GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Final Interim Remedial Measure Design Work Plan

50 Kent Avenue Parcel
Williamsburg Works Former MGP Site

Brooklyn, New York
NYSDEC AOC Index No. A2-0552-0606
Site No. 224055

Submitted to:
National Grid
287 Maspeth Avenue
Brooklyn, NY 11211

Submitted by:
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093060-1-1114

Professional Engineer's Certification

The undersigned on behalf of National Grid and GEI Consultants, Inc. certifies: that I am currently a [NYS registered professional engineer or Qualified Environmental Professional as defined in 6 NYCRR Part 375] and that this Report [Final Interim Remedial Measure Design Work Plan] was prepared in accordance with all applicable statutes and regulations and in substantial conformace with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

9/13/11
Date

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Abbreviations and Acronyms

AWQS	Ambient Water Quality Standards
AOC	Administrative Order on Consent
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BUG	The Brooklyn Union Gas Company
CAMP	Community Air-Monitoring Plan
Commercial SCO	Commercial Use Soil Cleanup Objective
CRZ	Contamination Reduction Zone
CSM	Cutter Soil Mix
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
EEA	Energy and Environmental Analysts, Inc.
EFR	Enhanced Fluid Recovery
ESA	Environmental Site Assessment
EZ	Exclusion Zone
FLS	Fleming-Lee Shue
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
KeySpan	KeySpan Corporation
LiRo	LiRo Engineers, Inc.
M&E	Metcalf and Eddy of New York, Inc.
M3-1	Manufacturing
MGP	Manufactured Gas Plant
NAPL	Non-Aqueous Phase Liquid
NGVD	National Geodetic Vertical Datum
NYC	New York City
NYCDOB	New York City Department of Buildings
NYCDOS	New York City Department of Sanitation
NYC Parks	New York City Parks Department
NYSASP	New York State Analytical Services Protocols
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORC	Oxygen Release Compound
PAH	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated biphenyls
PDI	Pre-Design Investigation
ppm	Parts Per Million
PPE	Personal protective equipment
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objectives

RCNY	Rules of the City of New York
RCRA	Resource Conservation and Recovery Act
RES	Raritan Enviro Sciences, Inc.
RI	Remedial Investigation
RIWP	Remedial Investigation Work Plan
RSCO	Recommended Soil Cleanup Objective
SCG	Standards, Criteria and Guidance
SCO	Soil Cleanup Objective
SCOPGQ	Soil Cleanup Objective to Protect Groundwater Quality
SI	Site Investigation
STARS	Spill Technology and Remediation Series
SVOC	Semivolatile Organic Compound
SZ	Support Zone
TAGM	Technical and Administrative Guidance Memorandum
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
TOGS	Technical and Operational Guidance Series
TPHC	Total Petroleum Hydrocarbon Content
Unrestricted SCO	Unrestricted Use Soil Cleanup Objective
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Executive Summary

On behalf of National Grid, GEI Consultants, Inc. (GEI) has prepared this Interim Remedial Measure (IRM) Design Work Plan for the 50 Kent Avenue parcel of the Williamsburg Works former Manufactured Gas Plant (MGP) site. The Williamsburg Works former MGP site consists of four parcels located in the Williamsburg neighborhood of Brooklyn, New York along North 12th and North 11th Streets, Kent Avenue, and the East River (Figure 1). The purpose of the IRM is to address MGP-related source material at the 50 Kent Avenue parcel.

The Williamsburg Works former MGP site is covered under an administrative order on consent and administrative settlement #A2-0552-0606, which was entered into by KeySpan Corporation, the predecessor to National Grid, and New York State Department of Environmental Conservation (NYSDEC). National Grid is currently conducting a Remedial Investigation (RI) at the Williamsburg Works former MGP site. Interim results of the RI were transmitted to NYSDEC on August 25, 2010 in the *Draft Remedial Investigation Interim Data Summary.* The Summary identified that further investigation was necessary to define the nature and extent of environmental impacts at the Williamsburg Works former MGP site. Field activities associated with a Supplemental RI are ongoing.

In a letter to National Grid dated September 23, 2010, NYSDEC stated that based on the Interim Data Summary sufficient data exist to initiate the design of an excavation/stabilization-based IRM for the 50 Kent parcel (the IRM Site). National Grid met with NYSDEC on October 26, 2010 to discuss NYSDEC's request for an IRM Work Plan. During the meeting, NYSDEC agreed with National Grid that additional pre-IRM design data are needed and asked that National Grid develop an IRM Work Plan inclusive of pre-design data gathering activities. National Grid provided a draft work plan to NYSDEC on January 13, 2011. After discussion with NYSDEC about the Draft, the IRM Design Work Plan was revised and resubmitted in April 2011 to provide details on and propose pre-design investigation (PDI) activities necessary to evaluate, select and design a remedial approach to sufficiently address MGP-related source material on the 50 Kent Avenue parcel in accordance with NYSDEC's March 8, 2011 comments. After additional correspondence with NYSDEC about the April 2011 Draft, this IRM Design Work Plan was revised in accordance with NYSDEC's May 13, 2011 guidelines and National Grid's June 8, 2011 responses. The proposed PDI activities include but are not limited to:

- Supplemental Investigation Activities
- Background Noise and Vibration Investigation
- Utility Survey and Subsurface Infrastructure Investigation
- Adjacent Building Foundation Investigation
- Baseline Groundwater Model

- Evaluate the Suitability of Recovery Wells
- NAPL Stabilization Bench Testing

If necessary, additional activities may be implemented during the IRM design depending on the selected remedy including:

- Sheet Pile Pilot Test
- CSM Wall Pilot Test
- Groundwater Pump Test
- NAPL Stabilization Pilot Test
- NAPL Monitoring and Recovery Pilot Test

Descriptions of each proposed activity are provided in this Work Plan.

1. Introduction

On behalf of National Grid, GEI Consultants, Inc. (GEI) has prepared this Interim Remedial Measure (IRM) Design Work Plan for the 50 Kent Avenue parcel of the Williamsburg Works former Manufactured Gas Plant (MGP) site. The Williamsburg Works former MGP site (the "MGP Site") is located in the Williamsburg neighborhood of Brooklyn, New York and consists of four parcels located along North 12th and North 11th Streets, Kent Avenue, and the East River. The 50 Kent Avenue parcel, the IRM Site, also labeled as 22 North 12th Street, is at Block 2287, Lot 1 and was the location for purifying operations, condensers and three gas holders. The 50 Kent Avenue parcel is bordered by North 12th Street to the northeast, Kent Avenue to the southeast, North 11th Street to the southwest, and Block 2287, Lot 16 to the northwest. Figure 1 shows the location of the 50 Kent Avenue parcel (herein referred to as the "IRM Site").

The Williamsburg Works former MGP site is covered under an administrative order on consent (AOC) and administrative settlement #A2-0552-0606, which was entered into by KeySpan Corporation (KeySpan), the predecessor to National Grid, and New York State Department of Environmental Conservation (NYSDEC) in 2007. National Grid is currently conducting a Remedial Investigation (RI) at the Williamsburg Works former MGP site. Remedial Investigation field work was conducted from June through December 2009 under a NYSDEC- and New York State Department of Health (NYSDOH)-approved work plan and follow-up addendums. The work plan, titled *Remedial Investigation Work Plan for the Williamsburg Former MGP Site*, was dated May 2008 and approved on June 23, 2008. A 50 Kent Avenue addendum was approved on December 3, 2008, and a 35 Kent Avenue addendum was approved on March 3, 2009. A second addendum for the 50 Kent Avenue parcel was conditionally approved on December 10, 2009, and finalized on December 17, 2009. Interim results of the RI were transmitted to NYSDEC on August 25, 2010, in the *Draft Remedial Investigation Interim Data Summary*. This summary identified that further investigation was necessary to define the nature and extent of environmental impacts at the Williamsburg Works former MGP site. A Supplemental RI Work Plan was submitted to NYSDEC on August 25, 2010 to continue investigation activities beyond the MGP Site. Field activities associated with this Supplemental RI began in October 2010 and are ongoing.

In a letter to National Grid dated September 23, 2010, NYSDEC stated that, based on the Draft RI Interim Data Summary, sufficient data exist to initiate the design of an excavation/ stabilization-based IRM for the 50 Kent Avenue parcel. National Grid met with NYSDEC on October 26, 2010 to discuss NYSDEC's request for an IRM Work Plan. During the meeting, NYSDEC agreed with National Grid that additional pre-IRM design data are needed and asked that National Grid develop an IRM Work Plan inclusive of pre-design data gathering activities.

National Grid provided a draft work plan to NYSDEC on January 13, 2011. After discussion with NYSDEC about the Draft, the IRM Design Work Plan was revised and resubmitted in April 2011to provide details on and propose pre-design investigation (PDI) activities. The PDI activities will collect data required to determine the design parameters of the remedial approach that will sufficiently address MGP-related source material on the 50 Kent Avenue parcel in accordance with NYSDEC's March 8, 2011 comments. After additional correspondence with NYSDEC about the April 2011 Draft, this IRM Design Work Plan was revised in accordance with NYSDEC's May 13, 2011 comments and National Grid's June 8, 2011 responses. These activities include, but are not limited to, additional soil borings; test pits; utility, subsurface and structural surveys; noise and vibration studies; development of a baseline groundwater model; and non-aqueous phase liquid (NAPL) stabilization bench testing.

1.1 Work Plan Organization

This work plan has been prepared in general accordance with the NYSDEC Division of Environmental Remediation (*DER-10) Technical Guidance for Site Investigation and Remediation* (DER-10), dated May 3, 2010, and specifically with Sections 5.1 and 5.2. The work plan has been organized as follows:

- Section 1 Introduction
- Section 2 Nature and Extent of Contamination
- Section 3 IRM Goals and Objectives
- Section 4 IRM Summary
- Section 5 Vapor/Odor Management
- Section 6 Erosion and Sediment Control Plan
- Section 7 Site Security Plan
- Section 8 Decontamination Plan
- Section 9 Waste Management Plan
- Section 10 Sample Collection and Analysis Plan
- Section 11 Groundwater Management Plan
- Section 12 Traffic Control Plan
- Section 13 Completion of Remedial Activities

1.2 Site Description and History

The Williamsburg Works former MGP operated from 1850 to the 1930s, first by the Williamsburg Gas Light Company and later by The Brooklyn Union Gas Company (BUG), a predecessor to National Grid. The Williamsburg Works MGP was dismantled prior to 1941 and was subsequently divided into four parcels, sold to third parties, and redeveloped for commercial and industrial uses. During manufactured gas production, the 50 Kent Avenue parcel housed MGP production facilities, including three gas holders (Relief Holder, Holder No. 1, and Holder

No. 2), purifying houses, salt water condensers, and offices. Historic MGP structures located on the 50 Kent Avenue parcel are shown along with current IRM Site conditions in Figure 2.

Following the closure of the MGP, the MGP structures were dismantled. However, the holder tanks and other structures remained underground. The 50 Kent Avenue parcel was temporarily leased by the United States Navy from July 1, 1945 and was sold by BUG on January 30, 1946. A warehouse/industrial building was constructed on the IRM Site prior to 1951 by the Site's then current owner, and was occupied by the Ferro-Co. Corporation and used for sheet metal product manufacturing. By 1965, the building was occupied by Commercial Corrugated Container Corporation. By 1978, the property, and same building, was occupied by a New York City Department of Sanitation (NYCDOS) garage and gas station facility. This building was dismantled in 2009. The New York City Parks Department (NYC Parks) currently owns the IRM Site and uses it for parking and storage. It wishes to redevelop the property as a park.

The IRM Site is zoned as "park" and the surrounding areas are zoned for manufacturing (M3-1), and the IRM Site is surrounded by commercial and manufacturing businesses. The IRM Site is bordered by North 12th Street and the Bayside Oil terminal to the northeast. A warehouse owned by 10th Street, LLC borders the IRM Site to the northwest and occupies two of the four former parcels of the MGP Site. The same company owns a warehouse across North 11th Street to the southwest of the IRM Site. Both warehouses are operated together as CitiStorage, a records and information storage facility. Kent Avenue borders the IRM Site to the southeast. Across Kent Avenue, on the fourth former parcel of the MGP Site, is an industrial-factory building. A portion of this building appears to be vacant at this time, as evidenced by a "for lease" sign observed on the 11th Street side of the building.

1.2.1 Previous Investigations

Previous environmental investigations have been conducted within and adjacent to the 50 Kent Avenue parcel. Approximate on-site sample locations from previous investigations are shown in Figure 2. The reports are included in Appendix A. The on site findings of these investigations are summarized below.

1.2.1.1 Figures, July 1992, Prepared by Soil Mechanics Environmental, Prepared for New York City Department of General Services

The report associated with these figures was not available for review. The figures depict 12 soil borings (B-1 through B-12) and eight monitoring wells (MW-1 through MW-4 and MW-6 through MW-9) with summaries of contaminant concentrations. Lead, Total Petroleum Hydrocarbon Content (TPHC), and total benzene, toluene, ethylbenzene, xylene (BTEX) are detected across the entire property. Correspondence between NYSDEC and New York City (NYC) states that the report indicates areas of the property with heavy metals (barium, lead, and mercury) in soils.

1.2.1.2 Technical Preliminary Report, June 21, 1995, Prepared by York Analytical Laboratories, Prepared for Lehrer McGovern, Bovis/Thacker Engineering, J. V.

This laboratory report did not provide conclusions about the soil samples collected. Six soil samples were collected and analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), herbicides, and metals. VOCs, SVOCs and metals were detected. Pesticides, PCBs, and herbicides were not detected.

1.2.1.3 Correspondence Between NYSDEC and NYC from May 17, 1995 through October 18, 1996

May 17, 1995 letter from NYSDEC to NYC Department of General Services indicates the presence of high concentrations of heavy metals discovered in a 1992 investigation.

June 7, 1995 letter from NYSDEC to NYC Department of General Services reports the NYCDOS submitted a 1992 report prepared by Soil Mechanics Environmental Services. The report refers to areas of soil contamination with heavy metals including barium, lead, and mercury on the 50 Kent Avenue parcel. NYSDEC requested the collection of additional samples in the areas of heavy metals to confirm the presence of potential hazardous waste and to delineate the areas of contamination.

A February 1, 1996, NYSDEC intra office memorandum indicates that lead concentrations range up to 1,420 parts per million (ppm) in the soils and exceed class GA groundwater standards. Mercury was found in borings at concentrations up to 1.28 ppm and boring logs indicate the presence of elemental mercury. Trichloroethylene was detected in one boring and thousands of ppm of several chlorinated compounds were detected in groundwater.

A March 27, 1996, NYSDEC intra office memorandum states that after review of the Investigative Summary and Remedial Plan for the Department of Sanitation, extensive soil and groundwater contamination was identified for heavy metals and VOCs for the entire property. Most of the concentrations are above the TAGM 4046 guidelines but none of the samples failed for Toxicity Characteristic Leaching Procedure (TCLP) analysis. The memorandum recommends the addition of the property for “P” delineation and recommends very limited remediation only for petroleum related contaminants. Further investigation and more extensive remediation will be required for the property.

April 8, 1996, letter from NYSDEC to NYC Department of General Services indicates that “P” notification designates the site as a potential hazardous waste site.

September 13, 1996, Raritan Enviro Sciences, Inc. (RES), memorandum reports that on September 11, 1996, free phase petroleum product appearing to be diesel fuel was discovered for the first time in MW-2 located adjacent to the motor fuel tank system at the site. The product

appeared to be a result of product loss incurred by the active diesel tank system earlier that year. Also, during the attempt to develop MW-3, evidence of possible free phase coal tar and/or creosote was discovered. Product was found in what appeared to be a separate dense phase at the bottom of the well. RES recommended the skimming off of petroleum product in MW-2 followed by implementation of a passive recovery system. Further discussion between all involved parties is proposed regarding the product in MW-3.

October 18, 1996 letter from NYSDEC to NYC Law Department provides comments on and conditional approval of the Phase Two RI Work Plan.

1.2.1.4 Quarterly Monitoring Report Brooklyn North 1 January 2004-April 2004 Prepared by LiRo Prepared for NYC

LiRo submitted a quarterly monitoring report to NYSDEC describing site conditions, progress of remediation, and future recommendations for the NYCDOS Brooklyn North 1 facility located at 50 Kent Avenue. In a letter dated February 7, 2002, NYSDEC approved a plan to use a combination of oxygen release compound (ORC), bio-nutrient slurry, and vacuum enhanced fluid recovery (EFR) to address impacts associated with NYCDOS activities at the Site.

LiRo reports that the facility consists of an approximately 44,000 square foot garage used for vehicle storage and maintenance bordered to the east by an approximately 34,000 square foot parking lot. One 2,000 gallon gasoline and two 2,000 gallon fuel oil underground storage tanks (USTs) located in a common vault are identified as closed in place with reported leakage associated with piping failure. Approximately 15 yards of visibly contaminated soils were removed from around the tank ports during closure. One petroleum spill was reported to NYSDEC for the site, the assigned spill number is 94-01167.

From 2000 through April 2004, LiRo has removed 6,402 gallons of contaminated fluids, of which approximately 131 gallons is free product.

Applications of bio-nutrient slurry began in January 2003 and continued once per week for six consecutive weeks and on February 27, 2003, and August 27, 2003, ORC was applied to the wells. A persistent plume of diesel fuel free product was identified around MW-2 and kerosene free product was intermittently observed in LW-1 and LW-2 located across N 12th Street. The kerosene is not attributed to the Site.

April 2004 groundwater sampling results indicate that aside from a significant decrease in total VOC concentrations in one well, recent groundwater quality in the treatment area remains relatively stable or slightly higher than concentrations measured in December 2003 and bacteria counts in the treatment area have significantly decreased. NYSDEC requested that LiRo either install a product skimmer in MW-2 or excavate the area. Due to the shallow depth of product,

LiRo recommends excavating an approximately 6 by 6 foot area around the well to a depth of 6.5 feet and reinstalling the well.

1.2.1.5 Quarterly Monitoring Report Brooklyn North 1 November 2004-January 2005 Prepared by LiRo Engineers, Inc. Prepared for NYC

LiRo submitted a quarterly monitoring report to NYSDEC describing site conditions, progress of remediation, and future recommendations for the NYCDOS Brooklyn North 1 facility located at 50 Kent Avenue.

Site conditions and bio-nutrient injections are reported the same as the previous January to April 2004 monitoring report. Quarterly groundwater samples collected on January 3, 2005 indicate an increase of total VOC concentrations in four of the five monitoring wells sampled compared to the previous quarter sampling results. Biochemical sampling results show substantial dissolved oxygen levels continue to be present on site. Heterotrophic bacteria counts continue to fluctuate with an increase in bacteria counts in two of the wells.

In December 2005 an area of approximately 10x10x7.5 feet deep was excavated around the MW-2 location where diesel fuel free product had been observed. No free product was observed within the excavation limits. Soil samples were collected from the four sidewalls and bottom of the excavated area before backfilling. Analytical results show elevated SVOC concentrations in all five samples and elevated VOC concentrations in four of the five samples. MW-2 was replaced in January 2005. LiRo will add two additional wells to the quarterly sampling plan and survey the existing site wells.

1.2.1.6 Site Investigation Report, November 2006, Prepared by Metcalf and Eddy of New York, Inc. (M&E), Prepared for NYC Department of Design and Construction

For the proposed construction of the Williamsburg Park by the City of New York, the City Department of Design and Construction completed a Site Investigation (SI) at a property identified by the NYC Office of Environmental Coordination which included the Williamsburg Works former MGP site and surrounding area. The purpose of the SI was to evaluate the lateral and vertical extent of potential contamination in subsurface soil, sediment, and groundwater that may relate to historic and current on site and off site operations. The following summary description of the report (prepared for the City by M&E and its findings only include the 50 Kent Avenue parcel).

A subsurface investigation of the parcel was conducted that included the following:

- Collection of 27 soil samples within 13 soil borings (BPB-10 through BPB-22)
- Collection of 8 groundwater samples taken from 5 newly installed wells (MW-5 through MW-8) and 2 previously installed wells (MW-7X and MW-8X).

M&E submitted the *Site Investigation Report* dated November 2006. The report describes the following nature and extent findings:

- Soil and groundwater samples were analyzed for target compound list (TCL) VOCs, TCL SVOCs, PCBs, and target analyte list (TAL) metals.
- Analytical soil samples were compared to the NYSDEC standards identified in Technical and Administrative Guidance Memorandum (TAGM) No. 4046 (Recommended Soil Cleanup Objectives [RSCO] and Soil Cleanup Objectives to Protect Groundwater Quality [SCOPGQ]); Spill Technology and Remediation Series (STARS) Memo No.1, TCLP Alternative Guidance Values; and, Characteristics of Hazardous Waste published in Resource Conservation and Recovery Act (RCRA) and NYSDEC Part 371.
- Analytical groundwater samples were compared to NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Memorandum (Ambient Water Quality Standards [AWQS] and Guidance Values and Groundwater Effluent Limitations); and, Characteristics of Hazardous Waste published in RCRA and NYSDEC Part 371.
- Visual petroleum impacts were observed in 4 of the 13 soil borings at depths ranging from 5 to 19 feet bgs.
- Visual coal tar impacts were observed in 11 of the 13 soil borings at depths ranging from 5 to 55 feet bgs.
- TCL VOCs were detected in 21 of the 27 soil samples above the NYSDEC RSCOs, NYSDEC RSCOs to Protect Groundwater, and STARS TCLP Alternative Guidance Value.
- TCL SVOCs were detected in 19 of the 27 soil samples above the NYSDEC RSCOs, 18 of the 27 soil samples above the NYSDEC RSCOs to Protect Groundwater, and 20 of 27 soil samples above the STARS TCLP Alternative Guidance Value.
- TAL Metals were detected in all 27 soil samples above the NYSDEC RSCOs, and 4 of the 27 soil samples above the NYSDEC Eastern USA Background Criteria.
- TCL VOCs were detected in all 8 of the groundwater samples above the NYSDEC TOGS Groundwater Criteria.
- TCL SVOCs were detected in 6 of the 8 Groundwater samples above the NYSDEC TOGS Groundwater Criteria.
- PCBs were not detected above the NYSDEC TOGS Groundwater Criteria.
- TAL Metals were detected in all 8 groundwater samples above the NYSDEC TOGS Groundwater Criteria.

The SI Report references and summarizes a number of previous investigations performed at the site. Titles and reported findings of these reports are listed below:

- A Phase I Environmental Site Assessment (ESA) was completed by Energy and Environmental Analysts, Inc. (EEA) in April 1998 at the NYCDOS yard. An UST was

identified beneath the floor of the building. The tank was reportedly used as an oil/water separator for rainwater runoff from delivery trucks at the lumber company which formerly occupied the Site. This report also reports 41 NYSDEC spill incidents within a half mile radius but concludes that although soil and groundwater contamination has resulted from some of the spills, it is unlikely that significant contamination at the site is a result of these spill incidents.

- A Limited Subsurface Corridor Investigation Report was completed by EMTEQUE Corporation in January 2003 which included one sample that was collected from the 50 Kent Avenue NYCDOS facility. The sample contained VOCs and SVOCs at levels greater than NYSDEC guidance values as well as concentrations of mercury and zinc above the NYSDEC RSCOs.
- An Interim Site Remediation Plan Addendum, prepared by LiRo in December 2001, identified three former USTs at the property leased by the NYCDOS. One 2,000 gallon gasoline UST and two 2,000 gallon diesel fuel USTs are reported as abandoned in place. NYSDEC noted that contamination from the former MGP was present within the subsurface soil and groundwater.
- A Phase I ESA was conducted by Fleming-Lee Shue (FLS) in 2003 for the proposed Williamsburg Park along Kent Avenue from 9th Street to Quay Street, including the 50 Kent Avenue parcel. The Phase I concluded that deep contamination likely exists at the site due to the former petroleum distillery and MGP operations and shallow contamination at the former MGP site appears to be more significant than the portion of the site formerly occupied by the petroleum distillery.

1.2.1.7 Remedial Investigation Work Plan for the Williamsburg Works Former MGP Site, May 2008 by GEI Consultants, Inc.

In August 2007 National Grid's predecessor, KeySpan, completed a modification to their AOC and administrative settlement #A2-0552-0606 with NYSDEC to include the Williamsburg Works former MGP in the order. In June 2009, National Grid began a RI of the Williamsburg Works former MGP. This work was completed in accordance with the NYSDEC-approved *Remedial Investigation Work Plan for the Williamsburg Works Former MGP Site*, dated May 2008, and three NYSDEC-approved addendums. A 50 Kent Avenue addendum was approved on December 3, 2008, a 35 Kent Avenue addendum was approved on March 3, 2009, and an addendum for deeper borings at 50 Kent Avenue was conditionally approved on December 10, 2009, and finalized on December 17, 2010.

GEI executed the RI work plan at and adjacent to the Williamsburg Works former MGP between June 4 and December 30, 2010. The field activities included:

- Surface soil samples at nine locations (WW-SS-01 through WW-SS-09)

- Fifty-six subsurface borings (WW-SB-01 through WW-SB-11, WW-SB-13 through WW-SB-32, WW-SB-34 through WW-SB-42, WW-MW-01 through WW-MW-08, and WW-MW-10 through WW-MW-17) installed using Geoprobe® or sonic drill rigs
- Six test pits (WW-TP-01 through WW-TP-06)
- Seven sediment cores (WW-SED-01 through WW-SED-07) installed using vibracore methods
- Groundwater samples at sixteen monitoring well locations (WW-MW-01 through WW-MW-08 and Ww-MW-10 through WW-MW-17) and six temporary monitoring well locations.

National Grid submitted a data transmittal letter, titled *Draft Remedial Investigation Interim Data Summary, Williamsburg Works Manufactured Gas Plant (MGP) Site* (Draft RI Interim Data Summary), to NYSDEC on August 25, 2010. This letter transmittal provided analytical results for the soil, sediment, and groundwater samples collected during the RI activities. The Interim Data Summary identified the need for further investigation to define the nature and extent of impacts at the Site; however, NYSDEC requested that National Grid not prepare an interpretative Remedial Investigation Report at this time.

1.2.2 Site Geology

The Williamsburg Works former MGP is underlain by artificial fill and glacial deposits (outwash sands and glacial till) according to published information. According to the 1989 *Surficial Geologic Map of New York, Lower Hudson Street* (Cadwell, 1989), the glacial till beneath the MGP is of variable texture (i.e., clay, silt-clay, boulder-clay) and typically poorly sorted, with variable clast contents that are well rounded and of varying lithologies. Crystalline bedrock underlies the till, the contact of which is located at approximately elevation -100 feet (National Geodetic Vertical Datum [NGVD] 1929) according to Buxton et al. (1981).

Fill material was observed in the subsurface soils beneath the IRM Site and surrounding areas during the RI and other previous investigations. Brick, concrete, wood, and coal were generally encountered to approximately 25 feet, and observed as deep as 35 feet. Below the fill layer, stratigraphy was predominately widely graded sand. A confining clay layer was observed across the IRM Site, ranging in thickness from 12.3 to 26.7 feet. The top of the clay layer was observed from 40.7 to 72 feet below ground surface (bgs).

1.2.3 Site Hydrogeology

During the RI and other previous investigations, groundwater was encountered between approximately 2 and 10 feet bgs. Groundwater on the IRM Site flowed west and northwest toward the East River. Groundwater measured within the gas holder tanks was elevated relative

to the surrounding water table. Groundwater immediately outside holder structures was also elevated relative to the surrounding water table.

The East River is located at the northwestern boundary of the Williamsburg Works former MGP site and is a saline Class I water body.

1.3 Project Organizational Structure and Responsibility

National Grid will coordinate with NYSDEC, NYSDOH, and local regulatory agencies to conduct the PDI activities proposed by this IRM Design Work Plan. Approval of this work plan by NYSDEC will be obtained prior to commencement of any PDI activities. It is anticipated that NYSDEC and/or NYSDOH will have representatives on site periodically during the PDI activities.

Data collected from PDI activities will be summarized and presented in an IRM Data Report. The report will be submitted to NYSDEC and will present the design parameters of the remedial approach (i.e., excavation and/or stabilization, recovery) that will sufficiently achieve the IRM goals as detailed in Section 3.0. It will also identify any remaining design data gaps (e.g. pilot testing). We anticipate meeting with NYSDEC following this submittal to discuss and make any necessary modifications that will facilitate the development of the Final IRM Design and Implementation Plan. Following NYSDEC approval of the IRM Data Report, National Grid will prepare and submit the Final IRM Design and Implementation Plan to NYSDEC. This plan will include supplemental work plans that may be necessary to close remaining data gaps and develop the final IRM design (i.e. sheet pile/cutter soil mix [CSM] pilot tests, groundwater pump test, etc.). This will also include the schedule to develop the final design of the remedial approach and provide an estimated implementation plan and schedule. NYSDEC approval of the Final IRM Design and Implementation Plan will be obtained prior to implementation of the IRM.

National Grid will have final responsibility for all aspects of the PDI, design and IRM activities at the IRM Site. National Grid will be responsible for all communication with regulatory agencies, members of the surrounding community and the media.

The Engineer (GEI), under contract to National Grid, will serve as the Engineer of Record for the IRM and act as National Grid's representative on the IRM Site. As such, the Engineer will be responsible for engineering design, oversight of contractors to ensure compliance with Contract Documents, implementation of the Community Air Monitoring Plan (CAMP), collection of PDI data, necessary confirmation and documentation samples, maintenance of IRM Site logs and contractor invoice and change order review if requested by National Grid. If necessary, National Grid and/or the Engineer will subcontract appropriate contractors (Contractor) to perform

specific activities associated with the activities proposed by this IRM Design Work Plan and future IRM work.

The following are key personnel or agencies involved with IRM activities at the IRM Site:

National Grid:	Mr. Donald Campbell Project Manager National Grid Site Investigation and Remediation 287 Maspeth Avenue Brooklyn, NY 11211 (718) 963-5453
NYSDEC:	Mr. Henry Willems Environmental Engineer New York State Department of Environmental Conservation 625 Broadway Albany, NY, 12233 (518) 402-9662
NYSDOH:	Ms. Bridget Callaghan New York State Department of Health 547 River Street Troy, NY 12180
GEI:	Ms. Melissa Felter Project Manager 455 Winding Brook Drive Glastonbury, CT 06033 (860) 368-5328
	Mr. Matt Levinson Senior Remediation Engineer 1 Greenwood Ave., Suite 210 Montclair, NJ 07042 (973) 873-7114

2. Nature and Extent of Contamination at 50 Kent Avenue

A summary of findings and the current conceptual site model developed from the findings is provided in the following paragraphs. These sections focus on soil and groundwater impacts on or adjacent to the 50 Kent Avenue parcel. Figure 2 presents locations of soil borings, monitoring wells, and test pits executed during the RI and previous site excavations.

2.1 Previous Site Investigations

Contamination at 50 Kent Avenue was identified in Figures prepared by Soil Mechanics Environmental in July 1992. These figures identify elevated concentrations of lead, TPHC and total BTEX in both soil and groundwater.

LiRo performed quarterly monitoring and used a combination of ORC, bio-nutrient slurry, and vacuum EFR to address impacts associated with NYCDOS activities and USTs during at least 2004 and 2005. LiRo has also removed over 6,500 gallons of contaminated fluids, of which approximately 131 gallons is free product from wells. In December 2005, an area of approximately 10 by 10 by 7.5 feet deep was excavated in an area where diesel fuel free product had been observed. No free product was observed within the excavation limits, but soil analytical results show elevated VOC and SVOC concentrations.

The *Site Investigation Report*, November 2006 by Metcalf and Eddy of New York, Inc. identified both petroleum and coal tar related visual impacts. Coal tar impacts are present throughout the majority of the site from depth ranging from 5 to 55 feet bgs. Petroleum impacts were observed in most of the western half of the site from depth ranging from 5 to19 feet bgs.

2.2 Remedial Investigation

GEI executed the NYSDEC-approved RI work plan at and adjacent to the Williamsburg Works former MGP site from June 4 to December 30, 2010. Analytical samples were submitted to TestAmerica, a New York State Analytical Services Program (NYSASP)-approved laboratory in Shelton, Connecticut, for chemical analyses. RI sample locations and results are presented in the August 25, 2010, Draft RI Interim Data Summary. This section focuses on soil and groundwater impacts on or adjacent to the 50 Kent Avenue parcel.

All test pit soil samples were analyzed for VOCs, SVOCs, metals, herbicides, pesticides, PCBs, and free cyanide. Groundwater samples were analyzed for the same parameters, with the

exception of free cyanide; groundwater samples were analyzed for total cyanide. All subsurface soil samples were analyzed for VOCs, SVOCs, metals, and free cyanide. In addition, one sample from the fill layer within each boring was analyzed for herbicides, pesticides, and PCBs.

The analytical results for soil samples were validated and compared against the 6NYCRR Subpart 375 Unrestricted Use Soil Cleanup Objectives (Unrestricted SCOs) and Restricted Use Commercial SCOs (Commercial SCOs). The Commercial SCOs were chosen because the planned future use of the IRM Site is a park.

Six test pits were installed to depths of 3 to 6.5 feet at the 50 Kent Avenue parcel during RI activities (Figure 2). There were no visual impacts observed in the test pits at the 50 Kent Avenue parcel. However, a petroleum-like sheen was observed on the infiltrated groundwater in one test pit (WW-TP-03). The concentrations of PCBs, herbicides, and free cyanide were either not detected or present below Unrestricted SCOs in test pit soils samples. Concentrations of VOCs, SVOCs, pesticides, and metals were present in these samples above the Unrestricted SCOs. Concentrations of polycyclic aromatic hydrocarbons (PAHs) and lead were present in test pit soil samples above the Commercial SCOs.

Visual impacts (e.g. petroleum staining) and tar-related impacts (e.g. sheen) were observed in the top 5 feet of soils at and adjacent to the IRM Site. Within these shallow soils, concentrations of VOCs, SVOCs, PCBs, pesticides, and metals were present above the Unrestricted SCOs. Concentrations of PAHs and some metals were detected above the Commercial Use SCOs.

Below 5 feet, subsurface soils exhibited visual petroleum impacts including staining and sheen to as deep as 18.5 feet bgs. Tar impacts including sheen, staining, blebs and globs, coatings, lenses, and tar saturation were also encountered to approximately 60 feet bgs. Naphthalene-like odors were detected in soils as deep as 65 feet bgs.

Soils deeper than 5 feet bgs contained concentrations of VOCs, SVOCs, and metals above the Unrestricted SCOs. BTEX, SVOCs, and metals were detected at concentrations above the Commercial SCOs. Samples collected at the termination of borings above the clay did not exceed the Commercial or Industrial SCOs with the exception of one boring on the 50 Kent Avenue parcel (WW-SB-23), which contained concentrations of PAHs slightly above the Commercial SCOs.

There were no visual impacts in soil collected below the clay layer. A naphthalene-like odor was recorded in the soil directly below the clay layer in one boring on the 50 Kent Avenue parcel (WW-SB-42). Within this soil, concentrations of BTEX, PAHs, and manganese were present above the Unrestricted SCOs. Benzo(a)pyrene was detected at a concentration above the Commercial SCO. Soils collected at the termination of the borings that extended below the clay

contained metals at concentrations above the Unrestricted SCOs. Barium was the only metal with a concentration that exceeded the Commercial SCOs.

The analytical results for groundwater samples were compared to the New York AWQS. These standards are for drinking water consumption; however, the IRM Site and surrounding area are supplied with potable water from the City of New York.

Tar and petroleum impacts, including sheen, petroleum-like odors, and naphthalene-like odors were encountered in multiple monitoring wells and temporary monitoring points during sampling. Groundwater samples detected concentrations of VOCs, SVOCs, metals, pesticides and total cyanide above the AWQS. Concentrations of PCBs and herbicides were not detected above the AWQS.

2.3 Site Conceptual Model

Following the RI activities, the eastern extent of tar-impacted soils at the Williamsburg Works former MGP site appears to have been delineated by sample locations on Kent Avenue, the 35 Kent Avenue parcel, and Wythe Street. The boundary of tar to the north, south, and west of the Site has not yet been defined. Data collected during the RI suggests the sources of tar are the former gas holder tanks and tar handling structures which are located within the 50 Kent Avenue parcel. Tar-saturated soils were generally observed in the coarse-grained sand and gravelly sand layers (fill) within and adjacent to the former gas holder at depths ranging from approximately 7.6 to 39.5 feet bgs.

Tar within the former holder tanks was encountered in soil borings WW-SB-03 through WW-SB-08 between 5 and 25.5 feet bgs. The tar impacts have extended from the holder tank on the southeast portion of the IRM Site to the northwest. It appears that tar from the source area generally migrated downward through the permeable fill and sandy deposits until it encountered denser silty lenses that impeded the downward migration of tar. In the center of the 50 Kent Avenue parcel, tar migrated downward until it encountered the clay layer at approximately 60 feet bgs.

The downward progression of tar generally stopped above dense sand and silty lenses prior to reaching the depth of clay. Tar impacts were encountered immediately above the clay layer in two borings outside of Holder No. 1 (WW-SB-23 and WW-SB-41). It appears the tar has not penetrated into the clay; there were no visual impacts observed below the clay layer.

Soil samples collected from the bottom of the former holder structures and adjacent to the former holder tank footprints had the highest concentrations of both total BTEX and total PAHs.

Generally, soil concentrations of total BTEX and total PAHs are significantly reduced away from the three former gas holder tanks and away from the tar.

No measurable dense non-aqueous phase liquid (DNAPL) tar was observed in any of the wells at the IRM Site. MGP and petroleum impacts that are un-related to the MGP were observed in groundwater samples collected at the IRM Site. The highest concentrations of total BTEX and total PAHs in groundwater were collected adjacent to the holder tanks and Department of Sanitation USTs (WW-MW-05[4-14] and WW-SB-07[2.5-7.5]).

Petroleum and solvent-impacted soils that are unrelated to the MGP were encountered within many of the borings installed during the RI. In many cases staining, sheen and odors were commingled with tar impacts. There were USTs containing diesel fuel and gasoline with releases on the Department of Sanitation yard at 50 Kent Avenue. In addition, Bayside Fuel Company is currently located adjacent to the northern property boundary of the IRM Site. The Bayside Fuel Company parcel has been operated by oil companies since at least 1887. The Pratt Works and Standard Oil operated the parcel to the south of the MGP site from prior to1887 until at least 1916. The petroleum and solvent impacts are likely associated with the Department of Sanitation, Bayside Fuel Company and adjacent historic oil operations.

3. IRM Goals and Objectives

3.1 IRM Goals

Section 1.11(a) of the NYSDEC DER-10 establishes "a priority during investigation and/or remediation is to contain and/or stabilize, to the extent possible, sources of contamination in any media to reduce/eliminate receptor exposure to contaminants or to contain further movement of contaminants through any pathway." The guidance further establishes that actions taken to mitigate human or environmental exposure -- such as removal of source areas, hot spots and contaminated material -- before the completion of the RI and appropriate remedial alternative selection are considered IRMs. As such, the goal of this IRM will align and be consistent with the goals described in NYSDEC DER-10 in a fashion that will address MGP-related source material at the IRM Site. While the current cover on the IRM Site (i.e. asphalt pavement and a former building slab) sufficiently eliminates exposure pathways between the MGP-related source material and potential human receptors; this IRM Design Work Plan proposes initial PDI activities to gather data necessary to define the practical extent and design that an appropriate IRM can address (i.e. remove, stabilize, and/or contain/cap) MGP-related source material.

The means, or the design parameters of the remedial technology, that will achieve this goal require additional data. The PDI activities proposed by this IRM Design Work Plan are meant to gather geotechnical and subsurface data required to effectively design the remedial approach (i.e., excavation and/stabilization, recovery) to address the MGP-related source material at the gas holder tanks, to the extent practicable. Additional soil borings are also required to further delineate the shallow and deep MGP-related source material between the former gas holder tanks and the Block 2287, Lot 16 property. These data points are needed to help determine the means to implement a remedial technology that will address the goals of this IRM.

3.2 IRM Design Work Plan Objectives

Remedial Action Objectives (RAOs) are medium-specific or operable-unit specific objectives for the protection of human health and the environment that are identified for the remedy selection process. RAOs are developed based on contaminant-specific Standards, Criteria and Guidance (SCGs) and the intended land use. DER-10 states that RAOs may be established using either generic RAOs as applicable to the contaminants at the IRM Site identified by the RI or site-specific RAOs where the generic RAOs do not address a unique site condition.

As stated above, the goal of this IRM will align and be consistent with the goals described in NYSDEC DER-10 in a fashion that will address MGP-related source material at the IRM Site. While the current cover on the 50 Kent Avenue parcel (i.e. asphalt pavement and a former

building slab) sufficiently eliminates exposure pathways between the MGP-related source material and potential human receptors; this IRM Design Work Plan proposes initial PDI activities to gather data necessary to define the practical extent and design that an appropriate IRM can address (i.e. remove, stabilize, and/or contain/cap) MGP-related source material. Therefore, the primary objective of these proposed PDI activities is to collect sufficient data necessary to properly determine the means to implement a remedial technology that will address the goals of this IRM. Examples of additional data required include:

- Geotechnical data related to soil strength and stability for design of potential earth support systems or stabilization technologies
- Hydraulic conductivity, site-specific yield, and other data for development of a baseline groundwater model to evaluate the management of the groundwater during IRM implementation
- Information regarding the construction of foundations of buildings adjacent to the IRM Site
- Data identifying noise and vibration levels anticipated and allowable under the site-specific circumstances during IRM activities

Other activities needed to develop an approach to meet the IRM goals include:

- Determine the design parameters to design and implement the remedial approach
- Develop an IRM Design and Implementation Plan (perform Supplemental Pilot Tests as needed to complete the Final Design)
- Develop and provide a schedule for the completion of the final IRM construction activities

More specific RAOs for both soil and/or groundwater will be developed and submitted with the Final IRM Design and Implementation Plan once a remedial approach is selected and designed.

4. IRM PDI and IRM Summary

4.1 Execution of the PDI for the IRM

This IRM Design Work Plan proposes PDI activities required to determine the design parameters necessary to design and implement the remedial approach (i.e., excavation and/or stabilization, recovery) that sufficiently addresses the goals of this IRM. Based on the PDI data, additional remedial design investigative activities may be necessary to fully design the remedial approach. Potential additional remedial design investigation activities are described below in subsection 4.4. These activities include sheet pile or CSM wall pilot tests, groundwater pump tests, NAPL stabilization and/or recovery pilot tests, and would be included in the IRM Design and Implementation Plan. The design parameters and any additional investigation activities required to complete its design will be presented and proposed in the IRM Data Report as detailed below.

Data collected from PDI activities will be summarized and presented in an IRM Data Report. The report will be used in support of the formal design effort and will be provided to contractors for preparation of bids and construction. The report will be submitted to NYSDEC and present the design parameters of the remedial approach that will sufficiently achieve the IRM goals. It will also identify any remaining design data gaps (e.g. pilot testing). Following NYSDEC approval of this submittal, National Grid will prepare and submit the Final IRM Design and Implementation Plan to NYSDEC. This plan will include supplemental work plans that may be necessary to close remaining data gaps and develop the final IRM design (i.e. sheet pile/CSM pilot tests, groundwater pump test, etc.). This also will include the schedule to develop the final design of the remedial approach and provide an estimated implementation plan and schedule. NYSDEC approval of the Final IRM Design and Implementation Plan will be obtained prior to implementation of the IRM.

In summary, the following are milestones that will require NYSDEC approval prior to IRM execution:

- IRM Design Work Plan (described below):
  - Pre-Design Investigation Activities
    - Environmental and Geotechnical Investigation Activities
    - Baseline Groundwater Model
    - Background Noise and Vibration Investigation
    - Utility Survey and Subsurface Infrastructure Investigation
    - Adjacent Building Foundation Investigation
    - NAPL Stabilization Bench Test
    - Evaluate the Suitability of Recovery Wells

- IRM Data Report
- IRM Design and Implementation Plan (activities, if necessary, not limited to):
  - Sheet Pile Pilot Test
  - CSM Wall Pilot Test
  - Groundwater Pump Test
  - NAPL Stabilization Pilot Test
  - NAPL Monitoring and Recovery Pilot Test
- Final IRM Design

The above milestones and anticipated submittal times are discussed in more detail below.

4.2 Pre-Design Investigation Scope of Work

The primary purpose of the PDI is to obtain supplemental IRM Site information that will help determine the design parameters necessary to design and implement the remedial approach that sufficiently addresses the goals of this IRM. For example, additional data on subsurface obstructions, utilities, and debris needs to be gathered. Additional information is needed to evaluate the constructability and design of various excavation support required to permit the potential removal of the remnants of the three former gas holder tanks which are estimated to extend approximately 30 feet bgs. A removal of this depth could require an excavation support system (i.e., sheeting) that could extend 70 to 80 ft bgs, a benching/sloping method, or a complex hybrid of sheeting and CSM. All various designs would require a significant groundwater management system and the PDI data proposed herein. NAPL compatibility with stabilization techniques also needs to be evaluated if MGP-related source materials are to be stabilized in place. This approach would also require an evaluation of potential ground heave/spoils management.

The following sections describe the PDI activities to be performed at the IRM Site. Based on the PDI data, additional IRM design investigation activities may still be needed to complete the final design of the remedial approach. This may include sheet pile, CSM wall, or NAPL stabilization pilot tests. It is anticipated that these types of investigative activities will be identified in the IRM Data Report and detailed in the IRM Design and Implementation Plan.

4.2.1 Environmental and Geotechnical Investigation

An investigation will be conducted to acquire geotechnical data and further delineate the extent of MGP-related source material through field explorations, including test borings and test pits. The geotechnical data will be used to evaluate excavation support systems and evaluate potential stabilization of deep MGP-related source material if necessary. The additional MGP-related source material delineation data will be used to evaluate the extent of potential excavation limits and the extent of mobile MGP-related source material suitable for stabilization or recovery.

Selected samples of soils and NAPL collected from the test borings will be subjected to geotechnical laboratory and potential compatibility testing.

4.2.1.1 Soil Borings, Monitoring Wells, and Test Pits

To evaluate removal of the gas holder tanks, the investigation will include four geotechnical soil borings (WW-SB-100 through WW-SB-103) along the location of the potential excavation support system at the IRM Site. The four borings will be spaced at intervals of approximately 200 feet surrounding the footprint of the former gas holders and will be advanced to depths ranging from approximately 70 ft to 80 ft bgs. The approximate locations of the borings are depicted in Figure 3. Additional locations may be necessary if subsurface conditions at adjacent boring locations are sufficiently variable as to impact design decisions.

To further delineate the extent of MGP-related source material and evaluate the feasibility of deep MGP-related source stabilization and further define the limits of any potential shallow excavation, a minimum of 7 borings (WW-SB-104 through WW-SB-110) will be advanced to the top of the clay layer encountered at approximately 60 ft bgs to delineate MGP-related source material and collect additional geotechnical information. These 7 borings are spaced roughly 50 feet from each other, previous borings installed during the RI, and other previously installed borings described in subsection 1.2.1 above.

The soil borings will be advanced using hollow-stem auger drilling methodologies. The initial 5 feet of each boring will be advanced using soft dig procedures to identify potential utilities. If refusal occurs, the depth and drilling information (e.g. hard refusal) will be noted and the boring will be offset approximately 5 feet.

Geotechnical data will be collected to support the evaluation of excavation support systems and potential MGP-related source material stabilization. Standard penetration tests will be performed in each boring. Borings WW-SB-100 through WW-SB-110 will be continuously sampled throughout from the surface to the clay layer to delineate the extent of MGP-related source material. Additional samples may be collected from organic and fine-grained soils using a thin-walled sampler. Field permeability tests (e.g., falling and/or constant head tests) will be performed in selected boreholes and monitoring wells to assist in evaluation of potential dewatering quantities.

Two intermediate and one deep monitoring well will be installed at proposed geotechnical soil boring locations WW-SB-100 and WW-SB-102. These monitoring wells are necessary to evaluate the groundwater conditions and parameters as discussed below. Intermediate wells will be installed above the clay layer at both borings. A deep well below the clay layer will also be installed at WW-SB-102. All wells will be installed in accordance with the NYSDEC-approved Field Sampling Plan. Borings not completed as wells will be tremie grouted to grade using a

Portland cement/bentonite slurry mixture. One round of site-wide groundwater elevation gauging will be performed, in which all accessible site monitoring wells associated with the Williamsburg Works former MGP site will be gauged. Additional elevation gauging will be necessary if seasonal variations are observed when comparing data from this initial round to historical measurements taken by previous Site activities

Laboratory testing of the samples collected from the test borings will consist of geotechnical index tests (i.e., grain-size, organic content, Atterberg Limits, bulk density, and moisture content tests, etc.) to assist in identifying appropriate geotechnical parameters for design of the excavation support systems, as well as, compatibility testing with stabilization materials. Selected samples of fine-grained soils may also be subjected to consolidation testing.

Test pits will be conducted at selected locations along the proposed shoring perimeter and adjacent to the gas holder tanks to assist in evaluating the nature and extent of obstructions and utilities present in the urban fill stratum and their potential impact on the installation of potential excavation shoring systems or stabilization procedures. If findings from the sampling conducted at WW-SB-105 through WW-SB-109 indicate that the currently anticipated shoring perimeter will need to be shifted to the northwest, then additional test pits would be conducted at the revised perimeter location.

Each test pit will be photographed and logged by the field representative during excavation. All material removed from the test pit will be placed on polyethylene sheeting. Odor-suppressing foam and/or other appropriate means to mitigate odor (e.g. plastic sheeting) will be used to control odor emissions that may result from excavating potentially impacted soils. Approximately 14 test pits (WW-TP-100 through WW-TP-113) will be conducted, extending to depths up to approximately 8 to 12 feet below the ground surface. The proposed test pit excavation locations are shown in Figure 3.

All work will be performed in accordance with the NYSDEC-Approved *Health and Safety Plan* (HASP), *Quality Assurance Project Plan* (QAPP), and *Field Sampling Plan,* Appendices B through D, respectively.

4.2.1.2 Groundwater Model

The potential dewatering rates and volume of groundwater to be removed during any type of excavation is a major concern. It is anticipated that a temporary groundwater treatment plant may need to be constructed somewhere on the property to treat and discharge it to the sanitary sewer. At a minimum, hydraulic conductivity, horizontal and vertical gradients, soil porosities, and other pertinent hydrogeologic data are necessary to evaluate the options for groundwater management. Therefore, a baseline groundwater model will be developed to establish design parameters required to appropriately design any type of excavation below the water table. The

field investigation described in subsection 4.2.1.1 includes well installation, groundwater elevation monitoring, and slug tests to assess and evaluate groundwater behavior and flow and support the model. Two intermediate and one deep monitoring well will be installed at proposed geotechnical soil boring locations WW-SB-100 and WW-SB-102. These monitoring wells are necessary to complete this evaluation. The purpose of installing intermediate and deep wells is to assess the potential for vertical gradients that could influence groundwater behavior during or after remedy implementation.

The baseline groundwater model will consist of a simplified three-dimensional numerical model. The model will be developed using Visual Modflow. The model will be constructed to represent the typical horizontal and vertical gradients and hydraulic conductivities measured in fill and native soil on site (significant localized variations within either strata would also be included if necessary). The objective of the model will be to estimate excavation dewatering pumping rates, and to assess the effect of an excavation support system on the surrounding water table. The model may be used to assist in the design of mitigation measures, such as relief drains, if the degree of model-predicted mounding of the water table upgradient of the excavation support system is unacceptable. Furthermore, the model will help determine if a groundwater pump test is required to complete the remedial design.

4.2.2 Noise and Vibration Investigation

A survey will be conducted at the IRM Site and structures immediately adjacent to the IRM Site to measure background noise and vibration levels. The background noise and vibration data will be used to determine if noise and vibration mitigation measures are needed during construction to comply with the New York City Noise Code and other noise and vibration guidelines. The general scope of work for this investigation includes the characterization of existing noise and vibration conditions and assessment of vibration propagation characteristics at the site and surrounding areas. It will also include the prediction of future noise and vibration conditions during remedial activities, assessment of noise and vibration impacts, and recommended mitigation measures. At a minimum, the investigation will include:

- A survey of noise- and vibration-sensitive land-use within 500 feet of the site
- Noise will be monitored adjacent to nearby residences and businesses at up to six locations and on a 24 hours basis for a minimum of one week to develop a baseline noise pattern. This will be performed in the summer months. An identical survey will be performed in the winter months. In addition, noise will be monitored for a minimum of 1 hour at up to six locations around the site perimeter during the above week-long events.
- Vibration propagation characteristics of the ground will be assessed between the site and adjacent properties/buildings and utilities considered to be potentially sensitive to vibrations. Vibration monitoring to evaluate these characteristics will be conducted during installation of the steel sheeting required for the pilot study.

- Additional monitoring of background vibration levels will be monitored in the IRM Site vicinity independent of the PDI to provide a record of baseline conditions. Background vibration monitoring would not impact the conclusions of the PDI.
- Projected maximum noise and vibration levels during the remediation construction will be assessed at identified sensitive receptors. Predictions of future noise and vibration scenarios will be made by modeling use of equipment uses, land uses, and hauling routes in conjunction with existing noise and vibration data and potential noise and vibration mitigative measures.

Background noise levels will be measured at nearby noise-sensitive receptors (primarily residences) during two different seasons at the same locations as required by NYC. A Noise Mitigation Plan in accordance with §24-219 of the New York City Noise Code, to be posted at the IRM Site in accordance with the Rules of the City of New York (RCNY) Title 15 §28-100, will be prepared and submitted with the Final IRM Design and Implementation Plan.

The ground vibration transfer mobility determined during the vibration study performed during the proposed PDI activities will be used to determine areas where pre-construction structural surveys of surrounding buildings will be required. Once these areas are established, property owners will be contacted to negotiate access for the pre-construction surveys and, if available, structural plans will be obtained from the property owners, the NYC Department of Small Business Services or the New York City Department of Buildings (NYCDOB) to evaluate potential structural issues.

4.2.3 Utility and Subsurface Infrastructure Investigation

Utilities or other subsurface infrastructure that pass through or are adjacent to the IRM Site perimeter (including the adjacent sewers in Kent Avenue) may impact the type and design of excavation support systems and/or stabilization means and methods. Utilities identified to be present along the proposed excavation support perimeter would significantly impact construction planning as they would require removal or relocation prior to construction. Utility identification in prior studies at the site has only consisted of the mark-out required by law which is needed to conduct subsurface investigations. However, utilities and structures from multiple eras (MGP plant era, City Sanitation building era) and the former Kent Avenue sewer line are known to exist but they were neither identified by utility mark-out, nor were they shown on available utility drawings.

Because of these considerations, additional investigation as part of this PDI to identify potential utilities/infrastructure will include the following:

- A utility mark-out to obtain readily available information regarding active utilities at and surrounding the IRM Site will be used to evaluate proposed or potential remediation activities with respect to adjacent utilities
- Geophysical testing (ground penetrating radar and electromagnetic induction surveys) along the IRM Site perimeter to confirm locations identified by the public utility mark-out and to investigate the presence of other unidentified underground infrastructure
- Review of historic maps and plans in our files obtained as part of our previous investigations at the IRM Site

4.2.4 Adjacent Building Foundation Investigation

The excavation support system used to remove the gas holder tanks and the removal or stabilization methods selected to address the contents of the gas holder tanks will need to be designed to protect the buildings located immediately adjacent to the IRM Site (i.e., Block 2287 (CitiStorage), Block 2294, Block 2277, Block 2288, and Block 2295) during construction activities. Design of the excavation support system or stabilization methods will be dependent on, but will not limited to, the nature and depth of the foundations supporting adjacent structures as well as on the distance of the required remedial excavation from those structures.

NYSDEC has indicated that IRM excavations will not need to encroach closer than 55 feet to the adjacent property line. Therefore, the initial phase of the adjacent building foundation investigation will be to evaluate the type of foundation information that is necessary if excavations are no closer than 55 feet. This initial investigation will include review of available plans in the NYC Department of Buildings and the NYC Department of Small Business Services files for information regarding foundation support of the building.

If the results of the initial phase of this investigation indicate that more detailed as-built data of the existing foundation are needed to design the excavation support system, then we would request permission from the building owner to conduct four or five test pits at the building to expose the existing foundations. If the building owner does not provide permission, design of the excavation support system would need to be conducted assuming worst case conditions.

4.2.5 NAPL Stabilization Bench Tests

Samples of the MGP-related source material will be collected from appropriate areas to evaluate the compatibility with various stabilization materials and develop the parameters to effectively design this remedial technology. A constructability analysis would then be conducted to

determine if there is sufficient space on site to effectively manage the spoils associated with the installation of this remedial approach.

4.2.6 Suitability of NAPL Recovery

Measurements of DNAPL will be collected and recorded using an electronic interface probe to determine the presence and thickness of DNAPL in each of the wells installed during PDI activities and existing wells at the IRM Site. These observations will be cross-analyzed with soil boring logs to determine if a NAPL Recovery Pilot test is necessary before or after source material is removed. However, it is anticipated that the dynamics of any MGP-related source material or residual NAPL in the subsurface would be significantly altered after any type of excavation. Therefore, it would be premature to evaluate NAPL recovery with a pilot test prior to a planned source removal. However, monitoring wells will likely be installed in appropriate areas as noted from PDI activities to monitor for NAPL accumulation after any remedial excavation activity is completed.

4.3 IRM Data Report

Information gathered from the PDI activities will be summarized and submitted to NYSDEC as an IRM Data Report. This report will be used in support of the design effort and will be provided to contractors for preparation of bids and construction. The report will be submitted to NYSDEC as an informational document and present the design parameters necessary to design and implement the remedial approach that will achieve the goals for the IRM Site. The IRM Data Report will be submitted to NYSDEC for approval.

4.4 Remedial Design

After the IRM Data Report is approved by NYSDEC, National Grid will prepare and submit to NYSDEC a Final IRM Design and Implementation Plan. The IRM Design and Implementation Plan will describe the final design activities and propose a schedule of design deliverables and IRM milestones (i.e., 50% Design Package, 95% Design Package; Final 100% Design Package; Procurement Process; Implementation; and Construction Completion Report). Implementation of the final IRM design will not proceed without NYSDEC approval of the Final IRM Design and Implementation Plan and the Final 100% Design Package. Potential investigations that may be included in the Final IRM Design and Implementation Plan are described below.

4.4.1 Pre-Construction Survey

A pre-construction survey will be performed, which will include the following:

- A photo/video-documentation of pre-construction conditions of the property and each structure adjacent to the property will be conducted.

- The locations of cracks or fractures will be identified, documented, measured, evaluated and the crack gauges installed and monitored, if necessary.
- Deformation monitoring points will be identified and monitored, where necessary.

A report of the pre-construction survey results stamped and sealed by a New York State-licensed Professional Engineer will be submitted with the Final IRM Design and Implementation Plan. Prior to construction of the remedial approach, the Contractor will also need to perform a pre-construction survey and develop a Noise Monitoring Plan and a Noise Mitigation Plan in accordance with §24-219 of the New York City Noise Code and posted at the IRM Site in accordance with the RCNY Title 15 §28-100. The Noise Monitoring Plan may include continuous vibration monitoring, periodic measurements of crack gauges and deformation monitoring points, and a mitigation plan to prevent damage to surrounding structures.

4.4.2 Sheet Pile and CSM Pilot Tests

Pilot tests may be necessary to evaluate wall construction for potential removal of the remnants of the three former gas holder tanks. Based on the available information, a potential excavation support system will likely consist of either a steel sheet pile wall or a concrete diaphragm wall installed using CSM methodology. A steel sheet pile wall may generate unacceptable vibrations at the adjacent warehouse building during installation. A pilot test would, therefore, be conducted to evaluate vibrations associated with installation of the steel sheets. If the vibrations associated with the sheet pile wall installation are judged to be unacceptable, a second pilot test would be conducted to evaluate vibrations associated with the CSM approach. The pilot test(s) would also provide information as to whether the presence of obstructions buried in the urban fill stratum would impact installation of either system.

4.4.3 Groundwater Pump Test

Any type of excavation that will extend into the water table may require a groundwater pump test to further define and evaluate groundwater management parameters. The field and laboratory testing conducted as part of subsection 4.2.1.2 above will provide a preliminary basis for evaluating the magnitude of the dewatering system that would need to accompany a selected excavation support system. Depending on the findings of that testing (e.g., the consistency of the findings and the potential cost implications if dewatering quantities are estimated to be very high), it may be necessary to conduct a groundwater pump test at the IRM Site to provide a more accurate estimate of potential dewatering effluent quantities. The pump test set-up would likely consist of one or two pumping wells and several (two to four) monitoring wells spaced at variable distances from the pumping well. The test itself would likely need to operate 24 hours per day for several days in order to achieve steady state or near steady state conditions.

Additional approaches could include:

1. Two relatively shallow (i.e., 30 to 40 feet) short-term pump tests at opposite ends of the parcel – this would address yields should a sump/pit approach be selected and if the floor of the excavation were deemed sufficiently stable.
2. A single longer duration (minimum 48 hour), deeper pump test to address a dewatering point approach that would draw down and maintain head levels below the target floor of the excavation should such an approach be required.

4.4.4 NAPL Stabilization Pilot Test

If appropriate areas are identified for NAPL stabilization, and bench scale testing determines that stabilizing MGP-related source material is feasible, a more extensive analysis of the subsurface strata and potential ground heave may be required. This analysis will help determine heave potential and the potential pattern and spacing of injection points. With proper delineation, the need for a stabilization pilot test can be reevaluated.

4.4.5 NAPL Monitoring and Recovery Test

Additional wells may be required to evaluate the recovery of MGP-related source material at the IRM Site after any excavation of MGP-related source material is completed. The dynamics of any MGP-related source material or residual NAPL in the subsurface would be significantly altered after any type of excavation. Therefore, monitoring wells will be installed in appropriate areas to monitor for NAPL accumulation after any remedial excavation activity is completed.

At each well location exhibiting measurable DNAPL, a pump or bailer will be used to remove tar from the well. Pumping rates will be minimal to inhibit mixing of DNAPL and groundwater. Pumping or bailing will continue until either the quantity of DNAPL is no longer measurable or until continued tar removal is ineffective (i.e. no significant drawdown of DNAPL after two volumes of tar are removed). The volume of DNAPL removed from each well will be measured and recorded and the DNAPL will be placed in an on-site 55-gallon drum for disposal. During removal, the DNAPL level in the monitoring well will be periodically measured and recorded to approximate the rate of removal. Pumping rates will also be measured and recorded. After pumping, the DNAPL level within each well will be measured and recorded to determine the rate of DNAPL recovery within each well. DNAPL recovery within these wells will be measured at least weekly for approximately four to six weeks.

One sample of DNAPL from each well will be collected and analyzed for VOCs, SVOCs, density, and viscosity. In addition, one sample for disposal characterization will be collected.

4.5 Schedule

A tentative schedule for the IRM process was submitted to NYSDEC under separate cover on November 22, 2010. This schedule was only tentative. There remains a large amount of PDI activities that are required to design the remedial approach to achieve the IRM goals. At this point, it is anticipated that the PDI activities described above will likely take at least a year to complete. This will include at a minimum:

- Environmental and Geotechnical Investigation Activities
- Background Noise and Vibration Investigation
- Utility Survey and Subsurface Infrastructure Investigation
- Adjacent Building Foundation Investigation
- Development of a Baseline Groundwater Model
- Evaluate the Suitability of Recovery Wells
- NAPL Stabilization Bench Tests

Each of the proposed activities is interrelated and would influence the scope and design of subsequent PDI activities. Therefore, as each investigation activity or test is completed, an evaluation will refine the scope of subsequent PDI activities (i.e. if no appropriate area outside the proposed excavation limits is identified for NAPL stabilization or if an insufficient amount of NAPL is found to justify stabilization, then a bench test would not be necessary). Furthermore, all of the above activities are contingent on negotiating and gaining access agreements. If additional PDI activities are necessary beyond the scope presented in this IRM Design Work Plan, additional supplemental work plans will be developed for NYSDEC review and approval.

After all the activities are completed, the data collected will be summarized in an IRM Data Report and submitted to NYSDEC. This report is anticipated to be completed and submitted one year following approval of this IRM Design Work Plan. The report will be submitted to NYSDEC and will present the design parameters of the remedial approach that will sufficiently achieve the IRM goals as detailed in Section 3.0. We anticipate meeting with NYSDEC following this submittal to discuss and make any necessary modifications that will facilitate the development of the Final IRM Design and Implementation Plan. Following NYSDEC approval of this IRM Data Report, National Grid will prepare and submit the Final IRM Design and Implementation Plan to NYSDEC. This will include the schedule to develop the final design of the remedial approach and provide an estimated implementation plan and schedule. This plan will likely be submitted to NYSDEC for approval three months after the IRM Data Report is approved. At that point, enough information will be gathered to propose a more specific and detailed implementation schedule. NYSDEC approval of the Final IRM Design and Implementation Plan will be obtained prior to implementation of the IRM. After receiving approval of this plan, National Grid will then proceed through the IRM design process as

proposed in the IRM Design and Implementation Plan. Once the design is complete, a Final IRM Design will be submitted to NYSDEC for approval. The IRM execution (procurement, implementation, and completion) can then proceed after that approval.

In summary, the following are milestones that will require NYSDEC approval prior to IRM execution:

- IRM Design Work Plan:
  - Pre-Design Investigation Activities
    - Environmental and Geotechnical Investigation Activities
    - Baseline Groundwater Model
    - Background Noise and Vibration Investigation
    - Utility Survey and Subsurface Infrastructure Investigation
    - Adjacent Building Foundation Investigation
    - Evaluate the Suitability of Recovery Wells
    - NAPL Stabilization Bench Testing
  - IRM Data Report
  - IRM Design and Implementation Plan (activities, if necessary, not limited to):
    - Sheet Pile Pilot Test
    - CSM Wall Pilot Test
    - Groundwater Pump Test
    - NAPL Monitoring and Recovery Pilot Test
  - Final IRM Design

5. Vapor/Odor Management

A new or revised CAMP has not been prepared specifically for this IRM Design Work Plan because the activities proposed are primarily associated with PDI activities. These investigative activities are interim in nature, necessary to determine the final scope and design of the IRM and do not require a new CAMP beyond what is already approved for investigation activities as detailed in the 2008 RI Work Plan (RIWP). A copy of this CAMP is provided in Appendix E. A revised CAMP will be prepared and submitted with the Final IRM Design and Implementation Plan if the proposed activities are not covered by the RIWP CAMP. A revised CAMP will be prepared and submitted with the Final IRM Design and Implementation Plan.

5.1 Fugitive Dust Control

PDI activities will be performed to limit the potential for fugitive dust emissions. Dust control measures will be implemented to minimize the potential for dust generation during any soil excavation and handling activities, as well as, placement of fill. Dust control measures will include water spraying and/or suppressant foams. Materials to act as a dust suppressant will be maintained at the IRM Site. This may include tarps and/or water, or chemical foam, (e.g., Rusmar™ foam) or other National Grid-approved method. Sufficient dust suppressant materials will be maintained on site to suppress fugitive dust from the excavation. The material will be stored near the excavation and will be easily mobile in case of need.

If applicable during PDI activities, heavily traveled truck routes within the EZ and SZ will be wet down to minimize dust emissions. These truck routes will be continuously monitored for excessive dirt or dust. Proper cleaning of trucks exiting the EZ zone will aid in minimizing/eliminating dusty conditions on site. If necessary, a decontamination pad large enough to accommodate equipment and truck traffic will be constructed at exit points to clean tires of transport trucks exiting the IRM Site.

Truck routes within the EZ zone will be inspected continuously during high truck traffic periods for excessive dirt or dust. Proper cleaning of trucks exiting the EZ zone will eliminate dusty conditions on adjacent roadways. Transport trucks exiting the EZ zone will pass through an inspection area and/or be inspected to ensure tires and undercarriages are clean and that tarps are secured. Excessive mud and loose dirt observed on the trucks will be manually removed with brooms and brushes as necessary.

6. Erosion and Sediment Control Plan

An Erosion and Sediment Control Plan has not been prepared specifically for this IRM Design Work Plan because the activities proposed are investigative and interim in nature necessary to determine the final scope and design of the IRM and do not require a formal Erosion and Sediment Control Plan. However, if PDI activities necessitate erosion and sediment control measures, the procedures detailed below will be implemented as appropriate to the activity. An expanded Sediment and Erosion Control Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

6.1 Stormwater Runoff Control

All stormwater runoff from areas outside PDI work areas will be monitored and routed into the local drainage structures prior to contact with any impacted materials. If necessary, access areas between the PDI area and the adjacent public streets will contain decontamination stations for all trucks and equipment. The decontamination waters will be collected and stored on site in either 55-gallon drums or fractioning tank. Collected water will be sampled and disposed off site at a properly-licensed, National Grid-approved disposal facility.

6.2 Implementation of Erosion Control Measures

Sediment fence or a hay bale system meeting the Engineer's approval will be installed around the entire perimeter of the IRM Site and/or PDI areas if more than an acre will be disturbed by proposed PDI activities. If necessary, decontamination stations will act as anti-tracking pads, thereby, removing all soil and sediment from all trucks/equipment wheels and bodies that are exiting the IRM Site onto public streets. All trucks potentially transporting material off the IRM Site shall have watertight compartments to prevent seepage from wet soil from leaking onto public streets.

During PDI activities, erosion control measures will be installed as appropriate to the specific activity. These measures will be maintained throughout the duration of the activity. Additional erosion control measures may be needed due to unforeseen conditions. These measures will be installed as necessary and as directed by the Engineer or National Grid.

6.3 Restoration

Upon completion of the remedy, all sediment control measures will be removed and the surface restored to pre-activity conditions. All sediment accumulated in the erosion control measures will be removed and transported to a properly-licensed, National Grid-approved disposal facility.

7. Site Security Plan

A Site Security Plan has not been prepared for specifically this IRM Design Work Plan because the activities proposed are investigative and interim in nature, necessary to determine the final scope and design of the IRM and do not require a Site Security Plan beyond what is already in use at the IRM Site. However, if PDI activities necessitate additional security measures, then procedures detailed below will be implemented as appropriate to the activity.

The objectives of the site security plan at the Site are to prevent the vandalism/destruction of construction equipment, prevent access and minimize health and safety concerns for the surrounding residential neighborhood.

An expanded Site Security Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

7.1 Perimeter Security

The current IRM Site property fence should be sufficient for the purposes of the PDI activities. If a proposed activity warrants it, a privacy screen will be installed on the existing fence. If necessary, a temporary fence will be erected, at a minimum, around the perimeter of the PDI work area. If this new, interior fence is required, it will be a minimum 8-foot high, equipped with a privacy screen. The fence will extend around all appropriate work areas to include the active construction area, potential waste handling equipment, and any necessary storage areas. The new fence will have at least one gate that will have the ability to be locked at the end of each working day. If necessary, temporary lighting (i.e., building floodlights, municipal streetlights, etc.) will be provided at the gate. Additionally, security cameras that cover the perimeter of the property may be necessary.

7.2 Equipment Security

All vehicles and/or equipment left in the work area will be secured at the end of each working day. In addition, vehicles and equipment must remain inside the perimeter fence, or at a remote secured area, overnight or during non-work days. No vehicles or equipment may be left overnight in an unsecured location. It will be the responsibility of contractors to ensure that all non-essential equipment is de-energized when left on Site and not in use to prevent electrical/ fire/explosive hazards.

7.3 Overnight Security

If necessary, overnight security measures will be provided.

8. Decontamination Plan

A new or revised Decontamination Plan has not been prepared specifically for this IRM Design Work Plan because the activities proposed are interim in nature and do not require a new Decontamination Plan beyond what is already in use at the Site and outlined in the HASP, Appendix B. However, if PDI activities necessitate additional decontamination measures, the procedures detailed below will be implemented as appropriate to the activity. An expanded Decontamination Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

The objectives of the decontamination plan at the IRM Site are to provide the procedures and equipment necessary to decontaminate personnel and equipment to prevent cross-contamination from PDI work areas to public areas (i.e., highways, roads, support trailer, vehicles, etc.). This plan does not replace the decontamination procedures outlined in the HASP, Appendix B. This plan provides additional guidelines on decontamination locations, necessary equipment, and procedures.

If necessary and appropriate to PDI activities, the IRM Site will be divided into three primary zones throughout the duration of the PDI activity: the EZ, the contamination reduction zone (CRZ), and the SZ. These locations will be further defined in the field based on work activities in an individual area, and if necessitated by the results of air monitoring activities.

8.1 Decontamination Procedures

Decontamination areas will be established for the following activities.

- Personnel decontamination
- Equipment decontamination

8.1.1 Personnel Decontamination Station

Personnel field decontamination/cleanup will take place at the exit of the established EZs in CRZs. If possible, these field decontamination facilities will be located upwind of the EZs.

Once removed, disposable personal protective equipment (PPE) will be collected at the field decontamination site in a drum or large plastic bag. The drum or plastic bag will be secured to prevent the accidental spread of contamination. Disposable PPE that has been worn in an EZ will be removed and placed in the disposal container before leaving the CRZ. Additional details for personnel decontamination are presented in the HASP contained in Appendix B.

The designated personnel field decontamination area will be equipped with basins for water and detergent, and trash bags or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and have taken off their PPE, they will proceed to a sink where they will wash themselves as a secondary means of personal hygiene (e.g., hands, face, etc.).

The specific decontamination procedures and requirements for the disposal of decontamination wastewater are outlined in the HASP, Appendix B.

8.1.2 Equipment Decontamination Station

If necessary and applicable to PDI activities, equipment decontamination will take place on a decontamination pad that will, at a minimum, be a plastic lined, bermed, wastewater collection sump. Decontamination activities shall include the removal of contaminated soil, debris and other miscellaneous materials from all construction equipment and tools utilized within the EZ using a high-pressure, low volume cleaner. In addition, physical/mechanical agitation (scraping with hand tools) of soil may be utilized during winter months to prevent freezing and icy conditions.

All equipment leaving the IRM Site that was utilized in the EZ will be decontaminated per these guidelines. In addition, any equipment previously utilized to excavate or contact impacted material will be decontaminated prior to use in backfilling (e.g., excavator bucket).

The decontamination pad will be constructed to adequately facilitate decontamination of the largest mobile construction equipment and to withstand the anticipated traffic loads throughout the duration of the project. The decontamination pad will be located and constructed as detailed in the Final Design Submittal. Provisions will be made to control overspray at the decontamination pad(s).

Drilling equipment, hand tools, and miscellaneous small equipment that come in contact with excavated soils or impacted groundwater will be decontaminated on the decontamination pad in buckets of water and detergent.

Wastewater from equipment decontamination will be collected and pumped into either 55-gallon drums or fractioning tanks. Disposal of the wastewater will be sent to the properly-licensed, National Grid-approved disposal facility as necessary.

Soils collected from the decontamination pads will be bulked and sent to the properly-licensed, National Grid-approved disposal facility as necessary.

8.1.3 Material Transport Vehicle Decontamination

Care will be exercised when loading trucks so as not to spill material on the outside of the trucks. Upon exiting the EZ, the trucks will be staged on the equipment decontamination/anti-traction pad. Trucks will then be visually inspected (i.e., box sidewalls, box tailgate, and tires, etc.), cleaned with brushes/brooms and will be decontaminated with pressure sprayers, if necessary, prior to being allowed to leave the IRM Site. In addition, trucks will be required to be covered with solid plastic tarp prior to departing the EZ. All collected soil and decontamination fluids will be bulked and sent to the properly-licensed, National Grid-approved disposal facility as necessary.

8.2 Decontamination Equipment

A sufficient supply of materials/equipment required to implement decontamination procedures will be maintained, including, but not limited to, the following items:

- Plastic trash barrels
- Liners for trash barrels
- Wash basins
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handled soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Stepladder(s)
- Steam generator
- Liquid detergent and paper towels
- Plastic trash bags
- Supplies/equipment to construct the decontamination pads
- All necessary hosing, connections, etc., to collect and transport decontamination fluids to the wastewater treatment system

9. Waste Management Plan

A new or revised Waste Management Plan has not been specifically prepared for this IRM Design Work Plan because the activities proposed are investigative and interim in nature and do not require a Waste Management Plan beyond what is already approved for investigative-derived waste generated at the Site. Any investigative-derived waste generated by the PDI activities will be managed in accordance with the approved measures detailed in the 2008 RIWP. An expanded Waste Management Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

10. Sample Collection & Analysis Plan

Because the activities proposed herein are primarily associated with PDI activities and are necessary to determine the final scope and design of the IRM, they do not require a Sample Collection & Analysis Plan beyond what is all ready approved for investigative activities as detailed in the 2008 RIWP. Therefore, PDI sample collection and analysis activities performed will be performed in accordance with the approved measures detailed in the 2008 RIWP. An appropriate Sample Collection & Analysis Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

11. Groundwater Management Plan

A Groundwater Management Plan has not been prepared for this IRM Design Work Plan because the activities proposed are primarily associated with PDI activities and are investigative and interim in nature. Groundwater generated during the PDI will be managed in accordance with the approved investigative-derived waste procedures detailed in the 2008 RIWP. If it is determined that a groundwater pump test is necessary as part of the Remedial Design, an appropriate Groundwater Management Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

12. Traffic Control Plan

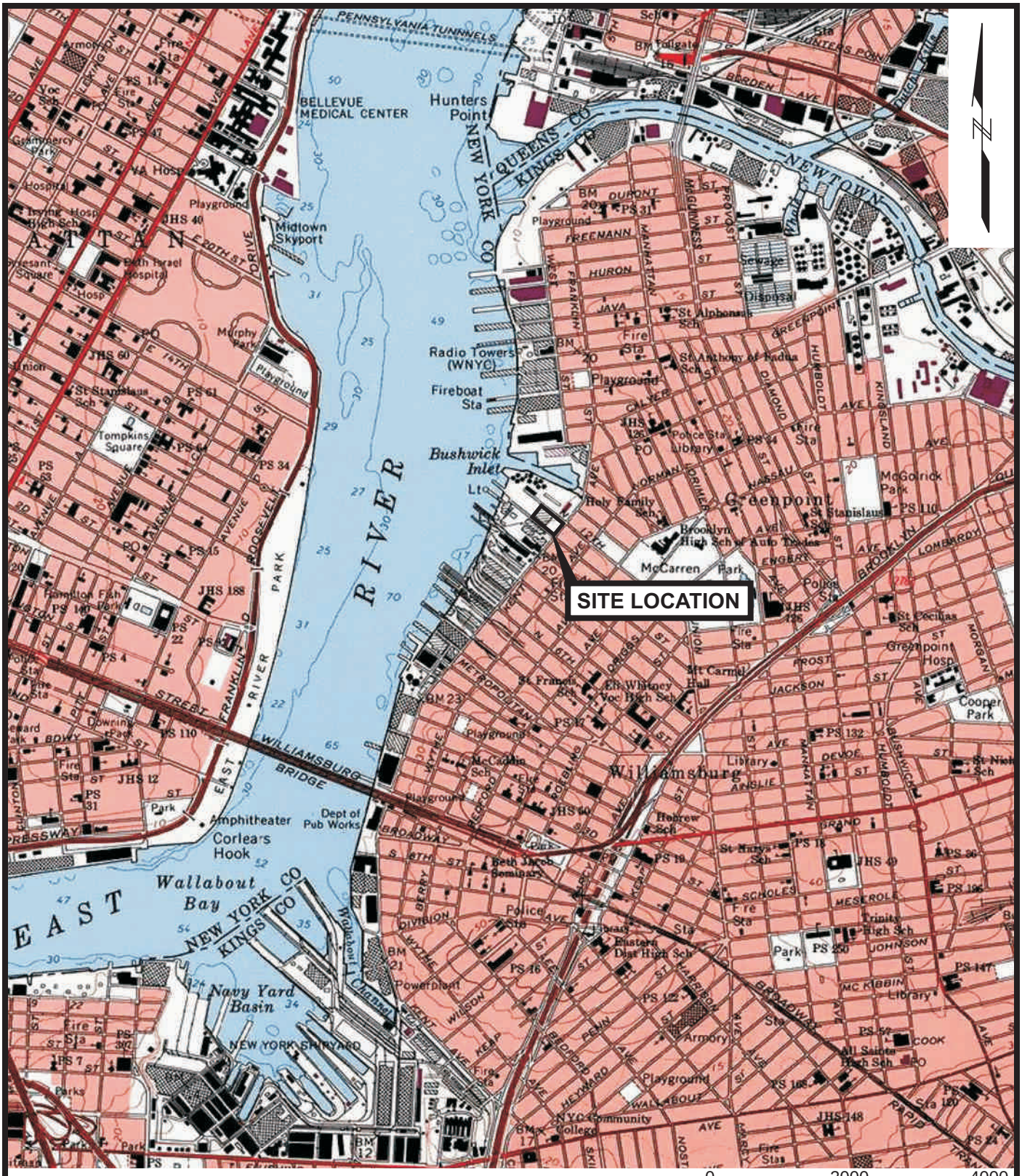
A new or revised Traffic Control Plan has not been prepared specifically for this IRM Design Work Plan because the activities proposed are primarily investigative and interim in nature and do not require a Traffic Control Plan beyond what is already in use at the Site. However, if PDI activities necessitate additional traffic control measures, National Grid, the Engineer and applicable PDI Contractors will develop a plan according to the specific activity. An appropriate Traffic Control Plan will be prepared and submitted with the Final IRM Design and Implementation Plan.

13. Completion of Remedial Activities

No remediation activities will be performed until a remedial approach is evaluated and designed. However, upon completion of the PDI activities, the IRM Site surface will be returned to the pre-PDI activity conditions. Sheet pile walls installed as part of a Remedial Design activity will remain in the subsurface; however, they will be modified or cut at the surface to prevent any surface expression. Restoration actions may include, but are not limited to:

- Backfill and compaction of the excavated areas and replacement of asphalt areas that were disturbed from PDI activities
- Demobilization of the dewatering storage fractioning tank(s)
- Removal of the temporary pilot test equipment
- Demobilization of the CAMP equipment
- Removal of any decontamination pads

Figures



SOURCE: MAP CREATED WITH TOPO!™ 2000 WILDFLOWER PRODUCTIONS (www.topo.com)

FINAL IRM DESIGN WORK PLAN
50 KENT AVENUE PARCEL OF THE
WILLIAMSBURG WORKS FORMER MGP SITE
BOROUGH OF BROOKLYN, NEW YORK

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SITE LOCATION MAP

Project 093060-1-1114 | August 2011 | Figure 1

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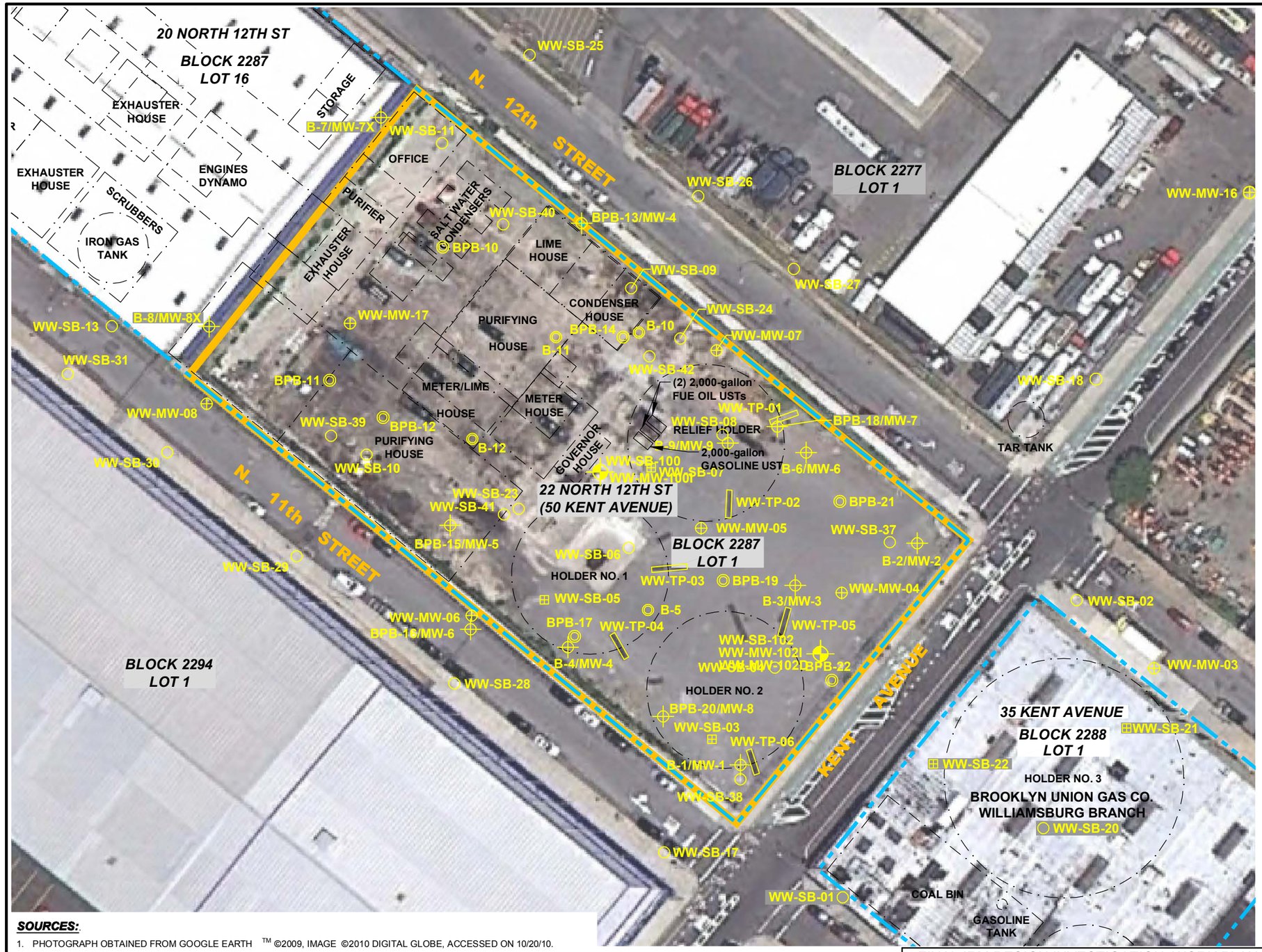

LEGEND

- APPROXIMATE CURRENT 50 KENT AVENUE PROPERTY BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MANUFACTURED GAS PLANT (MGP) SITE
- HISTORIC STRUCTURE

EXISTING SAMPLES

REMEDIAL INVESTIGATION

- WW-MW-05 — MONITORING WELL LOCATION
- WW-SB-01 — SOIL BORING LOCATION
- WW-SB-03 — SOIL BORING WITH TEMPORARY GROUNDWATER SAMPLE LOCATION
- WW-TP-01 — TEST PIT LOCATION

OTHER PREVIOUS INVESTIGATION

- MW-8X — MONITORING WELL LOCATION
- BPB-10 — SOIL BORING LOCATION

SOURCES:

1. PHOTOGRAPH OBTAINED FROM GOOGLE EARTH ™ ©2009, IMAGE ©2010 DIGITAL GLOBE, ACCESSED ON 10/20/10.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM http://www.oasisnyc.net, ACCESSED JANUARY 2008.
4. 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.
5. *FIG. 2: SOIL BORING, SEDIMENT WELL AND MONITORING WELL LOCATIONS,* SITE INVESTIGATION REPORT, PROPERTY WEST OF KENT STREET BETWEEN AND INCLUDING NORTH 10TH AND NORTH 12TH STREETS, BROOKLYN, NY, PREPARED BY METCALF & EDDY|AECOM, SCALE: 1" = 40', DATE: NOVEMBER 2006.

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SCALE, FEET

FINAL IRM DESIGN INVESTIGATION WORK PLAN
50 KENT AVENUE PARCEL OF THE
WILLIAMSBURG WORKS FORMER MGP SITE
BOROUGH OF BROOKLYN, NEW YORK

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August 2011

CURRENT AND HISTORICAL CONDITIONS MAP

Figure 2

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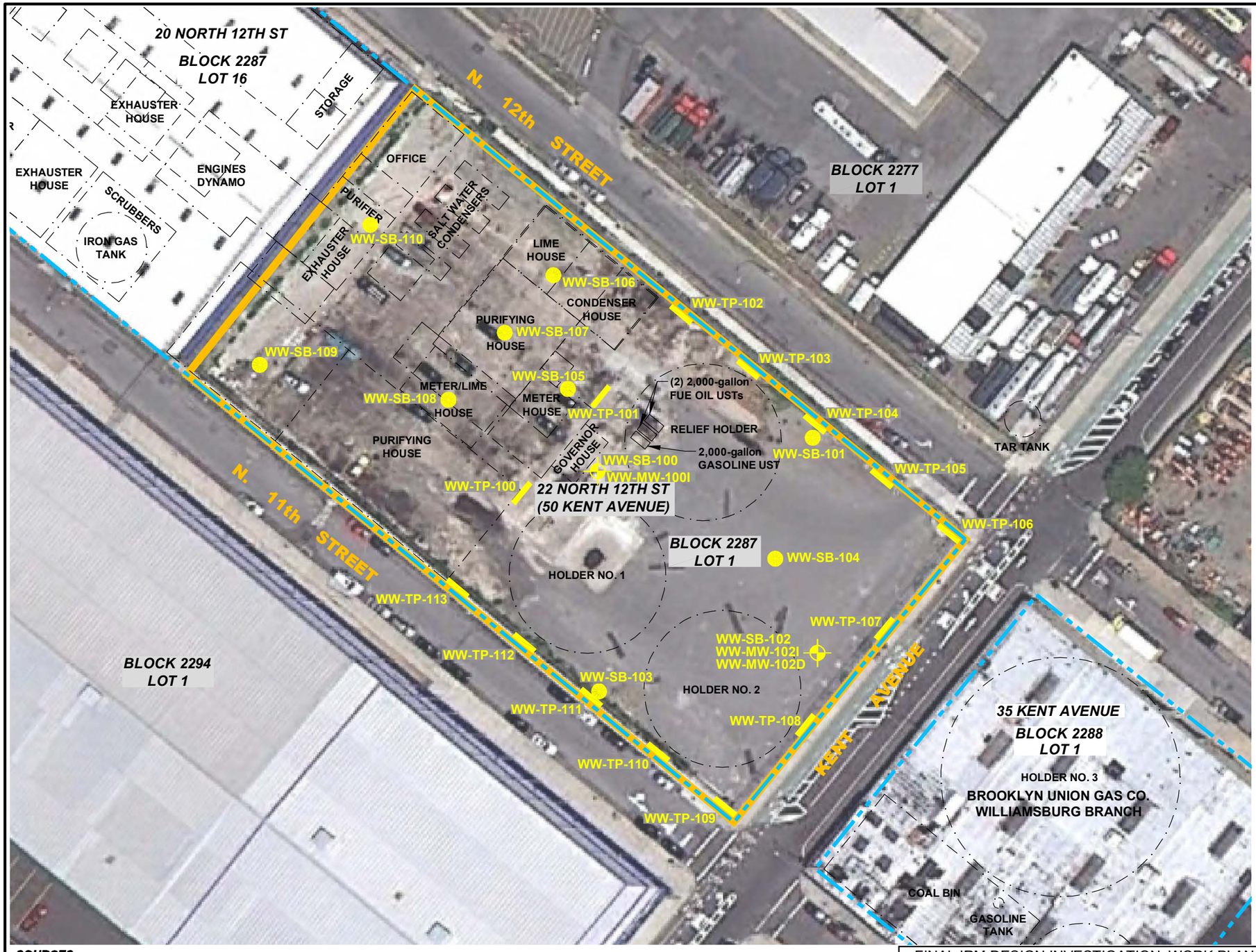

LEGEND

- APPROXIMATE CURRENT 50 KENT AVENUE PROPERTY BOUNDARY
- APPROXIMATE BOUNDARY OF FORMER MANUFACTURED GAS PLANT (MGP) SITE
- HISTORIC STRUCTURE

PROPOSED SAMPLES

- WW-SB-101 — PROPOSED INTERIM REMEDIAL MEASURE (IRM) SOIL BORING LOCATION
- WW-SB-100/ WW-MW-100I — PROPOSED SOIL BORING AND WELL LOCATION
- WW-TP-100 — PROPOSED IRM TEST PIT LOCATION

SOURCES:

1. PHOTOGRAPH OBTAINED FROM GOOGLE EARTH ™ ©2009, IMAGE ©2010 DIGITAL GLOBE, ACCESSED ON 10/20/10.
2. SANBORN FIRE INSURANCE MAPS (1887 THROUGH 1996).
3. NEW YORK CITY OPEN ACCESSIBLE SPACE INFORMATION SYSTEM http://www.oasisnyc.net, ACCESSED JANUARY 2008.
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SCALE, FEET

FINAL IRM DESIGN INVESTIGATION WORK PLAN
50 KENT AVENUE PARCEL OF THE
WILLIAMSBURG WORKS FORMER MGP SITE
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PROPOSED SAMPLE LOCATIONS

Project 093060-1-1114 | August 2011 | Figure 3

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