- Ingestion, dermal contact, and particulate/inhalation of subsurface soil

Potential risk associated with surface soil impacts remaining on Parcels 3 and 4 are similar to any urban area and are not related to former MGP operations due to the presence of the post-MGP fill wedge. Further, surface soils are currently inaccessible due to the overlaying concrete

foundations. Exposure to subsurface soil and groundwater would be expected to occur only during potential future ground-intrusive activities at the Site. 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 would be in the future. Refer to the exposure assessment in the Draft RI Report for a more detailed discussion of the potentially exposed populations.

Parcel 2 Previous Remediation Activities

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.

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 down to approximately 5 feet bgs. Materials suitable for reuse, as well as imported material meeting Restricted Residential SCO, were placed to bring the Parcel 2 back up to the grade of the adjacent streets prior to development into a park by NYC Parks Department. 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."

Further potential remediation activities for Parcel 2 will aim to address MGP-related groundwater contamination within Parcel 2.

Future Site Use

Following the completion of the IRM, Parcel 2 was redeveloped by NYCDPR as a portion of Bushwick Inlet Park, and its foreseeable future use is as a park.

The conceptual future use of Parcels 3 and 4 is redevelopment as a part of the overall development of Bushwick Inlet Park as shown in Figure 3. The depicted plan is conceptual and contingent on input from various stakeholders. On Parcels 3 and 4, the conceptual plan includes a portion of the central lawn, a play area, pedestrian walk and bike paths, and constructed wetlands. Adjacent to Parcels 3 and 4, a pair of 156-inch sewer mains run below North 12th Street and

intersect some of the conceptual wetland features that extend into Parcel 4. During a June 20, 2023, discussion with NYCDPR representatives, National Grid was notified that the conceptual plans would be modified as the sewer would remain in place and require accessibility after redevelopment. NYCDPR indicated that this would likely include some type of roadway or pathway along the alignment of the sewer to allow access for repairs.

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 developed based on contaminant-specific Standards, Criteria and Guidance (SCGs) to the extent practicable in a cost-effective manner. The RAOs applicable to the Parcels 2, 3, and 4 are presented below:

Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Prevent the discharge of contaminants to surface water and sediment.
- Remove the source of ground or surface water contamination.

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.

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.

Structure/Content of Alternatives Analysis Report

Following NYSDEC approval of the RI, National Grid will prepare and submit an AAR that addresses the reporting requirements of section 4.3 of NYCDEC DER-10. The AAR will include a detailed evaluation of remedial alternatives for Parcels 2, 3, and 4. Each alternative will be

evaluated based on the remedy selection evaluation criteria listed in section 4.2 of DER-10 and on DER-31, NYSDEC's Green Remediation Policy. This evaluation includes assessing how the conceptual redevelopment options may be affected by each alternative. The AAR will include the following sections:

- Introduction.
- Site Description and History.
- Summary of RI and Exposure Assessment.
- Remedial Goals and Remedial Action Objectives.
- General Response Actions.
- Identification and Screening of Technologies.
- Development and Analysis of Alternatives.
- Recommended Remedy.
- References.

General Response Actions

The following general response actions are being considered as means of achieving the RAOs for Parcels 2, 3, and 4. 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 MGP-related NAPL source materials and non-MGP-related impacts.

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 (*i.e.*, chemical oxidation, stabilization).

Containment (soil and groundwater): isolation of contaminant source areas by constructing and maintaining physical barriers that prevent continued migration of contamination (*i.e.*, 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 (*i.e.*, surface cap, fencing, bulkhead).

Institutional controls (soil, groundwater, soil vapor): controlling the type and nature of potential exposures through legal or administrative procedures or programs (*i.e.*, deed notice, 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 as a means of ensuring that potential, but currently incomplete, exposure pathways are not completed (*i.e.*, groundwater monitoring, indoor air sampling, sediment sampling).

The following matrix shows, for each RAO, the general response actions being considered for Parcels 2, 3, and 4. The response actions are media-specific, and the matrix does not explicitly show positive effects on secondary media.

	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						
▪ Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.	X	X	X			X
▪ 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
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 (include all appropriate media: groundwater, surface water, or 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	

Preliminary Alternatives Under Evaluation

Though the Consent Order states, “Contamination other than MGP Wastes is not required to be addressed under this Order unless it is commingled or intermingled with MGP-Site Contamination that alone would independently require the implementation of remedial action…", correspondence received from the NYDEC Division of Environmental Remediation on July 11, 2024, directs, “Regardless of liability, the fill wedge overlying Manufactured Gas Plant (MGP) contamination on Parcels 3 and 4 must be addressed by this submittal and the Alternatives Analysis. Removal of this [non-MGP-impacted fill] wedge is a necessary remedial component to implement [potential] removal and stabilization technologies on deeper contaminated environmental media. Technologies for removal of the [fill] wedge must be considered in this submittal.” Furthermore, DER’s March 4, 2024, letter states, “…the process to remove/handle contaminated overlying material must be coordinated between National Grid and the other

remedial parties involved. While the screening evaluation and the AAR will address the removal of the fill wedge, National Grid is committed to working with the NYSDEC and the responsible party to coordinate removal of the fill wedge, which will allow National Grid to complete their remedial obligations associated with the former MGP site.

The following components, alone or in combination, are currently being considered by GEI for the non-MGP and MGP-related impacts at Parcels 2, 3, and 4 at the Williamsburg Works site:

- Monitoring, only.
- Removal of contamination in the unsaturated zone.
- Excavation of MGP-related NAPL source materials to a practicable depth in the saturated zone.
- Excavation of all source areas to a maximum depth of contamination in the saturated zone to restore Parcels 2, 3, and 4 to pre-release conditions.
- Capping and containment of NAPL source areas.
- Containment of NAPL source areas in the saturated zone.
- Refurbishment of the existing bulkhead to prevent migration of NAPL or impacted groundwater to surface water.
- Restricting future uses of Parcels 2,3, and 4.
- Establishing protocols to manage future ground-intrusive work.

Table 1 below evaluates the effectiveness, implementability, relative cost, and status for alternative development for each of the remedial technologies screened for the remediation of Parcels 2, 3 and 4. As Parcels 3 and 4 are likely to be remediated together for the redevelopment of Bushwick Inlet Park, the potential application of these technologies focuses on those two parcels in Table 1 below. Due to the previous remediation activities, technology evaluation concerning Parcel 2 was limited to only those applicable to groundwater.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

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 the fill wedge material to access and remove 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 non-MGP fill wedge prior to excavation of MGP-impacted material in the unsaturated zone.	Retained 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 the fill wedge material to access and remove source material to a depth up to 12 feet bgs in areas of deeper impacts within Parcels 2, 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.	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 non-MGP fill wedge prior to excavation of MGP-impacted material in the unsaturated zone	Retained for alternative development.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

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 of the fill wedge material to access and remove source material to a depth of approximately 42 feet in areas of deeper impacts to restore Parcels 2, 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 non-MGP fill wedge prior to excavation of MGP-impacted material in the unsaturated zone	Not retained for alternative development.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status 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 affect 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.
Excavation/ Source Removal	Pressure Pulse Injection	Effective in recovering subsurface NAPL and MGP-related NAPL 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.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
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.
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 to treat soils at other similar sites effectively. Soil and groundwater RAOs for Environmental Protection can be achieved for material disposed off-site.	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.

Table 1. Summary of Remedial Technology Screening

Williamsburg Works Former MGP Site

Brooklyn, New York

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 source material removal.	Technology proven and readily implemented. Requires off-site water disposal or approved discharge location and permit.	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 material disposed off-site.	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.
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 NAPL 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.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
	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 NAPL 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.

Table 1. Summary of Remedial Technology Screening

Williamsburg Works Former MGP Site

Brooklyn, New York

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 NAPL source material difficult to control in this environment.	Technology proven. However, it will likely be ineffective at Parcels 2, 3, and 4 due to tidal action, limited downgradient area between the impacted zones requiring treatment and the water way for recovery/ treatment.	High capital and operating costs compared to other alternatives.	Not retained for MGP-related NAPL source material removal. May be considered for supplemental treatment.

Table 1. Summary of Remedial Technology Screening

Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
In-Situ Treatment	In-Situ Geochemical Stabilization (ISGS)	Effective in both destroying contaminants in soil and groundwater and limited NAPL mobility though stabilization. Has proven effective in reducing flux of contaminants to groundwater at other MGP sites. Tidal action and influx of extraneous oxidant scavengers make delivery and contact with target MGP-related NAPL source material difficult to control in this environment.	Technology proven. However, effectiveness may be limited at Parcels 2, 3, and 4due to tidal action, oxygen scavengers, and limited potential access for reinjections. Can be implemented at edges of Parcel 2 to reduce GW flux.	High capital costs driven by high volume of oxidants potentially required due to the oxygen scavengers when compared to other alternatives.	Retained for potential supplemental treatment.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status for Alternative Development
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 Site 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.

Table 1. Summary of Remedial Technology Screening

Williamsburg Works Former MGP Site

Brooklyn, New York

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 impact at the Site limits use. Must be combined with other recovery or treatment technologies to achieve soil and groundwater RAOs for Environmental Protection RAOs.	Technology proven but the site area 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 of PAHs is required. Long-term monitoring for MNA of PAHs is required.	Low compared to other alternatives.	Retained for alternative development.
In-Situ Treatment	Monitored Natural Attenuation (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. 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.

Table 1. Summary of Remedial Technology Screening

Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status 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 containment or source excavation. May require extensive earthwork to accommodate redevelopment plans.	Retained for alternative development.
Engineering Control	Refurbish Bulkhead Wall	Multiple bulkhead materials and configurations can be effective at controlling potential migration of contaminated soils to surface water. Groundwater RAOs for Environmental Protection related to discharge can be achieved.	Technology proven and readily implemented. An engineering assessment of the existing structure would be required to assess structural integrity of the structure.	Medium to high installation cost based on existing structure construction and permitting costs. Minimal operation and maintenance costs	Retained for alternative development

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status 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	Medium capital cost, high long-term maintenance, and treatment cost relative to other technologies.	Retained 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.

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

General Response Action	Technology	Effectiveness	Implementability	Relative Cost	Status 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.
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

Table 1. Summary of Remedial Technology Screening
Williamsburg Works Former MGP Site

Brooklyn, New York

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 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.

Identification and Screening of Technologies

The technologies retained for further analysis are:

- Unsaturated Zone Excavation
- Shallow Saturated Zone Excavation
- Off-site low temperature thermal desorption
- Oxygenation via biosparging
- Monitored natural attenuation
- Engineered cap/cover system
- Refurbish bulkhead wall
- NAPL recovery
- Hydraulic control using ex-situ groundwater pump-and-treat technologies
- Sheet pile wall
- Soil/bentonite cutoff wall
- Jet grouting
- In-situ stabilization including In-situ geochemical stabilization
- Institutional controls

Development and Analysis of Preliminary Alternatives

Below is a list of the preliminary alternatives being considered for the remediation of Parcels 3 and 4 and the remediation of groundwater impacts at Parcel 2. Institutional controls are anticipated to be included with each of the preliminary alternatives listed below.

1. Monitored natural attenuation. This preliminary alternative will not require the combination of additional remedial technologies. This preliminary alternative will not meet the RAOs for Parcels 2, 3, and 4 and would not be further evaluated in the AAR.
2. Excavation and off-site treatment and/or disposal of soils in the unsaturated zone to accommodate redevelopment of Bushwick Inlet Park. Construction of cap across Parcels 3 and 4. Containment of MGP-related NAPL source material and groundwater impacts within Parcels 2, 3, and 4 with hydraulic controls.
3. Excavation of non-MGP and MGP-related impacted soils in the unsaturated zone with off-site treatment and/or disposal. Construction of cap across Parcels 3 and 4. MGP-related NAPL source material removal, containment, and/or stabilization in the shallow saturated zone with hydraulic controls or other groundwater treatment to address impacts to groundwater from remaining source material.
4. Excavation of non-MGP and MGP-related impacted soils within the unsaturated and shallow saturated zone with off-site thermal treatment and disposal of treated materials as landfill cover material or direct disposal at a landfill. Deeper MGP-related NAPL source material removal, containment, and/or stabilization in the shallow saturated zone with hydraulic controls or other groundwater treatment to address impacts to groundwater from remaining source material at depth on Parcel 2. Construction of cap across Parcels 3 and 4

The preliminary alternative to complete excavation of impacted areas up to 42 feet below grade with off-site disposal in order to restore the Parcels 2, 3, and 4 to pre-disposal/pre-release conditions was not retained as the excavation adjacent to the river to this depth is technically infeasible at Parcels 2, 3, and 4.

Please feel free to contact Donald Campbell at 347-452-5973 or Donald.Campbell@nationalgrid.com, if you have any questions concerning this letter.

Sincerely,

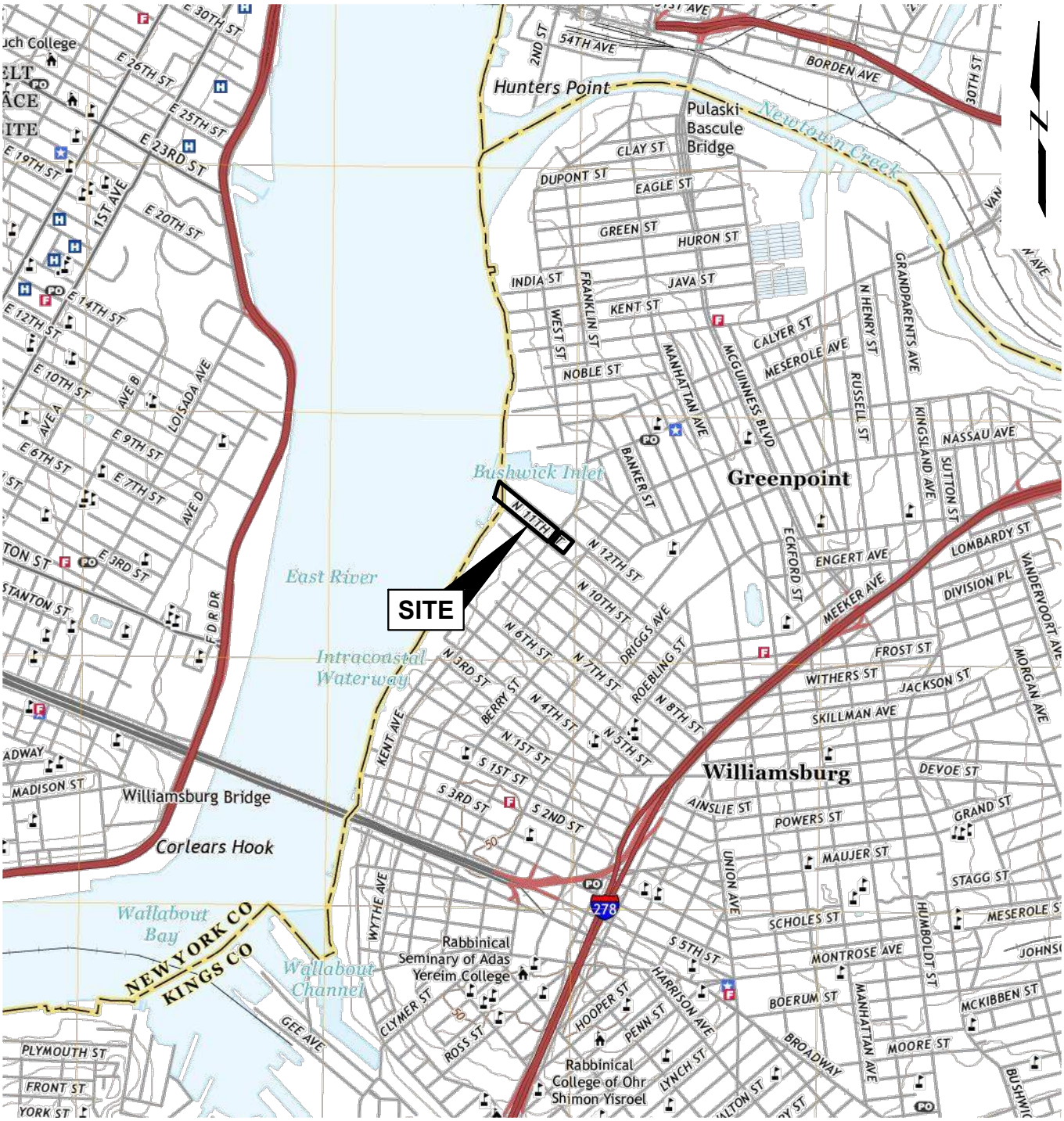
GEI CONSULTANTS, INC., P.C.

Matthew J. O'Neil, P.E.
Vice President, Senior Engineer

Eric Spazzarini, P.E.
Project Engineer

MJO/MF/ES:bp
c: William Bennett (NYSDEC)
William Ryan (National Grid)
Donald Campbell (National Gird)
Jessica Phillips (National Grid)
Melissa Felter (GEI Consultants)

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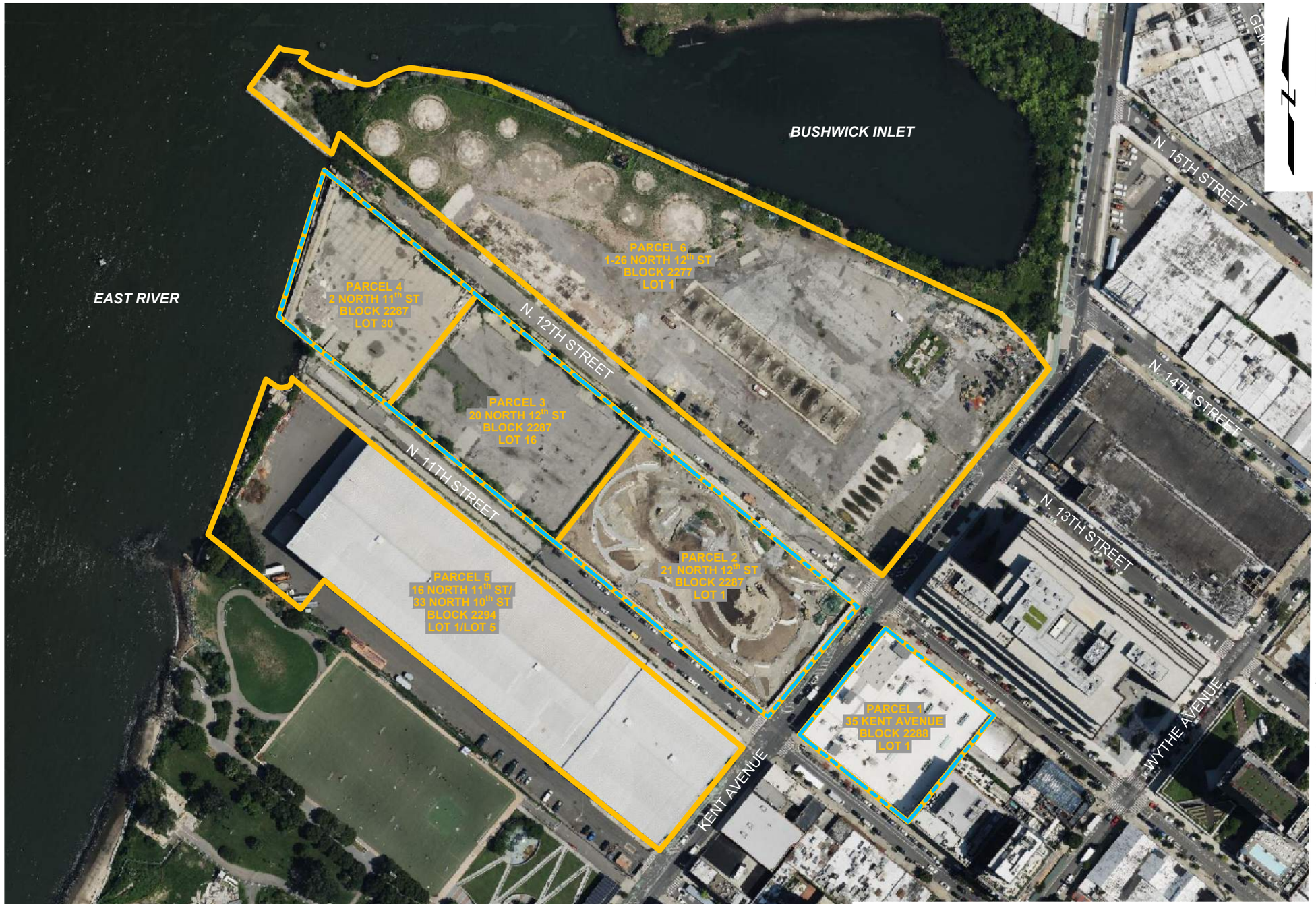


SOURCE:

USGS TOPOGRAPHIC QUADRANGLE, 7.5 MINUTE SERIES: BROOKLYN, NY 2019
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88)
10-FOOT CONTOUR INTERVAL

Preliminary Technology Screening Williamsburg Works Former MGP Site Borough of Brooklyn, New York	GEI Consultants	SITE LOCATION MAP
nationalgrid	Project 093060	AUGUST 2024 Fig. 1

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LEGEND:

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MGP PROPERTY

SOURCES:

1. AERIAL PHOTOGRAPH OBTAINED FROM MICROSOFT BING VIA CIVIL 3D, ©2023 MICROSOFT CORPORATION ©2022 MAXAR ©CNES (2022) DISTRIBUTION AIRBUS DS, ACCESSED ON 4/13/2023.
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

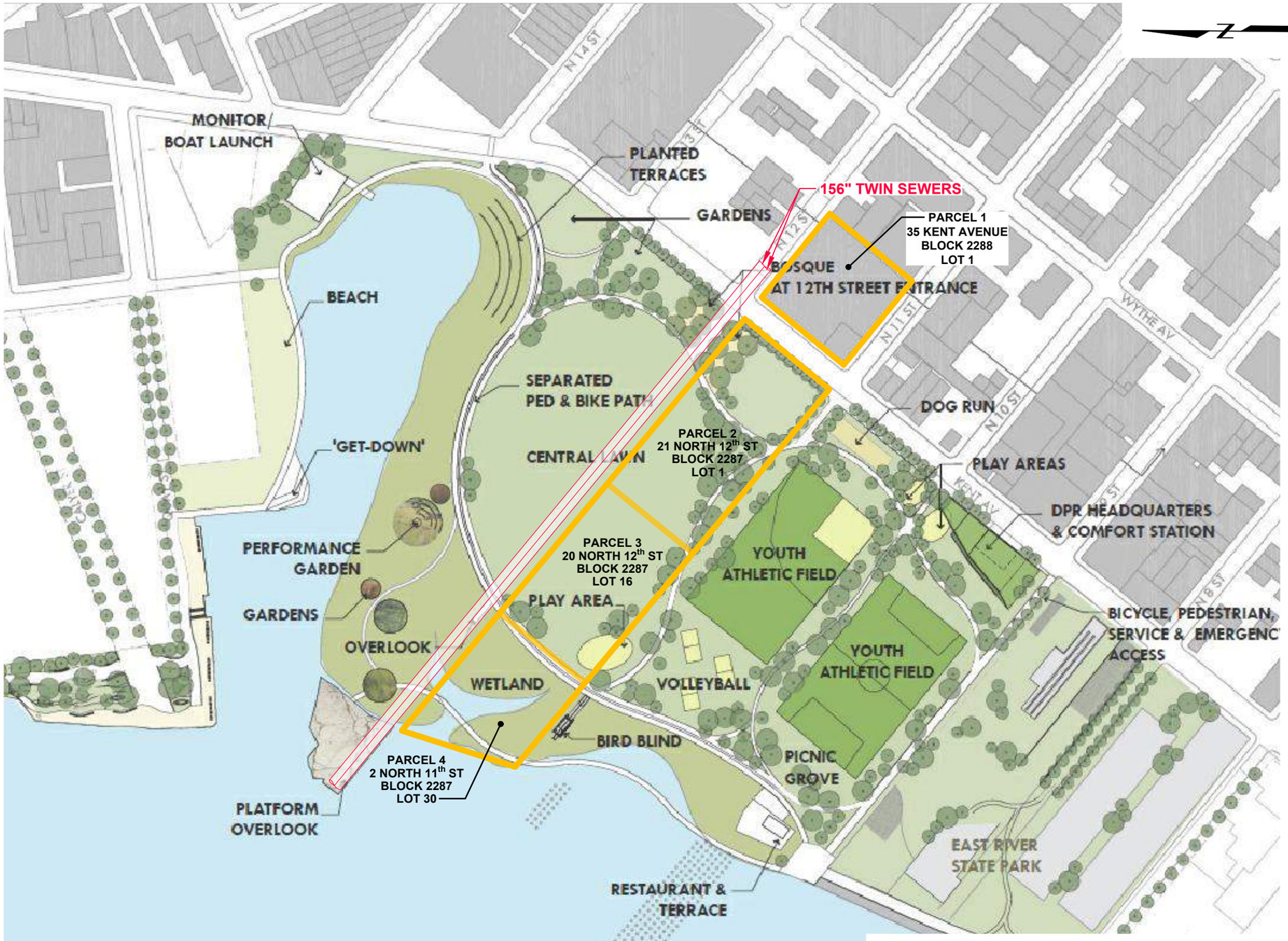
Preliminary Technology Screening
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

nationalgrid

GEI Consultants

PARCEL
IDENTIFICATION MAP

Project 093060 | AUGUST 2024 | Fig. 2



LEGEND:

APPROXIMATE SITE BOUNDARY

SOURCES:

1. *FIGURE 5-13: BUSHWICK INLET PARK, CONCEPTUAL DESIGN.*
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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Preliminary Technology Screening
Williamsburg Works Former MGP Site
Borough of Brooklyn, New York

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GEI Consultants

CONCEPTUAL
REDEVELOPMENT PLAN
FOR BUSHWICK INLET PARK

Project 093060 | AUGUST 2024 | Fig. 3

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Appendix B Alternative Cost Estimates

Appendix B-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 ($)	Extended Total ($)
	Fill Wedge Removal				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ -	$ -
B	Construction Activities				$ -
i)	Mobilization/Demobilization	1	Lump Sum	$ -	$ -
ii)	Temporary Facilities and Controls	1	Lump Sum	$ -	$ -
iii)	Concrete Slab Demolition (Non MGP)	-	Square Foot	$ 1.39	$ -
iv)	Unsaturated Zone Excavation (Non MGP Fill Wedge)	-	Cubic Yard	$ 82.00	$ -
v)	T&D Soil - NonHaz Landfill (Non MGP Fill Wedge)	-	Ton	$ 100.00	$ -
vi)	T&D Construction Debris (Concrete Slab)	-	Ton	$ 123.00	$ -
C	CAMP	1	Lump Sum	$ -	$ -
D	Construction Management, Project Management	1	Lump Sum	$ -	$ -
				Total Fill Wedge Removal Construction Cost	$ -
				Total OM&M Cost	$ -
				Total Fill Wedge Removal Project Cost	$ -
				Class 4 High Range Estimate (+50%)	$ -
				Class 4 Low Range Estimate (-30%)	$ -
	Site Remediation				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 2,231,000.00	$ 2,231,000.00
B	Construction Activities				$ 37,170,880.00
i)	Mobilization/Demobilization	1	Lump Sum	$2,432,000.00	$ 2,432,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$4,430,000.00	$ 4,430,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	-	Lump Sum	$2,180,000.00	$ -
iv)	Fence Removal	1,340	Linear Feet	$ 52.00	$ 69,680.00
v)	Unsaturated Zone Excavation (MGP)	-	Cubic Yard	$ 82.00	$ -
vi)	Installation of Excavation Support System	-	Lump Sum	$ -	$ -
vii)	Saturated Zone Excavation	-	Cubic Yard	$ 82.00	$ -
viii)	ISS Mobilization	-	Lump Sum	$ 70,000.00	$ -
ix)	ISS Implementation	-	Cubic Yard	$ 72.00	$ -
x)	ISGS Parcel 2	1	Lump Sum	$ 16,930,000.00	$ 16,930,000.00
xi)	ISGS Parcels 3 & 4	1	Lump Sum	$ 13,210,000.00	$ 13,210,000.00
xii)	T&D Soil - Thermal Desportion (MGP)	260	Ton	$ 110.00	$ 28,600.00
xiii)	T&D Impacted Debris	-	Ton	$ 186.00	$ -
xiv)	T&D Wastewater	-	Gallons	$ -	$ -
xv)	Backfill (Clean Import Fill)	-	Cubic Yard	$ 140.00	$ -
xviii)	Topsoil	1,957	Cubic Yard	$ 35.00	$ 68,495.00
xiv)	Seeding	42,100	Square Foot	$ 0.05	$ 2,105.00

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

C	CAMP	1	Lump Sum	$1,037,000.00	$	1,037,000.00
D	Construction Management, Project Management	1	Lump Sum	$4,089,000.00	$	4,089,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$820,000.00	$	820,000.00

Total Site Remediation Construction Cost	$	44,527,880.00
Total OM&M Cost		$820,000.00
Total Site Remediation Project Cost	$	45,347,880.00
Class 4 High Range Estimate (+50%)	$	68,021,820.00
Class 4 Low Range Estimate (-30%)	$	31,743,516.00

Total Project Cost	$	45,347,880.00
Class 4 High Range Estimate (+50%)	$	68,021,820.00
Class 4 Low Range Estimate (-30%)	$	31,743,516.00

Appendix B-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 ($)	Extended Total ($)
	Fill Wedge Removal				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 362,000.00	$ 362,000.00
B	Construction Activities				$ 6,029,420.00
i)	Mobilization/Demobilization	1	Lump Sum	$ 395,000.00	$ 395,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$ -	$ -
iii)	Concrete Slab Demolition (Non MGP)	118,000	Square Foot	$ 1.39	$ 164,020.00
iv)	Unsaturated Zone Excavation (Non MGP Fill Wedge)	19,100	Cubic Yard	$ 82.00	$ 1,566,200.00
v)	T&D Soil - NonHaz Landfill (Non MGP Fill Wedge)	32,400	Ton	$ 100.00	$ 3,240,000.00
vi)	T&D Construction Debris (Concrete Slab)	5,400	Ton	$ 123.00	$ 664,200.00
C	CAMP	1	Lump Sum	$ 287,000.00	$ 287,000.00
D	Construction Management, Project Management	1	Lump Sum	$ 664,000.00	$ 664,000.00
			Total Fill Wedge Removal Construction Cost		$ 7,342,420.00
			Total OM&M Cost		$ -
			Total Fill Wedge Removal Project Cost		$ 7,342,420.00
			Class 4 High Range Estimate (+50%)		$ 11,013,630.00
			Class 4 Low Range Estimate (-30%)		$ 5,139,694.00
	Site Remediation				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 1,928,000.00	$ 1,928,000.00
B	Construction Activities				$ 32,118,130.00
i)	Mobilization/Demobilization	1	Lump Sum	$2,102,000.00	$ 2,102,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$4,362,000.00	$ 4,362,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	1	Lump Sum	$2,180,000.00	$ 2,180,000.00
iv)	Fence Removal	1,340	Linear Feet	$ 52.00	$ 69,680.00
v)	Unsaturated Zone Excavation (MGP)	2,200	Cubic Yard	$ 82.00	$ 180,400.00
vi)	Installation of Excavation Support System	1	Lump Sum	$ 778,000.00	$ 778,000.00
vii)	Saturated Zone Excavation	2,800	Cubic Yard	$ 82.00	$ 229,600.00
viii)	ISS Mobilization	1	Lump Sum	$ 70,000.00	$ 70,000.00
ix)	ISS Implementation	15,300	Cubic Yard	$ 72.00	$ 1,101,600.00
x)	ISGS Parcel 2	1	Lump Sum	$ 16,930,000.00	$ 16,930,000.00
xi)	ISGS Parcels 3 & 4	1	Lump Sum	$ 1,870,000.00	$ 1,870,000.00
xii)	T&D Soil - Thermal Desportion (MGP)	8,500	Ton	$ 110.00	$ 935,000.00
xiii)	T&D Impacted Debris	300	Ton	$ 186.00	$ 55,800.00
xiv)	T&D Wastewater	1	Lump Sum	$ 154,000.00	$ 154,000.00
xv)	Backfill (Clean Import Fill)	7,300	Cubic Yard	$ 140.00	$ 1,022,000.00
xvi)	Topsoil	2,000	Cubic Yard	$ 35.00	$ 70,000.00
xvii)	Seeding	161,000	Square Foot	$ 0.05	$ 8,050.00

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

C	CAMP	1	Lump Sum	$1,021,000.00	$	1,021,000.00
D	Construction Management, Project Management	1	Lump Sum	$3,533,000.00	$	3,533,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$820,000.00	$	820,000.00

Total Construction Cost	$	38,600,130.00
Total OM&M Cost		$820,000.00
Total Project Cost	$	39,420,130.00
Class 4 High Range Estimate (+50%)	$	59,130,195.00
Class 4 Low Range Estimate (-30%)	$	27,594,091.00

Total Project Cost	$	46,762,550.00
Class 4 High Range Estimate (+50%)	$	70,143,825.00
Class 4 Low Range Estimate (-30%)	$	32,733,785.00

Appendix B-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 ($)	Extended Total ($)
	Fill Wedge Removal				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 362,000.00	$ 362,000.00
B	Construction Activities				$ 6,029,420.00
i)	Mobilization/Demobilization	1	Lump Sum	$ 395,000.00	$ 395,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$ -	$ -
iii)	Concrete Slab Demolition (Non MGP)	118,000	Square Foot	$ 1.39	$ 164,020.00
iv)	Unsaturated Zone Excavation (Non MGP Fill Wedge)	19,100	Cubic Yard	$ 82.00	$ 1,566,200.00
v)	T&D Soil - NonHaz Landfill (Non MGP Fill Wedge)	32,400	Ton	$ 100.00	$ 3,240,000.00
vi)	T&D Construction Debris (Concrete Slab)	5,400	Ton	$ 123.00	$ 664,200.00
C	CAMP	1	Lump Sum	$ 287,000.00	$ 287,000.00
D	Construction Management, Project Management	1	Lump Sum	$ 664,000.00	$ 664,000.00
				Total Fill Wedge Removal Construction Cost	$ 7,342,420.00
				Total OM&M Cost	$ -
				Total Fill Wedge Removal Project Cost	$ 7,342,420.00
				Class 4 High Range Estimate (+50%)	$ 11,013,630.00
				Class 4 Low Range Estimate (-30%)	$ 5,139,694.00
	Site Remediation				
A	Engineering Design, Plans, Specifications, Permitting	1	Lump Sum	$ 2,640,000.00	$ 2,640,000.00
B	Construction Activities				$ 43,985,850.00
i)	Mobilization/Demobilization	1	Lump Sum	$2,878,000.00	$ 2,878,000.00
ii)	Temporary Facilities and Controls	1	Lump Sum	$5,665,000.00	$ 5,665,000.00
iii)	Installation and Removal of Temporary Environmental Enclosure	1	Lump Sum	$2,180,000.00	$ 2,180,000.00
iv)	Fence Removal	1,340	Linear Feet	$ 52.00	$ 69,680.00
v)	Unsaturated Zone Excavation (MGP)	2,200	Cubic Yard	$ 82.00	$ 180,400.00
vi)	Installation of Excavation Support System	1	Lump Sum	$ 2,366,000.00	$ 2,366,000.00
vii)	Saturated Zone Excavation	21,400	Cubic Yard	$ 82.00	$ 1,754,800.00
viii)	ISS Mobilization	1	Lump Sum	$ 70,000.00	$ 70,000.00
ix)	ISS Implementation	810	Cubic Yard	$ 72.00	$ 58,320.00
x)	ISGS Parcel 2	1	Lump Sum	$ 16,930,000.00	$ 16,930,000.00
xi)	ISGS Parcels 3 & 4	1	Lump Sum	$ 1,870,000.00	$ 1,870,000.00
xii)	T&D Soil - Thermal Desportion (MGP)	40,120	Ton	$ 110.00	$ 4,413,200.00
xiii)	T&D Impacted Debris	3,400	Ton	$ 186.00	$ 632,400.00
xiv)	T&D Wastewater	1	Lump Sum	$ 850,000.00	$ 850,000.00
xv)	Backfill (Clean Import Fill)	28,500	Cubic Yard	$ 140.00	$ 3,990,000.00
xvi)	Topsoil	2,000	Cubic Yard	$ 35.00	$ 70,000.00
xvii)	Seeding	161,000	Square Foot	$ 0.05	$ 8,050.00

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

C	CAMP	1	Lump Sum	$1,331,000.00	$	1,331,000.00
D	Construction Management, Project Management	1	Lump Sum	$4,839,000.00	$	4,839,000.00
E	Operations, Monitoring, and Maintenance Costs (Present Value)	1	30 Year Period	$820,000.00	$	820,000.00

Total Construction Cost	$	52,795,850.00
Total OM&M Cost		$820,000.00
Total Project Cost	$	53,615,850.00
Class 4 High Range Estimate (+50%)	$	80,423,775.00
Class 4 Low Range Estimate (-30%)	$	37,531,095.00

Total Project Cost	$	60,958,270.00
Class 4 High Range Estimate (+50%)	$	91,437,405.00
Class 4 Low Range Estimate (-30%)	$	42,670,789.00